

Fraser Timber Supply Area Timber Supply Review

Data Package

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1. Introduction

The data package for the timber supply review program is an organized, simple and consistent format for supplying the basic inputs required for a 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;
- land-use decisions approved by Cabinet;
- by approved higher level plans under the Forest Practices Code; and
- 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 completing 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 required;
- 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 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 terms of reference.

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.

Table 1. Major forest management considerations

Consideration/issue	Description
Stand and landscape level biodiversity	Forest practices code requirements
Spotted owl management	Modelling of owl management prescriptions
Deer winter range	High value winter range
Community watersheds	Designated community watersheds mapped by district Ministry of Forests staff
Visual quality objectives (VQO)	Revised VQO mapping completed
Protected areas	Several new parks announced as part of the Lower Mainland protected areas strategy
Fraser TSA inventory audit	Mature inventory volumes are overestimated by an average of 23%

3. Inventories

3.1 Background information

List of 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. It is important in the space below to reflect 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.

Table 2. Inventory information

Data	Source	Vintage	Update	Scale
Forest cover	MoF		1996	1: 20 000
Revised VQO mapping	MoF	1996	N/A	1: 20 000
New protected areas	LUCO	1996	N/A	1: 20 000
Community watersheds	MoF	1997	N/A	1: 20 000
Operability mapping	MoF	1997	N/A	1: 20 000
Spotted owl SRMZs	MoF	1996	N/A	1: 20 000
Landscape units (for sensitivity analysis)	MELP	1996	N/A	

Data source and comments:

Age, height and volume adjustment factors will be applied to correct the mature stand volume estimates for the Fraser TSA in this analysis. The results of a 1996 inventory audit indicate that timber volumes per hectare in stands greater than 60 years old are overestimated by an average of about 23%. To correct the overestimated volumes, adjustments will be applied, by inventory type group to the projected stand ages and heights on the inventory file. In addition, volume adjustment factors will be applied, by inventory type group, to account for the difference in the predicted stand volumes that was not attributable to incorrect age and height estimates. The specific age, height and volume adjustment factors to be applied to each inventory type group can be found in the report, *Incorporation of the Inventory Audit in the Fraser Timber Supply Area Timber Supply Review*.

Revised visual quality objective (VQO) codes, spotted owl SRMZs, new protected areas, landscape unit, revised operability mapping and community watershed designations used in the analysis do not appear on the current MoF inventory file. Current VQO information, spotted owl areas, protected areas and revised operability mapping were digitized by Chilliwack Forest District staff and the draft landscape units were digitized by Ministry of Environment, Lands and Parks (MELP) staff. This information was then merged with the standard inventory file to produce the inventory file to be used in this analysis. VQO, owl areas, landscape unit, operability and watershed mapping is available in digital format from the Ministry of Forests, Vancouver Forest Regional Office upon request.

4. Division of the Area into Management Zones

4.1 Management zones and tracking of multiple objectives (grouping)

The concept of management zones 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 or wildlife consideration. The forest cover dataset can also be grouped by different variables. 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 with 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."

Table 3. Objectives to be tracked

Objectives	Inventory definition
Level 1 groupings	
Cutblock adjacency only	No VQO assigned
VQO = Retention	VQO code = R
VQO = Retention/partial retention	VQO code = RR
VQO = Partial retention	VQO code = PR
VQO = Partial retention/modification	VQO code = PM
VQO = Modification	VQO code = M
Level 2 groupings	
Spotted owl SRMZs	SRMZs as indicated on spotted owl SRMZ mapping
Community watersheds	Community watershed numbers indicated on mapping
Level 3 groupings	
Deer winter range, draft landscape units	Draft landscape unit number indicated on mapping

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 combination of stands dominated by specific tree species or a silvicultural regime with a set range of timber growing capability — as indicated by the species and site index in the forest inventory file. Each analysis unit is assigned its own timber volume projections for existing and future stands. While it is important for the forest district staff to fill out the following table in order to identify issues to the timber supply analyst, it should be noted that after determining the timber harvesting land base the timber supply analyst will review the amount of area found in specific analysis units, the site index ranges and the similarities between volume estimates to determine the final analysis units definitions in order to best reflect the management regime and the species/site profile of the stands in the TSA.

