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An Evaluation
of
Available Merchantable Volume
in Areas Subject to
Visual Quality Objectives

March, 1998

Prepared by:

INDUSTRIAL FORESTRY SERVICE LTD.,

In Conjunction with

MINISTRY OF FORESTS - FOREST PRACTICES BRANCH

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Executive Summary

An analysis of timber availability and timber supply within scenic areas was performed in the Robson Valley TSA. The analysis focussed on the impact of partial cutting (via uniform selective harvest) specific stands within the Robson Valley TSA.

The following report describes a procedure used to identify candidate stands suitable for partial cutting. The report then quantifies the potential change in availability and long-term timber supply when partial cut harvesting is conducted in conjunction with clear-cut harvesting within scenic areas. The methodology used to quantify this change is described in detail. The availability analysis is based upon the results of a previously published MOF report pertaining to the visual impacts of partial cutting. The long-term analysis is conducted using current (i.e., 1996) Timber Supply Review (TSR) assumptions.

The results of this analysis show that due to the temporal constraints (i.e., green-up delays and forest cover constraints) imposed upon the scenic timber harvesting land-base, both short-term timber availability and long-term timber supply will increase when partial cutting is chosen over clear-cut harvesting.

The report reveals how partial cutting 22% of the stands within scenic areas could impact short-term availability by as much as 58%. Similarly, a 36% increase in the long-term harvest from scenic areas could also be realized.

A discussion into the concerns that have inhibited licensees from embracing partial cut harvesting systems is also provided.

AN EVALUATION OF AVAILABLE MERCHANTABLE VOLUMES IN AREAS SUBJECT TO

VISUAL QUALITY OBJECTIVES

1.0 Introduction

In September 1997, the Ministry of Forests (MOF) Forest Resources Branch, in conjunction with Industrial Forestry Service Ltd. (IFS) of Prince George, commenced an FRBC-funded project to evaluate timber availability in scenic areas. The following report is the result of a pilot study on timber availability relative to the Robson Valley Timber Supply Area (TSA).

The fundamental goal of this project was to encourage the use of alternative harvest systems, by:

A. identifying stands within the Robson Valley TSA suitable for partial cutting.

B. estimating the short-term change in timber availability that occurs when partial cutting is used within these stands of merchantable timber.

C. estimating the potential long-term impact on the annual allowable cut (AAC) when select stands of timber (within scenic areas) are harvested using a partial cut system.

The specific objectives of this report are:

1. to evaluate/derive a methodology to determine the change in availability at the TS-level when partial cutting is combined with clear-cut harvesting.

2. to produce a tabular description of merchantable stands within scenic areas in the Robson Valley TSA, and assess availability on all stands within scenic areas (note: three scenarios with different levels of partial cutting were tested).

3. to produce a timber supply analysis data package and analysis report which quantifies the land-base, methodology, management assumptions and long-term impact of partial cutting and clear-cutting in scenic areas.

4. to create a colour map of the Robson Valley TSA (scale 1:250000) showing operable stands within scenic areas that are candidates for partial cutting as opposed to clear-cut harvesting.

In this report '*partial cutting*' is referred to as a silviculture/harvest system that retains on the site, sufficient basal area, volume or stems to maintain the visual quality objectives for various portions of the landscape. Although partial cutting systems include seed tree, patch cut,

shelterwood, selection harvest, and clear-cut with reserves, a uniform leave-tree partial cutting system is assumed to be the system best suited to maintain visual integrity.

'*Availability*' is a term used to describe a timbered area within a land-base which is currently mature, operable, merchantable, and not currently constrained by temporal restrictions such as adjacency, green-up, and aesthetics. Availability is relative to the immediate (1-20 year) accessibility of timber typically expressed through type of harvest, cut/leave pattern, number of passes, size of passes, and harvest delay periods.

'*Timber supply*' (or long-run sustained yield) differs from timber availability through reference to the planning horizon. Supply is related to long-term (100-400 year) timber yield, expressed through site productivity, silviculture programs, utilization, biodiversity, availability and the operability of mature and immature stands.

In this report, reference to *scenic area* is specific only to visual landscape units with a visual quality objective (VQO) of *retention, partial retention, or modification*. Preservation and maximum modification VQO areas were purposely disregarded in this analysis. Preservation VQO areas were ignored because they are typically excluded from the timber harvesting land-base. Maximum modification VQO areas, because they are generally considered a part of the working forest and do not constrain timber supply due to aesthetic concerns.

This project was undertaken to complement a previous study completed by the MOF on the visual impacts of partial cutting. The MOF report found that percent volume removed and tree height, when used together, provide the best variables for predicting if a particular VQO would be achieved. Table 1 was one of the results of this study and provides an estimate of what volume/tree height combination may be harvested from a visual landscape unit and still achieve a given visual quality objective. [1]

[1] The previous study and rationale in support of Table 1 is described within *Visual Impacts of Partial Cutting Summary Report - A Technical Analysis and Public Perception Study*. *MOF Forest Practices Branch, August 1997.*

Table 1 Predicting VQOs using partial cutting silvicultural systems

Volume (stems) Removed in %	Tree Height (metres) 5	10	15	20	25	30	35	40	45	50
10	R	R	R	R	R	R	R	R	PR	PR
20	R	R	R	R	R	R	PR	PR	PR	PR
30	R	R	R	R	PR	PR	PR	PR	PR	PR
40	R	R	PR	PR	PR	PR	PR	PR	PR	M
50	PR	PR	PR	PR	PR	PR	PR	M	M	M
60	PR	PR	PR	PR	PR	M	M	M	M	M
70	PR	PR	PR	PR	M	M	M	M	M	M
80	PR	PR	M	M	M	M	M	M	M	M
90	M	M	M	M	M	M	M	M	M	M

Note: R=Retention, PR=Partial Retention, M=Modification
There is a 90% or better chance of achieving the VQO shown, within 10-40 metre tree height

Table 1 is derived from forest stands within the following parameters. Any extrapolation outside these parameters should be used with caution.

SLOPE	3 - 47%
DBH	17.5 - 86.3 cm
TREE HEIGHT	11 - 39 m
PRE-HARVEST VOLUME	70 - 844 m^3/ha
PRE-HARVEST BASAL AREA	21 - 68 m^2/ha
PRE-HARVEST STEMS	136 - 1150 / ha

2.0 Methodology

Two methods for quantifying the change in available volume are described in this report, however, only one was applied to the Robson Valley TSA.

The first method, is aimed more toward a site-specific analysis encompassing no more than a few map sheets (i.e., as in an LRUP analysis). The second method is directed toward TSA-level analysis wherein an abundance of inventory information is required to accurately describe the visual land-base. Both of the following methods are equally valid and should in theory, provide the same result.

2.1 Method for site-specific analysis

Step 1: Summarize stand data within the operable forest of each Visual Landscape Unit (VLU).

Table 2 Summary of stand data within each VLU

VLU #	Stand Type	Slope Class	Operable Area (ha)	Volume (m3/ha)	Total Volume (m3)

Step 2: Using the information collected in Table 2, assess each stand type within each VLU for their applicability to be partially cut.

Table 3 Appropriateness of partial cutting (PC) by stand within VLUs

VLU #: _____ Stand type: _____ Slope Class: _____	**Appropriateness**	
Considerations	**Clear-cut**	**Partial Cut**
operational feasibility (access, equipment, piece size)		
ecological (species, site, slope, water, biodiversity, wildlife habitat)		
social (scenic values, community concerns, green-up)		
regeneration (species, shade tolerance, shade/seed requirements)		
forest health (disease / pest susceptibility)		
other (fir / protection concerns, etc.)		
Overall appropriate system? (Yes or No)		
System of choice (PC or CC)		

Note: if a NO appears in either column this suggests that the system being evaluated is not appropriate. Where both systems are appropriate, PC should be chosen as the preferred system.

Step 3: Using Figure 1 as a guide, complete Table 4 by applying the data collected in steps 1 and 2 (Tables 2 and 3).

Figure 1 Flow chart detailing procedure to evaluate potential timber supply gain by partial cutting in visually constrained areas

