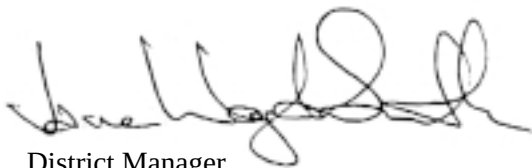


Cassiar Timber Supply Area Timber Supply Review

Data Package

November 1999

A handwritten signature in black ink, appearing to read 'D. H. S. S.', written in a cursive style.

District Manager
Bulkley/Cassiar Forest District

A handwritten signature in black ink, appearing to read 'G. F. Townsend', written in a cursive style.

Director
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1. Introduction

This data package outlines the basic information and assumptions that are required for the Cassiar 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;
- the standards used to approve or reject forest development (5-year development) plans;
- fully implemented land-use plans;
- 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". Due to the lack of harvesting history and demonstrated practice in the Cassiar TSA, it is difficult to model current management practices. This data package, therefore, reflects management objectives, standards and guidelines that would be implemented if harvesting was proposed and did take place. 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. A data table; and
3. A discussion of data sources 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 in some of the tables. In these cases, only the criteria are shown, and the columns for the missing values are shaded grey. In addition, if any major changes to management objectives, standards and guidelines occur over the next few months, an attempt will be made to incorporate them into the timber supply analysis. The final timber supply analysis report will include a technical appendix that highlights any changes made to this package. Section 7, "Critical Issues and Sensitivity Analyses," identifies areas of uncertainty with respect to the data and assumptions and outlines intended sensitivity analyses.

2. Current Forest Management Considerations and Issues

2.1 Base case management assumptions

The assumptions described in the following sections reflect current performance with respect to the status of forest land, forest management practices and knowledge of timber growth and yield. A base case harvest forecast will be developed using these assumptions, and will be a baseline for assessing the impacts of uncertainty with respect to the assumptions.

2.2 Major forest management considerations and issues

The major forest management issues and considerations in the Cassiar TSA are listed in the table below. Where issues are defined within legislation, regulations or standards, they will be included in the timber supply analysis. In cases of important uncertainties in defining current management, critical issues analysis may be done. Also, it may be difficult to quantify some issues for computer modelling, in which case sensitivity analysis may assist in assessing the timber supply implications and assigning degrees of risk to timber supply during allowable annual cut determination.

Because there is currently little harvesting activity in the Cassiar TSA, this timber supply analysis is focused on addressing several key issues identified by the chief forester in his last AAC determination as contributing to uncertainty in timber supply. Elements of this data package not related to those key issues are based on the data package for the last Timber Supply Review (TSR). The key issues are:

- size of the timber harvesting land base as determined by conventional (ground-based) harvesting methods;
- site productivity;
- northern growing conditions;
- forest cover requirements for wildlife habitat;
- green-up for cutblock adjacency;
- riparian habitat; and,
- unsalvaged losses due to fire, insects and disease.

Timber supply analysis will be focused on updating the base case for these key issues. A few key sensitivity analyses and critical issue analyses will be conducted, but not the full range usually done for TSRs.

2. Current Forest Management Considerations and Issues

Table 1. Major forest management considerations

Consideration/issue	Description
Timber harvesting land base*	The timber harvesting land base for the last TSR included stands harvestable by conventional (ground-based) and non-conventional (cable, helicopter) means. For this analysis, only those stands harvestable by conventional means, that are within an operable corridor establishing the limits of accessibility and economic viability, will be included. A sensitivity analysis will examine the impact of reducing or increasing the size of the timber harvesting land base.
Site productivity*	Site index is believed to be incorrectly defined for regenerated stands in certain biogeoclimatic (BEC) variants. Site indices using the SIBEC database will be examined through a critical issue analysis. See Sections 6.3.1 and 7.
Northern growing conditions*	See data source and comments below.
Wildlife*	Forest cover requirements for newly mapped high value habitat areas will be applied in the base case.
Green-up for cutblock adjacency*	A 3-pass, 3 metre green-up will be modelled to represent cutblock adjacency requirements.
Riparian habitat*	Riparian management area requirements of the Forest Practices Code will be incorporated.
Unsalvaged losses*	Revised estimates for unsalvaged losses from fire will be included in the analysis. As well, the analysis will account for unsalvaged losses due to insects.
Cassiar Iskut-Stikine Land and Resource Management Plan (LRMP)	The LRMP is incomplete and therefore, will not be included in the base case harvest forecast. A critical issue analysis will examine the impact to timber supply from proposed LRMP land use zones, including proposed Protected Areas, if these become available.
TSA boundary change	A TSA boundary change process is underway which, on approval through order-in-council (OIC), will pass administrative control of the Muskwa-Kechika Area (currently in the Cassiar TSA) to the Fort Nelson Forest District. The Fort Nelson LRMP, approved in October 1997, provides management strategies for this area even though it is part of the Cassiar TSA. These management strategies will be included in the base case for the Cassiar TSR. Because the boundary change may be approved before an AAC is determined, a critical issue analysis is necessary to determine the impact on timber supply of removing this area from the Cassiar TSA.
Recently protected areas	Several areas within the Muskwa-Kechika Area have become Provincial Parks as a result of the Fort Nelson LRMP. These areas will be removed from the timber harvesting land base.
Landscape-level biodiversity	The landscape-level biodiversity requirements of the Forest Practices Code will be addressed in the analysis through application of higher wildlife tree patch requirements. See Section 6.4.1, "Forest cover requirements."

continued

Items marked with an * were identified by the Chief Forester as critical issues in his last AAC Determination for the Cassiar TSA.

2. Current Forest Management Considerations and Issues

Table 1. Major forest management considerations (concluded)

Consideration/issue	Description
Stand-level biodiversity	The wildlife tree requirements of the <i>Biodiversity Guidebook</i> will be incorporated.
Visual quality	Visual quality objectives (VQO) have not been approved for the Cassiar TSA. To account for visual quality, a land base withdrawal will be made along Highway 37 consistent with the 1994 (TSR 1) analysis. See Section 5.2.12, "Visual quality management."
Cassiar TSA inventory audit	The audit results will be examined through a critical issue analysis. See Section 7.
Pulp-quality stands	The timber profile for the Cassiar TSA includes a significant component of pulp-quality stands, which have not been historically harvested. A critical issue analysis will address the impact of removing pulp-quality stands from the timber harvesting land base. See Section 7.

Items marked with an * were identified by the Chief Forester as critical issues in his last AAC Determination for the Cassiar TSA.

Data source and comments:

In his last AAC determination, the Chief Forester identified that the analysis had overestimated site productivity for stands on immature poor and medium sites for spruce, subalpine fir and hemlock. Since then, staff from the Prince Rupert Forest Region research and inventory sections, and the Research and Forest Practices branches have developed an ecosystem-based process for estimating site indices that more closely reflect site productivity. It is now believed that site productivity is actually underestimated. A critical issue analysis will examine the potential timber supply implications of uncertainty about site productivity.

The issue of northern growing conditions that the Chief Forester identified in his last AAC determination proved to be less critical than was originally believed. Operational adjustment factors (OAFs) for regenerated stand yield curves were increased in the last TSR to account for unique northern conditions, such as a short growing season, severe climate and soil limitations. This issue was investigated by the Regional Growth and Yield Forester and by the Regional Research Silviculturalist. They concluded that a short growing season would be offset by longer daylight hours, and that the climate and soil conditions would be reflected in the site index of the growing sites. Thus, there is no reason to adjust (OAFs) for northern growing conditions.