4. Division of the Area into Management Zones

Table 4. Definition of analysis units

Analysis unit	Criteria	
	Inventory type groups	Site index range ^a (metres)
1 Fir, good site	1 - 8	> 27
2 Fir, medium site	1 - 8	20 through 27
3 Fir, poor site	1 - 8	< 20
4 Cedar, good site	9 - 11	> 25
5 Cedar, medium site	9 - 11	19 through 25
6 Cedar, poor site	9 - 11	< 19
7 Hemlock/balsam, good site	12 - 20	> 21
8 Hemlock/balsam, medium site	12 - 20	14 through 21
9 Hemlock/balsam, poor site	12 - 20	< 14
10 Spruce, good site	21 - 26	>20
11 Spruce, medium site	21 - 26	15 through 20
12 Spruce, poor site	21 - 26	< 15
13 Pine/larch, good site	27 - 31 (inc. Pw)	> 19
14 Pine/larch, medium site	27 - 31 (inc. Pw)	16 through 19
15 Pine/larch, poor site	27 - 31 (inc. Pw)	< 16.
16 Alder	37 - 38	all sites
17 Maple	39	all sites

(a) Reference age 50 years.

Data source and comments:

The site index ranges used to separate stands of each leading tree species into good, medium and poor site analysis units were determined by natural breaks in the distribution of area by site index for each species, summarized from the current forest inventory file.

5. Timber Harvesting Land Base Definition

5.1 Identification of the timber harvesting land base

The timber harvesting land base for the 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 principle 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;
- it is unavailable for timber harvesting.

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 addition of productive forest land (e.g., timber licence reversions).

The timber harvesting land base for the TSA is determined by separating out the categories of area which do not contribute to timber harvesting in the area. The classification 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 the area will be subject to stringent constraints.

After all areas that do not contribute to the timber harvesting land base have been identified, any additional lands are added to the land base. 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. Areas with all other ownership codes will be removed from the land base considered available for timber supply. Ownership code 70N, timber licence land in a TSA is considered under Section 5.2.12, "Timber licence reversions."

5.2.2 Land classified as non-forest

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

5.2.3 Non-commercial cover

Type identity 5 represents those areas which were inventoried to have non-commercial brush species growing on them. These areas are considered to be unlikely sites for timber production.

5. Timber Harvesting Land Base Definition

5.2.4 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 categories: 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.

In the context of timber supply analysis, ESAs may result in a reduction in the harvesting opportunity on these sites. Two possible 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 should only deal with those areas in which harvesting will not occur.

Table 5. Description of environmentally sensitive areas

ESA category	ESA description	Reduction per cent (%)
S1	Highly sensitive soils	90
A1	Avalanche hazard	100
P1	Severe regeneration problems	100

Data source and comments:

The removal of S2 areas (moderately sensitive soils) was also considered. However, exclusions for other factors (low site productivity, inoperable areas etc.) already exclude almost all of the S2 area. Given that some timber harvesting does occur on S2 areas, a decision was made to retain the remaining S2 areas as part of the timber harvesting land base.

Wildlife habitat requirements are modelled using forest cover requirements rather than area exclusions (see Section 6.4.1, "Objectives which require forest cover requirements.")

5.2.5 Areas with high recreation values

Recreation areas such as campgrounds, trails and lookout sites are identified in the inventory file through the recreation feature significance and recreation management code variables. Recreation management codes are more current and are used instead of ESA designations for the purpose of excluding areas with high recreation value. Areas with a recreation management class code of '0' are those areas such as established campsites that have very high, identified recreation values.

5. Timber Harvesting Land Base Definition

Table 6. Description of areas with high recreation values

Recreation management class code	Recreation value description	Reduction per cent (%)
0	High recreation value	100

Data source and comments:

Areas with a recreation management class code of '1' are predominantly visually sensitive areas in which harvesting is expected to occur. These areas are dealt with in the analysis by applying forest cover requirements rather than excluding the areas from the timber harvesting land base (see Section 6.4.1, "Objectives which require forest cover requirements.")