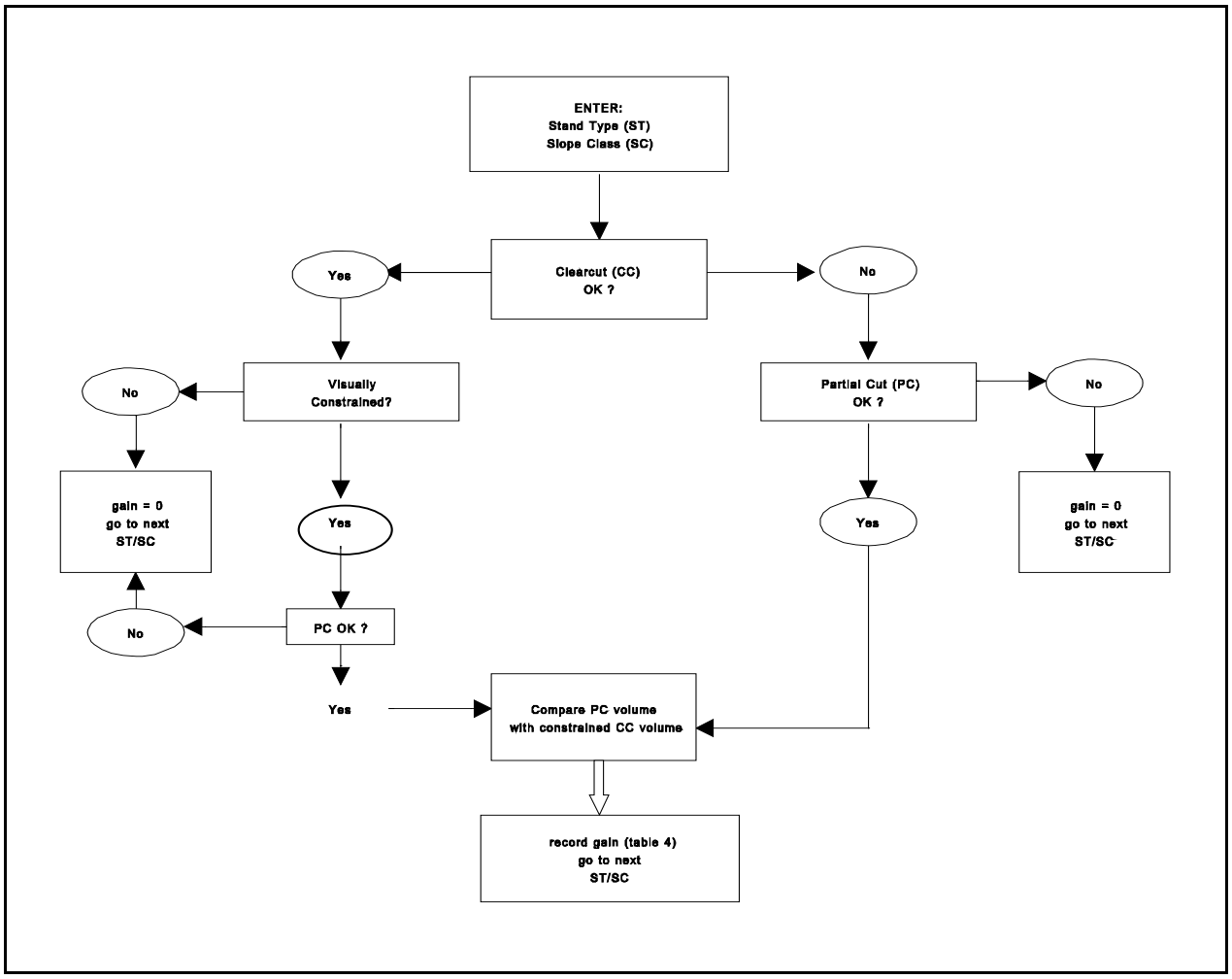

Table 4 Constrained clear-cut volume made available through partial cutting

VLU #	Stand Type	Slope Class	Net Area (ha)	Net Vol. m3/ha	Total Net Vol (m3)	VQO	C.C. % Avail.	C.C. Const Vol. Avail.	P.C. % Avail.	P.C. Const Vol. Avail.	Gain from P.C. (m3)	Gain from P.C. (%)

Columns in Table 4 are defined as follows:

"VLU"	Visual Landscape Unit. Each VLU has a designated VQO.
"C.C.% Avail"	Clear-cut percent available is the maximum percent denudation attributable to each VQO This is typically the forest cover constraint found in a TSA's Timber Supply Review (TSR) Appendix.
"C.C. Const. Vol. Avail."	Clear-cut constrained volume available is the current volume available for clear-cutting in a VQO, assuming no denudation currently exists within the VLU. Derived by multiplying "Total Vol. (m3)" by the "C.C. % Avail."
"P.C. % Avail."	Partial cut percent available is the available volume in a VQO, if using a partial cutting system. The value is derived using Table 1 in combination with VQO and stand height.
"P.C. Const. Vol. Avail."	Partial cut constrained volume available is the volume of timber available in a stand when using a partial cut harvest system. Derived by multiplying "Total Vol. (m3)" by "P.C. % Avail."
"Gain from P.C."	Gain from partial cut is the difference between the "P.C. Const. Vol. Avail." and the "C.C. Const. Vol. Avail."

The sum of all the "Gain from PC (m3)" is the potential increase in short-term available volume from scenic areas in the study site.

2.2 Method for TSA-level analysis

At the TSA-level of analysis, several changes to the foregoing methodology are warranted to both expedite the evaluation and maintain consistency. Specific to the Robson Valley TSA, reasons for using an alternative methodology include:

i. An intersected GIS file was already available wherein visual landscape inventory, social concerns, merchantability, operability, wildlife habitat, and biological information are a few of the items appended to the traditional MOF Forest Inventory and Planning files (FIP). The file is called the Robson Valley Land and Resource Management Plan (LRMP) file.

ii. VLU=s within the Robson Valley were not distinguished from one another by a distinct polygon number.

iii. The size of the visual landscape inventory in the Robson Valley TSA (i.e., 44% of the TSA) would have made the foregoing methodology very labour intensive and beyond the time-frame allocated to complete the study.

iv. Discussions were held with silviculture foresters and operational foresters throughout the province. This resulted in an appreciation of the silvicultural,

social, and operational qualifications which licensees consider in the selection of candidate partial cut stands. From these discussions emerged the realization that: (1) any stand can be partially cut, and (2) the operational decision to partial cut are based upon stand, site, and other resource considerations which are easily programmed when given access to the appropriate files.

As a result of these factors, Table 4 and the steps followed in Section 2.1 were modified. Table 4b, depicted below, was derived following these steps:

Table 4b Constrained clear-cut volume made available through partial cutting (revised)

Planning Cell	VQO	VAC	Species	Operable Class	Height	Age	Operable Area (ha)	Net Vol. m3/ha	Total Net Vol. (m3)	C.C. % Avail.	C.C. Const. Vol. Avail.	P.C. % Avail	P.C. Const. Vol. Avail.	Recom-mended Harvest Method	Harvest Vol. Avail. (m3)	Gain from P.C. (m3)	Gain from P.C. (%)	Vol. harvest over 150 years

Step 1. Acquire the necessary maps, digital files, overlays, and management documents. Intersect the files and overlays to create a comprehensive data base.[2]

Step 2. Information regarding the selection of candidate partial cut stands was obtained from the following sources:[3]

- Silviculture foresters with a significant background in partial cutting were solicited for advice on which forest stands were most appropriate for partial cutting.
- Operational foresters with experience in selective harvesting in the south-central Interior were approached for their views on *where* and *why* they utilize partial cut harvesting systems.
- Industry and MOF District foresters located in the Robson Valley TSA were questioned on local concerns and local experience regarding partial cutting.

2 Permission to utilize the Robson Valley LRMP files was obtained from the MOF=s Prince George Regional office. The LRMP files are defined by a list of attributes created through the intersection of FIP files and Forest Cover graphics (FC1) . A list of intersected attributes is included in Appendix IV.

3 See acknowledgements, Appendix VII

Step 3. The criteria used to select candidate partial cut stands was programmed and applied to the visual layer within the LRMP file. All operable stands contributing to the Robson Valley Timber Supply Review (TSR) land-base received a tag which denoted partial cut or clear-cut. Section 3.1 describes the criteria used to identify candidate partial cut stands.

Step 4. Table 4b was programmed as a file extract against the LRMP land-base. Several changes to the original Table 4 were made to facilitate the calculation of the gain in partial cut.[4] Changes of note are:

a. "Planning Cell" was used to localize the position of VLUs as much as possible within the TSA, since VLUs in the Robson Valley visual landscape inventory do not have polygon identifiers.

b. Visual Absorption Capacity ("VAC") was used to predict the volume available within the ranges provided in Table 1.

c. "Operable Class" is used in place of "Slope Class". Operability class was defined in previous work done by staff within the MOF=s PG Regional office. Operability incorporates slope and soil conditions. The use of operability class was both more expedient and more specific to the actual logging systems that would be used.[5]

d. "Height" was read from FIP file information and is required for the query on Table 1.

e. "Age" was noted so that only stands currently mature (i.e., at or above regional priority cutting age) or thrifty (i.e., will achieve cutting age within the next twenty years) were assessed for contributing volume.

f. "Operable Area" denotes only those stands contributing to the annual allowable cut.

g. "C.C. % Avail." and AC.C. Const. Vol. Avail." provide the benchmark wherein all mature stands in the net land-base were assumed to be clear-cut. AC.C. % Avail." was calculated using green to operable ratios.[6]

h. Since the constrained volume available from clear-cutting and partial cutting was calculated for every polygon, "Recommended Harvest Method" was included to denote the most appropriate cutting system (i.e., C.C. or P.C.) for each polygon.

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4 The results of this table are shown in Appendices I, II, and III

5 In the Appendix under AOperable Class@: C=Cable, M=Mixed, A=conventional. Operability was defined by the P.G. MOF Regional office in 1988 using slope, soil and mature volume/ha criteria. The slope criteria used was: conventional operability occurred on 0-30% slopes on lacustrine soils and 0-55% on non-lacustrine. Cable operability occurred on >30% slopes on lacustrine soil and > 55% slope on non-lacustrine soils. Mature volume/hectare refined this classification.

6 Derived using *Procedures for Factoring Recreation Resources into Timber Supply Analyses Recreation Branch Technical Report 1993:1* See Appendix VI for calculations.

i. "Volume achieved over 150 years" is a tabular attempt to forecast the volume achievable over a 150-year period. Several broad assumptions had to be made in deriving these figures. [7]

Step 5. Three scenarios, assessing three different methods of aggregating stands suitable for partial cutting, were tabulated.

