

Kalum Timber Supply Area Timber Supply Review

Data Package

January 1998

District Manager
Kalum Forest District

Director
Timber Supply Branch

Table of Contents

1. INTRODUCTION	1
2. CURRENT FOREST MANAGEMENT CONSIDERATIONS AND ISSUES	2
2.1 BASE CASE MANAGEMENT ASSUMPTIONS	2
2.2 STATEMENT OF MAJOR FOREST MANAGEMENT CONSIDERATIONS AND ISSUES.....	2
3. INVENTORIES	4
3.1 BACKGROUND INFORMATION	4
4. DIVISION OF THE AREA INTO MANAGEMENT ZONES	5
4.1 MANAGEMENT ZONES AND TRACKING OF MULTIPLE OBJECTIVES (GROUPING)	5
4.2 ANALYSIS UNITS	6
5. TIMBER HARVESTING LAND BASE DEFINITION	8
5.1 IDENTIFICATION OF THE TIMBER HARVESTING LAND BASE	8
5.2 DETAILS ON LAND BASE CLASSIFICATION.....	8
5.2.1 Land not administered by the British Columbia Forest Service for timber supply purposes	8
5.2.2 Land classified as non-forest	8
5.2.3 Non-commercial cover	9
5.2.4 Environmentally sensitive areas.....	9
5.2.5 Areas with high recreation values	11
5.2.6 Areas considered inoperable	11
5.2.7 Sites with low timber growing potential	12
5.2.8 Problem forest types.....	12
5.2.9 Roads, trails and landings	13
5.2.10 Cultural heritage resources.....	14
5.2.11 Riparian management areas.....	14
5.2.12 Timber licence reversions	15
6. CURRENT FOREST MANAGEMENT ASSUMPTIONS.....	16
6.1 HARVESTING.....	16
6.1.1 Utilization levels	16
6.1.2 Volume exclusions for mixed species stands.....	16
6.1.3 Minimum harvestable age derivation	17
6.1.4 Harvest scheduling priorities.....	17
6.1.5 Silvicultural systems	17
6.1.6 Commercial thinning	17
6.2 UNSALVAGED LOSSES	18
6.3 SILVICULTURE.....	18
6.3.1 Site productivity estimates for managed stands.....	18
6.3.2 Silviculture and regeneration activities in managed stands	18
6.3.3 Immature plantation history	20
6.3.4 Not satisfactorily restocked (NSR) areas	20
6.4 INTEGRATED RESOURCE MANAGEMENT.....	21
6.4.1 Objectives which require forest cover requirements	21
6.4.2 Wildlife trees (WT) and tree patches (WTP).....	24
7. SENSITIVITY ANALYSES TO BE PERFORMED	25

Table of Contents

Tables

1.	Major forest management considerations	2
2.	Inventory information	4
3.	Objectives to be tracked	5
4.	Definition of analysis units.....	6
5.	Description of environmentally sensitive areas.....	9
6.	Total terrain stability mapping and ESA soils mapping for selected mapsheets	10
7.	Terrain stability and coincident ESA soils mapping by operability category	10
8.	Description of inoperable areas.....	11
9.	Description of sites with low timber growing potential.....	12
10.	Problem forest types criteria	13
11.	Estimates for existing and future roads, trails and landings	13
12.	Riparian management areas	14
13.	Utilization levels	16
14.	Volume exclusions for mixed species types	16
15.	Minimum harvestable age criteria	17
16.	Commercial thinning regime	17
17.	Unsalvaged losses	18
18.	Regeneration assumptions by analysis unit	19
19.	Immature plantation history	20
20a.	Forest cover requirements for integrated resource management (IRM) and visual quality objectives (VQO) areas within each draft landscape unit	21
20b.	Forest cover requirements for the Deep Creek community watershed.....	22
20c.	Forest cover requirements for the Thunderbird integrated resource management area.....	23
20d.	Forest cover requirements for landscape level biodiversity	23
21.	Area reductions to reflect retention of wildlife tree patches in cutblocks.....	24
22.	Sensitivity issues specific to the Kalum TSA	25
23.	Standard sensitivity analysis	25

1. Introduction

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

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

- by the current forest management regime — the productive forest land available for timber harvesting, the silviculture treatments, the harvesting systems and the integrated resource management guidelines used in the area;
- by the standards used to approve or reject forest development (5-year development) plans;
- by fully implemented land-use plans;
- by land-use decisions approved by Cabinet;
- by approved higher level plans under the Forest Practices Code; and
- other approved B.C. Forest Service and joint agency forest management practices and policies.

