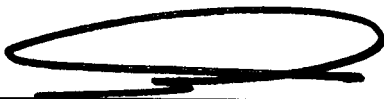


Boundary Timber Supply Area Timber Supply Review

Data Package

September 1999



District Manager
Boundary Forest District



Director
Timber Supply Branch

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1. Introduction

This data package outlines the basic information and assumptions that are required for the Boundary 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;
- land-use decisions approved by Cabinet;
- approved higher level plans under the Forest Practices Code, and
- other approved B.C. Forest Service and joint agency forest management practices and policy.

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 model the specified management practices;
- 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 will be the base case harvest forecast and will be used as a baseline reference. Section 7, "Sensitivity Analyses," outlines areas of uncertainty with respect to data and assumptions, and outlines intended sensitivity analyses.

The *Kootenay-Boundary Land Use Plan Implementation Strategy* (KBLUPIS) has been approved by government as a policy statement. The District Manager of the Boundary Forest District has provided guidance to licensees for the preparation of forest development plans in 1999. This direction guides licensees and small business to consider the Implementation Strategy in the preparation of their forest development plans. Guidance contained in the strategy is reflected in this data package, and will be incorporated into the timber supply analysis either in the base case or in sensitivity analyses.

2.2 Statement of major forest management considerations and issues

The major forest management issues and considerations are listed in the Table 1 below. Where issues are defined within legislation, regulations or standards, a timber supply assessment will be made. If there are important uncertainties in defining current management, sensitivity analysis may assist in assessing the potential timber supply implications and assigning degrees of risk to timber supply during AAC determination.

Table 1. *Major forest management considerations and issues*

Consideration / issue	Description
Grizzly bear	<p>The grizzly bear is a blue listed (vulnerable) species within the Boundary Forest District. Part of the district has been identified as a recovery area in the Provincial Grizzly Bear strategy. Work on a Grizzly bear recovery plan is expected to begin next year (2000). If this plan is approved and implemented prior to the chief forester's AAC determination, it will be considered in this Timber Supply Review.</p> <p>Access management is recognized as an important factor in the survival of grizzly bears. The Boundary Forest District has developed guidelines for the management of grizzly bear, including an access management strategy. Sensitivity analyses are planned to estimate the timber impacts of potential access management guidelines.</p>

(continued)

2. Current Forest Management Considerations and Issues

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

Consideration / issue	Description
Root rot	Growth of some stands is significantly affected by a type of root rot called <i>Armillaria ostoyae</i> (Armillaria). In general, it is believed that timber yields projected for existing stands over 20 years old by the variable density yield prediction (VDYP) model account for volume losses to diseases such as <i>Armillaria</i> ; therefore no unsalvaged losses will be attributed to this disease in the analysis. However, there is uncertainty about whether VDYP fully accounts for losses due to <i>Armillaria</i> , but at present there is no reliable method of calculating the actual impact in these unmanaged stands. For managed stands in Boundary District, recent research data is available that more accurately reflects the impact of root disease in these younger stands. An operational adjustment factor (OAF 2) will be applied to managed stand volume estimates for the various tree species groups (analysis units) depending on their susceptibility to the disease.
Problem forest types (PFT)	The major problem forest types (unmerchantable or marginally merchantable) identified in the last timber supply review were re-examined through extensive, statistically designed field work. The merchantability and/or potential merchantability of each sampled stand within each problem forest type was examined. This work helped define timber types that should be classified as a PFT.
Dense pine stands	<p>In the previous Timber Supply Review, dense pine stands were divided into two classes (analysis units). One analysis unit—good and medium site classes with 310,410, 420 or stocking class 4 labels—was included fully in the timber harvesting land base. The other analysis unit consisted of poor site classes of the same description, but with 50% of the stands with 310, 410 and 420 labels excluded from the timber harvesting land base and considered as problem forest types.</p> <p>Following the last TSR, dense pine stands on poor sites were examined employing Vegetation Resource Inventory methodologies and standards. Appropriate management regimes (rotation length) and the potential merchantability of these stand types were examined. The analysis indicated that an extended rotation was not required, and the amount of dense pine forest type was less than previously estimated. The results of the statistical analysis will be incorporated into this timber supply review. MOF staff will review the results of the study and make appropriate adjustments to inventory information. (For a fuller discussion of the results of the dense pine study see reports titled <i>Statistical Adjustment of Dense Lodgepole Pine Polygons in the Boundary Forest District</i>, March 16, 1999 and <i>Boundary Forest District, Dense Pine Management Inventory, Management Strategy</i>, June 1999.)</p>

(continued)

2. Current Forest Management Considerations and Issues

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

Consideration / issue	Description
Kootenay-Boundary Land Use Plan Implementation Strategy	Government has approved the <i>KBLUP Implementation Strategy</i> as a policy statement. Forest practices designed to meet the objectives of this initiative, and that are current management will be represented in the base case or as a sensitivity analysis.
Landscape-level biodiversity	Biodiversity emphasis objectives have not been formally established. For the analysis, a weighted biodiversity emphasis option assignment will be used. A sensitivity analysis will be conducted to reflect <i>Kootenay-Boundary Land Use Plan Implementation Strategy</i> biodiversity emphases and draft landscape unit (LU) objectives.
Stand-level biodiversity	The wildlife tree requirements specified by Table 20 (a) of the <i>Biodiversity Guidebook</i> for the biogeoclimatic variants within each landscape unit in the district will be incorporated into the analysis to reflect current practice.
Mule deer winter range	Winter range areas for mule deer have been updated for the timber supply review as per the <i>KBLUP Implementation Strategy</i> . The analysis will reflect the updated mapping and guidelines. A sensitivity analysis will examine the effects of uncertainty in the winter range guidelines.
Riparian habitats	The Boundary TSA has a substantial amount of riparian habitat. Riparian reserves will be modeled in the analysis.
Hydrological concerns	Hydrological considerations may be a concern in some areas with extensive past harvesting or road building, potentially limiting the timing of future harvest. Within community watersheds, equivalent clearcut area (ECA) limits will be modeled in the base case. In other areas, forest cover requirements for biodiversity and other resource emphasis values are assumed to be sufficient to address general hydrological concerns. Sensitivity analysis is planned to assess the implications of applying the ECA limits in the guidelines to anticipated domestic watersheds and high value fish streams identified in the MELP watershed atlas.
Fire maintained ecosystem restoration	The KBLUP calls for a Fire Maintained Ecosystem Restoration (FMER) program which has the objective of converting areas of generally overstocked forest in areas subject to frequent stand-maintaining fires (natural disturbance type (NDT) 4) to a mosaic of open range, open forest, and managed forest in defined proportions. The target vegetation cover has been spatially defined through a geographic information system process. The conversion of the existing vegetation cover to the target vegetation cover will be modeled in a sensitivity analysis using specific management zones, and analysis units for open forest and open range conversion areas (see Section 7 "Sensitivity analyses").

3. Inventories

3.1 Background information

The inventories that will be used to determine the timber harvesting land base and represent forest management activities are listed in Table 2.