2.3 Method used for long-term timber supply analysis

To assess the long-term impact of partial cutting in visually constrained areas, the forest estate model FSSIM (Windows 95/NT v. 2.1) was used as the engine to forecast a harvest flow. For comparative purposes, the operable area, VQO, and partial cut designations from Table 4b comprised the net land-base. Volume/age curves were derived using the VDYP model for natural stands and TIPSY for managed stands. Partial cutting was based upon a 30% stand removal at first entry. Subsequent harvests removed the equivalent of the culmination MAI's multiplied by the re-entry period. Technical details of the simulation can be found in Appendix VI.

3.0 Results

3.1 The selection of stands appropriate for partial cutting

The selection of stands appropriate for partial cutting was determined based upon information provided by a cross-section of foresters experienced in this field. In light of the debate surrounding the topic, three scenarios were assessed. The first scenario, or 'benchmark,' defined the stands suitable for partial cutting based upon criteria that might be logically applied anywhere in the B.C. Interior. A 'conservative' scenario was assessed using the hypothesis that, in spite of any potential volume gain from partial cutting, the harvest system would only be performed on sites sensitive to concerns in addition to visual quality. A final, 'liberal,' scenario was assessed using the direction taken from the Robson Valley LRMP. With these three scenarios, a range of impact could be established. The scenarios were programmed as follows:

I. Definition of 'Benchmark' scenario

The following logic was used to define the harvest system in the benchmark scenario:

1 Merchantable stands are defined within the resultant net land-base as provided

[7] These assumptions are described in Appendix V. Note the assumptions did not include current NSR, reductions for the Forest Practices Code, or volume reductions for Non-Recoverable Losses (NRLs).

in the Robson Valley LRMP file (only stands with a VQO of R, PR or M were assessed).

2 All stands that are within proposed protected areas are excluded from harvesting.

3 If stands fall into areas where there is medium to high risk of root rot, ***clear-cut only.***

4 Stands existing within LRUPs within the settlement corridor, ***partial cut only.***

5 If stands are in medium sensitive Caribou habitat, ***partial cut only***. (Note: highly sensitive caribou habitat is excluded from harvesting activity).

6 Stands requiring cable harvesting systems, ***clear-cut only.***

7 If stands have a crown closure less then 40%, ***clear-cut only.***

8 If stands are multi-layered, ***partial cut.***

9 High value spruce stands (i.e., site index (SI) > 12 and stocking class = 1), ***partial cut***.

10 High value Douglas-fir stands (i.e., SI > 16 and stocking class = 1), ***partial cut.***

11 High value cedar stands (i.e., SI > 15, age <120 and stocking class = 1), ***partial cut.***

12 All remaining stands, **clear-cut**.

Note that many stands fall into one or more of the criteria listed above. The points are therefore listed in the priority whereby a decision to partial cut or clear-cut was made.

II. Definition of 'Conservative' scenario

The same definition as the benchmark scenario was used up to point # 8. After this point, a clear-cut harvest system was assumed.

III. Definition of 'Liberal' scenario

The Robson Valley LRMP Table expressed that some form of partial cutting is the preferred harvest system to be used within Retention or Partial Retention VQOs. This scenario assesses partial cutting in all retention and partial retention stands, and in medium caribou habitat stands. Conventional clear-cut harvesting would occur in all remaining VQO areas.

3.2 Constrained volume made available through partial cutting

The results of Table 4b, as described in the methodology, are provided in Appendices I, II and III. Table 5 on the following page summarizes these results.

Table 5 Summary of the constrained volume made available through partial cutting in scenic areas

Scenario	VQO	Total Current Mature and Thrifty		Proportion of VQO Area Suitable for Partial Cut[8]	Available Volume (m3)		Gain from Partial Cutting[9]	
		Net Area (ha)	Net Volume (m3)		Clear-cutting only[10]	Clear-cutting & Partial Cutting[11]	Total Volume (m3)	Total Volume (%)
'Benchmark'	Modification	34,138	11,675,623	23.0%	3,035,662	4,564,608	1,528,946	50%
	Partial Retention	23,755	6,327,554	20.4%	696,031	1,294,840	598,808	86%
	Retention	5,174	1,386,833	26.6%	41,605	86,657	45,053	108%
	Total	**63,067**	**19,390,010**	**22.3%**	**3,773,298**	**5,946,105**	**2,172,807**	**58%**
'Conservative'	Modification	34,138	11,675,623	4.6%	3,035,662	3,230,091	194,429	6%
	Partial Retention	23,755	6,327,554	13.3%	696,031	971,696	275,664	40%
	Retention	5,174	1,386,833	19.3%	41,605	71,946	30,341	73%
	Total	**63,067**	**19,390,010**	**9.1%**	**3,773,298**	**4,273,733**	**500,435**	**13%**
'Liberal'	Modification	34,138	11,675,623	0.0%	3,035,662	3,036,020	358	0%
	Partial Retention	23,755	6,327,554	100.0%	696,031	2,811,753	2,115,722	304%
	Retention	5,174	1,386,833	100.0%	41,605	189,939	148,335	357%
	Total	**63,067**	**19,390,010**	**45.9%**	**3,773,298**	**6,037,712**	**2,264,414**	**60%**

8 This is the proportion of the mature and thrifty-mature land-base within the VQO which was tagged as suitable for Partial Cutting

9 This is the difference in available volume between AClear-cutting & Partial Cutting@ and AClear-cutting only.@

10 Denotes the maximum available volume within VLUs. Achieved by multiplying the total stand volume by the AC.C. % available@ (i.e., M=26%, PR =11%, R=3%).

11 Derived using the percent available volume for either clear-cutting or partial cutting (whichever was the most appropriate). In the appendices, this is the available volume under ARecommended Harvest Method A and AHarvest Vol. Avail@.

3.3 Long-term timber supply analysis

3.3.1 FSSIM analysis

Three scenarios were examined to assess the long-term timber supply using the FSSIM forest estate model. To add some scale to the sensitivity of the results, several 'sensitivity' scenarios were also examined.

Descriptions of the scenarios are:[12]

Scenario 1a This scenario is the Base Case which assesses the long-term timber supply on the visual land-base. The scenario assumes clear-cutting would occur in all VQOs. Forest cover constraints of 3, 11 and 26% were applied to the retention, partial retention, and modification VQO zones respectively.

Scenario 1b This scenario assesses the harvest level if visual constraints were removed from the land-base. It models scenario 1a, with the exceptions that: (1) forest cover constraints on the retention and partial retention zones are reduced to 26%; (2) green-up constraints were reduced from 5 metres to 3 metres.

Scenario 1c This scenario follows scenario 1a, but examines the possibility of an accelerated harvest level.

Scenario 2a This scenario assesses the impact of partial cutting selected stands within R, PR, and M VQOs. The partial cut stands were the same as those identified in the tabular Benchmark scenario under "Recommended Harvest Method". The VQO zones maintain the same management criteria established in scenario 1a. The Partial Cut zone is managed such that 30% of the original volume of the partial cut stands are removed at first entry. Subsequent re-entries extract 82 cubic metres per hectare.[13] Adjacency, forest cover, and green-up constraints are not applied to the partial cut zone.

In scenario 2a, several points are implicit in the assumptions used: (1) partial cutting can occur across an entire VLU, regardless of size; (2) partial cutting will occur in these stands every thirty years; and (3) the road development program providing access to these stands will be accelerated, although the total amount of area converted to roads will remain the same.

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[12] Specific management assumptions can be found in the Data Package in Appendix VI.

[13] Calculated as the TIPSY MAI at culmination age multiplied by a thirty-year re-entry period.

Scenario 2b This scenario describes the impact of an adjacency constraint on the Partial Cut zone. Harvesting is constrained in the Partial Cut zone by only allowing half of the stands designated for partial cutting in a VLU to be entered in a given 30-year entry period.[14]

Scenario 2c This scenario follows scenario 2a, but examines the possibility of an accelerated harvest level. The harvest flow was modelled with a maximum 10 percent drop in harvest every decade until the long-term yield was reached.

Scenario 2d This scenario assess the resilience of the land base to support a harvest level which is 44 percent of the current AAC (i.e., 264,000 m3/year). [15] The results show the effect on the long-term yield.

Scenario 2e Utilizing the same assumptions as scenario 2a, the sensitivity of the long-term yield to a 10% decrease in the average volume/hectare obtained from partial cut stands on re-entry is assessed.

Scenario 2f Utilizing the same assumptions as scenario 2a, the sensitivity of the long-term yield to a 10% increase in the average volume/hectare obtained from partial cut stands on re-entry is assessed.

Scenario 3 This scenario, for interest and discussion only, examines the result of unconstrained partial cutting across the entire scenic land-base.

The results for all of these scenarios are provided in Table 6 and in Figures 3, 4, and 5.

[14] In FSSIM this was modelled using a 30 year, 50% age group 2 constraint.