In the last AAC determination, the estimated times to reach green-up heights for spruce, subalpine fir and hemlock were believed to be underestimated. Recent information shows that the stands examined were actually suppressed, and thus were not fully utilizing the potential of the site. This suppression was confirmed by a study for spruce (*Juvenile Height Development in Interior Spruce Stands of British Columbia*, by Gordon Nigh and Bobby Love). When harvested, these stands will produce trees that can fully utilize the site, and grow at faster rates than those stands that were suppressed on the same site. Therefore, no adjustments are necessary in this analysis for expected time to reach green-up.

3. Inventories

3.1 Background information

The following inventories will be used to determine the timber harvesting land base and represent forest management activities.

Table 2. Inventory information

Data	Vintage	Update	Scale
Biogeoclimatic units	1995	—	1:250 000
Forest cover	1970	1993	1:20 000
TRIM planimetric base/contours	1995	—	1:20 000
Fort Nelson LRMP land use zones, including protected areas	1995	—	1:50 000
Cassiar Iskut-Stikine (CIS) LRMP boundary	1997	—	1:500 000
Draft CIS LRMP resource management zones	1998	—	1:250 000
Existing protected areas	1997	—	1:250 000
Draft landscape units	1993	1997	1:50 000
Timber feasibility mapping for CIS LRMP	1998	—	1:400 000
Accessible corridor for CIS LRMP area	1998	—	1:400 000
Operable corridor (outside the CIS LRMP)	1999	—	1:500 000
Existing land use zones (Lower Stikine Management Plan)	1997	—	1:500 000
Visual corridor along Highway 37	1999	—	1:20 000
High value habitat mapping for ungulates and grizzly bear	1999	—	1:400 000
Riparian mapping	1998	—	1:20 000
Community watersheds	1980	—	1:50 000
Agriculture land reserves	1996	—	1:50 000

Data source and comments:

Biogeoclimatic units — used to define analysis units and allow examination of landscape-level biodiversity.

Forest cover — the last complete update was in 1985. Maps with recent harvesting, silviculture activities and major wildfires were last updated in 1993. Some of the forest cover has been spatially shifted from a NAD27 to a NAD83 base, and the forest inventory files will be projected for growth and aging to 1999.

TRIM planimetric base/contours — used to create slope-class coverage to allow removal of stands on slopes exceeding 35% from the timber harvesting land base, per Section 5.2.5, "Areas considered inoperable."

Fort Nelson LRMP land use zones, including protected areas — included to accommodate possible removal of Muskwa-Kechika if OIC for boundary change occurs before the analysis, and also to model forest management requirements from the Fort Nelson LRMP.

3. Inventories

CIS LRMP boundary, Draft CIS LRMP resource management zones — included to aid in defining and running land base sensitivity analyses.

Existing protected areas — areas not currently included on forest cover maps.

Draft landscape units — included to allow application of forest cover requirements at the landscape unit level. They are based on 1:50 000 scale watershed boundary mapping available in the *Watershed Atlas*.

Timber Feasibility Mapping/Accessible corridor for CIS LRMP — a geographic information system (GIS) overlay depicting areas highly feasible for harvest by ground-based systems.

Operable corridor — for Cassiar TSA outside the CIS LRMP area, a GIS coverage of an operable corridor was produced.

Existing land use zones — used to identify areas with existing land use designations where forest cover requirements may be applied. The Lower Stikine Management Plan contains details of the only approved land use zones in the TSA. The CIS LRMP will supercede the Lower Stikine Management Plan.

Visual corridor on Highway 37 — used in the absence of approved VQOs to approximate the most visually sensitive areas within the Cassiar TSA.

High-value habitat mapping — environmentally sensitive area (Ew) mapping is present for only part of the TSA. Within the Cassiar TSA, high-value habitat maps were generated for moose, grizzly bear, caribou and goat, using biophysical habitat and terrestrial ecosystem maps. These high-value habitat areas were used as Ew replacements.

Riparian mapping — spatially mapped buffers in all CIS LRMP area mapsheets were used to determine a proportional land base reduction across biogeoclimatic variants for the entire Cassiar TSA.

Community watersheds — one registered community watershed services the community of Telegraph Creek. It is included because there are forest cover requirements associated with forest management in community watersheds.

4. Division of the Area into Management Zones

4.1 Management zones, groups and objectives

Management zones are used to differentiate areas with distinct management emphasis and homogenous forest cover. For example, a zone may be based on a harvesting or 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 analyst will decide whether to put an objective into a group or a mutually exclusive management zone after data assessment. In addition, for some objectives, the role of forest land that is unavailable for timber harvesting may be considered when evaluating forest cover objectives.

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
Community watersheds	Non-standard mapped layer
Harvest levels by supply block	Timber supply block
Critical wildlife habitat	Non-standard mapped layer
Green-up for cutblock adjacency	Areas not subject to other specific objectives
LRMP management zones	Non-standard mapped layer

Data source and comments:

Because the Cassiar Iskut-Stikine LRMP process is ongoing, the management zones are unknown at this time. We will use the information in the analysis if possible, when it becomes available. The LRMP Table is expected to make a decision on the zones by early 2000.

4.2 Analysis units

An analysis unit is composed of forest stands with specified tree species composition, timber growing capability and treatment regimes. Each analysis unit is assigned its own timber volume projections (yield tables) for existing and future stands.

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

The following table lists the draft analysis units to be used for existing stands.

4. Division of the Area into Management Zones

Table 4. Definition of analysis units

Mature stand analysis units	Criteria	
	Inventory type groups	Site index range (m @ 50 years)
Analysis units — coastal/transitional		
1 Spruce — good	21-26	
2 Spruce — medium	21-26	
3 Spruce — poor	21-26	
4 Pine — G	28-31	
5 Pine — M	28-31	
6 Pine — P	28-31	
7 Balsam — G	18-20	
8 Balsam — M	18-20	
9 Balsam — P	18-20	
10 Hemlock — G	12-17	
11 Hemlock — M	12-17	
12 Hemlock — P	12-17	
13 Cedar	9-11	
Analysis units — interior		
21 Spruce — G	21, 23-26	
22 Spruce — M	21, 23-26	
23 Spruce — P	21, 23-26	
24 Pine — G	28, 30, 31	
25 Pine — M	28, 30, 31	
26 Pine — P	28, 30, 31	
27 Balsam — G	18-20	
28 Balsam — M	18-20	
29 Balsam — P	18-20	

4. Division of the Area into Management Zones

Data source and comments:

The Cassiar TSA can be divided into a coastal/transitional area and an interior area, based on biogeoclimatic ecosystem classification (BEC) zone boundaries. This breakdown will reduce the variability around analysis unit yield curves related to different climatic conditions. The coastal/transitional area incorporates the CWH, ESSF, ICH, SBS, and MH zones, while the interior area incorporates the BWBS and SWB zones.