Table 2. *Inventory information*

Data	Source	Vintage	Update	Source scale
Boundary TSA forest cover FC1 files ¹	Ministry of Forests (MoF) standard inventory files	1988	July, 1996	1:20 000
Granby and Gladstone provincial parks ²	KBLUP file — regional non-standard inventory file, originally created in Nelson Regional office, Recreation Section.	ca 1994	Not applicable	1:50 000
TFL 8	Pope & Talbot; although a NAD83 base it is not TRIM NAD83.	1994	n/a	1:20 000
³ Mule deer winter range	Ministry of Environment, Lands, and Parks (MELP) Boundary staff; non-standard files	1994	1998	1:50 000
⁴ Community watersheds	MELP	1995	1998	1:20 000
⁵ Anticipated domestic watersheds and high value fish streams.	MELP watershed atlas; Boundary Forest District non-standard file.	March/1999	n/a	1:20 000
⁶ Draft landscape unit boundaries	Boundary Forest District mapping based on non-standard overlay; update based on MELP watershed atlas.	1996	1998	1:125 000
⁷ Operating area units	District non-standard inventory file, based on MELP watershed atlas and FAMAP chart areas	1998	1998	1:125 000 1:50 000; 1:20 000
Grizzly bear priority areas	MELP;KBLUP – IS	1998	n/a	1:250 000
⁸ Grizzly bear suitability rating	MELP; Terrestrial ecosystem map	April/1997	n/a	1:20 000; 1:50 000
⁹ Grizzly bear compartments	Boundary Forest District non-standard file	Feb/Mar, 1998	n/a	1:125 000
¹⁰ Draft visual landscape inventory	MOF non-standard overlay;	1996	n/a	1:50 000
¹¹ New woodlots and top-up areas	FAMAP atlas map	1989	1998	1:20 000

3. Inventories

Table 2. Inventory information (concluded)

Data	Source	Vintage	Update	Source scale
Draft biodiversity emphasis	Defined by biogeoclimatic variants and draft landscape units as per local MELP and MOF agreement	Oct/96	1997	1:20 000
¹² Riparian management areas	MELP Fisheries Stream Atlas	1996	n/a	1:50 000
Slope, elevation, aspect	KBLUP file - regional non-standard inventory file created from NAD83 TRIM files (20 metre pixel resolution)	May/97	n/a	1:20 000
KBLUP resource management zones	KBLUP file - regional non-standard inventory file	May/97	n/a	1:50 000

Data source and comments:

¹The photo interpretation and field work for the previous Boundary TSA forest cover inventory was based on 1988 aerial photography and the inventory was completed in 1989. In 1995-1996 the original forest cover typelines from the 1988 cartographic aerial photographs were mono-restituted onto a NAD83 TRIM base. The overlay levels were not updated but transformed from NAD27 to NAD83. The last forest cover update was completed in 1997, including changes to forest cover and disturbances up to July 1996, and is based on orthoimagery of that date.

²Linework for Granby and Gladstone provincial parks originally derived in Nelson Forest Region by Recreation Section using gazetted description. Subsequently incorporated into the KBLUP process.

³Mule Deer Winter range mapping was derived by a consultant working with local Ministry of Environment Lands and Parks staff, and is based on 1:50 000 topographic maps.

⁴Community watershed map from MELP. Original digital files were received from Information Services Branch. Revisions include significantly decreasing the McKinney Creek watershed area and elimination of the Twin and Lind creek watersheds.

⁵Anticipated domestic watershed and high value fish streams linework was derived by Boundary District staff in consultation with local MELP staff. The MELP watershed atlas was used as a base.

⁶Draft landscape unit boundaries were derived by Regional and District staff in consultation with local MELP staff.

⁷Operating Area Units were originally drafted by Boundary Forest District staff in 1997 on a 1:125 000 base map derived from the MELP watershed atlas. Revisions to reflect the intention of following height-of-land were incorporated using 1:20 000 TRIM contour maps for portions of some landscape units.

3. Inventories

⁸Under contract to MELP, Okanagan Wildlife Consultants produced a grizzly bear suitability rating map by overlaying ecosystem maps and forest cover maps.

⁹In 1996 a visual landscape inventory was produced by Mirkwood Consultants (modified by Boundary Forest District).

¹⁰The ownership level is 1989 vintage and does not reflect woodlot top-up areas or new woodlots. The FAMAP cadastral base is considered to be more positionally accurate than the cadastre in the FC1, and therefore, the linework for the top-up areas and new woodlots from the FAMAP map were used. See section 5.2.5 for more detail on woodlot licences.

¹²Riparian management areas — this non-standard layer contains streams, wetlands and lakes from MELP Fisheries Stream Atlas. This layer will be used for determining areas in riparian reserve zones.

4. Division of the Area into Management Zones

4.1 Management zones, groupings and objectives

Management zones represent areas with distinct management emphasis. For example, a zone may be based on a harvesting system, silviculture system, visual quality objective or wildlife consideration. Sometimes one area of forest is subject to more than one management objective. In the simulation model, groups can be used to represent and track different combinations of areas, and thereby allow application of overlapping management objectives. The timber supply analyst will decide whether to put an objective into a group or a mutually exclusive management zone after data assessment. In addition, the role of forest land that is unavailable for timber harvesting will be considered when evaluating forest cover objectives.

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

Table 3. Objectives to be tracked

Group level	Description	Inventory definition	Function
1	Timber harvesting land base by landscape unit (LU) and licensee operating area	Non-standard layer defined by refining MELP watershed layer.	Reporting purposes. Provide an assessment of the total timber harvesting land base by landscape unit and licensee operating area.
2	All forested land by landscape unit (LU) and licensee operating area	Non-standard layer defined by MELP watershed layer. Includes forested basic class 10 (alpine forest) and 12 (non-productive forest)	Reporting purposes. Provide an assessment of the total forest by landscape unit and licensee operating area. All Crown forested area included except woodlots.
3	Biodiversity — all forest	Biogeoclimatic ecosystem classification (BEC) defined in FC1 file.	Provides a means to model biodiversity management at the LU / operating area / biodiversity emphasis / biogeoclimatic subzone-variant level. All Crown forested area included except woodlots.
4	Grizzly bear compartments	Non-standard overlay defined by MELP/MOF	Reporting purposes. Provides a means to run a sensitivity analysis around grizzly bear management alternatives.
5	Grizzly bear conservation strategy	Non-standard overlay defined by landscape units 9,10,11, & 4.	Sensitivity analysis will examine the possible implications of the recently launched Kettle/Granby grizzly bear recovery planning process. A draft recovery plan is scheduled to be developed during 2000.

4. Division of the Area into Management Zones

Table 3. Objectives to be tracked (concluded)

Group level	Description	Inventory definition	Function
6	Community watersheds	Non-standard overlay.	Resource emphasis areas — community watersheds. Provides a means to model watershed guidelines by LU. All Crown forested area included.
7	Anticipated domestic watershed	Non-standard overlay defined by subset of MELP watershed boundaries.	Reporting purposes. Provides a means to run a sensitivity analysis for applying ECA constraints to anticipated domestic watershed.
8	Draft high value fish streams	Non-standard overlay defined by subset of MELP watershed boundaries	Reporting purposes. Provides a means to run a sensitivity analysis for applying ECA constraints to protect high value fish streams.
9	MELP Watershed Map	Non-standard overlay.	Sensitivity analysis. Provides units for applying suggested ECA constraints.
10	Draft visual quality	Non-standard overlay.	Sensitivity Analysis. Provides a means to model draft VQO guidelines by VQO by LU. All Crown forested area included.
11	Mule deer winter range	From MELP data — non-standard mapped layer. Resource emphasis area — ungulate winter range (UWR).	Provides a means to model UWR guidelines by LU. All Crown forested area included except woodlots & TFL.
11	Integrated resource management (IRM)	All areas not subject to objectives for specific values such as watersheds, wildlife, and visual quality. Resource emphasis area — integrated resource management (IRM).	Modeling cutblock adjacency restrictions within each LU. Only timber harvesting land base included.
13	Fire maintained ecosystem restoration (FMER)	Defined by non-standard map layer or site series.	Provides a means to model KBLUP FMER guidelines. All Crown forested area included except woodlots.

Data source and comments:

See Section 3.1, "Background Information," for the sources of mapping and zones referenced above.

4. Division of the Area into Management Zones

4.2 Analysis units

An analysis unit represents a grouping of forest stands that have similar tree species composition (as indicated by the inventory type group) and similar timber growing capability (as indicated by the site index in the forest inventory file). Each analysis unit is assigned its own timber volume projections (growth curves) for existing and future stands.