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; and
- 3) The source of the data and comments.

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

2. Current Forest Management Considerations and Issues

2.1 Base case management assumptions

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

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
Site index application	A "paired plot" study completed in 1996 showed that the site index in old-hemlock stands is currently underestimated by 10 metres when compared to adjacent managed hemlock stands. The results of this study show that some adjustment to site productivity estimates should be made when the old-hemlock forest is harvested and replaced with managed hemlock stands. The inventory file will be reviewed for appropriate application of the study results in consultation with the Research Branch, Ministry of Forests.
Land claim settlement area	The Kalum TSA encompasses four First Nations Tradition Territories. Only the Nisga'a Agreement-in-Principle lands are adequately defined by all concerned parties to be reflected in the data package. If land use decisions are made and implemented before the AAC determination is made, they will be considered.
Minimum harvestable age	A review of harvesting activity indicates that reasonable minimum criteria for harvesting is 250 cubic metres per hectare and an average of 25 centimetres diameter at breast height (DBH). A corresponding age will be derived.
Community watersheds	The Deep Creek community watershed will be modelled to reflect the standards outlined in the <i>Community Watershed Guidebook</i> .

2. Current Forest Management Considerations and Issues

The identified forest management considerations and issues are derived from:

- local resources plans;
- district silviculture strategies;
- licensee's forest development plans and management working plans;
- public responses to the Kalum TSA 1994 Timber Supply Review;
- Chief Forester's comments on the Kalum TSA 1994 Timber Supply Review;
- the *Forest Practices Code of British Columbia Act* and Guidebooks; and
- forest district policies.

3. Inventories

3.1 Background information

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

Table 2. Inventory information

Data	Source	Vintage	Update	Scale
Forest cover	Ministry of Forests (MoF)		mid-1995	1:20,000
Thunderbird local resource use plan (LRUP)	MoF	1992		1:20,000
Fiddler Creek local resource use plan	MoF	1995		1:50,000
Draft landscape units	MELP/MoF	1997		1:250,000
Riparian management areas (six mapsheets)	MoF	1997		1:20,000
Nisga'a Agreement-in-Principle lands	MoF, Aboriginal Affairs Branch	1996		1:250,000

Data source and comments:

A number of other maps and studies were used to develop the data package including forest development plans, Kitimat drainage survey, the Kalum forest district commercial thinning strategy, and the Kalum forest district incremental silviculture strategy.

The Thunderbird Integrated Resource Management Plan was completed in 1992 and the Fiddler Creek Total Resource Plan was completed in 1995. These plans are guiding operational activities in the respective areas.

Digital stream classification of classes S1 through S3 were obtained by the Kalum forest district. The district GIS analyst buffered each stream class for appropriate riparian reserve and riparian management zone. Riparian data will be discussed in Section 5.2.11, "Riparian management areas."

Landscape units were developed from the Ministry of Environment, Lands and Parks (MELP) watershed atlas.

Nisga'a Agreement-in-Principle land mapping was provided by the Aboriginal Affairs Branch of the Ministry of Forests.

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 data set 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 by the timber supply analyst.

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

Table 3. Objectives to be tracked

Objectives	Inventory definition
Commercial thinning	Hemlock — site index > 24, density range from 800 - 1000 stems per hectare.
Short rotation	See specific analysis unit for Kitimat Valley.
Visual quality areas	Established visual quality objectives (VQOs) in the forest cover maps recreation component. Codes 01 through 04 will be used.
Forest retention by draft landscape unit	This area is identified on a separate digital map.
Hecate (reporting of harvest activity)	Area that is contained within the Agreement-in-Principle Nisga'a lands.
Kitimat municipality (reporting only)	This zone is identified as BCGS mapsheets: 103H076, 103H086, 103H096, 103H098, 103I007 and 103I008.
Kitimat Valley (reporting only)	This zone is identified as BCGS mapsheets: 103I017, 103I018, 103I027 and 103I028.
Thunderbird LRUP (forest required above 140 years of age)	This area is identified on a separate digital map.
Fiddler LRUP (reporting only)	This area is identified on a separate digital map.
Deep Creek	Community watershed identified as ownership code 69C on mapsheets: 103I058, 103I068.
Integrated resource management (IRM)	Areas where harvesting operations are not otherwise constrained by visual resources or wildlife habitat.

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 specific timber growing capability — as indicated by the inventory type group and site index in the forest inventory file. Each analysis unit is assigned its own timber volume projections (yield tables) for existing and future stands.