Once a data set is available, the distribution of area by site index will be produced for each leading species. The site index criteria for each analysis unit in Table 4 will be determined as follows:

- use site index 10 as the lower boundary of the poor site class;
- use the maximum site index from the distribution as the upper limit of the good site class, excluding outliers;
- divide the site index range from 10 to the upper limit into three equal pieces, rounding the class boundaries to the nearest whole number.

The timber supply analyst may group the analysis units where yield curves are similar, or if the area in an analysis unit is very small.

5. Timber Harvesting Land Base Definition

5.1 Identification of the timber harvesting land base

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

- it is not administered by the B.C. Forest Service for timber supply (e.g., private land, parks, etc.);
- it is not suitable for timber production or harvesting; or
- 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); or
- by the acquisition of productive forest land (e.g., timber license reversions).

The classification of "unavailable for timber harvesting" applies only to land where no harvesting is anticipated to occur. Any area in which some timber harvesting will occur remains in the timber harvesting land base, even if the area will be subject to stringent constraints. Any such constraints will be represented in the timber supply analysis.

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 forested land base is defined as the "current timber harvesting land base" for the Cassiar TSA.

5.2 Details on land base classification

5.2.1 Land not administered by the B.C. Forest Service for timber supply

Ownership codes are used to broadly identify whether land can be considered to contribute to timber supply. Generally, only ownership codes 62C and 69C contribute to TSA timber supply. These codes indicate crown land in a forest management unit and miscellaneous reserves respectively. However, since ownership in the forest cover inventory is not up to date for Provincial Parks, the parks were added to the database in a separate layer and were assigned a timber supply block code of 99Z. Timber Supply Block code 99Z and all ownerships other than 62C and 69C will be removed from the land base considered to contribute to timber supply.

5.2.2 Land classified as non-forest

Areas with projected type identity 6 are non-forested, and areas with projected type identity 8 have no typing available. These categories include alpine areas, rock and ice, lakes, swamps and rivers, all of which do not contribute to timber supply and are therefore excluded from the area considered available for timber harvesting. However, some of these areas, such as alpine forests, may contribute to forest cover requirements. Forest classified as non-productive will be evaluated for its ability to contribute to forest cover requirements when the inventory file is received.

5.2.3 Non-commercial cover

Areas with projected type identity 5 are occupied by non-commercial brush species. These areas are considered to be unlikely sites for timber production and are therefore excluded from the area considered available for timber harvesting.

5. Timber Harvesting Land Base Definition

5.2.4 Environmentally sensitive areas

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

In the context of timber supply analysis, environmental sensitivity may result in a reduction in the harvesting opportunity. Two strategies for accounting for this are; per cent area reductions, and the specific evaluation of individual ESA polygons for harvesting opportunity. The first approach will be used for the Cassiar TSA analysis.

Table 5. Description of environmentally sensitive areas

ESA category	ESA description	Reduction per cent
Es 1	Very sensitive soils	100
Es 2	Sensitive soils (moderate)	25
Ep 1	Regeneration problems	80
Ep 2	Regeneration problems	25
Ea 1+2	Avalanche risk	100
Er 1	Recreation	100
Er 2	Recreation	100
Ew 1	Wildlife	0
Ew 2	Wildlife	0

Data source and comments:

ESA mapping is available for only 39 of the 1181 Cassiar TSA forest cover maps. The land base reductions shown in the above table will be used solely for those 39 maps.

Reduction factors reflect those used for the 1994 (TSR 1) analysis. Past logging in Es2 areas reveals most are harvestable, therefore a lower reduction per cent will be applied than for Es1 areas. A review of Ep polygons revealed a high proportion are associated with riparian areas, so are likely mapped as Ep because of heavy brush or the presence of a high water table. Areas with moderate regeneration problems are expected to be mostly treatable based on past silviculture experience, therefore a lower per cent will be applied.

5. Timber Harvesting Land Base Definition

It is likely that there are environmentally sensitive areas on the remaining mapsheets, which have not been delineated as ESAs. However, with the exception of Ew, it was considered unnecessary to map additional areas to serve as ESA replacements. The following rationale was used:

Es1 and 2, Ea1 and 2 — according to the *Mapping and Assessing Terrain Stability Guidebook*, Es and Ea polygons are comparable to detailed terrain stability polygons, and specifically to polygons with moderate to high likelihood of landslide initiation following road building or forest harvest operations. However, all areas where slopes exceed 35% are being removed from the contributing land base as part of the reduction for inoperable. Landslides and avalanches are highly improbable on areas with slopes of less than 35%.

Ep1 and 2 — an inspection of all Ep areas on a sample of 5 of the 39 mapsheets with ESA mapping indicates a strong correlation between Ep and riparian areas — 46% of all Ep polygons were greater than 50% enclosed within riparian management areas, and close to 75% were partially enclosed. It is assumed that land base reductions for riparian management will account for unmapped Ep1 and 2 areas.

Er1 and 2 — extensive areas for the Use, Recreation, and Enjoyment of the Public (UREP) have been mapped across the TSA at a 1:20 000 scale. UREPs (ownership code 61C or N) will be excluded in their entirety from the timber harvesting land base. Because there is a high degree of overlap between mapped Er areas and UREPs, it is assumed that when UREPs are removed that unmapped Er areas will also be removed.

Ew — more detailed habitat mapping will replace Ews for the analysis. Ews on the 39 mapsheets possessing ESA mapping were not removed from the timber harvesting land base. Habitat areas will not be removed, but will be subject to forest cover requirements.

5.2.5 Areas considered inoperable

Operability codes are generally used to describe the presence or absence of physical barriers or limitations to harvesting, appropriate logging methods (e.g. cable), and the merchantability of stands.

Table 6. Description of inoperable areas

Inventory description	Code	Reduction per cent
Alsek and Kechika timber supply blocks	Supply block = A, D	100
Operable corridor	Operability = I	100
Timber harvest feasibility (Iskut and Boundary timber supply blocks — CIS LRMP area)	Low, moderate	100
Slope class (outside of CIS LRMP)	> 35%	100

5. Timber Harvesting Land Base Definition

Data source and comments:

For the area outside of the CIS LRMP (Alsek, Atlin, Dease-Liard, and Kechika timber supply blocks), there is an operability line that defines an operable corridor, outside of which all land will be excluded from the timber harvesting land base. All area in the Alsek and Kechika supply blocks is classified as inoperable. The operability line is based on the amount of timber to which a road provides access (e.g., isolated patches of merchantable timber are considered inoperable if accessing them would require construction of a large amount of road through unmerchantable timber), on difficulty of access, and on volumes and quality of wood accessed. This operability line is based on fieldwork conducted in 1998 and 1999. Slope class further defines this operability line. The timber harvesting land base for the last timber supply analysis (1994) included stands harvestable by conventional (ground-based) and non-conventional (cable, helicopter) means. For this analysis only those stands harvestable by conventional means, and that are within an operable corridor establishing the limits of accessibility and economic viability, will be included.

For the CIS LRMP area, timber harvest feasibility mapping identifies areas as having high, moderate or low feasibility for timber harvesting. High feasibility is limited to higher volume sawlog and pulpwood stands that can be harvested with conventional, ground-based logging methods, and are reasonably accessible in the short term (slope class is less than or equal to 35%). Lower volume sawlog and pulpwood stands, areas that require cable or helicopter logging methods, and areas that are difficult to access, have been assigned moderate or low feasibility. Low and moderate feasibility areas will be removed from the timber harvesting land base. The feasibility mapping is based on fieldwork conducted in 1998 and 1999.