Yield tables for existing natural stands will be derived using the variable density yield prediction (VDYP) growth and yield model. Yield tables for recent plantations and future stands will be derived using the table interpolation program for stand yields (TIPSY). The following table identifies draft analysis units. After determining the timber harvesting land base, the timber supply analyst will determine the final analysis unit definitions.

Table 4. Draft analysis units

Analysis unit ID #	Species description	Site index range (m@50 years)	Inventory type groups	Age @ June 1996 (years)	Comments
112	PI (pure)	>17.9	28	> 20	
122	PI (pure)	13.5-17.9	28	> 20	
132	PI (pure)	7.5-13.4	28	> 20	
111	PI (pure)	>17.9	28	≤ 20	TIPSY
121	PI (pure)	13.5-17.9	28	≤ 20	TIPSY
131	PI (pure)	7.5-13.4	28	≤ 20	TIPSY
212	PI (mix)	>17.9	29-31	> 20	
222	PI (mix)	13.5-17.9	29-31	> 20	
232	PI (mix)	7.5-13.4	29-31	> 20	
211	PI (mix)	>17.9	29-31	≤ 20	TIPSY
221	PI (mix)	13.5-17.9	29-31	≤ 20	TIPSY
231	PI (mix)	7.5-13.4	29-31	≤ 20	TIPSY
312	F, Py	>18.5	1- 8,32,33	> 20	
322	F, Py	14.5-18.5	1- 8,32,33	> 20	
332	F, Py	8.5-14.4	1- 8,32,33	> 20	
311	F, Py	>18.5	1- 8,32,33	≤ 20	TIPSY
321	F, Py	14.5-18.5	1- 8,32,33	≤ 20	TIPSY
331	F, Py	8.5-14.4	1- 8,32,33	≤ 20	TIPSY
412	L (leading)	>17.9	34	> 20	
422	L (leading)	13-17.9	34	> 20	
432	L (leading)	7.5-12.9	34	> 20	
411	L (leading)	>17.9	34	≤ 20	TIPSY
421	L (leading)	13-17.9	34	≤ 20	TIPSY
431	L (leading)	7.5-12.9	34	≤ 20	TIPSY

(continued)

4. Division of the Area into Management Zones

Table 4. Draft analysis units (concluded)

Analysis unit ID #	Species description	Site index range (m@50 years)	Inventory type groups	Age @ June 1996 (years)	Comments
512	SB types	>16.9	18-26	> 20	
522	SB types	13-16.9	18-26	> 20	
532	SB types	8-12.9	18-26	> 20	
511	SB types	>16.9	18-26	≤ 20	TIPSY
521	SB types	13-16.9	18-26	≤ 20	TIPSY
531	SB types	8-12.9	18-26	≤ 20	TIPSY
612	Cw, Hw, Pw	>19.9	9-17, 27	> 20	
622	Cw, Hw, Pw	16-19.9	9-17, 27	> 20	
632	Cw, Hw, Pw	9-15.9	9-17, 27	> 20	
611	Cw, Hw, Pw	>19.9	9-17, 27	≤ 20	TIPSY
621	Cw, Hw, Pw	16-19.9	9-17, 27	≤ 20	TIPSY
631	Cw, Hw, Pw	9-15.9	9-17, 27	≤ 20	TIPSY

Data source and comments:

The site index ranges used to define the analysis units are approximate. Once the timber harvesting land base has been defined, and the distribution of area by site index for each species is known, a more detailed analysis will be performed to confirm the values shown.

Analysis unit numbering:

Forest type	Site	Age
1 — Pure PI	1 — good	1 — ≤20 years
2 — PI leading	2 — medium	2 — >20 years
3 — F or Py leading	3 — poor	
4 — Larch leading		
5 — S,B types		
6 — Cw, Hw, Pw types		

Some aggregation or splitting of analysis units may occur after examining the amount and distribution of area within each analysis unit.

5. Timber Harvesting Land Base Definition

5.1 Identification of the timber harvesting land base

This section outlines the steps that are used to identify productive forest that is expected to support timber harvesting (the timber harvesting land base) within the timber supply area. Land may be unavailable for timber harvesting for three principle reasons:

- it is not administered by the British Columbia Forest Service for timber supply (e.g., private land, parks, etc.);
- it is not suitable for timber production; 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);
- changes in administrative boundaries

There are no such additions relevant to this analysis.

The classification of area unavailable for timber harvesting applies to land where no harvesting is anticipated to occur. Areas where some timber harvesting is anticipated to occur remain in the timber harvesting land base, even if the area will be subject to stringent constraints. Any such constraints will be reflected in the analysis.

The area remaining after identifying all areas that do not contribute to timber supply, is defined as the "current timber harvesting land base" for the Boundary TSA.

5.2 Details on land base classification

5.2.1 Land not owned and administered by the province of British Columbia

Only provincial Crown Land contributes to the land base used to determine timber supply. Private lands (Crown granted lands) ownership code 40N and federal Crown lands (Indian Reserves and Dominion Government Blocks) ownership codes 52N and 54N do not contribute to the net timber harvesting land base.

5.2.2 Land classified as non-forest or non-productive forest

Alpine, lakes, rock, etc. — type identity 6 and 8 — do not contribute to the timber harvesting land base.

5.2.3 Non-commercial cover

Type identity 5 represents areas currently occupied by non-commercial brush species. These areas are considered to be unlikely sites for timber production, and are excluded from the area considered available for timber harvesting.

5. Timber Harvesting Land Base Definition

5.2.4 Provincial land not administered by the British Columbia Forest Service for timber supply purposes

The total land base is stratified into various ownership codes. Of the provincial Crown ownership codes, only three are considered to contribute to timber supply for harvest forecast and AAC determination purposes: 62C (Crown land in a forest management unit), 69C (Crown land in miscellaneous reserves), and 61C (contributing UREP areas).

UREP areas (areas set aside for the Use, Recreation, and Enjoyment of the Public — ownership code 61C) will be managed for recreation purposes subject to specific forest cover constraints.

5.2.5 Exclusion of specific, geographically defined areas

This section specifies 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 been accounted for in the inventory file.

The only specific, geographically-defined Crown forest areas that do not contribute to TSA timber supply, and that have not been accounted for in the inventory file, are recently allocated woodlot licence areas, and Granby and Gladstone Provincial Parks.

Since the last TSA determination (March 1, 1996) 15 woodlots were topped up to approximately the maximum 600 hectares of Crown land allowed. The total top up area is 3086 ha with an accompanying AAC of 2250 m³. Also, since that time 18 new woodlots have been issued and 3 of the original woodlots deleted, with a net increase of 8803 ha and 11 142 m³ of crown AAC (see Table 5).

The following table shows the area of crown land that has been excluded from the TSA land base for woodlots since March 1, 1996.

Table 5. Woodlot area and AAC increases since March, 1996

Woodlots	Crown area (ha)	Crown AAC (m ³)
Top up of 12 previous woodlots	3 086	2 250
18 new woodlots	10 036	12 712
3 removed woodlots	-1 233	-1 570
Total	11 889	13 392

Data source and comments:

The starting AAC starting point will be reduced to 686 608 m³ to account for the reduction associated with woodlots.

Woodlot licenses and their AACs are administered and determined separately from the TSA. The woodlot areas will consequently be excluded from the TSA timber harvesting land base.

5. Timber Harvesting Land Base Definition

The woodlot license expansion areas noted above have not been updated for ownership in the inventory. The ownership level is 1989 vintage and does not reflect woodlot top-up areas or new woodlots. The FAMAP cadastral base is considered to be more positionally accurate than the cadastre in the FC1, and therefore, the linework for the top-up areas and new woodlots from the FAMAP map were used.