Table 4. Definition of analysis units

Analysis unit (leading species)		Criteria		
		Inventory type group	Age range	Forest inventory zone
H/B/C/S	good – coast	9 – 26	All	A
H/B/C/S	medium – coast	9 – 26	0 – 140	A
H/B/C/S	medium – coast	9 – 26	140+	A
H/B/C/S	poor – coast	9 – 26	0 – 140	A
H/B/C/S	poor – coast	9 – 26	140+	A
Pl	good, medium, poor – coast	28 – 31	All	A
Ac	good, medium, poor – coast	35, 36	All	A
H/B/C	good – interior	9 – 26	All	J
H/B/C	medium – interior	9 – 26	0 – 140	J
H/B/C	medium – interior	9 – 26	140+	J
H/B/C	poor – interior	9 – 26	0 – 140	J
H/B/C	poor – interior	9 – 26	140+	J
Pl	good, medium, poor – interior	28 – 31	All	J
Ac	good, medium, poor – interior	35, 36	All	J
H/B	good – Kitimat Valley	9 – 26	All	A
H/B	medium – Kitimat Valley	9 – 26	All	A
H/B	poor – Kitimat Valley	9 – 26	0 – 140	A
H/B	poor – Kitimat Valley	9 – 26	140+	A
Ss (short rotation)	good – Kitimat Valley	21 – 26	All	A

4. Division of the Area into Management Zones

Data source and comments:

The general site productivity class given for each analysis unit (either good, medium or poor) will be assigned using the distribution of site index values for the timber harvesting land base and does not necessarily reflect site class designations found in the inventory file.

Spruce is not anticipated to be a dominant species in regenerated stands because of the spruce leader weevil. Stands currently labelled as spruce-leading, and younger than 30 years are assumed to be in the process of converting to hemlock- or balsam-leading stands. An exception is approximately 880 hectares of young spruce in the Kitimat Valley that is assumed to be old enough, and sufficiently dominated by spruce to manage on a short rotation (about 40 years), and then convert to hemlock.

5. Timber Harvesting Land Base Definition

5.1 Identification of the timber harvesting land base

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

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

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

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

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

After all areas that do not contribute to the timber harvesting land base have been identified, 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. All areas with other ownership codes will be removed from the land base considered available for timber supply. This includes areas under woodlot licence as their AAC is determined independently of the timber supply review process. Timber licence area — ownership code 70N — is considered under Section 5.2.12, "Timber licence reversions" as a portion of these areas will revert to Crown land status.

5.2.2 Land classified as non-forest

Type identity 6, areas such as alpine, lakes, rocks, etc., and type identity 8 where no typing is available, will be excluded from the land base considered for timber supply. However, type identity 6 area where coniferous leading species is present, will be reviewed for consideration towards providing biodiversity in the form of older forest characteristics.

5. Timber Harvesting Land Base Definition

5.2.3 Non-commercial cover

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

5.2.4 Environmentally sensitive areas

Some forest 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 classification: soil (Es), forest regeneration problems (Ep), snow avalanche (Ea), recreation (Er), and wildlife (Ew). With the exception of avalanche for the Kalum TSA, 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 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 deals with those areas in which harvesting will not occur.

Table 5. Description of environmentally sensitive areas

ESA category	ESA description	Reduction per cent (%)
S1	Soil — high	50
S2	Soil — moderate	30
R1	Recreation — high	100
P1	Regeneration — high	100
P2	Regeneration — moderate	50
A1	Avalanche — high	100

Data source and comments:

Land base exclusions for recreation ESAs were not applied on mapsheets 103I057 and 103I058 because the classifications were outdated.

Forest district staff have reviewed the Ew mapping and determined that it should not be used for TSR2 because of the following reasons:

- The extent of area mapped under this category is small and generally does not reflect the range of wildlife issues.
- Most of the high wildlife habitat area are captured in riparian management areas.

5. Timber Harvesting Land Base Definition

Approximately 17.5% of the productive forest in the Kalum South TSA with current terrain stability inventory has been reviewed. The following table compares the total area of terrain stability against the area found to be classified as Es1 and Es2 area per mapsheet reviewed.