5.2.6 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 7. Description of inoperable areas

Inventory description	Code	Reduction per cent (%)
Inoperable	I	100

Data source and comments:

Revised operability mapping resulting from a recent review of the operability lines were digitized and added to the current forest inventory file. The effect that future changes in operability mapping may have on the timber supply forecast will be tested in sensitivity analyses.

5.2.7 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.

5. Timber Harvesting Land Base Definition

Table 8. Description of sites with low timber growing potential

Species	Characteristics	Reduction per cent (%)
Fir	Existing volume less than 350 m ³ /hectare and SI _{BHA50} less than 16 metres (projected not to produce 350 m ³ /hectare by age 150 years). In heli-log areas (operability = 'H') volume and SI criteria will be based on achieving 400 m ³ /hectare.	100
Cedar	Existing volume less than 350 m ³ /hectare and SI _{BHA50} less than 13 metres (projected not to produce 350 m ³ /hectare by age 150 years). In heli-log areas (operability = 'H') volume and SI criteria will be based on achieving 400 m ³ /hectare.	100
Hemlock/balsam	Existing volume less than 350 m ³ /hectare and SI _{BHA50} less than 11 metres (projected not to produce 350 m ³ /hectare by age 150 years). In heli-log areas (operability = 'H') volume and SI criteria will be based on achieving 400 m ³ /hectare.	100
White spruce (FIZ D)	Existing volume less than 300 m ³ /hectare and SI _{BHA50} less than 11 metres (projected not to produce 300 m ³ /hectare by age 150 years).	100
Sitka spruce (FIZ A, B, C)	Existing volume less than 350 m ³ /hectare and SI _{BHA50} less than 6 metres (projected not to produce 350 m ³ /hectare by age 150 years). In heli-log areas (operability = 'H') volume and SI criteria will be based on achieving 400 m ³ /hectare.	100
Pine	Existing volume less than 300 m ³ /hectare and SI _{BHA50} less than 13 metres (projected not to produce 300 m ³ /hectare by age 120 years).	100
Alder	Existing volume less than 150 m ³ /hectare.	100
Maple (used for sensitivity analysis only)	Existing volume less than 150 m ³ /hectare.	100

5. Timber Harvesting Land Base Definition

Data source and comments:

All areas with an activity code of 'L' (logging history) or those stands that currently have more than the required existing volume (indicated in the above table by leading species type) will be retained in the timber harvesting land base regardless of site index. Volumes and site indices used for the purpose of this exclusion will be values calculated after correcting the age, height and volume figures on the inventory file, as recommended through the Fraser TSA inventory audit process. No age criteria is applied to alder and maple stands. Historically, these stands have only been harvested through temporary tenures of relatively short duration. Unless a stand of these types has an existing timber volume that is high enough to be harvested in the short term, it is excluded from the timber harvesting land base. The rate of harvest that can be achieved from alder and maple stands over the short term will be tested in the timber supply analysis.

5.2.8 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.

Table 9. Problem forest types criteria

Leading species	Inventory type group	Reduction per cent (%)
Cottonwood	35, 36	100
Aspen, birch	40, 41, 42	100

Data source and comments:

Cottonwood, birch and aspen leading stands are not currently utilized in the Fraser TSA.

5.2.9 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 percentages 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.

5. Timber Harvesting Land Base Definition

Table 10. Estimates for existing and future roads, trails, and landings

Location	Age class	Road length	Road width	Reduction area (hectares) or per cent
Existing RTLs				
Roads	1 to 6	7500	15	11 250 hectares
Trails, landings	1 to 6			3 400 hectares
Future RTLs				
Roads, trails, landings	7 - 9			1%

Data source and comments:

Existing roads reductions are based on an estimated length of road (Forest Service, road permit, and non-status roads) in the Fraser TSA of 7500 kilometres and an average right of way width of 15 metres, for a total estimated road area of 11 250 hectares. The estimated length of forest road in the TSA was derived by Chilliwack Forest District staff from road lengths shown on current forest inventory maps. An additional 3400 hectares is added to the estimate to account for existing landings and trails not shown on the inventory maps.