The two new parks are delineated on the inventory, and will be 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 roads trails and landings 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 are applied after stands are harvested for the first time.

All highways and larger municipal roads are of sufficient size to be mapped as polygons and classified as non-forest areas in the forest inventory file. These polygons are removed from the timber harvesting land base as non-forest area.

All other roads trails and landings are depicted only as lines on forest cover maps, and have no associated polygons. These areas are accounted for as described in Table 6.

Table 6. *Right-of-way widths for existing classified roads, resource access trails and other infrastructure categories*

Location	Road length (km)	Right -of-way width (m)	Reduction area (ha)
Existing RTLs < 20 years			
Secondary road	219	16	350
Logging roads	2921	8.5	2482
Trails	594	3.0	178
Landings ^a			1770
Powerline	6.6	49.0	32
Pipeline ^b	18.6	30	55.8
Future RTLs			
Roads/Trails/Landings ^c (inside and outside of logging blocks)			247ha/year

Notes: discussion corresponding to superscripts is in data source and comments, below

Data source and comments:

- Existing road reductions are based on the length of road mapped in the forest inventory files (Forest Service, road permit and non-status roads) in the Boundary TSA. Only landings were not captured on the forest inventory files. The estimate for landings was derived from sampling Silviculture Prescriptions, and considering the typical maximum skidding distance of logging equipment, and the typical landing size used. An estimated one landing is used for every 8 ha of net area to reforest of mapped openings. The average size of a landing is 0.25 ha. There are 56 645 ha of openings (net area), meaning 7040 landings, with a total area of 1770 ha.

5. Timber Harvesting Land Base Definition

- b) A new pipeline right of way is being constructed (additional to that listed in Table 6) across the southern part of the district. Losses to the land base as a result have not been included. Current estimates indicate no more than 16 ha will be lost (insignificant considering losses from other causes).
- c) Future roads, trails and landing reductions were projected based on approximate average yearly road building carried out by Forest License holders (80 km), the small business program (30 km), and the Forest Service (25 km), a total of 135 km. Assuming a road width of 8.5 m, the area of road constructed annually averages 115 ha. This total is for outside-block roads. Inside-block reductions were calculated using the population of logged openings with silviculture approval dates later than 1994. MLSIS /ISIS forest cover data was used to determine NP UNN (Non productive unnatural) as a percent of the harvested forest area (NP UNN area + Net area to reforest) and was found to be 6%. The average area logged each year is about 2200 ha (ISIS/ML SIS net area data). The NP UNN area is therefore 6% of 2200 ha, or 132 ha. In summary: the predicted annual permanent losses to the forested land base due to new logging roads, landings and trails inside and outside logging openings is 247 ha (115+ 132).

The estimated area of future roads, trails and landings will be deducted as a percentage of all previously unharvested areas the first time they are harvested in the simulation model. Future roads, trails and landing reductions were projected to be similar to recent disturbances (1995-98). The amount of new roads, trails and landings is expected to start declining by 2005 as roads finally access the entire land base and areas are logged for the second time. This trend will be reflected in the analysis.

5. Timber Harvesting Land Base Definition

5.2.7 Riparian management areas

The information needed to estimate the area of riparian reserves, and the reserved portions of riparian management zones is indicated in Table 7. The reserved area will be excluded from the timber harvesting land base.

Table 7. *Riparian management areas*

Feature	Fisheries stream atlas code	Buffer (m)
Single line, main flow	1000	10
Lake Shoreline	1500	10
Island Shoreline	1600	10
Single line, secondary flow through wetland	1150	15
Lake shoreline, shared with wetland	1525	15
Wetland shoreline	1700	20
Single line, main flow through wetland	1050	25
Island shoreline shared with wetland	1625	40
Double line, right bank	1800	40
Double line, right bank shared with wetland	1825	40
Double line, left bank	1850	40
Double line, left bank shared with wetland	1875	40
Island in river , right bank	1900	40
Island in river , right bank shared with wetland	1925	40
Island in river, left bank	1950	40
Island in river, left bank shared with wetland	1975	40

Data source and comments:

MELP has linked the Fisheries Stream Atlas to each stream vector in the forest cover inventory. Each stream vector has a database tag that holds a value called “code.” This value represents the feature code from the stream atlas (for more details see the Kootenay/Boundary Land Use Plan Data Package).

5. Timber Harvesting Land Base Definition

5.2.8 Environmentally sensitive areas

Environmental sensitivity or high value for non-timber resources may preclude or restrict timber harvesting on some sites. Two analysis approaches to account for harvesting limitations in environmentally sensitive areas (ESAs) are: per cent area reductions, and evaluation of individual ESA polygons for harvesting opportunity. The following table provides percentage area reductions that represent the portion of ESAs where harvesting will not likely occur.

Table 8. Description of environmentally sensitive areas

ESA class	ESA description	% area reduction
E1s	Areas having extremely fragile or unstable soils.	100
E2s within community watersheds.	Areas having significantly fragile or unstable soils.	50
E2s outside of community watersheds	Areas having significantly fragile or unstable soils.	0 (see discussion below)
E1p	Areas having severe regeneration problems caused by biotic factors.	100
E2p	Areas having significant regeneration problems caused by biotic factors.	0 (see discussion below)

Data source and comments:

Area-based reductions for ESAs are based upon professional judgment and analysis of past harvesting activities. Where reasonable, deductions were stated as 100% or 0% of specific areas to enable them to be spatially explicit (that is, inventory polygon is either deducted as an ESA, or is not, which improves mapping capability).

Most E2s outside of community watersheds and E2p sites can be harvested without damaging soils or creating regeneration problems by adjusting operations after site-specific assessment.

Areas identified as being sensitive for wildlife concerns will be addressed through management zones with specific forest cover constraints (see Section 6.4.1 "Forest cover requirements").

5. Timber Harvesting Land Base Definition

5.2.9 Sites with low timber growing potential

Sites are generally classified as having low productivity because of inherent site factors (nutrient availability, moisture availability, lack of soil, extreme climatic conditions, etc.) which results in there being a low probability of growing a merchantable crop of trees in a reasonable amount of time. These stands are not considered unlikely to produce an economically harvestable crop of trees and are excluded from the timber harvesting land base.

Table 9. Description of sites with low timber growing potential

Species	Inventory type groups	Site index (m@50 years)	Reduction (%)
PI leading	28 - 31	< 7.5	100
F leading	1 - 8, 32, 33	< 8.5	100
L leading	34	< 7.5	100
Cw, Hw, Pw	9 - 17, 27	< 9.0	100
SB types	18 - 26	< 8.0	100

Data source and comments:

The site index values shown in the above table approximate the upper SI limit of the old site class low. This value is based upon the table “Site Class-Site Index Relationships Used in VDYP Batch Application” VDYP Batch Application User Guide Version 6.4. Historically, harvesting has not occurred in stands with volumes less than would be produced at the listed site indexes.

5.2.10 Specific excluded forest types

Some forest types are excluded from the timber harvesting land base to reflect that they have non-merchantable characteristics. The forest types referred to in Table 10 are excluded entirely from the timber harvesting land base.

Table 10. Description of excluded forest types (EFT)

Description	Type group	Age	Comments
Deciduous-leading stands	35-42	Any	Not currently utilized. Also important for wildlife

5. Timber Harvesting Land Base Definition

5.2.11 Areas considered inoperable

Operability codes are used to describe the presence or absence of physical barriers or limitations to harvesting and the merchantability of stands. Inoperable areas are defined as areas unavailable for harvest for terrain-related or economic reasons. Characteristics used in defining operability include slope, topography (e.g., the presence of gullies or exposed rock), difficulty of road access, soil instability, elevation and timber quality. Operability can change over time as a function of new harvesting technologies and changing economics.