Table 6. Total terrain stability mapping and ESA soils mapping for selected mapsheets

Mapsheet #	Terrain stability total (hectares)	Terrain class V (hectares)	Terrain class IV (hectares)	Total Es1 (hectares)	Total Es2 (hectares)
103I045	6 000	214	926	1 474	195
103I055	800	130	120	836	142
103I059	8 000	299	1 170	1 775	1 184
103I060	6 600	199	661	889	1 101
103I069	1 700	12	162	1 447	1 167
103I079	2 000	83	1 327	2 588	659
103I080	2 700	116	640	1 547	0
103I088	6 500	1 048	1 240	3 991	7 342
103I089	700	91	161	1 245	538
Total	35 000	2 192	6 407	15 792	12 328

The following table compares the area with terrain stability classifications with limited harvest opportunity against the soils ESA category by operable category within the study area. The ESA soils areas do not equal those found in Table 6 above because only the ESA areas directly related to the terrain class IV and V areas were included in the summary.

Table 7. Terrain stability and coincident ESA soils mapping by operability category

	Terrain class IV (hectares)	Terrain class V (hectares)	Es1 (hectares)	Es2 (hectares)	Es1 + Es2 (hectares)
Within operability lines	1 708.0	152.0	739.4	1 953.0	2 692.4
Outside operability lines	4 699.0	2 040.0	2 199.7	1 613.8	3 813.5
Total hectares	6 407.0	2 192.0	2 939.1	3 566.8	6 505.9

Forest district staff reviewed 35 000 hectares with existing terrain classification mapping for correlation between ESA and terrain class V. Within the operable land base, 80% of Es1 and over 90% of Es2 polygons are not classified as terrain class V — high soil sensitive. However, given that terrain stability mapping is not completed for the Kalum TSA and the terrain stability mapping is not integrated with the forest inventory file, a reduction of 50% for Es1 polygons and 30% for Es2 polygons will be used.

5. Timber Harvesting Land Base Definition

5.2.5 Areas with high recreation values

Areas with a recreation management class code of '1' are predominantly visually sensitive areas in which harvesting is expected to occur. These areas are modelled by applying forest cover requirements rather than being excluded for consideration for 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 and district dependent.

Table 8. Description of inoperable areas

Inventory description	Code	Reduction per cent (%)
Operable	I, N	100

Data source and comments:

The operable codes used in the table above reflect the following considerations:

1. I = Inoperable;
2. N = No typing available and assumed to be inoperable.

Areas defined as physically inoperable are not considered as part of the timber harvesting land base. Characteristics used in defining operability include slope, topography (for example, the presence of gullies, exposed rock), difficulty of road access, soil instability, elevation and timber characteristics. Operability maps for Kalum TSA were drafted in late 1991.

Methods used in determining operability lines are documented in *A Report on Mapping of Operability Lines within the South Kalum* (November 25, 1991).

While the current operability mapping is considered to be accurate, there is some heli-logging above the operability. These operations are very small and require high stand volumes to be economical (e.g., 10 hectares per block and requires between 500 and 700 cubic metres per hectare merchantable volume). Forest district staff feel that only a minor difference may be observed if a complete operability review was conducted. A sensitivity analysis on heli-logging operations will be performed by including the inoperable areas with the minimum volume requirements listed.

5. Timber Harvesting Land Base Definition

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.

Table 9. *Description of sites with low timber growing potential*

Species	Forest inventory zone	SI limit (metres)	Per cent (%) excluded
Balsam	A	< 6.5	100
	J	< 6.5	
Cedar	A	< 8.5	100
	J	< 9	
Hemlock	A	< 7	100
	J	< 7.5	
Spruce	A	< 3	100
	J	< 5	
Pine	A	< 8.5	100
	J	< 9.5	
Cottonwood	A	< 8	100
	J	< 7	

Data source and comments:

Low site cut-off was set at the site index for which the maximum annual increment was one cubic metre per hectare per year.

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.

5. Timber Harvesting Land Base Definition

Table 10. Problem forest types criteria

Species	Inventory type groups	Age	Height (metres)	Crown closure (%)	Volume (m ³ /hectare)	Reduction per cent (%)
All deciduous except cottonwood	37-42					100
All species		> 100	< 22			100
All species		> 60		0-25		100
All species		> 100			< 250	100

Data source and comments:

Currently, deciduous-leading stands and open-grown stands are not targeted for harvest.

Forest district experience indicates that trees greater than 22 metres and older than 100 years are eligible for harvest.

Stands with less than 250 cubic metres per hectare of merchantable volume are currently not being harvested to any significant degree.

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 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.

Table 11. Estimates for existing and future roads, trails and landings

Roads, trails and landings	Age (years)	History reference	Total reduction per cent (%)
Existing	≤ 35	1	8.8
Future	> 35	—	8.8

5. Timber Harvesting Land Base Definition

Data source and comments:

To account for productive land lost to date during timber harvesting and road building, and not reclassified as non-forest land, 8.8% of areas in Kalum TSA with a timber harvesting history (HIST_REF=1), and age less than or equal to 35 years were considered not to contribute to further timber production.