In addition, there is an operable corridor in the CIS LRMP area, which is based on physical and economic accessibility, including terrain, distance to markets and wood quality.

Note that reductions in Table 6 (inoperable areas) may overlap with reductions in Table 7 (sites with low timber growing potential).

5.2.6 Sites with low timber growing potential

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

Table 7. Description of sites with low timber growing potential

Supply block	Inventory type group	Characteristics				
		Age class	Height class	Volume (m ³ /ha)	Site index (m @ 50 years)	Reduction per cent
All	All	5-9	< = 2	—	—	100
Dease-Liard and Atlin				< 150 (mature ^a)	< 10 (all stands)	100
Iskut and Boundary				< 220 (mature ^a)	< 10 (all stands)	100

(a) Mature is defined as age class 5+ (over 80 years) for lodgepole pine, and age class 7+ (over 120 years) for other coniferous species.

5. Timber Harvesting Land Base Definition

Data source and comments:

The parameters listed in Table 7 above also contributed to the definition of feasibility and operability used in Table 6, therefore reductions according to Tables 6 and 7 may overlap.

The minimum height and age criteria are converted to minimum site index criteria, which are used to identify which existing stands will not likely ever meet the minimum height and age criteria.

Mature stands that do not have a minimum volume of 150 cubic metres per hectare or 220 cubic metres per hectare, depending on location, and all stands that do not have a minimum site index of 10 metres at 50 years, will be removed from the timber harvesting land base. Minimum volume criteria are based on historical harvesting data for the Cassiar TSA.

5.2.7 Problem forest types

Problem forest types are stands that are physically operable and exceed low site criteria yet are not currently utilized or have marginal merchantability. In the Cassiar TSA, these types are excluded from the timber harvesting land base.

Table 8. Problem forest types criteria

Inventory type group	Characteristics			
	Age class	Height class	Leading species	Reduction (%)
28	—	—	Whitebark pine	100
32-42	—	—	Yellow pine, tamarack, deciduous	100

Data source and comments:

The criteria are the same as used in the 1994 (TSR 1) timber supply analysis. As for low site productivity (Table 7), these criteria also contributed to the definition of harvest feasibility for the CIS LRMP area, so there is some overlap with operability reductions.

5.2.8 Roads, trails and landings

Separate estimates are made to reflect the loss in productive forested 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. Future RTL reductions are applied after stands are harvested for the first time in the timber supply model.

5. Timber Harvesting Land Base Definition

Table 9. Estimates for existing and future roads, trails, and landings

	Age (years)	Reduction (%)
Existing RTLs	1 - 15	6.9
Future RTLs	> 15	6.9

Data source and comments:

These figures are based on an analysis of existing roads, trails and landings in 10 cutblocks completed for the 1994 timber supply analysis.

5.2.9 Wildlife habitat reductions

The Forest Practices Code allows for the establishment of wildlife habitat areas to protect habitat for species classified as identified wildlife under the Code. The *Managing Identified Wildlife: Procedures and Measures* document describes management prescriptions, including core "no harvesting" areas around nesting sites and other valuable habitats for identified species. However, no wildlife habitat areas under the Identified Wildlife Management Strategy have been established in the Cassiar TSA at this time. Therefore, no land base adjustments are planned for the analysis.

5.2.10 Cultural heritage resource reductions

Cultural heritage values include trap lines and sites of archaeological value or traditional use.

In the Cassiar TSA, 410 km of trails were identified in the Iskut and Boundary supply blocks within the timber harvesting land base. However, there is no history of harvesting along cultural trails. Therefore, there is no experience regarding the extent and nature of adjustments to practices that would be necessary to protect such areas, and whether such adjustments would affect timber supply. No adjustments will be incorporated in the analysis. Any new information on this issue will be included in future analyses.

5.2.11 Riparian reserve and management zones

To account for management along streams and around lakes and wetlands, a percentage of the forested area will be excluded from the timber harvesting land base. The percentages are listed in Table 10, and were derived using the stream, lake and wetland inventory for the CIS LRMP area together with reserve and retention practices from the Forest Practices Code *Riparian Area Management Guidebook*, as well as present on the ground practices.

5. Timber Harvesting Land Base Definition

Table 10. Riparian reserve and management zones

Location (BEC unit)	Riparian reserve zone — RRZ (% of timber harvesting land base)	Reduction (%)	Riparian management zone — RMZ (% of timber harvesting land base)	Reduction (%)	Total reduction to timber harvesting land base (%)
Atp	0	100	0	0	0
BWBSdk	8.6	100	6.8	0	8.6
CWHwm	35.1	100	20.5	0	35.1
ESSFmc	0	100	6.7	0	0
ESSFwv	0	100	6.7	0	0
ICHvc	7.5	100	9.4	0	7.5
ICHwc	9.4	100	5.5	0	9.4
Mhunr	0	100	5.2	0	0
SBSunr	12.3	100	6.7	0	12.3
SWBunr	5.7	100	5.5	0	5.7

Data source and comments:

All streams for the CIS LRMP area were buffered in order to generate these reduction factors. The LRMP boundary approximates the Iskut and Boundary supply blocks. The procedure assumed that double line mapped water features were S1 or S2 streams, single line features were S3 to S5 streams, and intermittent single line features were S6 streams.

The procedure also included all lakes and wetlands greater than 0.5 hectares.

To calculate the per cent of the timber harvesting land base within riparian management areas (RMA), the following criteria were applied to double, single, and intermittent line features, and to lakes and wetlands:

5. Timber Harvesting Land Base Definition

Table 10a. Water features criteria

Feature	RRZ (metres)	RMZ (metres)
Double line	50	20
Single line	20	30
Intermittent line	0	20
Lakes > 5 hectares	10	20
Lakes 0.5 – 5 hectares	0	30
Wetlands > 5 hectares	10	40
Wetlands 0.5 – 5 hectares	0	30

Data source and comments:

Based on this procedure, RRZs of 5.2% for AT, 9.0% for ESSF, and 56.2% for MH were determined. These were all reduced to 0% based on local knowledge of the areas (i.e., fish-bearing streams do not occur in the AT, ESSF, or MH units). Although the RRZ for CWH of 35.1% seems high, it was determined to be an appropriate figure based on local knowledge and the extremely small component of CWH within the timber harvesting land base.

The reduction per cent applied to the RMZ is 0%. This is based on an assessment of current practice in the Bulkley TSA and what would be the most likely scenario if harvesting were to take place in the Cassiar TSA. Typically, under current practice, all merchantable wood is removed from the RMZ down to a diameter of 17.5 cm, and non-merchantable trees are left adjacent to the RRZ. In some areas, wildlife tree patches are placed in the RMZ. These will be accounted for elsewhere in the analysis.

It was assumed that RRZ and RMZ percentages for comparable BEC variants in the Atlin and Dease-Liard Supply Blocks (outside the CIS LRMP area) were consistent with those for the Iskut and Boundary Supply Blocks (within the CIS LRMP area).

5.2.12 Visual quality management

This section identifies areas to be excluded from the timber harvesting land base to account for any area exclusions that are a part of current forest management, and that are not identified in previous sections.