Due to the long history of timber harvesting in the area, the Fraser TSA is almost completely roaded (estimated at about 96.5% by Chilliwack Forest District staff). If the per cent reduction for existing roads is applied to the 3.5% (approximately) of the TSA that is not roaded, the total additional reduction from the timber harvesting land base for future roads is 1% of the older age classes.

5.2.10 Riparian reserve zones

In order to account for riparian reserve zones the timber harvesting land base will be reduced by 4.8%. This figure is based on coastal average figures for stream length by stream class, estimated in a 1994 study completed by Wild Stone Resources and the riparian reserve width specifications for each stream class found in the *Riparian Management Area Guidebook*. The per cent area excluded from the timber harvesting land base is calculated by multiplying the specified reserve width for each stream class by the lengths of stream of each class found on the cutblocks sampled (92 coastal cutblocks), then dividing by the total area of cutblocks sampled. The information to be used in the analysis to capture the effect on timber supply from the riparian management zone is dealt with in Section 6.4.2, "Riparian management zones (RMZ)."

5.2.11 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.

5. Timber Harvesting Land Base Definition

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

Table 11. *Exclusion of specific, geographically defined areas*

Identifying inventory variables (location descriptors)	Excluded area (hectares)
Mehatl Creek Protected Area (P.A.) (on new PAS mapping)	All
Liumchen P.A. (on new PAS mapping)	All
Chilliwack Lake P.A. (on new PAS mapping)	All
Mystic Lake P.A. (on new PAS mapping)	All
Nahatlatch P.A. (on new PAS mapping)	All
Sumas Mountain P.A. (on new PAS mapping)	All
Yale/Garry Oak P.A. (on new PAS mapping)	All

Data source and comments:

The new protected areas identified in the above table have been announced by government, but are still in the process of being officially legislated. If this legislation does not occur before the timber supply model is set up for the Fraser TSA, the exclusion of the new protected areas will not form part of the base case, but the effect of these announced new parks on the timber supply forecast will be examined in a sensitivity analysis.

Pinecone-Burke Mountain and Indian Arm Parks are already accounted for on the forest inventory and are excluded from the timber harvesting land base by the ownership code criteria shown in Section 5.2.1, "Land not administered by the British Columbia Forest Service for timber supply purposes."

5.2.12 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 attain free-growing status, the timber licence 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 supply.

Timber licence areas need to be accounted for from the time the stands have been harvested, and/or from the time stands are estimated to be harvested. Time of harvest is used as the reference point so that 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 70-N to 62-C). These reversions should be included in the following table.

5. Timber Harvesting Land Base Definition

Table 12. Timber licence reversion schedule

Area of timber licences (TL) harvested (hectares) (year of harvest)		
1997-2001	2002-2006	2007-2011
1/3 of unharvested TL area	1/3 of unharvested TL area	1/3 of unharvested TL area

Data source and comments:

One-third of the area of the timber harvesting land base that is in currently unharvested timber licences (defined as age class 7, 8 and 9 stands that are ownership code 70N on the inventory file) is assumed to revert to the TSA in each of the five-year periods identified in the above table. Timber licence areas that are younger than age class 7 are assumed to have already been harvested and reverted for the purpose of this analysis.

Timber licence areas are initially assigned to "groups" and analysis units (see Tables 3 and 4) in the same way as the rest of the land base. When a timber licence area reverts it will remain in the same groups and analysis units that it is initially assigned to.

6. Current Forest Management Assumptions

6.1 Harvesting

6.1.1 Utilization levels

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

Table 13. Utilization levels

Leading species	Utilization		
	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
Pine/larch	12.5	30	10
Interior spruce	12.5	30	10
All others	17.5	30	10

Data source and comments:

Table 13 reflects current regional utilization standards, licence requirements and current performance.

6.1.2 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 be not be harvested until past the minimum timber production ages because management of other resource values take precedence (e.g., requirements for the retention of older forest).