The 8.8% figure is a weighted average from studies done for Tree Farm Licences (TFLs) 1 and 41, and forest licences in the Kalum TSA.

5.2.10 Cultural heritage resources

Archaeological overview and cultural heritage inventories for the entire Kalum TSA have been completed. Within the Kalum TSA, there are 2512 hectares which are identified for high archaeological potential. The management measures that will be taken on these sites are not known and thus cannot be addressed at this time.

5.2.11 Riparian management areas

In order to determine appropriate riparian considerations in the Kalum TSA, a fisheries biologist was tasked with classifying streams S1-S3 for the entire TSA. Forest district staff reviewed this information, and six representative mapsheets were chosen to be digitized. The streams were then buffered for riparian reserve zones and riparian management zones. These buffers have been merged with the forest cover information. An examination of the buffer areas will be performed to determine an appropriate reduction to be applied to the area outside the sample area. Care will be taken to ensure that the reductions only remove riparian areas that have not already been accounted for by other factors such as operability or ESAs.

Table 12. Riparian management areas from six sample mapsheets

Stream classification	Reserve zone width (metres)	Total area (hectares)	Management zone width (metres)	Total area (hectares)
S1 (20 m < width < 100 m)	50	1267	20	365
S1 (width > 100 m)	0	0	100	2 419
S2	30	660	20	342
S3	20	1 028	20	845
Total riparian management area	2 955		3 971	
Total TSA area surveyed	67 750			

5. Timber Harvesting Land Base Definition

Data source and comments:

Current practice in the Kalum TSA is 100% retention of the riparian reserve zones and about 10% retention of the riparian management zones. To reflect this, the management zone width will be effectively reduced by 90% to reflect that 90% of the management zone is available for harvest. A percentage of the productive forest, based on the information from six mapsheets already surveyed, will be reduced to reflect both riparian reserve and management zones.

5.2.12 Timber licence reversions

Timber licences (TLs) are a form of timber tenure that gives the holder exclusive right to harvest merchantable timber from defined areas of Crown land. After the area is harvested and reaches a free-growing condition the land reverts to Forest Service jurisdiction. The timber cut from TLs is not part of the allowable annual cut of a TSA. There are about 3300 hectares of timber licences in the Kalum TSA. A portion of this is considered to be unharvestable by the definitions used to define the timber harvesting land base. While the remainder of this area is expected to revert to the Forest Service, about 1000 hectares in the Kitimat Valley will be transferred to TFL 41. The TL area expected to revert to the Forest Service (change from ownership code 70N to 62C) is assumed to be harvested within the next 5 years.

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

Analysis unit	Utilization		
	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
Cottonwood	22.5	30	10
All others	17.5	30	10

Data source and comments:

In the Kalum TSA, the current practice is to utilize volume to the 15 cm minimum dib. However, the volume between 15 cm and 10 cm dib is recorded for cut control purposes.

6.1.2 Volume exclusions for mixed species stands

One or more species in mixed species stands may be unmerchantable. For example, the deciduous species in a predominantly coniferous stand may not be harvested, or may only be partially harvested. The unharvested portion should not contribute to the estimated stand volume. The species that do not contribute and that will be excluded from the estimation of stand volume are shown in the table below.

Table 14. Volume exclusions for mixed species types

Species	Volume exclusion (%)
All deciduous except cottonwood	100

Data source and comments:

Forest district staff reviewed whether the deciduous components of coniferous stands may contribute to biodiversity. However, given the harvesting techniques employed in the Kalum TSA, any small contribution made by such components would be negligible.

6. Current Forest Management Assumptions

6.1.3 Minimum harvestable age derivation

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

Table 15. Minimum harvestable age criteria

Analysis unit	Minimum criteria		
	Height (metres)	Volume (m ³ /hectare)	Average diameter
All	22	250	25

Data source and comments:

Stands will meet all three criteria before being eligible for harvest.

6.1.4 Harvest scheduling priorities

Short rotation spruce harvest will start in decade 2, when these stands will be eligible to convert to hemlock-leading stands.

6.1.5 Silvicultural systems

The majority of the Kalum TSA is being harvested using clearcut harvesting methods. Forest district staff anticipate some increased use of partial or selection harvest systems. However, there is little current performance and factoring partial or selection harvest silvicultural systems into the TSA timber supply is not reasonable at this time.