Table 11. Description of inoperable areas

Inventory description	Code	Reduction per cent (%)
Inoperable	Operability (I)	100
Not typed	Operability (N)	100
Operable	Operability (A)	0

Data source and comments:

Operable areas are those parts of the Boundary TSA forested land base which are likely to be accessible for timber harvesting when considering ecological, economic and terrain factors. These factors are not precisely defined, making determination of operable/inoperable areas a relatively subjective task.

Operability lines were revised after study in 1991 by the Boundary Forest District office. During this revision, some areas were added and some areas were deleted from the operable classification. The overall result was an increase in the amount of inoperable area relative to the previous classification.

In 1993 Pope & Talbot did an independent operability project on 6 map sheets which indicated the existing district-defined operability lines overestimated the inoperable area by 14%. No further work has been completed on operability, so the 1991 study is still considered the more comprehensive study and will be used to define operability for the analysis.

5.2.12 Problem forest types

Problem forest types occur within the operable land base and occupy sites that have the potential to produce merchantable timber but are not currently utilized due to marginal merchantability. The stand types identified as problem forest types in most cases include some merchantable and some unmerchantable stands in varying proportions. Each problem forest type must be evaluated separately to determine the proportion that should be excluded from the timber harvesting land base.

The following table identifies proportions of specific forest types that are not currently being utilized. Based on licensee input, problem forest types are unmerchantable if they do not produce 100 m³/ha by age 120 years.

5. Timber Harvesting Land Base Definition

Table 12. Area reductions for problem forest types

Type group	Age class	Height class	Stocking class	Site index (m@50 yrs)	Proportion of samples <100 m ³ /ha@ 120 yrs ^a	Operable stratum area (ha)	THLB Area Reduction (ha)
28-31	any	any	4	any	2/5	2012	805
28-31	3	1	0	7.5-14.7	1/2	910	455
28-31	3	2	0	7.5-14.7	4/16	5355	1338
28-31	4	2	0	7.5-14.7	8/63	17564	2230
28-31	any	any	3	any	5/24	6500	1354

Note: (a) $(\# \text{ samples } 120 \text{ years} < 100 \text{ m}^3 / \text{total } \# \text{ samples}) \times \text{Total Area} = \text{Reduction of Timber harvesting land base for TG 28-31 problem forest type}$

Data source and comments:

The areas and proportions in the above table were determined utilizing data collected during Boundary Forest District, Dense Pine Management Study. Licensees identified stands not making 100 m³/ha by age 120 years as unmerchantable.

Volumes for sample stands younger than 120 years were projected using straight line MAI calculations based on the current age and volume. This was done to approximate volumes at ages over 120 years. Samples projected not to produce 100 m³/ha by 120 years of age were identified. A ratio was calculated by dividing the number of samples over 120 years with at least 100 m³/ha by samples with less than 100 m³/ha. This ratio was applied to an estimate of the total area (timber harvesting land base).

The areas listed in the table are provided for information only. For the analysis, the proportions will be applied to the area of pine types remaining after other land base deductions.

5.2.13 Cultural heritage resource reductions

Cultural heritage values include archaeological sites, and traditional uses of the land base.

An Archaeological Overview Assessment (AOA) has been completed for the Boundary Forest District. The AOA used a predictive model to delineate areas where the potential for finding archaeological sites is medium or high. Currently the district completes Archaeological Impact Assessments (AIAs) on about 20% of blocks that fall in areas rated as high potential. To date out of the 41 completed assessments, only one has confirmed an archaeological site. Based on these results it is believed that archaeological sites will restrict timber harvesting on only a very small portion of the timber harvesting land base, and no adjustments are planned for this timber supply analysis.

The district refers forest development activities to First Nations with interests in the Boundary Forest District. To date there have been no long term deferrals of harvesting as a result of comments received from First Nations.

6. Current Forest Management Assumptions

6.1 Harvesting

6.1.1 Utilization levels

The utilization levels define the maximum stump height, minimum top diameter inside bark (dib) and minimum diameter at breast height (dbh) by species, and are used in the analysis when deriving projections of merchantable volume.

Table 13. Utilization levels

Analysis unit	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
Pine	12.5	30	10
All other species	17.5	30	10

Data source and comments:

These levels reflect current interior utilization standards, license requirements and current performance.

6.1.2 Volume exclusions for mixed deciduous / coniferous stands

The deciduous component of mixed deciduous / coniferous stands is for the most part not harvested in the Boundary TSA and should not contribute to the estimated stand volume.

Table 14. Volume exclusions for mixed species stands

Inventory type group	Species	Volume exclusion of deciduous component (%)
8,17,26,31	All deciduous	100

Data source and comments:

The exclusion pertains to only the deciduous portions of these coniferous-leading mixed species types (8-Douglas-fir leading; 17-hemlock-leading; 26-spruce-leading; 31-pine-leading). Deciduous-leading stands are fully excluded from the timber harvesting land base (see section 5.2.10 “Specific excluded types”).

6.1.3 Minimum harvestable age derivation

The minimum harvestable age is the time required for a stand to grow to a harvestable size, and defines the lower limit for harvesting. The *Biodiversity Guidebook* recommends retention of a minimum percentage of each landscape unit in older age classes to satisfy old-seral requirements. This is exerting pressure on licensees to harvest in younger stands. There have been several instances in recent years where harvesting has occurred in stands that barely exceed the minimum harvesting ages listed in the following table.

6. Current Forest Management Assumptions

Table 15. Minimum harvestable age criteria

Analysis unit ^a	Species description	Site index range (m@ 50 years)	Minimum harvestable age natural stands (years)	Minimum harvestable age regenerated stands (years)
112, 111	PI (pure)	>17.9	60	55
122, 121	PI (pure)	13.5-17.9	80	75
132, 131	PI (pure)	7.5-13.4	100	95
212, 211	PI (mix)	>17.9	60	55
222, 221	PI (mix)	13.5-17.9	80	75
232, 231	PI (mix)	7.5-13.4	100	95
312, 311	F, Py	>18.5	90	80
322, 321	F, Py	14.5-18.5	110	100
332, 331	F, Py	8.5-14.4	130	120
412, 411	L (leading)	>17.9	90	80
422, 421	L (leading)	13-17.9	110	100
432, 431	L (leading)	7.4-12.9	130	120
512, 511	SB types	>16.9	80	75
522, 521	SB types	13-16.9	100	95
532, 531	SB types	8-12.9	120	115
612, 611	Cw, Hw, Pw	>19.9	80	75
622, 621	Cw, Hw, Pw	16-19.9	100	95
632, 631	Cw, Hw, Pw	9-15.9	120	115

Note: (a) refer to section 4.2 "Analysis units" for explanation of the analysis unit codes.

Data source and comments:

For the pure pine and pine-leading analysis units, criteria of a 100 m³ minimum volume per hectare and a 20-cm. minimum average diameter at breast height (DBH) were used to predict minimum harvestable ages. For all the other analysis units, these criteria (with a 25-cm. minimum average DBH), plus the achievement of 95% of culmination mean annual increment (MAI) were used. Yields and diameters were derived using VDYP for existing natural stands, and TIPSYP for managed (regenerated) stands. The ages derived using these criteria were adjusted to reflect current harvesting practices and input received from licensees.

6. Current Forest Management Assumptions

6.1.4 Harvest scheduling priorities

For the Boundary TSA, the Forest Service Simulator (FSSIM) timber supply model will set highest harvest priority to stands that are the oldest relative to their minimum harvestable age. Current management of harvest priority may more closely resemble a random distribution of ages above the minimum harvest age rather than relative oldest first. Sensitivity analysis will be done to determine the effect of assigning harvest priority randomly.