[15] The scenic land-base is 44% of the net operable TSA land-base. The current AAC for the TSA is 602,000 m3/year

Table 6 Timber supply analysis on the visual land-base

Scenario		Net long-term harvest level (m3/year)[16]	Accelerated harvest level (m3 / year)[17]	% change from base case	Interpolated TSA-level impact
1a	**Base Case** clear-cut (i.e., visual constraints applied)	90,000	n/a	0%	290,000 m3/year
1b	As per 1a but clear-cut with no visual constraints	130,000	n/a	44%	n/a
1c	As per 1a but accelerate harvest (i.e., visual constraints applied)[18]	90,000	90,000	0%	n/a
2a	Clear-cut (visual constraints applied) & partial cut (i.e., no constraints)	122,000	n/a	36%	9-11% increase
2b	As per 2a but with a 50% adjacency on partial cutting	111,000	n/a	23%	n/a
2c	As per 2a but accelerate harvest (using harvest flow rules)	122,000	223,000 (for 10 years)	36% and 148%	n/a
2d	As per 2a but accelerate harvest (ignoring changes to harvest flow)	122,000	264,000 (for 30 years)	36% and 193%	n/a
2e	As per 2a but decrease partial cut re-entry yield by 10%	116,000	n/a	29%	n/a
2f	As per 2a but increase partial cut re-entry yield by 10%	131,000	n/a	46%	n/a
3	Partial cut entire visual land-base (i.e., no visual constraints)	130,000	n/a	44%	324000 m3/year

The net operable area for all scenarios is 82,260 hectares. This is the area in retention, partial retention and modification stands as read from the Robson Valley LRMP file inclusive of mature, immature and NSR.[19]

The results shown under “Interpolated TSA Impact” were extracted from a timber supply analysis report performed by IFS (using a different simulation model) for the Robson Valley LRMP. The forecast 9-11% increase on a TSA-level is based upon the change in yield as a result of this analysis.

16 This is the maximum non-declining harvest level that the land-base can support over a 400-year period. The harvest level has been adjusted for non-recoverable losses to insects, fire and disease estimated to be 24,000 m3/year.

17 An accelerated harvest is a short-term/mid-term harvest level, above the non-declining yield, that is available when there is a surplus of existing mature and over mature stands.

18 An accelerated harvest above the long-term non-declining yield was not possible.

19 The LRMP net area was then reduced by 7.3 percent to account for area reductions for riparian reserves (5.3%) and biodiversity (2%).