Table 11. Land base exclusions to account for visual quality management

Identifying inventory variables (location descriptors)	Excluded area (hectares)	Reason for exclusion
Visual corridor along Highway 37	500 metres each side	Visual quality concerns

5. Timber Harvesting Land Base Definition

Data source and comments:

Visual quality objectives have not been approved for the Cassiar TSA. Since there is no recent history of harvesting in visually sensitive areas, there is no recent experience regarding the extent and nature of adjustments to practices that would be necessary to protect such areas, and how such adjustments would affect timber supply. Therefore, no further adjustments above what was modelled for the 1994 (TSR 1) analysis will be incorporated in this analysis. A 500-metre no-harvest buffer will be applied along each side of Highway 37. Any new information on this issue will be included in future analyses.

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 to calculate merchantable volume.

Table 12. Utilization levels

Species	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
Lodgepole pine	12.5	30	10
All others	17.5	30	10

Data source and comments:

Table 12 reflects current provincial standards.

6.1.2 Volume exclusions for mixed species stands

This section identifies the portions of mixed species stands that are not utilized. The unharvested portion does not contribute to the estimated stand volume. The species that do not contribute and that will be excluded from the estimation of stand volume are shown in Table 13 below. Stands are fully excluded from the timber harvesting land base if any of the species listed in Table 13 is the leading species (see Table 8, Problem forest types criteria). Table 13 identifies the volumes that are excluded from yield tables.

Table 13. Volume exclusions for mixed species types

Inventory type group	Species	Volume exclusion (%)
All	Deciduous	100
All	Whitebark pine	100
All	Tamarack	100

6.1.3 Minimum harvestable age derivation

The minimum harvestable age is the time required for a stand to grow to a harvestable size. While harvesting may occur in stands when the minimum requirements are achieved in order to meet forest level objectives (e.g., maintaining overall harvest levels for a short period of time), some stands may not actually be harvested until well past "optimal" timber production ages. This usually occurs when management of other resource values takes precedence over timber (e.g., requirements for the retention of older forest).

Table 14 identifies the minimum criteria an analysis unit must meet to be eligible for harvest.

6. Current Forest Management Assumptions

Table 14. Minimum harvestable age criteria

Natural stand analysis unit	Description	Minimum criteria		Minimum harvestable age	Managed stand analysis unit	Minimum criteria		Minimum harvestable age (years)
		Height class	Volume (m ³ /ha)			Height class	Volume (m ³ /ha)	
1	Spruce – G	3	220		101	3	150	
2	Spruce – M	3	220		102	3	150	
3	Spruce – P	3	220		103	3	150	
4	Pine – G	3	220		104	3	150	
5	Pine – M	3	220		105	3	150	
6	Pine – P	3	220		106	3	150	
7	Balsam – G	3	220		107	3	150	
8	Balsam – M	3	220		108	3	150	
9	Balsam – P	3	220		109	3	150	
10	Hemlock – G	3	220		110	3	150	
11	Hemlock – M	3	220		111	3	150	
12	Hemlock – P	3	220		112	3	150	
13	Cedar	3	220		113	3	150	
21	Spruce – G	3	150		121	3	150	
22	Spruce – M	3	150		122	3	150	
23	Spruce – P	3	150		123	3	150	
24	Pine – G	3	150		124	3	150	
25	Pine – M	3	150		125	3	150	
26	Pine – P	3	150		126	3	150	
27	Balsam – G	3	150		127	3	150	
28	Balsam – M	3	150		128	3	150	
29	Balsam – P	3	150		129	3	150	

6. Current Forest Management Assumptions

Data source and comments:

- The minimum harvestable age is the age at which both the minimum height and minimum volume criteria are met.
- Minimum volume and height criteria were derived from a district compilation of historic harvest information, which was used as an indicator of what small business licensees considered economically operable.
- A height class 3 (which begins at 19.5 metres) cutoff was chosen because it reflects the limit of piece sizes commonly accepted by the mills along Highway 16. This is also consistent with the Problem Forest Type (PFT) definition.
- Volume criteria for existing stands in the coast/transitional analysis units are higher than for regenerated stands because a higher volume/hectare is required to offset the higher cost of initial road access in more challenging terrain.

6.1.4 Silvicultural systems

Minimal harvest has occurred in the Cassiar TSA in the past 5 years. However, within the past 10 years most harvesting has used the clearcut with reserves silvicultural system, with only one entry. The area provided within the reserves equates to wildlife tree patch size requirements specified by Table 20b of the *Biodiversity Guidebook* (see Section 6.4.2, "Wildlife trees (WT) and tree patches (WTP)"). Because the reserves equate to the wildlife tree patches, further reductions to the timber harvesting land base have not been made to accommodate the reserves.

6.2 Unsalvaged losses

For the analysis, the estimated average annual loss of timber to catastrophic insect infestations and fires over the long-term will be determined for the timber harvesting land base. The losses will be calculated when the Cassiar forest inventory data set becomes available.

Table 15. Estimated unsalvaged losses

Cause of loss	Unsalvaged losses (m ³ /year)
Fire	To be determined
Insects	To be determined
Total	To be determined

Data source and comments:

As the data set for the Cassiar TSA is not yet available, we have included the procedure for determining the annual unsalvaged losses.

Fire:

Fire suppression began in the 1950s, and at that time the level of response to wildfire depended on the number of other fires burning elsewhere in the province. By the 1970s, suppression efforts aimed to extinguish all fires. By 1980, the selective suppression period began, in which suppression efforts were focused around communities, highways, other infrastructure, and valuable timber. Selective suppression has continued from 1980 to the present.

6. Current Forest Management Assumptions

In determining how to account for unsalvaged losses due to fire for the upcoming analysis, the selective suppression era was chosen as the most representative of current management. Fire history from 1980 to 1998 was examined, and the following assumptions were made:

- all fires < 4 hectares will not be counted.
- all losses due to fire are unsalvageable.
- A very large fire in 1982 (the EGG fire) burned 182 725 hectares of mature volume, amounting to 11 654 248 cubic metres. It is uncertain what portion of this fire falls within the timber harvesting land base. Also, the periodicity of such fires is uncertain. If fires of this size occur much less frequently than every 19 years, which appears likely, including the EGG fire in the unsalvaged loss calculation would over-estimate losses. Given the level of uncertainty, the 1982 fire (# 3090015) will not be factored into the unsalvaged loss calculation for the base case.

In practice, occurrence of very large catastrophic fires would likely warrant a prompt re-determination of harvest level based an inventory updated to incorporate the damage caused.

The potential timber supply impact of an event of the magnitude of the 1982 fire will be addressed through a critical issue analysis (see Section 7).

The following is a summary of all fires from 1980 to 1998 that are four hectares or greater (excluding the EGG fire), that occurred within the operable corridor as defined for the upcoming analysis.