6.1.6 Commercial thinning

The district has a commercial thinning strategy that can be used to provide volume if there is a shortfall in the harvest forecast. Many stands have already been spaced to prepare for this. Testing will be done during the timber supply analysis to determine if a contribution from commercial thinning is needed.

The commercial thinning opportunities are available with the following regime.

Table 16. Commercial thinning regime

Eligible analysis units and location	Juvenile spacing density	Basal area removal (%)	Age at commercial thinning	Age at final harvest
H/B good sites	800	35-40	40	60-80

6. Current Forest Management Assumptions

Data source and comments:

Commercial thinning is occurring within hemlock stands of good site productivity. Operational practice is to remove 35-40% of the basal area at 40 years of age and return for final clearcut felling a minimum of 20 years later. Currently timber sales are planned for about 10 000 cubic metres of volume from commercial thinning.

6.2 Unsalvaged losses

Table 17 shows the estimated average annual unsalvaged volume loss to catastrophic events such as insect 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 17. *Unsalvaged losses*

Cause of loss	Total loss (m ³ /year)	Annual unsalvaged loss (m ³ /year)
Fire	2 500	2 500
Wind	14 000	7 000
		9 500

Data source and comments:

The windthrow and fire estimates are based upon district records, district experience with salvage and district fire occurrence records. There is currently no other information available.

6.3 Silviculture

6.3.1 Site productivity estimates for managed stands

A "paired plot" study completed in 1996 showed that the site index in old-hemlock stands is currently underestimated by about 10 metres when compared to adjacent managed hemlock stands. The results of this study show that some adjustment to site productivity estimates should be made when hemlock-leading stands currently greater than 140 years of age, are harvested and replaced with managed hemlock stands. The actual practices and the inventory file will be reviewed for appropriate extrapolation of the study results to very young stands. This will be accomplished in consultation with the Research Branch, Ministry of Forests and the results will be examined in the analysis.

6.3.2 Silviculture and regeneration activities in managed stands

The silviculture program reflects the mix of treatments expected to be carried out. This level of activity assumes basic silviculture on all sites plus incremental silviculture on some sites. Table 18 shows the proportion of each analysis unit to be treated under each silviculture regime and the expected average regeneration delay.

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

6. Current Forest Management Assumptions

Table 18. Regeneration assumptions by analysis unit

Analysis unit		Regen delay ^a	OAFs ^b		Method		Density	
			1 %	2 %	Type	%	Initial	Space
H/B/C/S	G - Coast	3	15	5	Planted	100	1400	1000
H/B/C/S	M - Coast < 140	3	15	5	Planted	50	1400	1000
		6	15	5	Natural	50	4000	1000
H/B/C/S	M - Coast 140+	3	15	5	Planted	50	1400	1000
		6	15	5	Natural	50	4000	1000
H/B/C/S	P - Coast < 140	6	15	5	Natural	100	4000	
H/B/C/S	P - Coast 140+	6	15	5	Natural	100	4000	
PI	G/M/P - Coast	3	15	5	Planted	100	1400	
Ac	Coast	3	15	5	Planted	100	1400	700
H/B/C	G - Interior	3	15	5	Planted	100	1400	1000
H/B/C	M - Interior < 140	3	15	5	Planted	50	1400	1000
		6	15	5	Natural	50	4000	1000
H/B/C	M - Interior 140+	3	15	5	Planted	50	1400	1000
		6	15	5	Natural	50	4000	1000
H/B/C	P - Interior < 140	6	15	5	Natural	100	4000	
H/B/C	P - Interior 140+	6	15	5	Natural	100	4000	
PI	Interior	3	15	5	Planted	25	1500	700
Ac	Interior	3	15	5	Natural	100	4000	800
H/B	G - Kitimat Valley	3	15	5	Planted	100	1400	1000
H/B	M - Kitimat Valley	3	15	5	Planted	50	1400	1000
		6	15	5	Natural	50	4000	1000
H/B	P - Kitimat Valley < 140	6	15	5	Natural	100	4000	
H/B	P - Kitimat Valley 140+	6	15	5	Natural	100	4000	
Ss (early rotation)	G - Kitimat Valley	3	15	5	Planted	100	1400	1200

(a) Regeneration delay reflects current operational practice and is defined as the time after harvest but before planting or seed germination occurs. Regeneration delays will be applied in the FSSIM forest estate model, not in the TIPSy yield model.