6. Current Forest Management Assumptions

Table 14. Minimum harvestable age criteria

Analysis unit	Estimated age to reach required average stand volume		Estimated age for 250 biggest stems to reach 30 cm	Estimated minimum harvestable age (years)	MAI (m ³ /hectare/year) and age (years) at culmination (regen. stands)
	Age (years)	Minimum volume (m ³ /hectare)			
1 Fir, good site	50	350	40	50	9.0 @ age 75
2 Fir, medium site	70	350	55	70	5.4 @ age 85
3 Fir, poor site	155	350	125	105	2.1 @ age 105
4 Cedar, good site	N/A	N/A	N/A	70	12.6 @ age 95
5 Cedar, medium site	N/A	N/A	N/A	80	7.4 @ age 120
6 Cedar, poor site	N/A	N/A	N/A	95	3.1 @ age 110
7 Hemlock/balsam, good site	45	350	50	50	9.6 @ age 90
8 Hemlock/balsam, medium site	90	350	90	90	3.8 @ age 135
9 Hemlock/balsam, poor site		350			
10 Sitka spruce, good site	N/A	N/A	N/A	40	32.2 @ age 40
11 Interior spruce, medium site	70	300	75	75	4.4 @ age 90
12 Interior spruce, poor site		300			
13 Pine/larch, good site	80	300	70	60	4.7 @ age 60
14 Pine/larch, medium site	100	300	95	75	3.4 @ age 75
15 Pine/larch, poor site	N/A	300	210	125	1.7 @ age 125
16 Alder – all sites		150		40	
17 Maple – all sites		150		40	

6. Current Forest Management Assumptions

Data source and comments:

Minimum harvestable ages for cedar stands will be set at the age at which the estimated growth rate of the stand is within 5% of the culmination (maximum) of mean annual increment (MAI). The reason that minimum harvestable ages for cedar are set using different criteria than is used for other stands is that cedar is not expected to be merchantable at the ages that are indicated if only the minimum volume/piece size criteria are used (i.e., little clear wood and poor decay resistance at young ages).

For all analysis units, minimum harvestable ages are based on managed stands growth and yield estimates. No minimum harvestable age for any analysis unit will be less than 40 years. Estimated minimum harvestable ages may be subject to change once the timber harvesting land base has been finalized, and the productivity of stands included in the timber harvesting land base determined.

6.1.3 Silvicultural systems

The majority of the TSA will be harvested utilizing clearcut harvesting methods. The area that is expected to be harvested using a selection system is not expected to be a large proportion of the overall TSA area (primarily in some areas of spotted owl habitat). Therefore, silvicultural system is not expected to be a significant issue affecting the overall TSA timber supply and is not factored into the timber supply analysis.

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 over the long term on the timber harvesting land base. The unsalvaged loss column only reflects those areas in which the volume will not be recovered or salvaged.

Table 15. Unsalvaged losses

Cause of loss	Total loss (m ³ /year)	Annual unsalvaged loss (m ³ /year)
Fire	17 000	15 925
Wind damage	31 500	2 500
Total	48 500	18 425

Data source and comments:

Wind Damage

Based on the *1992 Insect and Disease Report* the average area lost to wind damage is 90 hectares per year. The average volume is 350 cubic metres per hectare thus, the total projected volume loss is 31 500 cubic metres. On average about 29 000 cubic metres per year is salvaged, therefore the unsalvaged losses attributed to wind is 2500 cubic metres per year.

6. Current Forest Management Assumptions

Fire

TSA average area burned in the last 10 years as a result of fire is 130 hectares per year of productive forest. It is assumed that at least 50% (65 hectares) of the area burned is operable timber and the average volume is estimated at 350 cubic metres per hectare. Thus, the total volume lost due to fire is estimated at 22 750 cubic metres. About 30% of burned areas are salvaged each year, therefore the net annual unsalvaged loss due to fire is 15 925 cubic metres per year.

The total unsalvaged loss for the Fraser TSA is 18 425 cubic metres per year. No other losses are projected for insect or disease as they do not represent any significant problem in this TSA.