6. Current Forest Management Assumptions

Table 16. Summary of fires for the Cassiar TSA — 1980-1998

Year	Fire number	Fire size (hectares)	Gross merchantable volume burned (m ³ , mature)
1980	309002	81	900
	309005	7	570
1981	N/A	0	0
1982	309023	7 947	1 411 161
	309026	15 022	1 487 538
	309031	1 204	149 744
	309037	275	1 677
	309038	1 473	147 147
	309039	9 631	811 636
	309041	1 200	5 000
1983	309007	370	51 940
	309022	19	0
1984	309002	34	156
	309007	34	0
1985	309001	16	0
1986	309013	30	0
1987	N/A	0	0
1988	N/A	0	0
1989	309035	5	1 560
	309053	375	9 028
1990	309010	3 072	153 678
1991	309003	10	0
	309005	114	5 500
	309006	55	4 000
	309016	35	5 530
	309036	130	13 020
1992	309022	236	781
	309028	5	0
1993	N/A	0	0
1994	N/A	0	0
1995	309010	8	0
	309028	14	1 500
	309061	40	5 625
	309063	60	0
	309087	20	0
1996	N/A	0	0
1997	N/A	0	0
1998	309018	384	125
	309030	300	18 750
	309039	30	4 500
	309048	25	0
	309068	462	56 000
	309076	825	100 000
Total		43 548	4 447 066

6. Current Forest Management Assumptions

Methodology for determining unsalvaged losses:

1. determine volume losses due to the 36 fires listed above, based on the general fire summary reports. This number divided by 19 years (the period examined) will be the total annual loss within the operable corridor. Therefore, $4\,447\,066\text{ m}^3 / 19\text{ years} = 234\,056\text{ m}^3/\text{year}$.
2. the total unsalvaged loss must be adjusted in recognition that all forest in the operable corridor is not within the timber harvesting land base:

$$\text{annual unsalvaged loss} = 234\,056\text{ m}^3/\text{year} \times \frac{(\text{Timber harvesting land base})}{(\text{Forested land base in operable corridor})}$$

The ratio of timber harvesting land base to forested land base in the operable corridor will be calculated when the Cassiar TSA forest inventory data set is available.

Insects

Balsam Bark Beetle (BBB)

A review of 1994-1996 forest health overview maps revealed that BBB is presently at endemic levels in balsam-leading stands in several BEC variants, but is building to increasingly severe levels in the ESSF. Endemic levels of BBB are accounted for in natural stand yield curves (VDYP). The extent to which yield curves include more epidemic BBB levels is unclear. However, it is generally believed that yield estimates exclude epidemic losses. The assumption that epidemic BBB losses are not included in yield estimates was also used for the Bulkley TSA timber supply review. Therefore, unsalvaged losses to BBB were investigated for susceptible stands in the ESSF.

Interpretation of an operational study conducted in balsam-leading stands in the Bulkley TSA led to the estimation of an annual loss in the Cassiar TSA balsam-leading stands of 0.65 cubic metres/hectare/year. The area of balsam-leading stands in the ESSF in the timber harvesting land base is approximately 30 000 hectares, with a weighted average balsam volume/hectare of 196 cubic metres per hectare. Applying the annual loss figure to the total area results in an annual net loss of 45 250 cubic metres per year. The area and volume figures will be verified when the Cassiar TSA forest inventory data set is available. All losses to BBB are assumed to be unsalvaged.

Other pests

Other known forest pests include spruce beetle, spruce budworm, large aspen tortrix, and porcupine. Incidences of windthrow, flooding, and animal damage (porcupine, bear, squirrel and rabbit) have been noted. Isolated occurrences of *tomentosus* root rot were noted in the BWBSdk1. With the exception of spruce beetle, these damaging agents are concentrated within a few isolated patches of the Cassiar TSA, or are already excluded from the timber harvesting land base; therefore, they are not significant enough to warrant calculation of an unsalvaged loss figure.

Spruce beetle is known to be presently at light to moderate levels in coastal drainages, with attack areas mostly concentrated around the US-Canada border. This pest is primarily affecting spruce-leading stands that have already been excluded from the timber harvesting land base; therefore, no annual loss figure will be calculated.

6. Current Forest Management Assumptions

6.3 Silviculture

6.3.1 Regeneration activities in managed stands

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

Table 17 specifies the regeneration assumptions for existing analysis units. The same assumptions will be applied to regenerated analysis units.

Table 17. Regeneration assumptions by analysis unit

Analysis unit	Site index	Regen delay (years)	OAFs %		Method		Species		Density stems/ha
			1	2	Type	%	Code	%	Initial
1, 2, 21, 22		2	15	5	Plant	100	Sw PI	60 40	2000 2000
3, 23		2	15	5	Plant	100	Sw PI	80 20	2000 2000
4, 5, 24, 25		2	15	5	Plant	100	PI Sw	50 50	2000 2000
6, 26		2	15	5	Plant Natural	60 40	PI PI	100 100	2000 5000
7, 8, 27, 28		2	15	5	Plant	100	Sw PI	50 50	2000 2000
9, 29		2	15	5	Plant	100	Sw PI	50 50	2000 2000
10, 11		2	15	5	Plant	80	Sw PI	80 20	2000 2000
		2 -10	15	5	Natural	20	Hw BI	80 20	4000 2000
12		2	15	5	Plant	80	Sw	100	2000
		2	15	5	Natural	20	Hw	100	4000
13		2	15	5	Plant	70	Ss Yc Ba	70 20 10	2000 2000 2000
		-5	15	5	Natural	30	Hw	50	4000
			15	5			Ss PI	50 20	3000 2000
29		3	15	5	Plant	100	Sw PI	50 50	2000 2000

6. Current Forest Management Assumptions

Data source and comments:

Table 4, in Section 4.2, lists analysis unit definitions.

Site index — Table 17 reflects the regeneration assumptions to be applied after harvesting the mature stand analysis units. When the Cassiar TSA data file is available, the analyst will complete the site index column. An alternate approach, using site index estimates for BEC site series (SIBEC), will be examined in a critical issue analysis.

Regeneration delay — the figures are based on an analysis of regeneration delay conducted for all areas harvested prior to 1995. Regeneration delay is planting delay (from initiation of harvest), less planting stock age.

A negative regeneration delay indicates advanced regeneration. The figure represents the number of years it would likely take before planted seedlings would grow to the same height as advanced-growth regeneration that exists at time of harvest.

Operational adjustment factor (OAF) — OAFs are used to adjust timber yield estimates to account for operational factors. OAF 1 is a constant percentage reduction to account for small unproductive areas within stands, uneven stem distribution and endemic losses that do not increase with age. OAF 2 accounts for losses that increase with stand age, for example, decay due to disease. The value of OAF 2 increases from zero and passes through the shown value when the stand is 100 years old. Provincial average OAF values will be applied to the managed stand yield curves as recommended by the Ministry of Forests, Research Branch, as no local values are available.

Method type; species code; density — an analysis was conducted to determine which BEC zone comprised the highest proportion of stands of each analysis unit. The regeneration assumptions for each analysis unit were derived based on this representative BEC zone, and adhere in general to stand characteristics and stand management recommendations summarized in *A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region*. No thinning is expected to occur in the Cassiar TSA.

Regeneration assumptions were further modified to reflect forest district staff field experience with characteristics of harvested stands at time of free growing.

Initial density

- refers to the expected density of trees at time of free growing that will contribute to 250 prime stems at maturity (a TIPSYS parameter).
- in the past, 1600 stems per hectare were planted. An assessment of historical regeneration trends for the 1994 timber supply analysis revealed well-spaced densities averaging 1200 stems per hectare at time of free growing.
- the average total stems per hectare (planted and naturally regenerating) at time of free growing ranges from 2000 to 5000, depending on the BEC unit. The above table reflects the likely densities that would occur at year 0 on the TIPSYS yield curves, given the indicated regenerated stand profiles.