(b) Provincial average operational adjustment factors (OAFs) values are applied to the managed stand yield curves as recommended by the Ministry of Forests, Research Branch — as no local values are available. OAF 1 reflects non-productive, unplatable spots in productive forest land while OAF 2 reflects an estimate for waste and breakage.

6. Current Forest Management Assumptions

Data source and comments:

All values in the above table are based on current performance as estimated by the forest district staff. The average density is 4000 stems per hectare for natural regeneration. The range is from 3000 to 7000 sph. All good sites and half of the medium sites are 100% planted. Planting density is on average 1400 stems per hectare for all species and sites. The remainder of the logged areas, half of the medium and all poor sites, are managed for natural regeneration and are fill planted at the end of regeneration delay period if density is not 1400 stems per hectare.

Analysis units are assumed to regenerate to the leading species of the respective analysis unit with the exception of Sitka spruce which will regenerate to hemlock.

6.3.3 Immature plantation history

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

Table 19. Immature plantation history

Analysis unit	Area to be assigned to MSYTs (%)			
	Age 1 - 10	Age 11 - 20	Age 21 - 30	Age 31 - 40
All types	100	100	70	30

Data source and comments:

The proportion of immature stands that are considered "managed" is based on the best professional estimate of the forest district silviculture staff. Density levels will be reviewed in the inventory file. Any stands with more than 10 000 stems per hectare in stands older than 20 will not be assigned to MSYTs.

6.3.4 Not satisfactorily restocked (NSR) areas

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

There is currently about 6493 hectares of NSR listed in MLSIS/ISIS records. Forest district silvicultural records show 4431 hectares of backlog NSR (i.e., harvested prior to 1987) and 2062 hectares of current NSR. 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 overall distribution of harvest within analysis units has not changed significantly over this period of time and is assumed to regenerate within the regeneration delays provided in Table 18.

All NSR within the operable land base is included in the timber harvesting land base. Any NSR within the inoperable portion of the land base will be reviewed when the forest inventory file is available to determine if this area should contribute to the timber harvesting land base.

6. Current Forest Management Assumptions

The amount of NSR in the forest inventory file will not be available until processing of the file is complete. Any discrepancy in area between the forest inventory files and ML SIS/ISIS records (which are more up-to-date), aside from inoperable considerations, will be assumed to have already been restocked and is currently about 1 to 5 years old. This area of discrepancy will be assigned to analysis units in proportion to the distribution of analysis units by geographic unit.

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 Geographic Information System (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 20a. Forest cover requirements for integrated resource management (IRM) and visual quality objectives (VQO) areas within each draft landscape unit

Note: The following forest cover requirements will be applied to management emphasis within each landscape unit. The Fiddler Creek landscape unit and Fiddler Total Resource Plan share a great deal of common forest area. The inventory file will be reviewed to determine whether landscape unit designations alone will be adequate to reflect current management.

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)	Application
IRM areas	3	35	Timber harvesting land base
VQO = R	5	5	Productive forest
VQO = PR	5	15	Productive forest
VQO = M	5	25	Productive forest

6. Current Forest Management Assumptions

Data source and comments:

The maximum allowable disturbance constraint for the integrated resource management (IRM) areas is assumed to be applied to the timber harvesting land base. Kalum Forest District staff indicate that the IRM areas are generally large contiguous patches of harvestable forest and the maximum disturbance of 35% adequately describes the cutting pattern used at this time.

Visual quality objectives have been assigned by the Kalum Forest District and the Prince Rupert Forest Region recreation staff. Kalum Forest District staff indicate that the large amount of non-contributing forest will have a great deal of impact on the application of the forest cover requirements. For this reason, the maximum allowable disturbance will be applied to the productive forest.

Table 20b. Forest cover requirements for the Deep Creek community watershed

	Green-up height (metres)	Green-up maximum allowable disturbance (% area)	Application
Deep Creek community watershed	5	30	Productive forest

Data source and comments:

The regional research hydrologist indicates that the above guideline is appropriate for the Deep Creek community watershed due to its relatively gentle topography.

Table 20c. Forest cover requirements for the Thunderbird integrated resource management area

Note: The following forest cover requirements will be applied to areas that have been identified under the Thunderbird Integrated Resource Management Plan (IRMP).

	Minimum age (years)	Minimum retention (% area)	Application
Thunderbird IRMP	140	12	Productive forest

Data source and comments

Older forest retention guidelines were derived from the *Thunderbird Integrated Resource Management Plan*.