Figure 2 Initial Age Class Distribution by Zone

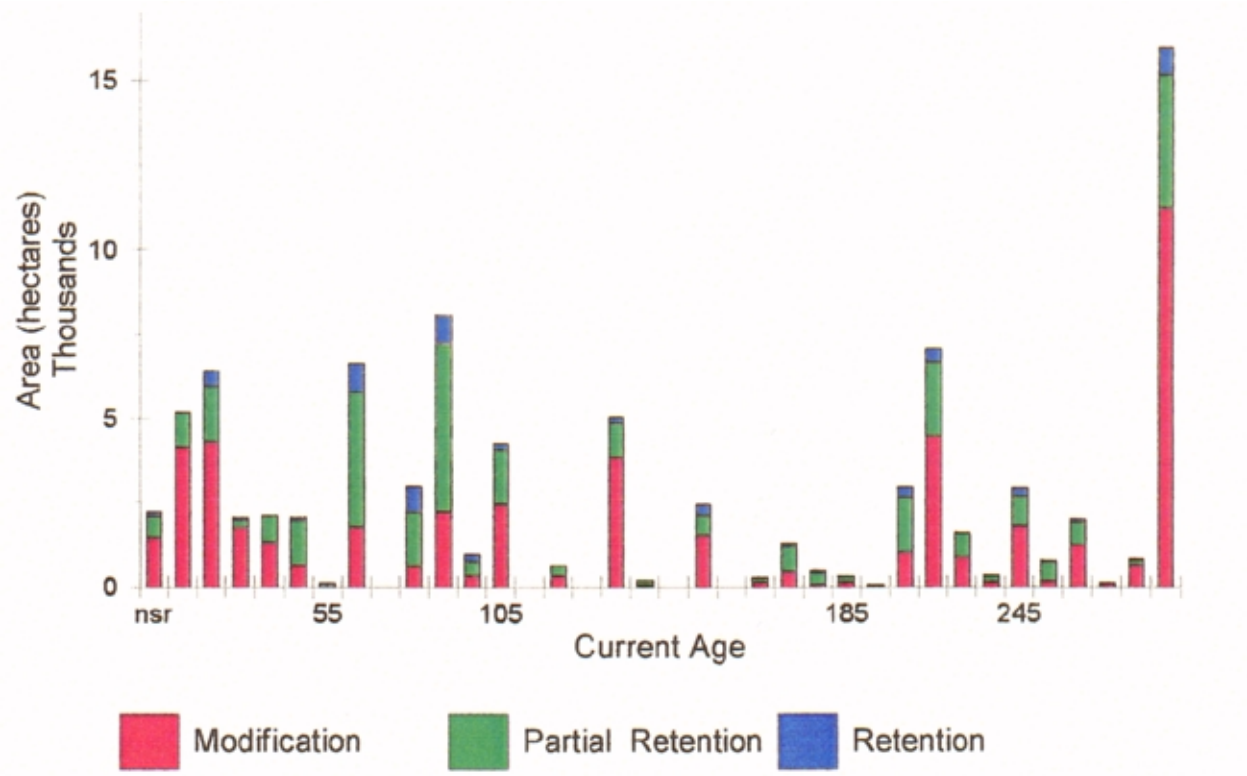


Figure 3 Long-term Harvest Levels

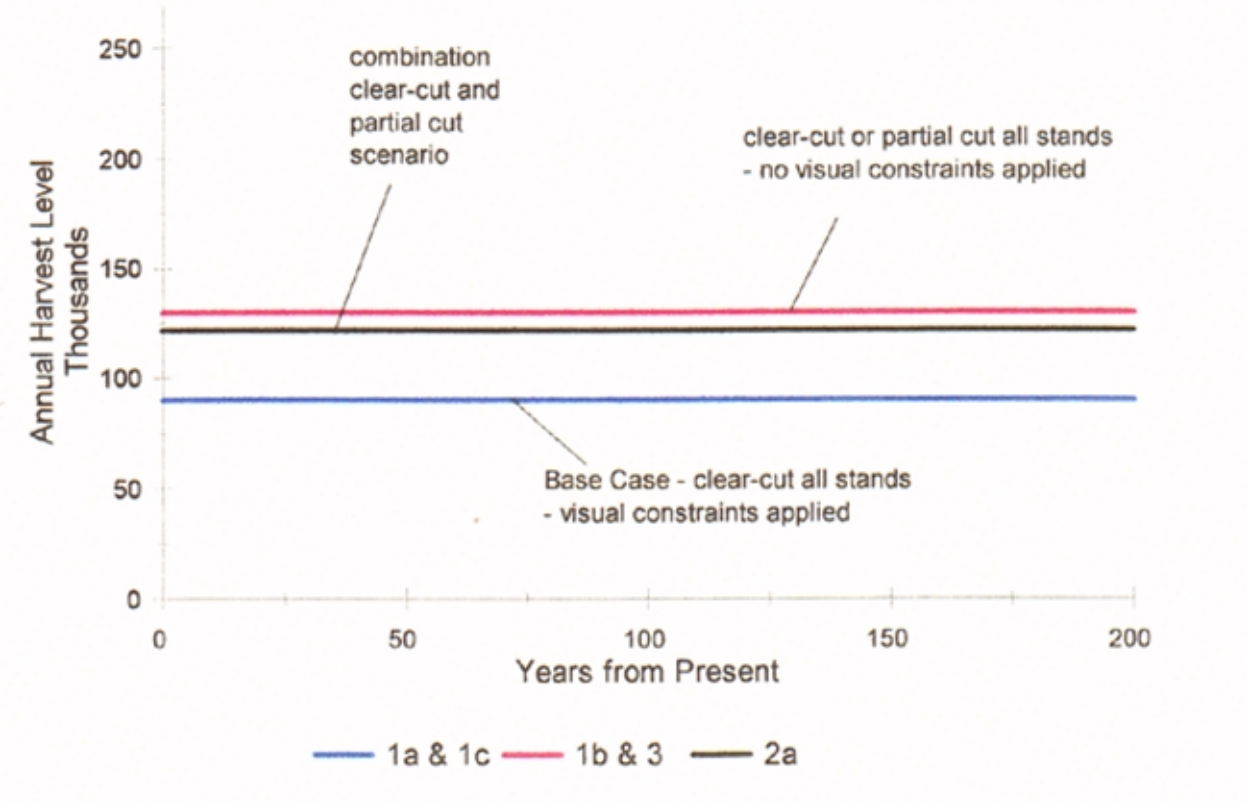


Figure 4 Alternative Harvest Levels

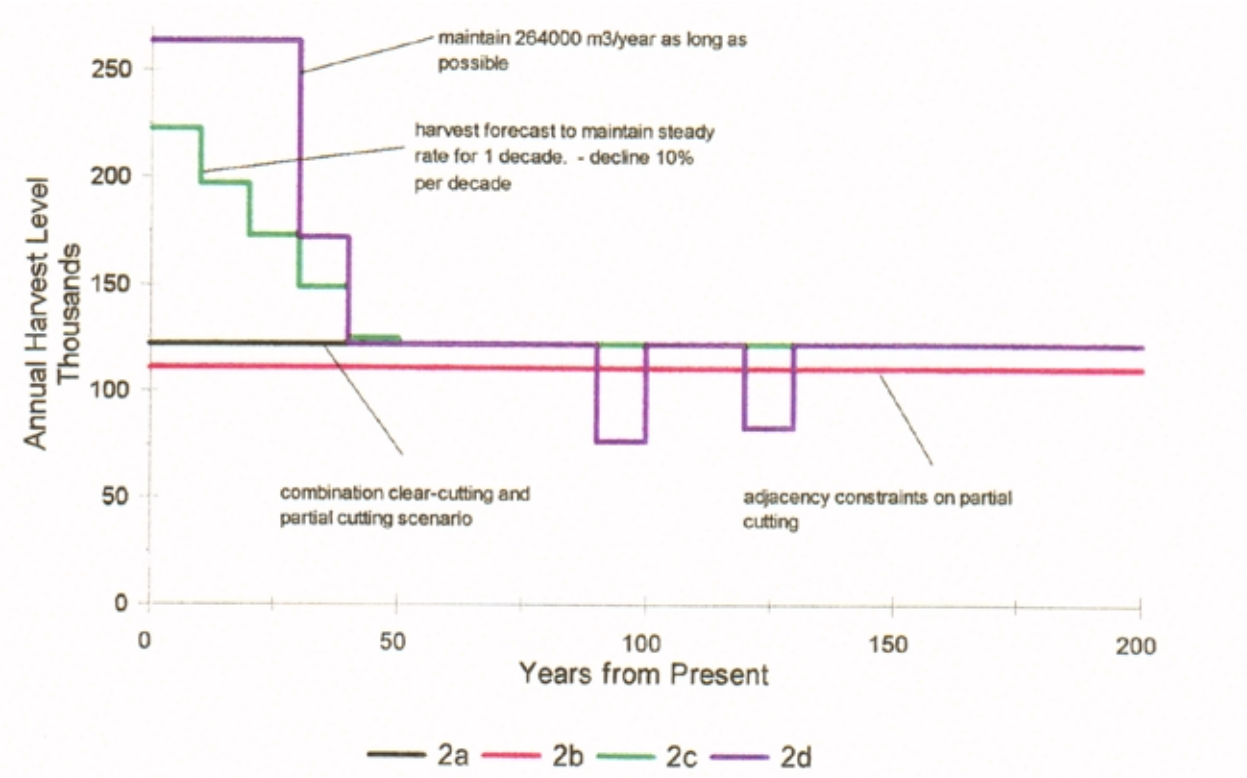
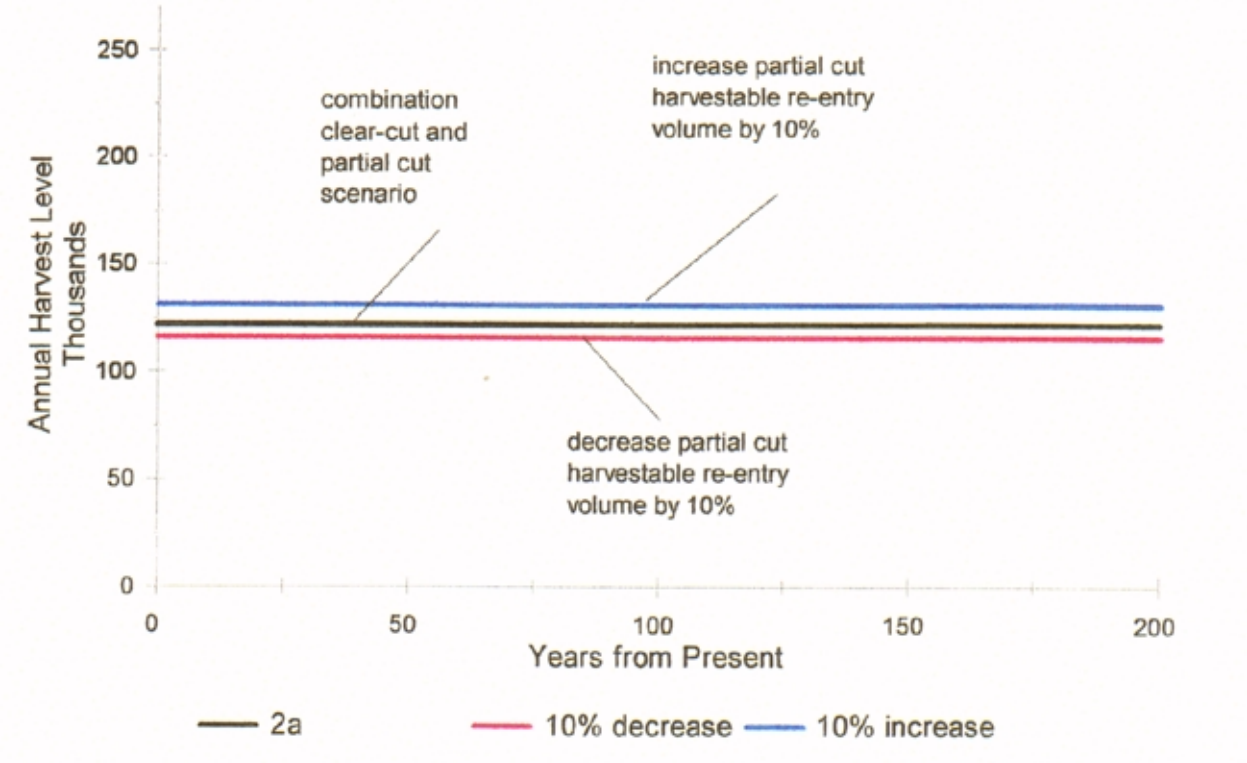


Figure 5 Sensitivity Analysis (MAI)



As can be seen in Figure 2, much of the area in the net land-base is currently over-mature. In addition, the following statistics are worth noting:

- The area within retention, partial retention, and modification VQOs in the Robson Valley TSA accounts for 44% of the TSA=s entire net land-base. [20]
- Within the scenic land-base 73% of the area is mature or over-mature. An additional 17% of the net land-base will become mature during the next twenty years.
- Fifty-six percent of the net operable area has been assigned a modification VQO. Similarly, 37% of the net area is partial retention and 7% is retention. Preservation areas have been excluded from harvesting.

3.3.2 Tabular analysis

Supplemental to the completion of Table 4b (as provided in the Appendices) is an estimate of the volume achievable from partial cut and clear-cut harvests over a 150-year period. This was an estimate on all the forest cover polygons listed in Table 4b, and not performed as part of an estate model simulation. To account for the range in the volumes harvested by partial cutting (i.e., based on VQO and stand height), many assumptions were required to derive this estimate. These assumptions and the calculations used, are described in Appendix V.

The “Volume harvested over 150 years” as provided in Appendices I, II, and III are:

Table 7 Long-term tabular analysis

Considerations	Volume by Scenario (m3)		
	Benchmark	Conservative	Liberal
Max. Volume achieved in 150 Years[21]	24,042,089	23,411,514	30,573,643
Gross Annual Volume (Max. / 150)	160,281	156,077	203,824
Volume Adjusted for the FPC[22]	148,580	144,683	188,945
NET ANNUAL HARVEST (reduced for 24,000 NRLs)	124,580	120,683	164,945

20 Reference page iii, Data Package, Appendix VI.

21 Reference Appendices I, II, and III.

22 Gross Annual Volume was reduced by 7.3% to duplicate the land-base reduction preformed in the FSSIM analysis. This reduction was also applied in the previous LRMP analysis to the resultant net land-base. It is the estimated impact on the land-base as a result of the Forest Practices Code wildlife tree patch, riparian, and biodiversity requirements.

4.0 Conclusions

From the results in this analysis, there is no doubt that partial cutting can help alleviate temporal constraints on a visually sensitive land-base. As a direct result of this relief, harvest levels within scenic areas can be increased. Often dramatically. The increase occurs in scenic areas for several reasons , most of which are discussed in Section 5.2. Other conclusions which can be drawn from this report are:

- In the short-term, assuming 22 percent of the areas in VQOs are deemed suitable for partial cutting, there is a 58% increase in available merchantable volume in the visual land-base.[23]
- In the long-term, assuming 22 percent of the areas in VQOs are deemed suitable for partial cutting, a 36% increase in the harvest level attributed to the visual land-base can be sustained. Since the visual land-base is approximately 44% of the TSA land-base, the increase in the long-term harvest level can be interpolated for the entire TSA to be from 9-11 percent.[24]
- The FSSIM analysis produced long-term results which were only 2% different from the long-term tabular analysis (i.e., FSSIM Scenario 2a vs. Tabular Benchmark Scenario). This suggests that a 30% first-entry removal followed by a 30-year re-entry period is an equitable comparison to the volumes achieved using Table 1.
- The FSSIM model predicted a proportionally large, short-term accelerated harvest level (i.e., Scenario 2c, 2d) as a result of partial cutting. Accelerated harvests are possible when there is a surplus of existing mature and over-mature stands available for harvest (i.e., not restricted from immediate harvest due to temporal constraints). Accelerated harvests are operationally desirable because they convert the volume in forests which are old, decadent and decaying into vigorous new growth producing volume far in excess of the old-growth forest (e.g., the average MAI converts from 0.5 m3/ha/year in old-growth to 4.0 m3/ha/year in immature plantations).
- In a land-base that is not constrained by visual forest cover constraints, partial cutting yields the same long-term harvest level as clear-cutting in a working forest environment (i.e., scenario 3 vs. scenario 1b).

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[23] Reference Table 5, Benchmark scenario.

[24] This assumption is based on the premise that previous analysis assumed clear-cutting in visual areas. In the Robson Valley TSR, LRUP areas were designated as partial cut. Therefore these results cannot be directly applied to the current AAC.