6.3 Silviculture

6.3.1 Regeneration activities in managed stands

Recent plantations and future stands will be grown on managed stand yield tables (MSYTs) produced using the Forest Service table interpolation program for stand yields (TIPSY) growth and yield model. The table below contains the inputs required to produce MSYTs for this analysis. 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 16. Regeneration assumptions by analysis unit

Analysis unit	Regen delay	OAFs		Method		Species		Density
		1	2	Type	%	Code	%	
1 Fir, good site	2	15	5	Plant	100	Fd	100	1200
2 Fir, medium site	2	15	5	Plant	100	Fd	100	1200
3 Fir, poor site	3	15	5	Plant	100	Fd	100	1200
4 Cedar, good site	2	15	5	Plant	100	Cw	100	1200
5 Cedar, medium site	2	15	5	Plant	100	Cw	100	1200
6 Cedar, poor site	3	15	5	Plant	100	Cw	100	1200
7 Hemlock/balsam, good site	2	15	5	Plant/natural	100	Hw	100	1200
8 Hemlock/balsam, medium site	3	15	5	Plant/natural	100	Hw	100	1200
9 Hemlock/balsam, poor site	4	15	5	Plant/natural	100	Hw	100	1200
10 Spruce, good site	3	15	5	Plant	100	S	100	1200
11 Spruce, medium site	3	15	5	Plant	100	S	100	1200
12 Spruce, poor site	3	15	5	Plant	100	S	100	1200
13 Pine/larch, good site	2	15	5	Plant	100	PI	100	1200
14 Pine/larch, medium site	2	15	5	Plant	100	PI	100	1200
15 Pine/larch, poor site	3	15	5	Plant	100	PI	100	1200
16 Alder	2	15	5	Plant	100	Fd Dr	75 25	1200
17 Maple	2	15	5	Plant	100	Fd Mb	75 25	1200

Data source and comments:

All stands are assumed to have their density controlled by free-to-grow, whether planted or natural regeneration is used. Therefore, yield curves for all regenerated stands will be based on planted stands. Operational adjustment factors (OAFs) applied to the managed stand yield curves are as recommended by MoF, Research Branch. The values in the above table are based on current performance as estimated by Forest District staff. The silviculture records system (ISIS) has recently been updated and the forest district is utilizing this system to do a more detailed analysis to confirm the values shown. Any changes required as a result of the ISIS work will be completed before the timber supply analysis is started.

6. Current Forest Management Assumptions

6.3.2 Immature plantation history

The purpose of this section is to identify areas of existing immature forest where the density (stems per hectare) was controlled and therefore should be assigned to a managed stand yield curve (TIPSY).

Table 17. Immature plantation history

Analysis unit	Area managed (%)		
	Age 1-10	Age 11-20	Age 21-30
All Douglas-fir	100	100	100
All hemlock/balsam	100	100	
All cedar	100		
All pine/larch	100		
All spruce	100		

Data source and comments:

The proportion of immature stands that are considered "managed" is based on the best professional estimate of forest district silviculture staff. Douglas-fir stands less than 30 years old and hemlock leading stands less than 20 years old are considered to be "managed" stands due to the longer history of management (control of density at establishment and through stand tending) in these stands. In stands with leading species other than Douglas-fir or hemlock, only those stands established within the last 10 years have had a similar level of density management.

6.3.3 Not satisfactorily restocked (NSR) areas

Land classified in the TSA inventory file as type identity 4 or 9 is included in the current timber harvesting land base. These type identities indicate not satisfactorily restocked 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. If the figures provided in this table (usually from forest district silviculture records) differ from the NSR area showing on the inventory file, the figures in this table will be prorated to match the inventory file NSR total area.

6. Current Forest Management Assumptions

Table 18. Not satisfactorily restocked (NSR) areas

Analysis unit	Area (hectares)	Hectares of NSR restocked during the first decade	
		Already restocked	1 – 10
1 Fir, good site	961	538	423
2 Fir, medium site	681	381	300
3 Fir, poor site	2 624	1 469	1 155
4 Cedar, good site	133	74	59
5 Cedar, medium site	91	51	40
6 Cedar, poor site	150	84	66
7 Hemlock/balsam, good site	4 111	2 301	1 810
8 Hemlock/balsam, medium site	2 170	1 215	955
9 Hemlock/balsam, poor site	9 277	5 193	4 084
10 Spruce, good site	145	81	64
11 Spruce, medium site	1 642	919	723
12 Spruce, poor site	660	369	291
13 Pine/larch, good site	72	40	32
14 Pine/larch, medium site	21	12	9
15 Pine/larch, poor site	125	70	55
16 Alder	55	31	24
17 Maple	26	15	11
Total	22 945	12 844	10 100

Data source and comments:

A total of 22 945 hectares is classified as NSR on the forest inventory. However, ISIS and MLSIS summaries (which are more up-to-date) indicate that only 10 100 hectares of NSR remain to be restocked. The difference between these two figures (12 844 hectares) is assumed to have already been restocked and will be immediately assigned to age group 1 to 10 years in FSSIM.