6. Current Forest Management Assumptions

6.3.2 Immature plantation history

This section identifies areas of existing immature forest where the density (stems per hectare) has been controlled, thereby justifying assignment of these stands to a managed stand yield table (MSYT).

Table 18. Immature plantation history

Species	Area managed (%)			
	Age 1 – 10	Age 11 – 20	Age 21 – 30	Age 31 – 40
All except deciduous	100	50	0	0

Data source and comments:

The above table deals solely with stands that have been harvested (Activity = "L"). All harvested coniferous-leading stands have had some form of density control, or plantability or pre-spacing survey which showed the stands were well-spaced or free-growing, and therefore should be modelled as managed stands. Stands are managed to free growing, which generally occurs 12-15 years after harvest. Plantations in the Cassiar TSA are generally less than 20 years old. All wildfires in the Cassiar TSA are assumed to regenerate naturally.

6.3.3 Not satisfactorily restocked (NSR) areas

Land classified in the Cassiar 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. The area of NSR by analysis unit, and the estimated rate of restocking will be determined when the Cassiar TSA data inventory file is available. Areas will be derived to fill a table similar to Table 19 below.

Table 19. Not satisfactorily restocked (NSR) areas

Analysis unit	Total area (hectares)	NSR restocking (hectares restocked, years from now)			
		Restocked	1 – 10	11 – 20	> 20
Total					

6. Current Forest Management Assumptions

Data source and comments:

NSR areas (type identity 4 or 9) are included in the current timber harvesting land base as follows:

- a) The proportion of each analysis unit in age classes 1-20 (excluding NSR) is calculated
- b) Ages are assigned to NSR areas as follows:
 - If current age is ≤ 10 years and there is a logging history, then NSR age = 0. Harvest depletions in the inventory file are current only to 1992. Because the forest district promptly restocks all harvested stands, where the file indicates a stand has been harvested, it is unlikely to still be NSR in 1999;
 - otherwise a 20-year regeneration delay is assumed for natural regeneration.
NSR age = (current age – 20 years).
- c) The NSR areas are assigned to analysis units using the proportions calculated for step (a).

6.4 Integrated resource management

6.4.1 Forest cover requirements

As noted in Section 4.1, "Management zones, groups and objectives," forest cover requirements may be examined at a number of different levels. With the requirement to retain different forest characteristics across the landscape, it is important to consider the role of non-contributing forest (productive forest which does not contribute to the timber harvesting land base) in achieving forest cover requirements (i.e., maximum allowable disturbance or minimum area retention).

6. Current Forest Management Assumptions

Table 20. Forest cover requirements

Resource emphasis	Maximum allowable disturbance (% area)	Green-up	Minimum retained area (%)	Minimum age for retention (years)	Land base to which constraints apply
IRM – cutblock adjacency (Dease-Liard, Iskut and Boundary supply blocks)	33	3 m			Timber harvesting land base
IRM – cutblock adjacency for caribou (Atlin supply block)	20	3 m			Timber harvesting land base
Moose in CWH	33.3	3 m			Timber harvesting land base
Grizzly bear and goat in CWH	20	3 m	30	250	Timber harvesting land base
Moose in BWBS	33.3	3 m			Timber harvesting land base
Grizzly bear, goat and moose in ICH	25	3 m	30	250	Timber harvesting land base
High value caribou habitat	25	3 m	30	140	Timber harvesting land base
Community watersheds	5	5 years			Timber harvesting land base

Data source and comments:

Minimal harvesting and related forest practices have occurred in the Cassiar TSA, Table 20 therefore reflects management objectives and guidelines that would apply if harvesting did take place.

The integrated resource management (IRM) green-up requirement for cutblock adjacency and the wildlife habitat requirements will be applied by landscape unit.

The Ministry of Environment, Lands and Parks (MELP) supplied high-value habitat mapping from interpretations of the radio-collared studies conducted by the Spatsizi Association of Biological Research, and other studies. These maps exist only for grizzly bear, goat, moose and caribou in the Iskut and Boundary supply blocks, and for caribou only in the Dease-Liard supply block.

A 3-pass harvesting system will be modelled for the integrated resource management area that covers these maps. For the Atlin supply block, where there are no existing mapped high-value habitats, a 5-pass harvesting system will be modelled in the integrated resource management area to account for unidentified high-value habitats.

Outside the integrated resource management area, and where high-value habitat maps exist, harvesting systems with a range of passes from 3 to 5 will be modelled according to Table 20 above.

6. Current Forest Management Assumptions

In the registered community watershed that services the community of Telegraph Creek, the maximum allowable disturbance will be 5%, with a green-up restriction of 5 years between harvesting in adjacent areas.

Forest cover requirements for landscape-level biodiversity (primarily old-growth retention) will not be applied. Although FSSIM can model landscape-level biodiversity by including the forested land outside of the timber harvesting land base, it assumes that this area ages continuously over the analysis time frame. This would lead to an accumulation of old growth outside of the timber harvesting land base with the result that, after some time, all of the old-growth requirements would be fulfilled outside of the timber harvesting land base. This is not a realistic assumption in the Cassiar TSA because of the large amount of natural disturbance that occurs, particularly fire.

It is believed that forest outside the timber harvesting land base will meet the bulk of landscape-level biodiversity requirements in most areas. This issue will be examined when the inventory data set is available. For the analysis, landscape-level biodiversity will be addressed using higher wildlife tree patch requirements (see Section 6.4.2).

6.4.2 Wildlife trees (WT) and tree patches (WTP)

The *Biodiversity Guidebook* describes two methods for maintaining stand structure over time: wildlife trees (WT) and wildlife tree patches (WTP). Under different silvicultural systems, the planned persistence of WTs and WTPs may vary, so it is important to consider 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.

Table 21. Reductions to reflect retention of wildlife tree patches in cutblocks

Management zone	Analysis unit	Reason for residual volume	Persistence	Per cent (%) recommended applicable guidebook	Area estimate on the timber harvesting land base (hectares)
All	All	WTP	Permanent		

Data source and comments:

The WTP requirements of Table 20b of the *Biodiversity Guidebook* will be applied, as there are no approved landscape units and biodiversity emphasis options for the Cassiar TSA, and old-seral requirements are not being applied. It is assumed that 50% of WTPs are already contained within riparian reserve zones.

WTPs will be treated as an area reduction for this analysis.

When the Cassiar TSA inventory data file is available, it will be possible to calculate the "per cent area available for harvest" required to derive the area requirements for WTPs, as described in Table 20b of the *Biodiversity Guidebook*.

7. Critical Issues and Sensitivity Analyses

Critical issue analysis is used to determine the impact of defined issues. For example, a land use decision may be pending that includes the designation of new protected areas. While the proposed size and location of the protected areas is known, the final decision is uncertain. Sensitivity analysis can provide a measure of the timber supply impact of uncertainty in management assumptions and/or data. By performing a number of sensitivity analyses, it is possible to determine which variables most affect results.