6.1.5 Silviculture systems

Based on major licensee and Small Business Forest Enterprise records from 1994 to 1998, the leading silviculture system used in the Boundary TSA was clearcut (57% of the areas). The partial cutting systems used were: seed tree (20%), selection systems (9%), shelterwood (5%), patch cuts (5%) and intermediate cuts (4%). The percent figures are based on the area logged using each silviculture system. MOF staff will examine the implications for growth and yield and non-timber values of alternative silvicultural methods, as well as methods for modeling partial harvesting, and incorporate these systems into the analysis if possible.

6.2 Unsalvaged losses

The purpose of this section is to provide an estimate of average annual loss of timber on the net timber harvesting land base that is not salvaged, is not already accounted for in the forest inventory, and is unconstrained and actually available for harvest. These losses are attributable to a number of factors that result in tree mortality, including: wildfire, blowdown, snow damage and bark beetles. Estimates were derived using the “Method to Estimate Non-Recoverable Losses for Timber Supply Reviews” produced by Forest Practices Branch (John Henigman) in co-operation with Research and Timber Supply Branches. Another source of loss is from retention trees left on blocks to provide structural diversity, which are not removed once the stand is regenerated. The portion of these trees we are concerned with are those that die before the next harvest entry.

Table 16. *Unsalvaged losses*

Cause of Tree Mortality	Estimated average annual unsalvaged loss (m ³ per year)
Mountain pine beetle	400
Spruce bark beetle	400
Douglas-fir bark beetle	50
Floods	n/a
Catastrophic blowdown	2 000
Non-catastrophic blowdown adjacent/in cut blocks	300
Non-catastrophic blowdown adjacent to FSR	225
Blowdown along other roads, fences, trails and r/w	1 000
Snow damage	300
Wildfires	60
Retention tree mortality	1 250
Total	5 985

6. Current Forest Management Assumptions

Data source and comments:

All unsalvaged losses noted in the above table occur on the net timber harvesting land, and refer to volume that is unconstrained and available for harvest (not being retained for non-timber values), that is not being salvage logged, and that is not accounted for in VDYP yield predictions.

Information regarding unsalvaged losses was collected from forest district staff, forest health overview flight maps, Forest Insect Disease Surveys (FIDS), industry and SBFEP forest development plan maps, and wildfire reports from the protection fire reporting system. As many years of reliable data as possible were used to determine the extent of total losses due to each causal agent. Where possible, the most current salvage performance of the forest licensees and SBFEP was then used to adjust the average historical losses to determine the estimate of future losses to be applied. Local knowledge, estimates from staff, and professional judgment are a key part of the estimates of unsalvaged losses. Reinstitution of the small-scale salvage program has helped to reduce the non recoverable losses since the last analysis.

6.3 Silviculture

6.3.1 Silviculture and regeneration activities

The silviculture program reflects the mix of treatments expected to be carried out in the Boundary TSA. Table 17 shows the proportion of each analysis unit to be treated under each silviculture regime, and the expected average regeneration delay.

Growth and yield of recent plantations and future stands will be projected using managed stand yield tables (MSYT) produced from 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. If this is the case, tables will be produced for the different regeneration methods (each method and species combination) and then aggregated into one table.

6. Current Forest Management Assumptions

Table 17. Regeneration assumptions by analysis unit

Analysis unit	Species description	Regen method (A = artificial, N = Natural)	% of analysis unit regen artificially or naturally	Regen delay (years)	OAF ^a 1 (%)	OAF ^a 2 (%)	Regen species	Regen species (%)	Initial density (sph)	Target density (sph)
112 122 132	PI (pure)	A	65	3	15	10	PI Lw,Fd,Py Sx,BI	47 37 16	2500	1600
112 122 132	PI (pure)	N	35	5	15	10	PI Lw,Fd,Py	93 7	6300	1600
212 222 223	PI (mix)	A	75	3	15	10	PI Lw,Fd,Py Sx,BI	43 37 20	2200	1600
212 222 223	PI (mix)	N	25	5	15	10	PI Lw,Fd,Py Sx,BI	81 12 7	4700	1600
312 322 332	F, Py	A	25	3	15	12	Lw,Fd,Py PI	82 18	2000	1200
312 322 332	F, Py	N	75	4	15	12	Lw,Fd,Py PI Sx	84 10 6	2200	1200
412 422 432	L (leading)	A	75	3	15	7	PI Lw Sx	67 22 11	2600	1400
412 422 432	L (leading)	N	25	4	15	7	PI Lw	57 43	3300	1400
512 522 532	SB types	A	100	2	15	10	Sx,BI PI	57 43	2300	1600
612 622 632	Cw, Hw, Pw	A	95	2	15	10	PI Sx Lw	59 35 6	2300	1600
612 622 632	Cw, Hw, Pw	N	5	2	15	10	Hw Sx,BI	60 40	5500	1600

Note (a) OAF is operational adjustment factor. OAF 1 is a constant percentage reduction to account for small stocking gaps in stands. OAF 2 accounts for losses that increase with age, for example, due to disease. The value of OAF 2 increases from zero and passes through the shown value when the stand is 100 years old.

6. Current Forest Management Assumptions

Data source and comments:

The regeneration regimes summarized in the table will be applied to stands that are currently older than 20 years after they are harvested in the simulation model.

Most of the values in the above tables are based on estimates derived from a joint query of ISIS and MLSIS databases for those stands that had information about previous stand type. Where necessary, local knowledge was used to supplement the ISIS and MLSIS data. In many cases the sample size is relatively small and the variation in the values is large. The initial stocking figures shown in Table 17 are averages extracted from the silviculture databases. They may be averaged or rounded when developing timber yield tables for analysis units.

Operational adjustment factor (OAF) values are applied to the managed stand yield curves as recommended by the Ministry of Forests, Research Branch. The standard default value of OAF 1, which accounts for small stocking gaps in the stand, is 15%. The standard default value of OAF 2 accounts for breakage and waste (2%) and decay (3%) for a total of 5%. For the Boundary TSA, OAF 2 has been increased by 5% in most analysis units to account for losses due to *Armillaria ostoyae*, weevil, and stem and foliage diseases. The OAF 2 has been increased to 7% in the F, Py analysis unit to account for additional *Armillaria ostoyae* losses due to unevenaged management. The OAF 2 has been increased by only 2% in the larch-leading analysis unit to reflect a greater resistance to *Armillaria ostoyae*.

Prior to the analysis, information on the proportion of planting stock that is class A (genetically improved) will be compiled to allow assessment of the potential timber supply implication through sensitivity analysis.

6.3.2 Immature plantation history

This section identifies areas of existing immature forest where the density (stems per hectare) was controlled and which therefore should be assigned to a managed stand yield table (MSYT). Volume growth on all NSR areas and stands projected for future harvest will be estimated using MSYTs.

Table 18. Immature plantation history

Analysis unit	Species description	Age (years)	Area managed (%)
111,121,131	PI (pure)	<21	100
211,221,231	PI (mix)	<21	100
311,321,331	F, Py	<21	100
411,421,431	L (leading)	<21	100
511,521,531	SB types	<21	100
611,621,631	Cw, Hw, Pw	<21	100

Data source and comments:

Stands less than 21 years old—those listed in Table 18—will be assigned to MSYTs using inventory information and the same operational adjustment factors (OAF's) that are listed in Table 17. These stands have a history of density control and stand tending and are considered managed stands.

6. Current Forest Management Assumptions

6.3.3 Not satisfactorily restocked areas

Not satisfactorily restocked (NSR) areas consist of current NSR and backlog NSR. Current NSR refers to areas that were logged or disturbed after October 1, 1987 and for which there are legal reforestation obligations. The restocking period for current NSR areas is accounted for in regeneration delay assumptions. Backlog NSR refers to areas that were logged or disturbed before October 1, 1987, and for which there are no legally required reforestation obligations. Backlog NSR areas listed in Table 19 were derived from the ISIS database and relate to the timber harvesting land base. Land classified in the TSA FIP file as not satisfactorily restocked (type identity 4 or 9) will be included in the current timber harvesting land base.