6. Current Forest Management Assumptions

NSR is restocked in proportion to the current area of each analysis unit in stands less than 20 years old, on the assumption that the last few years harvesting has been in similar stands to those harvested over the last 20 years.

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 may be examined at a number of different levels. These may be considered as layers in GIS terminology. One possible layer may be landscape units, another may be wildlife areas, while another may be 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) may be considered in the forest cover requirements (i.e., maximum allowable disturbance or minimum area retention).

Table 19a. Forest cover requirements

Note: The following forest cover requirements will be applied to each zone or "Level 1 grouping" within each landscape unit (Level 3 grouping). VQO prescriptions will be adjusted to account for the non-contributing forest and to account for the dispersion of excluded areas within the timber harvesting land base.

	Green-up height (metres)	Green-up maximum allowable disturbance (% area)	Minimum older age (years)	Minimum older age retained area (%)
1 IRM (base)	3	25		
2 VQO = R (base)	5	3 (of total forested area)		
3 VQO = R/PR (base)	5	6 (of total forested area)		
4 VQO = PR (base)	5	10 (of total forested area)		
5 VQO = PR/M (base)	5	15 (of total forested area)		
6 VQO = M (base)	5	20 (of total forested area)		

6. Current Forest Management Assumptions

Table 19b. Forest cover requirements

Note: The following forest cover requirements will be applied to areas that fall into each of the "Level 2" groupings within each landscape unit (Level 3 grouping) to model spotted owl management and community watershed guidelines.

	Green-up age	Green-up maximum allowable disturbance (% area)	Minimum older age (years)	Minimum older age retained area (%)
Spotted owl areas			100	67
Community watersheds	5 years	5		

Table 19c. Forest cover requirements

To model deer winter range requirements, the following forest cover requirements will be applied to the timber harvesting land base within each draft landscape unit. These requirements are based on maintaining, in perpetuity, the same amount of area in mature forest stands within each landscape unit that is currently identified as deer winter range. Deer winter range is designated on the inventory file by a 'W' (wildlife) code in the ESA1 field, with a ESA modifier code 'D' (deer). The per cent area in each landscape unit that is maintained at older ages for deer winter range will vary by landscape unit depending on the per cent area that is currently identified for deer winter range and will not be finalized until the size of the timber harvesting land base has been determined. The deer winter range requirements do not specifically utilize the draft landscape units. However ensuring alternative areas of deer winter range are available in the same general location as the existing winter range is a requirement. Landscape units are simply a convenient method of ensuring that, in the modelling process the deer winter range requirements are spread across the land base.

	Green-up height or age (metres)	Green-up maximum allowable disturbance (% area)	Minimum older age (years)	Minimum older age retained area (%)
Deer winter range in each draft landscape units			100	Existing percentage of the timber harvesting land base in deer winter in each landscape unit

6. Current Forest Management Assumptions

Table 19d. Forest cover requirements (concluded)

Note: In order to ensure that the maintenance of older forests is spread out within the TSA the following forest cover requirements will be applied to the draft landscape units (Level 3 grouping). The landscape units are not yet finalized, however, as the draft units are available in digital format they will be utilized as a convenient modelling tool. This does not imply these units are final.

	Green-up height or age (metres)	Green-up maximum allowable disturbance (% area)	Minimum older age (years)	Minimum older age retained area (%)
All draft landscape units			240	13 (of forested area) by analysis unit

Data source and comments:

Visual quality objectives (VQO) have been assigned by Chilliwack Forest District recreation staff. Community watershed guidelines are taken from the *Forest Practices Code Community Watershed Guidebook*. Spotted owl management guidelines have been developed by the Spotted Owl Management Interagency Team and have been approved by government.