Table 22. *Intended sensitivity analyses*

Issue to be tested	Sensitivity levels
Land base changes	+/- 10, 20, 40% of the timber harvesting land base
Harvest flow alternatives	Various alternatives to base case

Data source and comments:

The timber harvesting land base for the last timber supply review (TSR) (1994) included stands harvestable by conventional (ground-based) and non-conventional (cable, helicopter) means. For this analysis only those stands harvestable by conventional means, that are within an operable corridor establishing the limits of accessibility and economic viability, will be included. A sensitivity analysis will examine the impact of reducing or increasing the size of the timber harvesting land base.

Harvest flow alternatives are a standard sensitivity analysis performed for the TSR.

Table 23 lists critical issues in the Cassiar TSA. The data source and comments following the table provide supplementary information.

Table 23. *Critical issues*

Issue to be tested	Sensitivity levels
Muskwa – Kechika zones	Exclude from the timber harvesting land base.
Utilization of pulpwood	Remove pulpwood from the timber harvesting land base (see definition in Data source and comments, below).
CIS LRMP	Exclude Protected Area recommendations from the timber harvesting land base. Include forest management considerations.
Cassiar TSA inventory audit	Adjust the yield curves as the audit suggests.
Unsalvaged fire losses	Include loss of 182 725 hectares of timber due to 1982 fire.
Site productivity	Use site indices from SIBEC.

7. Critical Issues and Sensitivity Analyses

Data source and comments:

Muskwa-Kechika

A TSA boundary change process is underway which, on approval through order-in-council (OIC), will pass administrative control of the Muskwa-Kechika area (currently in the Cassiar TSA) to the Fort Nelson Forest District. The Fort Nelson LRMP, approved in October 1997, provides management strategies for this area even though it is part of the Cassiar TSA. These management strategies will be included in the base case for the Cassiar TSR. Because the boundary change may be approved before an AAC is determined, a critical issue analysis is necessary to determine the impact on timber supply of removing this area from the Cassiar TSA.

Pulpwood stands

The timber profile for the Cassiar TSA includes a significant component of pulp-quality stands, which have not been historically harvested. A critical issue analysis is necessary to address the impact of removing pulp-quality stands from the timber harvesting land base.

Stands are classed as 'pulp' quality (i.e., likely to yield more than 50% pulp upon harvest) if one of the following criteria are met:

- Mature: Inventory Type Group (ITG) 18-20 (balsam) and age class > 6 (> 120 years) and average total tree height < 24 metres and volume > 60% subalpine fir.
- Immature: ITG 18-20 (balsam) and age class ≤ 6 and site index ≤ 14.4 and volume > 60% subalpine fir.
- ITG 12, 15-17 (hemlock) and net volume > 50% hemlock

Proposed protected areas

Initial discussions for the Cassiar Iskut-Stikine LRMP have led to potential protected areas and no harvesting zones. As these zones have not been approved, it would be speculative to exclude them from the timber harvesting land base. The effect of removing these areas from the timber harvesting land base will be examined in a critical issue analysis. The current potential protected areas under discussion are the Upper Stikine, the Klastline and others. The final report submitted to the government by the LRMP Table may contain different protected area proposals than these.

As part of the CIS LRMP, the Klappan River area has been tentatively identified by the table as being subject to deferral for up to 20 years. Removal of the Klappan River from the timber harvesting land base for 20 years will therefore be assessed through critical issue analysis.

Inventory audit

Field work for an inventory audit in the Cassiar TSA was carried out by contract during 1996, using standards and procedures developed by the Ministry of Forests, Resources Inventory Branch. The audit indicated that projected volumes per hectare were acceptable for the Cassiar timber supply area as a whole, but less accurate for the Dease-Liard and Atlin timber supply blocks. A re-compilation of the audit results, to correspond with the Cassiar TSA timber harvesting land base, is planned. If warranted, the results of the audit will be examined in a critical issue analysis to evaluate the potential effects of uncertainties in stand volumes.

Unsalvaged losses due to fire

In 1982, a fire of 182 725 hectares burned 11 654 248 cubic metres of gross merchantable mature timber. We will examine the impact that a fire of this proportion could have on timber supply. Between now and the time of AAC determination, forest district and regional staff will investigate the potential periodicity of such an event.

7. Critical Issues and Sensitivity Analyses

Site productivity

SIBEC is an ecologically based method for estimating site indices. Forest district silviculture and regional research and inventory staff believe the current site indices for the Cassiar TSA are underestimated for immature and regenerating stands. Staff have therefore recommended using the SIBEC approach.

The following is the SIBEC-based site index adjustment procedure:

- determine the proportion of each analysis unit in each BEC subzone;
- assign a site type breakdown of 80% mesic / 20% rich to each subzone, as advised by the Regional Ecologist (see discussion below Table 24);
- determine the regeneration prescription percentage by species;
- obtain site index for the site unit and species from *Site Index Estimates by Site Series for Coniferous Tree Species in British Columbia*;
- aggregate regenerated species with similar site indices into regenerated analysis units.

7. Critical Issues and Sensitivity Analyses

Table 24. SIBEC data

Zone	Subzone	Variant	Species	Site type	%	Site index (m @ 50 years)
BWBS	dk	1	PI	Mesic	80	15
BWBS	dk	1	PI	Rich	20	18
BWBS	dk	1	Sx	Mesic	80	15
BWBS	dk	1	Sx	Rich	20	18
BWBS	dk	2	PI	Mesic	80	12
BWBS	dk	2	PI	Rich	20	15
BWBS	dk	2	Sx	Mesic	80	12
BWBS	dk	2	Sx	Rich	20	15
ICH	wc		PI/Hw	Mesic	80	18
ICH	wc		PI/Hw	Rich	20	18
ICH	wc		Sx	Mesic	80	18
ICH	wc		Sx	Rich	20	18
SBS	mc		PI	Mesic	80	18
SBS	mc		PI	Rich	20	18
SBS	mc		Sx	Mesic	80	18
SBS	mc		Sx	Rich	20	18
CWH	wm		Ba	Mesic	80	24
CWH	wm		Ba	Rich	20	28
CWH	wm		Hw/Hm	Mesic	80	24
CWH	wm		Hw/Hm	Rich	20	28
CWH	wm		PI	Mesic	80	22
CWH	wm		PI	Rich	20	22
CWH	wm		Ss	Mesic	80	24
CWH	wm		Ss	Rich	20	30
ESSF	wv		Bl	Mesic	80	12
ESSF	wv		Bl	Rich	20	12
ESSF	wv		Hm	Mesic	80	12
ESSF	wv		Hm	Rich	20	12
ESSF	wv		PI	Mesic	80	12
ESSF	wv		PI	Rich	20	12
ESSF	wv		Se	Mesic	80	12
ESSF	wv		Se	Rich	20	12
ICH	vc		Bl	Mesic	80	18
ICH	vc		Bl	Rich	20	21
ICH	vc		Hw	Mesic	80	15
ICH	vc		Hw	Rich	20	15
ICH	vc		Sx	Mesic	80	18
ICH	vc		Sx	Rich	20	21

The site unit breakdown was derived through conversations with the Regional Ecologist. Two classes of site units were identified for each subzone: mesic and rich. The mesic unit contains the mesic and sub-mesic site series, and the rich unit contains the more productive site series (i.e., 05 and 06). For each subzone it was determined that the bulk of the unit is comprised of mesic conditions (80%). The remaining 20% are likely composed of rich sites.