5.0 Discussion

Over the course of completing this project, information and discussion was received from a variety of individuals over a wide range of topics associated with partial cutting. To place some structure to these discussions, this section has been divided into three subsections. The first deals with the issue of the selection of partial cut stands; “where” and “why” the system is used, and “why” it is avoided by many licensees. The second, deals with partial cutting as currently modelled in long-term timber supply analysis, and the assumptions implicit in the methodology. The last subsection deals with the results of this report.

5.1 Selection of partial cut stands

Partial cutting is a sensitive topic among many of the foresters and licensee operators within B.C. It was this topic and the selection of stands as candidates for partial cutting that was the most difficult to assess, and is the most difficult to justify and explain. To address this, three questions have to be understood regarding the selection of candidate stands: (a) where can we apply partial cut silvicultural systems? (b)where do we do it? (c) why don’t we do more? Some of the following points contradict others. The point is made, right or wrong, to illustrate the conflicting opinions that exist among foresters.

Where <u>can</u> we use partial cut silvicultural systems?

The overwhelming response from silviculture foresters who are intimately familiar with partial cutting is that <u>any stand</u> can be partially cut. Regardless of slope, operability, merchantability or stand species, a partial cut silvicultural system can be appropriately designed. This should have made the project simple. Assume that all merchantable stands that are currently included in the operable land-base will be partially cut to achieve a specific VQO objective, with the possibility of a future increase in the AAC. When this hypothesis was suggested to licensees experienced with partial cutting, the response was anything but favourable.

Where <u>do</u> we use partial cut silvicultural systems?

The amount of area that is harvested using partial cutting systems in B.C. is relatively small compared to clear-cutting. Yet it is done, often quite successfully, in many areas of B.C. When licensees were prompted for an operational reply to where and why they partial cut, two reasons were tallied:

- The celebrated response, which challenges the answer to the foregoing question, is that some stands, being uneven-aged, are better suited for partial cutting given the regeneration characteristics of the under-story. Uneven-aged, dry belt Douglas-fir stands fit this description almost perfectly. Hence, most partial cutting is carried out in the South-central Interior of B.C.

- The second reason is that many licensees accept some partial cutting within their annual harvest as a demonstration of performance. Geographic areas exist in all TSAs which are very sensitive to other resource concerns (e.g., caribou habitat, community watersheds, etc.) yet these areas still contribute to the calculation of the annual allowable cut. By having a small, annual partial cut program, where anywhere from 5 to 15 percent of their total harvest is partial cut, licensees can absorb the cost/loss as a result of logging these stands against the gains realized by clear-cutting the remaining 85 to 95% of their annual apportionment. In this way, they demonstrate performance on the timber profile.

In 1994/95 approximately 12 percent of the total B.C. harvest (by area) was by partial cut harvest type. Almost half of this harvest came from the Nelson Forest Region. The following statistics localize the use of partial cut harvesting by region.[25]

Table 8 Area (ha) harvested by harvest type in 1994/95, by forest region

Type of Harvest	Cariboo	Kamloops	Nelson	P. George	P. Rupert	Vancouver	**TOTAL**
Area Clear-cut	29,506	20,919	14,824	47,811	21,870	32,634	167,564
Area Partial cut	4,138	5,784	9,810	1,242	533	1,173	22,680
% area PC	12.3%	21.7%	39.8%	2.5%	2.4%	3.5%	11.9%

The range in values presented by Region can be attributed to three concerns - silvicultural, social, operability. Within the Cariboo and Kamloops forest regions, silviculture concerns (i.e., dry belt Douglas-fir and a variety of mixed-wood stands) are the predominate reason for the selection of partial cut stands. Within the Nelson and Prince George forest regions social concerns have dictated where and how much partial cutting is done. In the Prince Rupert and Vancouver forest regions, operability concerns arising as a result of steep slopes, decadent, over-mature hemlock and balsam, and the difficulties in devising a partial cutting system are the principle factors inhibiting partial cutting.

[25] Excerpt from *Just the Facts - A review of silviculture and other forestry statistics*, 1996, K. Bartlett, Government of Canada, Prov. of B.C. p.11

Why don't we partial cut more often?

The reason why partial cutting is not done more often can be divided into four arguments:

(1) The majority of B.C.'s forests are old, decadent stands. As a result, partial cutting within these stands may and have resulted in: (a) leave trees which often blow-down or contribute little in future incremental growth; (b) concerns about worker safety.

(2) Most forests within B.C. are of an even-aged structure. The management principle has thereby evolve through time that the practice of even-aged forestry is an appropriate course to follow.

(3) Forest management objectives in B.C. in the past, have place more emphasis on timber values then on other resource values.

(4) The relative cost is prohibitive when compared to the cost of clear-cut harvesting.

Of these four arguments, the cost of partial cutting is possibly the most sensitive issue. This cost can either be immediate, or perceive to occur at some time in the future. Most of the following bullets in one way or another, relate back to cost.

- From 20 percent to 300 percent higher development costs are realized by various licensees as a result of using partial cutting systems. The wide range is likely due to the economies of scale. Licensees which harvest 20-25% of their apportionment will have much lower development costs then those who harvest only the minimum amount possible. Increases in development costs are associated with the increase in annual area need to harvest the same volume of timber (i.e., if we assume that 33% of a stand is harvested by partial cutting, then three times the area would need to be developed and harvested in order to recover the same volume). The increase in development costs are associated with:

  1. The increased labour required in marking trees and laying out blocks.

  2. The machinery cost required to operate in these stands (unconventionally smaller and slower, and usually not readily available).

  3. The increased time required to complete proportionally more silviculture prescriptions (SPs).

4. The increased tree-to-truck time required when consideration is given to avoiding damage to leave trees.

- The silvics of various tree species are not 'ideally' suited for a partial cutting system. Concerns that the health of the stand will be endangered as a result of root rot, blow down or the migrations of budworm from mature trees to the residual stems are prime examples. An incorrectly prescribed partial cut system may result in the additional cost to clean up blowdown, deal with root rot, or the loss of future merchantable volume.

- There is a perceived fear, verified by past practices, where partial cuts have resulted in the regeneration of undesirable species; such as balsam or aspen (e.g., the area adjacent to the CN Rail line east of Prince George, toward the Robson Valley). This transformation of the stand composition will result in a decrease in the future AAC, as well as the quality of the products that sawmills will be able to produce in the future.

- The management of forest resources over the past 50 years has resulted in a record-keeping system that is geared toward demonstrating performance using clear-cut harvest systems. The comparative-value stumpage valuation system, cruising, free growing forms, SPs, and silviculture survey forms are focussed toward providing information for (or as a result of) a clear-cut system.

- Lastly, the current economic situation which arose as a result of lumber markets and revenues paid to the Crown have a large bearing on whether or not licensees can accept the higher costs incurred by partial cutting. Licensees within B.C. are paying from 3 to 50 times the stumpage fees as other provinces in Canada. [26] As a result, little or no profit margin remains within the forest industry to justify changes to a system which has preformed successfully in the past.

5.2 Partial cutting and long-term timber supply analysis

The long-term harvest results exhibited in Table 6 demonstrate that partial cutting provides the same yield under conventional integrated resource management as clear-cutting. However, this is not the case when partial cutting is applied to visual landscape units for several reasons:

[26] *1995 Compendium of Canadian Forestry Statistics* - National Forestry Database, Ottawa 1996

(1) Partial cutting eliminates adjacency constraints in areas where clear-cuts have not yet reached visually effective green-up.

(2) Mature stands adjacent to partial cut stands are not deferred from harvesting.

(3) The rotation age of stands is dramatically reduced. The implied rotation age for one complete harvest pass in "Retention" areas within the Robson Valley is 900 years.[27] Similarly, rotation ages for partial retention and modification VQOs are 264 years and 142 years respectively. Partial cutting, as modelled in this project, has an implied rotation age of 100 years.

(4) Retention and partial retention stands, which are deferred from harvesting due to visual green-up and forest cover constraints, will eventually reach an age where the stand volume/hectare is not increasing, and may in reality be on the decline. The mean annual increment (MAI) for many of these stands becomes negative. Partial cutting assumes stand growth according to the culmination age MAI of a stand for the duration of the re-entry period and beyond (note that although the maximum MAI at culmination was used in this analysis, the actual value would likely be some percentage less then maximum for most species).

All of these points add up to an increase in long-term yield, as indicated in the results in Section 3.0. However, some of the assumptions presumed in the method used to model clear-cutting and partial cutting in scenic areas are worth mention.

Modelling forest cover in retention and partial retention VQOs

Forest management policy within visual landscape units have resulted in implied rotation ages which are often far in excess of the life expectance of many B.C. tree species. Assuming fire detection and prevention continues over time, the assumption that these stands will not die from old age, become infected with disease, or blow down is very far reaching. Apart from non-recoverable losses (NRLs), which are assumed to be constant throughout time, this assumption was used in this project and has been in all TSRs. If you argue these points than you must accept the theory of 1,000-year old stands containing 300-year old trees, and you are obliged to accept also that these stands have reached a climax state and are self-perpetuating. This implication means that they are "all-aged." Thus it follows that even-aged yield estimates (as derived through TIPSY) are no longer applicable and should be adjusted downward to include only the mature component of the stocking above the specified utilization standard. In some cases this could mean as much as a 70% reduction in the harvestable volume per hectare.

[27] Calculated as [100% of operable forest ÷ 3% max denudation] x 27 year green-up delay.