Table 19. Not satisfactorily restocked (NSR) areas

Backlog NSR (hectares)	Current NSR area (hectares)
280	8570

Data source and comments:

The district silviculture data (ISIS) indicates that 280 hectares of backlog NSR remain to be restocked. The difference between the operable portion of this area, listed in Table 19, and the amount of operable NSR on the inventory file (if any) will be assumed to have already been restocked.

Backlog NSR is targeted to be restocked within the next 5 years.

Current NSR areas will be assigned to the analysis units from which they came. It is assumed that all current NSR areas will be regenerated within the standard regeneration delay period in Table 17. Current NSR areas total approximately 8570 hectares.

6.4 Integrated resource management

6.4.1 Forest cover requirements

As noted in Section 4.1, "Management zones, groupings and objectives," forest cover requirements are to be examined at a number of different levels. These levels include biodiversity management in landscape units, mule deer winter habitat, and community watersheds. 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 to be retained).

Tables 20a through 20d indicate the forest cover requirements for landscape biodiversity, community watersheds, mule deer winter range, and general integrated resource management (IRM). The forest cover requirements for all values except general IRM apply to the total Crown forest area. Requirements for IRM (specified in Table 20d) apply to the timber harvesting land base.

6. Current Forest Management Assumptions

Table 20a. Forest cover requirements for landscape biodiversity (group level 3)

BEC ^a subzone	NDT ^b	Time frame	Old seral minimum retention area (%)	Old seral minimum age (years)
ESSFdc1	3	Now – 70 years	10.5	140
ESSFwc4	2	Now – 70 years	6.7	250
ICHmw2	2	Now – 70 years	6.7	250
ICHmk1	3	Now – 70 years	10.5	140
ICHdw	3	Now – 70 years	10.5	140
MSdm1	3	Now – 70 years	10.5	140
IDFdm1	4	Now – 70 years	9.7	250
IDFhx1	4	Now – 70 years	9.7	250
PPdh1	4	Now – 70 years	9.7	250
ESSFdc1	3	71 - 140 years	12.6	140
ESSFwc4	2	71 - 140 years	8.1	250
ICHmw2	2	71 - 140 years	8.1	250
ICHmk1	3	71 - 140 years	12.6	140
ICHdw	3	71 - 140 years	12.6	140
MSdm1	3	71 - 140 years	12.6	140
IDFdm1	4	71 - 140 years	11.7	250
IDFhx1	4	71 - 140 years	11.7	250
PPdh1	4	71 - 140 years	11.7	250
ESSFdc1	3	141 + years	14.7	140
ESSFwc4	2	141 + years	9.4	250
ICHmw2	2	141 + years	9.4	250
ICHmk1	3	141 + years	14.7	140
ICHdw	3	141 + years	14.7	140
MSdm1	3	141 + years	14.7	140
IDFdm1	4	141 + years	13.6	250
IDFhx1	4	141 + years	13.6	250
PPdh1	4	141 + years	13.6	250

(a) BEC – biogeoclimatic ecosystem classification.

(b) NDT – natural disturbance type, from the FPC Biodiversity Guidebook.

6. Current Forest Management Assumptions

Data source and comments:

Biodiversity guidelines will be modeled using information from the *Biodiversity Guidebook* and policy guidance in the *Landscape Unit Planning Guide*. Because the *Kootenay-Boundary Land Use Plan Implementation Strategy* biodiversity emphasis designations have not been formalized through the legal landscape unit establishment process, the timber supply analysis base case will incorporate forest cover requirements that do not prejudice the outcome of this legal process. For the base case, a single weighted forest cover requirement for the old-seral stage will be developed based on the anticipated final distribution of assignments to 45% low-, 45% intermediate- and 10% high-emphasis. The values shown in Table 20a above reflect the weighted values based on the September 1995, *Biodiversity Guidebook*. The old-seral requirement within low emphasis biodiversity areas will be modelled based upon achievement of one-third of the guidebook requirement in the first rotation, two-thirds in the second rotation, and full old-seral representation by the end of the third, and in subsequent rotations. The mature plus old forest cover requirements will not be assumed to be current management, and will be assessed through sensitivity analysis, not in the base case.

As an example, the old-seral forest cover requirements for low emphasis biodiversity areas in the ESSFdc1 subzone, for each of the time periods, were calculated as follows:

$$\begin{aligned}\text{Time 0:} \quad & \text{old forest \%} = 14\% * 0.33 = 4.62 \\ \text{Time 70:} \quad & \text{old forest \%} = 14\% * 0.67 = 9.38 \\ \text{Time 140:} \quad & \text{old forest \%} = 14\% * 1.00 = 14\end{aligned}$$

Thus, the old-forest requirements increase over time. However, this increase in older forest cover requirements applies only to low-emphasis biodiversity areas. Given the weighted-average approach being taken in the absence of designated landscape units for the Boundary area (45% low-biodiversity emphasis, 45% medium emphasis, and 10% high emphasis), a further calculation must be performed:

$$\begin{aligned}\text{Older forest requirement} &= (0.45 * \text{low emphasis older forest requirement}) \\ &+ (0.45 * \text{medium emphasis requirement}) + (0.10 * \text{high emphasis requirement})\end{aligned}$$

So, for example, over time, the old-forest cover requirements for ESSFdc1 would be calculated as follows:

$$\begin{aligned}\text{Time 0:} \quad & \text{old forest \%} = (14\% * 0.45) * 0.33 \\ & \quad + 14\% * 0.45 \\ & \quad + \underline{21\% * 0.10} \\ & \quad 10.48 \\ \text{Time 70:} \quad & \text{old forest \%} = (14\% * 0.45) * 0.67 \\ & \quad + 14\% * 0.45 \\ & \quad + \underline{21\% * 0.10} \\ & \quad 12.62\% \\ \text{Time 140:} \quad & \text{old forest \%} = (14\% * 0.45) * 1.00 \\ & \quad + 14\% * 0.45 \\ & \quad + \underline{21\% * 0.10} \\ & \quad 14.7\%\end{aligned}$$

The *Biodiversity Guidebook* seral stage requirements for old forest will first be met from the non-contributing land base (forest outside the timber harvesting land base). Early-seral and mature plus old requirements for biodiversity will not be modeled as part of the base case. A sensitivity analysis will be done to model the effects of implementing early and mature plus old seral requirements for biodiversity.

6. Current Forest Management Assumptions

Landscape unit boundaries extend into provincial park lands where the biogeoclimatic subzones are the same as in the adjacent TSA lands. In such instances, the park lands will be assumed to be part of the non-contributing land base within the landscape unit for the model; that is, forest in these areas is considered when evaluating forest cover requirements, but does not contribute to timber supply.

A sensitivity analysis will be done applying the *KBLUP* biodiversity emphases within each draft landscape unit.

Landscape-level biodiversity requirements apply to and will be evaluated for all Crown forested land, both above and below the operability line. The forest not contributing to the timber harvesting land base within each landscape unit will be assumed to age over the duration of the analysis horizon.

Table 20b. Forest cover requirements for community watersheds,

Resource emphasis	Green-up height (metres)	Green-up age (years)	Maximum area less than green-up age (%)
Community watersheds	9		30

Table 20c. Forest cover requirements for mule deer winter range

Resource emphasis	BEC subzone	Minimum older age (years)	Minimum area older than older age (%)
Ungulate winter range	PPdh1	101	25
	IDFxh1	101	25
	IDFdm1	101	25
	MSdm1	121	35
	ICHmk1	121	35
	ICHdw	121	35

Table 20d. Forest cover requirements for IRM

Resource emphasis	Green-up height (metres)	Green-up age (years)	Maximum area less than green-up age (%)
Community watersheds	3		25

Data source and comments:

All forest cover requirements for zones or groups, including community watershed, and mule deer winter range zones, will be modelled by landscape unit.