Biodiversity guidelines will be modelled using the *Forest Practices Code Biodiversity Guidebook* and the modelling assumptions used in the *Forest Practices Code Timber Supply Analysis*. A low biodiversity emphasis is assumed to apply to all landscape units, as the assignment of biodiversity emphasis options is not complete. It should be noted that as per the guidebook once the timber harvesting land base is finalized the minimum older retained per cent will be adjusted if required to prevent short-term significant economic and social disruption. If this adjustment is necessary a recruitment plan will be put in place to ensure the old-seral objective is in place by the end of three rotations. The modelling process will also ensure the full minimum older retained area will be met by the end of three rotations.

All stand heights shown in Table 19 refer to top heights (inventory definition), not average stand heights.

6.4.2 Riparian management zones (RMZ)

The appropriate method to account for the timber supply implications of riparian management practices within riparian management zones (RMZs) depends upon the management practices applied in these zones (e.g., harvest pattern) and the availability of inventory information (e.g., FPC riparian management area stream classification).

To account for the timber volume that will be left unharvested in riparian management zones, as specified under the *Forest Practices Code Riparian Management Area Guidebook*, all volume over age curves for both existing natural and regenerated stands will be reduced by 4.2%. This assumption is based on average coastal stream density figures for the coast, as were noted in Section 5.2.10, "Riparian reserve zones."

6. Current Forest Management Assumptions

6.4.3 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. It is important to discuss the anticipated persistence of the particular method in different stand types. For instance, 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.

Table 20. Reductions to reflect volume retention in cutblocks for wildlife tree patches

Management zone	Analysis unit	Persistence	Per cent (%) recommended in applicable guidebook	Residual volume estimate on the timber harvesting land base (%)
All	All	Long term	12	3

Data source and comments:

The figure of 3% shown in Table 20 is based on the assumption that only 1/4 of the total requirement of 12% must be provided by the timber harvesting land base after considering areas already excluded for other reasons. The figure of 12% is taken from Table 20B of the *Forest Practices Biodiversity Guidebook* using the assumptions (estimated from inventory file summaries) that about 50% of the forested area of the TSA is harvestable, and that 70% of the area has already been harvested once without recommended wildlife tree retention. These figures may be adjusted once the netdown stage of the analysis is complete and the timber harvesting land base has been more accurately determined.

A volume reduction is used to model wildlife tree patch requirements rather than an area reduction because it is felt to more accurately portray the area upon which harvesting has occurred. For example, a 10 hectare block with 0.3 hectares (3% of the cutblock area) in wildlife tree patches will have the dimensions of a 10 hectare block (i.e., 200 metres by 500 metres), not a 9.7 hectare block that would be assumed using an area reduction.

7. Sensitivity Analyses to be Performed

Sensitivity analysis provides a measure of the timber supply impact for those factors in which 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 that are carried out in all TSAs.

Table 21. *Sensitivity issues specific to the Fraser TSA*

Issue to be tested	Sensitivity levels
Inventory audit inventory file adjustments	Will test sensitivity of using regression rather than ratio method for making adjustments to stand attributes. Also, will test the confidence interval limits of the audit ratio.
Sensitivity to increasing the proportion of the harvest from second growth stands (harvest scheduling priorities)	The Chilliwack Forest District is currently working on a second-growth harvesting strategy.
Sensitivity to deer winter range prescriptions	

7. Sensitivity Analyses to be Performed

Table 22. Standard sensitivity issues

Issue to be tested	Sensitivity levels
Minimum harvestable age	10 years
Existing stand yields	5%, 10% and at the confidence limits of the inventory audit.
Regenerated stand yields	5% to 20%
Site index estimate for older stands	20%
Age when forest achieves "old" forest characteristics	50 years
Land base changes	10%
Visual quality objectives (area in stands below VEG)	5% change
Years to visually effective green-up (VEG)	20%
Harvest flow alternatives	
Green-up periods	10%
Adjacency and green-up guidelines	5% area "not greened-up" 10% faster "green-up"
Sensitivity to landscape level biodiversity requirements	Test effect of a distribution of low, medium and high biodiversity emphasis options (45%, 45%, 10% respectively)