6. Current Forest Management Assumptions

Table 20d. Forest cover requirements for landscape level biodiversity

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. The landscape units are not yet finalized, however, as the draft units are available in digital format they will be used as a modelling tool to simulate the geographic retention of older forest characteristics across the Kalum TSA. This does not imply these units are final. The numbers in the minimum retention area column coincide with the per cent requirement in the first, seventh and fourteenth decade respectively.

Biogeoclimatic unit	NDT	Old-seral stage			Minimum age (years)	Application
		Minimum retention area by decade (%)				
		1	7	14		
CWH	1	10	12	14	250	Productive forest
MH	1	14	17	20	250	Productive forest
CWH	2	7	8	9	250	Productive forest
ICH	2	7	8	9	250	Productive forest

Data source and comments:

Biodiversity guidelines will be modelled using information from the *Forest Practices Code Biodiversity Guidebook*.

A process to establish biodiversity objectives for each landscape unit is currently underway and will be completed over the next several years. As a first step in this process, draft biodiversity emphasis options and landscape unit boundaries for use in the regional landscape unit planning process were approved by the Kalum forest district manager and the designated environment official on October 31, 1997. However, these boundaries and emphasis options are not currently being used operationally.

As it is unknown at this time which landscape units will be assigned low-, intermediate- or high-biodiversity objectives, a single weighted constraint for the old-seral stage will be developed based on the anticipated distribution of 45% low-, 45% intermediate- and 10% high-emphasis. The values shown in Table 20d above reflect the weighted *Biodiversity Guidebook* values. The values in Table 20d are initially based achieving one-third of the *Biodiversity Guidebook* old-seral stage constraint in the low-emphasis portion. As seen in the table this is built up over time to ensure that the full minimum retention of old-seral forest will be met by the end of three rotations.

All stand heights shown in Tables 20a and 20b refer to top heights (inventory definition), not average stand height.

6. Current Forest Management Assumptions

6.4.2 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 when 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.

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

Management zone	Analysis unit	Persistence	Per cent (%) recommended in applicable guidebook	Residual area estimate on the timber harvesting land base (%)
IRM, VQO=M	All	Long term	9	2-3

Data source and comments:

Forest district staff estimate that about 75% of WTP will be accounted for from non-contributing land base areas (e.g., riparian management zone, inoperable forest, etc.).

The remaining 25% for WTP will be removed from the timber harvesting land base, this area will also contribute to old forest account because the WTP will be larger than two hectares and require old-growth characteristics to be considered eligible. This additional reduction will be assumed to be located in the integrated resource management (IRM), and modification visual quality objective (VQO), (i.e., not in the partial retention, retention or community watershed) as forest district staff feel that only these areas will require some management activity to retain stand structure. It is assumed that these wildlife tree patches will not be economical to harvest at a later date, nor will they be available to harvest in subsequent harvesting of the stand.

The figure of 2-3% shown in Table 21 is based on the assumption that only about a 1/4 of the total requirement of 9% will need to be provided by the timber harvesting land base after considering areas already excluded for other reasons at the TSA level. The figure of 9% is taken from Table 20(a) of the *Forest Practices Biodiversity Guidebook* using the assumptions that about 50% of the forested area in the IRM and modification VQO management emphasis areas are harvestable, and that about 70% of the area has already been harvested once without recommended wildlife tree retention. Individual landscape unit percentages will be developed after identification of the timber harvesting land base is complete.

7. Sensitivity Analyses to be Performed

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

Table 22. *Sensitivity issues specific to the Kalum TSA*

Issue to be tested	Sensitivity levels
Age when forest achieves "old" forest attributes.	+/- 20 years, +/- 100 years
Merchantable volume per hectare limit required for heli-logging operations.	Addition of inoperable stands with 500-700 cubic metres per hectare for harvest
Reduce old-growth site index adjustments provided by the Research Branch of the Ministry of Forests.	Reduce SI adjustment on hemlock stands above 140 years of age to 5 metres and 0 metres

Table 23. *Standard sensitivity analysis*

Issue to be tested	Sensitivity levels
Existing stand yields	+/- 10%
Regenerated stand yields	+/- 10%
Minimum harvestable age	+/- 10 years +/- 50 m ³ /ha
Landscape level biodiversity	Model biodiversity emphasis options as described in the draft Regional Landscape Unit Planning Strategy, October 31, 1997.
Land base changes	+/- 10%
Visual quality objectives	Mid-range % denudation
Harvest flow alternatives	
Seral stage distributions	Apply the early and mature + old-seral stage requirements
Green-up periods	+/- 5 years and +/- 10 years
IRM zone	Change maximum area below green-up age to 25%