If 1,000-year old stands containing 300-year old trees is your goal in VQO areas then you are faced with a partial cutting system if the regeneration is to be preserved. Past timber supply reviews have not considered the long-term dynamics of the forest in this way. The base assumption is that stands achieve a maximum age and volume, at which time they "float" at a fixed age and volume, contributing to old growth, biodiversity and the harvest level as required. This assumption likely resulted in some overestimation of past yield calculations. Conversely, the change to partial cutting in scenic areas would result in a relative change in yield that may be greater than that determined in this project.

5.3 Results of this Report

This report has demonstrated that a move towards partial cutting over clear-cutting results in an increase in short-term availability and long-term yield within retention, partial retention and modification VQO stands.

The dilemma within the Robson Valley however, is that due to the age class structure (i.e., mostly old and over-mature) and amount of historic logging (i.e., very little) within scenic areas, availability is the lessor of the two issues. With a TSA-level AAC of 602,000 cubic metres per years[28] and a base case long-term yield of 351,000 cubic metres per year[29] the impact of partial cutting on long-term yield and the accelerated harvest level is far more serious for this TSA. Other TSA's (i.e., Strathcona, Soo, Sunshine Coast) may have problems relating to from short-term availability due to a large, immature age class structure. These TSAs would likely find the gain in availability to be a very significant benefit.

Table 6 interpolated the impact of partial cutting in scenic against the possible impact on the entire TSA as a 9 to 11 percent increase in long-term yield. These figures must be used with caution. Since the completion of the 1994 Robson Valley Timber Supply Review, changes to forest management practices could have varying impacts on the long-term yield. The LRMP process, landscape units, and protected area strategy are some of the changes that must be incorporated into future yield calculations. Most of these practises place downward pressure on the AAC. A move to partial cutting in scenic areas will decrease some of this downward pressure. A move to partial cutting in the "working forest" will have little or no effect in the long-term.

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28 Robson Valley TSA Rationale for Allowable Annual Cut Determination, June 1996.

29 Robson Valley Timber Supply Analysis Timber Supply Review, September 1994.

Appendices I, II, and III

Constrained Clear-cut Volume made available through Partial Cutting

Benchmark Scenario
Conservative Scenario
Liberal Scenario

Note: Only the final page of each scenario is included in this report as samples. The entire Appendix for I, II, and III is available upon request

[Addendum — The entire appendices are now available on this web site. The individual (.PDF) files can be found through the links from the Abstract.]

Planning Cell	VQO	VAC	Species A/H/S/C	Operable CLass	Average Height (m)	Average Age (yrs)	Operable Area (ha)	Vol/ha (m3/ha)	Total Volume (m3)	Clearcut % Avail	CC const Vol Avail m3	PC % Avail	PC const Vol Avail	Recommended Harvest Method	Harvest Vol Avail (m3)	Gain from PC (m3)	Gain from PC (%)	Volume harvest over 150 years
H071	R	M	Fd731M	M	27	130	5.0	282	1,398	3	42	15	210	100% Partial Cut	210	168	400	1,468
H071	R	M	Fd620P	A	18	110	2.2	109	238	3	7	20	48	0% PC, 100% CC	7	0	0	50
H071	R	M	Fd731M	A	27	130	1.4	268	362	3	11	15	54	100% Partial Cut	54	43	400	380
H071	R	M	Pl420M	A	16	70	5.4	90	483	3	14	20	97	92% Partial Cut	90	75	519	938
H071	R	M	Pl531G	A	24	90	31.2	244	7,602	3	228	15	1,140	0% PC, 100% CC	228	0	0	1,596
H071	R	M	Pl531G	M	28	90	0.6	306	185	3	6	15	28	100% Partial Cut	28	22	400	194
H071	R	M	Pl440G	M	29	70	5.8	268	1,561	3	47	15	234	100% Partial Cut	234	187	400	1,640
H071	R	M	Pl430G	M	21	70	2.1	109	226	3	7	20	45	100% Partial Cut	45	38	567	430
H071	R	M	Pl440G	A	29	70	16.1	256	4,103	3	123	15	615	100% Partial Cut	615	492	400	4,308
I033	R	L	S 831P	A	26	245	92.9	263	24,459	3	734	10	2,446	100% Partial Cut	2,446	1,712	233	9,784
I033	R	L	S 831P	C	26	245	3.7	263	980	3	29	10	98	100% Partial Cut	98	69	233	392
I033	R	L	Bl831P	A	21	213	12.6	203	2,555	3	77	10	255	100% Partial Cut	255	179	233	1,022
I033	R	L	Bl831P	M	21	185	7.6	204	1,552	3	47	10	155	100% Partial Cut	155	109	233	621
I033	R	L	S 941P	C	31	282	0.1	311	45	3	1	10	4	100% Partial Cut	4	3	233	18
I033	R	L	S 941P	M	31	282	4.2	311	1,305	3	39	10	130	100% Partial Cut	130	91	233	522
I033	R	L	S 831P	M	26	245	3.4	263	881	3	26	10	88	100% Partial Cut	88	62	233	352
I033	R	L	S 941P	A	31	279	47.2	319	15,074	3	452	10	1,507	100% Partial Cut	1,507	1,055	233	6,030
I041	R	L	Cw931P	C	27	265	4.2	318	1,345	3	40	10	135	0% PC, 100% CC	40	0	0	242
I041	R	L	Cw931P	A	27	265	14.5	318	4,604	3	138	10	460	0% PC, 100% CC	138	0	0	829
I041	R	L	Cw931P	M	27	265	25.3	318	8,048	3	241	10	805	0% PC, 100% CC	241	0	0	1,449
I041	R	L	Cw941P	C	34	285	0.4	432	165	3	5	10	16	0% PC, 100% CC	5	0	0	30
I041	R	L	Cw941P	A	30	267	67.8	370	25,077	3	752	10	2,508	0% PC, 100% CC	752	0	0	4,514
I041	R	L	Cw841P	M	29	247	6.7	345	2,318	3	70	10	232	0% PC, 100% CC	70	0	0	417
I041	R	L	Cw831P	C	27	229	5.0	315	1,580	3	47	10	158	0% PC, 100% CC	47	0	0	284
I041	R	L	Cw831P	A	28	222	8.1	310	2,522	3	76	10	252	0% PC, 100% CC	76	0	0	454
I041	R	L	Cw831P	M	28	224	9.2	314	2,901	3	87	10	290	0% PC, 100% CC	87	0	0	522
I041	R	L	Cw841P	C	30	246	10.6	363	3,851	3	116	10	385	0% PC, 100% CC	116	0	0	693
I041	R	L	Cw841P	A	29	247	34.3	350	12,021	3	361	10	1,202	0% PC, 100% CC	361	0	0	2,164
I041	R	L	S 831P	M	27	219	1.8	346	632	3	19	10	63	0% PC, 100% CC	19	0	0	76
I041	R	L	S 831P	C	26	234	0.9	321	302	3	9	10	30	0% PC, 100% CC	9	0	0	36
I041	R	L	S 841M	A	32	195	37.6	341	12,798	3	384	10	1,280	100% Partial Cut	1,280	896	233	5,119
I041	R	L	S 841P	M	30	205	0.2	374	79	3	2	10	8	100% Partial Cut	8	6	233	32
I041	R	L	S 841P	A	30	205	4.4	374	1,636	3	49	10	164	100% Partial Cut	164	115	233	654
I041	R	L	S 831P	A	26	235	3.8	329	1,240	3	37	10	124	0% PC, 100% CC	37	0	0	149
I041	R	L	Imat	A	21	75	13.4	170	2,276	0	0	10	228	100% Partial Cut	228	228	0	911
I041	R	L	Cw941P	M	31	278	5.8	376	2,179	3	65	10	218	0% PC, 100% CC	65	0	0	392
I041	R	L	Imat	C	22	75	25.1	173	4,339	0	0	10	434	0% PC, 100% CC	0	0	0	263
I041	R	L	S 741M	A	29	135	5.0	261	1,296	3	39	10	130	100% Partial Cut	130	91	233	518
I041	R	L	Imat	M	20	75	8.5	141	1,191	0	0	10	119	100% Partial Cut	119	119	0	477
Total for the Modification VLUs in the TSA as-a-whole							48,096	249	11,972,574		3,035,662		9,176,772		4,564,608	1,528,946	50	17,254,276.8
Total for Partial Retention VLUs in the TSA as-a-whole							32,070	221	7,083,940		696,031		2,811,753		1,294,840	598,808	86	6,207,559.9
Total for the Retention VLUs in the TSA as-a-whole							6,322	233	1,475,931		41,605		189,939		86,657	45,053	108	580,251.8
Total for all the VLUs in the TSA as-a-whole							86,488	237	20,532,445		3,773,298		12,178,464		5,946,105	2,172,807	58	24,042,089