The integrated resource management zone (IRM) encompasses that portion of the timber harvesting land base not occupied by any other zone or group, aside from biodiversity emphasis. The maximum area less than green-up age within the IRM zone is meant to approximate the effects of cutblock adjacency restrictions, not early-seral requirements for biodiversity which will not be modeled as part of the base case. The maximum area younger than green-up age within the community watershed zones represents hydrological green-up constraints.

6. Current Forest Management Assumptions

To ensure an appropriate distribution of winter habitat, the *Kootenay-Boundary Land Use Plan* requires that each 250-hectare portion (or suitable multiples up to a planning cell scale) of mule deer winter range be managed as a discrete unit, with the forest cover requirements being met within each unit. This will not be modeled as part of the base case. Given the strategic focus of this analysis, application of the forest cover requirements to mule deer habitat area within each landscape unit should provide a reasonable approximation of operational-scale practices.

6.4.2 Reductions to reflect area retention in cutblocks

Volume may be retained within cutblocks to achieve a variety of forest management considerations. For this analysis, only those trees that are expected to remain on site at least until the next harvest, and are outside of areas excluded from the timber harvesting land base for riparian reserve zones (RRZ) and riparian management zones (RMZ), and other forest areas excluded from the timber harvesting land base, are identified as residual volume retention. Timber volumes left standing after employing silviculture systems that involve subsequent re-entry into the stand and removal of those leave-trees (seed-tree, shelterwood, selection and true selection silviculture systems) are excluded from this estimate. Some of the trees left during application of these alternative systems may die, and would then be included in the estimate of unsalvaged losses (see Section 6.2)

Wildlife tree patches (WTPs) are used to maintain stand structure attributes over time. Plans are to maintain them for a minimum of one rotation. If harvested before that time, WTPs of comparable size and structure will be identified as replacements.

Table 21. *Wildlife tree retention in cutblocks*

Analysis unit	Persistence	Percent (%) recommended from Biodiversity Guidebook	Residual area estimate on the timber harvesting land base (%)
All	Long term	5.4	2.7

Data source and comments:

Table 20a of the *Biodiversity Guidebook* recommends levels of wildlife tree patches to be retained in conjunction with harvesting activities. Recommended retention levels vary depending on the percentage of the area in a landscape unit that has already been harvested without recommended wildlife tree patches, and the percentage of the biogeoclimatic subzone within the landscape unit that is available for harvest. The 1999 biodiversity tables, which outline wildlife tree targets for the district, have incorporated these recommended levels by landscape unit and biogeoclimatic variant. The target for wildlife tree patches is 5.4% of proposed cutblocks. During operations, these wildlife tree patches will be placed in the non-contributing forested land base where possible, or where they can serve multiple functions (riparian or deciduous retention). It is believed that this will reduce the percentage required from the timber harvesting land base by one-half, to 2.7%.

An area (rather than volume) reduction will be used to model wildlife tree patch requirements because it more accurately reflects current management and thus the area upon which harvesting will occur. Wildlife tree patches, in conjunction with other riparian reserves and area removals, are generally larger than two (2) hectares in size, and are left to maintain stand structure within the landscape over time. As the wildlife tree patches are larger than 2 hectares in size, this area will contribute to meeting seral-stage forest requirements at the landscape level. It is assumed that these wildlife tree patches will not be economical to harvest at a later date, nor will they be harvested in subsequent harvesting of the stand.

7. Sensitivity Analyses

Sensitivity analysis provides a measure of the timber supply impact of uncertainty in management assumptions and/or data. The first table shows issues of uncertainty that are particular to this TSA. This table is followed by a list of standard sensitivity analysis that are carried out in all TSAs

Table 22. *Uncertainties specific to the Boundary TSA*

Issue to be tested	Potential sensitivity levels
Harvest priority	Test oldest first, youngest first, and random harvest rules.
Biodiversity - Draft BEO	Reduce old seral definition by 20 and 40 years
Biodiversity - Draft BEO	Maintain old-seral requirement only and 1/3 old target in low.
Biodiversity - Draft BEO	Do not grow non -contributing (static approach)
Biodiversity - Draft BEO	Do not grow non -contributing (static approach) and reduce old seral age by 20 and 40 years
Biodiversity - Draft BEO	Apply landscape biodiversity “proportional representation” rule.
Biodiversity - Draft BEO	Apply landscape biodiversity Mature + Old
Residual volumes within cutblocks	Reduce to 1% and increase to 5.4%.
AAC by Operating Area	Test AAC by licensee and small business operating areas.
Draft VQO	Apply retention and partial retention requirements.
Mule deer winter range	Remove requirement.
Mule deer winter range	Increase forest cover requirements to 35 % then to 55 % and 121 + years at MELP watershed level
Mule deer winter range	Increase forest cover requirements to 35 % then to 55 % and 121 + years at forest cover polygon level or 250 ha square grid
ECA constraints	Test ECA (% derived from IWAP). Apply to individual IRM watersheds - green up height 6 m and maximum area < green up 30%.

(continued)

7. Sensitivity Analyses

Table 22. *Uncertainties specific to the Boundary TSA (concluded)*

Issue to be tested	Potential sensitivity levels
NDT 4 (fire maintained ecosystem restoration)	Remove predicted open range from THLB
NDT 4 (fire maintained ecosystem restoration)	Reduce stocking class/crown closure for predicted open forest
Grizzly bear access management	Test access management strategy at 5 years and at 20 years
Grizzly bear access management	Test seasonal harvest restrictions by reducing mature available volumes by 50%.
Anticipated domestic watershed and possible high-value fish streams	Examine impacts of draft domestic watershed guidelines on anticipated domestic watersheds and high-value fish streams.
Forested area contributing to biodiversity	Change definition of forested to exclude basic class 10 (alpine forest) and 12 (non-productive forest)
OAF 2	Increase OAF 2 to 20% and 25% and decrease to 5% to reflect uncertainty about disease losses.

For the *KBLUP Implementation Strategy* sensitivity analysis, about 12% of the timber harvesting land base in the Boundary TSA is considered high emphasis for biodiversity management, 45% intermediate emphasis, and the remaining 43% low emphasis (percentages to be reviewed when the forested area is determined from the inventory). The Boundary TSA biodiversity emphasis management approach is spatially deployed using landscape units and biogeoclimatic subzone as boundaries. The deployment follows that of the recently approved *Kootenay-Boundary Land Use Plan*. The potential sensitivity levels listed in the second column of Table 22 are the currently planned levels; however, these may be altered depending on the outcome of preliminary analysis.

7. Sensitivity Analyses

Table 23. Standard sensitivity analysis

Issue to be tested	Potential sensitivity levels
Minimum harvestable age	± 10 and 20 years
Minimum harvestable age	Culmination age (maximum mean annual growth)
Existing stand yields	$\pm 10\%$
Regenerated stand yields	$\pm 5, 10, 15$ & 20%
Land base changes	$\pm 5 / 10\%$ of mature net operable
Harvest flow	alternatives to base case
Unsalvaged losses	Treat as a percentage of standing inventory
Regeneration delay	± 2 years
Green-up heights	$\pm 1/3$ current green up height
Adjacency approximation	Decrease and increase constraint to check for levels that may have short-term impacts
Biodiversity – biodiversity emphasis options	Apply draft biodiversity options to specific landscape units
Biodiversity - old-seral requirements in low emphasis areas	Apply full requirement immediately (no phase-in of requirements in low emphasis areas)
Biodiversity – early-seral forest cover requirement	Apply
Biodiversity - old/mature-seral requirements	No requirements (to examine impact of requirements)
Old growth site index	Adjustments from paired plot and veteran studies
Unsalvaged losses	$\pm 50\%$