Planning Cell	VQO	VAC	Species A/H/S/C	Operable CLass	Average Height (m)	Average Age (yrs)	Operable Area (ha)	Vol/ha (m3/ha)	Total Volume (m3)	Clearcut % Avail	CC const Vol Avail m3	PC % Avail	PC const Vol Avail	Recommended Harvest Method	Harvest Vol Avail (m3)	Gain from PC (m3)	Gain from PC (%)	Volume harvest over 150 years
H071	R	M	Fd731M	M	27	130	5	282	1,398	3	42	15	210	100% Partial Cut	210	168	400	1,468
H071	R	M	Fd620P	A	18	110	2	109	238	3	7	20	48	0% PC, 100% CC	7	0	0	50
H071	R	M	Fd731M	A	27	130	1	268	362	3	11	15	54	100% Partial Cut	54	43	400	380
H071	R	M	Pl420M	A	16	70	5	90	483	3	14	20	97	92% Partial Cut	90	75	519	938
H071	R	M	Pl531G	A	24	90	31	244	7,602	3	228	15	1,140	0% PC, 100% CC	228	0	0	1,596
H071	R	M	Pl531G	M	28	90	1	306	185	3	6	15	28	100% Partial Cut	28	22	400	194
H071	R	M	Pl440G	M	29	70	6	268	1,561	3	47	15	234	100% Partial Cut	234	187	400	1,640
H071	R	M	Pl430G	M	21	70	2	109	226	3	7	20	45	100% Partial Cut	45	38	567	430
H071	R	M	Pl440G	A	29	70	16	256	4,103	3	123	15	615	100% Partial Cut	615	492	400	4,308
I033	R	L	S 831P	A	26	245	93	263	24,459	3	734	10	2,446	100% Partial Cut	2,446	1,712	233	9,784
I033	R	L	S 831P	C	26	245	4	263	980	3	29	10	98	100% Partial Cut	98	69	233	392
I033	R	L	Bl831P	A	21	213	13	203	2,555	3	77	10	255	100% Partial Cut	255	179	233	1,022
I033	R	L	Bl831P	M	21	185	8	204	1,552	3	47	10	155	100% Partial Cut	155	109	233	621
I033	R	L	S 941P	C	31	282	0	311	45	3	1	10	4	100% Partial Cut	4	3	233	18
I033	R	L	S 941P	M	31	282	4	311	1,305	3	39	10	130	100% Partial Cut	130	91	233	522
I033	R	L	S 831P	M	26	245	3	263	881	3	26	10	88	100% Partial Cut	88	62	233	352
I033	R	L	S 941P	A	31	279	47	319	15,074	3	452	10	1,507	100% Partial Cut	1,507	1,055	233	6,030
I041	R	L	Cw931P	C	27	265	4	318	1,345	3	40	10	135	0% PC, 100% CC	40	0	0	242
I041	R	L	Cw931P	A	27	265	14	318	4,604	3	138	10	460	0% PC, 100% CC	138	0	0	829
I041	R	L	Cw931P	M	27	265	25	318	8,048	3	241	10	805	0% PC, 100% CC	241	0	0	1,449
I041	R	L	Cw941P	C	34	285	0	432	165	3	5	10	16	0% PC, 100% CC	5	0	0	30
I041	R	L	Cw941P	A	30	267	68	370	25,077	3	752	10	2,508	0% PC, 100% CC	752	0	0	4,514
I041	R	L	Cw841P	M	29	247	7	345	2,318	3	70	10	232	0% PC, 100% CC	70	0	0	417
I041	R	L	Cw831P	C	27	229	5	315	1,580	3	47	10	158	0% PC, 100% CC	47	0	0	284
I041	R	L	Cw831P	A	28	222	8	310	2,522	3	76	10	252	0% PC, 100% CC	76	0	0	454
I041	R	L	Cw831P	M	28	224	9	314	2,901	3	87	10	290	0% PC, 100% CC	87	0	0	522
I041	R	L	Cw841P	C	30	246	11	363	3,851	3	116	10	385	0% PC, 100% CC	116	0	0	693
I041	R	L	Cw841P	A	29	247	34	350	12,021	3	361	10	1,202	0% PC, 100% CC	361	0	0	2,164
I041	R	L	S 831P	M	27	219	2	346	632	3	19	10	63	0% PC, 100% CC	19	0	0	76
I041	R	L	S 831P	C	26	234	1	321	302	3	9	10	30	0% PC, 100% CC	9	0	0	36
I041	R	L	S 841M	A	32	195	38	341	12,798	3	384	10	1,280	0% PC, 100% CC	384	0	0	1,536
I041	R	L	S 841P	M	30	205	0	374	79	3	2	10	8	0% PC, 100% CC	2	0	0	9
I041	R	L	S 841P	A	30	205	4	374	1,636	3	49	10	164	0% PC, 100% CC	49	0	0	196
I041	R	L	S 831P	A	26	235	4	329	1,240	3	37	10	124	0% PC, 100% CC	37	0	0	149
I041	R	L	Imat	A	21	75	13	170	2,276	0	0	10	228	0% PC, 100% CC	0	0	0	141
I041	R	L	Cw941P	M	31	278	6	376	2,179	3	65	10	218	0% PC, 100% CC	65	0	0	392
I041	R	L	Imat	C	22	75	25	173	4,339	0	0	10	434	0% PC, 100% CC	0	0	0	263
I041	R	L	S 741M	A	29	135	5	261	1,296	3	39	10	130	0% PC, 100% CC	39	0	0	156
I041	R	L	Imat	M	20	75	8	141	1,191	0	0	10	119	0% PC, 100% CC	0	0	0	89
Total Modification VLUs for the TSA as-a-whole							48,096	249	11,972,574		3,035,662		9,176,772		3,230,091	194,429	6	17,626,575
Total Partial Retention VLUs for the TSA as-a-whole							32,070	221	7,083,940		696,031		2,811,753		971,696	275,664	40	5,273,748
Total for the Retention VLUs in the TSA as-a-whole							6,322	233	1,475,931		41,605		189,939		71,946	30,341	73	511,192
Total for all the VLUs in the TSA as-a-whole							86,488	237	20,532,445		3,773,298		12,178,464		4,273,733	500,435	13	23,411,514

Planning Cell	VQO	VAC	Species A/H/S/C	Operable CLass	Average Height (m)	Average Age (yrs)	Operable Area (ha)	Vol/ha (m3/ha)	Total Volume (m3)	Clearcut % Avail	CC const Vol Avail m3	PC % Avail	PC const Vol Avail	Recommended Harvest Method	Harvest Vol Avail (m3)	Gain from PC (m3)	Gain from PC (%)	Volume achieved over 150 years
H071	R	M	Pl440G	M	28.6	70	5.8	268	1,561	3	47	15	234	Partial Cut	234	187	400	1,640
H071	R	M	Pl531G	M	28.4	90	0.6	306	185	3	6	15	28	Partial Cut	28	22	400	194
H071	R	M	Pl531G	A	23.8	90	31.2	244	7,602	3	228	15	1,140	Partial Cut	1,140	912	400	7,982
H071	R	M	Pl420M	A	16.3	70	5.4	90	483	3	14	20	97	Partial Cut	97	82	567	1,016
H071	R	M	Fd731M	A	27.0	130	1.4	268	362	3	11	15	54	Partial Cut	54	43	400	380
H071	R	M	Fd620P	A	17.7	110	2.2	109	238	3	7	20	48	Partial Cut	48	41	567	383
H071	R	M	Fd731M	M	27.0	130	5.0	282	1,398	3	42	15	210	Partial Cut	210	168	400	1,468
H071	R	M	Imat	M	23.9	50	5.1	167	857	0	0	15	129	Partial Cut	129	129	0	900
H071	R	M	Imat	A	10.3	34	19.0	31	591	0	0	23	118	Partial Cut	118	118	0	3,255
I033	R	L	S 941P	A	31.1	279	47.2	319	15,074	3	452	10	1,507	Partial Cut	1,507	1,055	233	6,030
I033	R	L	S 831P	M	26.3	245	3.4	263	881	3	26	10	88	Partial Cut	88	62	233	352
I033	R	L	S 941P	M	31.0	282	4.2	311	1,305	3	39	10	130	Partial Cut	130	91	233	522
I033	R	L	S 941P	C	31.0	282	0.1	311	45	3	1	10	4	Partial Cut	4	3	233	18
I033	R	L	Bl831P	M	21.4	185	7.6	204	1,552	3	47	10	155	Partial Cut	155	109	233	621
I033	R	L	Bl831P	A	21.5	213	12.6	203	2,555	3	77	10	255	Partial Cut	255	179	233	1,022
I033	R	L	S 831P	C	26.3	245	3.7	263	980	3	29	10	98	Partial Cut	98	69	233	392
I033	R	L	S 831P	A	26.3	245	92.9	263	24,459	3	734	10	2,446	Partial Cut	2,446	1,712	233	9,784
I041	R	L	Cw931P	M	27.2	265	25.3	318	8,048	3	241	10	805	Partial Cut	805	563	233	4,829
I041	R	L	Cw941P	A	30.4	267	67.8	370	25,077	3	752	10	2,508	Partial Cut	2,508	1,755	233	15,046
I041	R	L	Cw931P	C	27.2	265	4.2	318	1,345	3	40	10	135	Partial Cut	135	94	233	807
I041	R	L	Cw841P	M	28.7	247	6.7	345	2,318	3	70	10	232	Partial Cut	232	162	233	1,391
I041	R	L	Cw931P	A	27.2	265	14.5	318	4,604	3	138	10	460	Partial Cut	460	322	233	2,762
I041	R	L	Cw941P	C	34.0	285	0.4	432	165	3	5	10	16	Partial Cut	16	12	233	99
I041	R	L	Imat	M	19.6	75	8.5	141	1,191	0	0	10	119	Partial Cut	119	119	0	477
I041	R	L	S 741M	A	28.6	135	5.0	261	1,296	3	39	10	130	Partial Cut	130	91	233	518
I041	R	L	Imat	C	21.7	75	25.1	173	4,339	0	0	10	434	Partial Cut	434	434	0	1,736
I041	R	L	Cw941P	M	30.7	278	5.8	376	2,179	3	65	10	218	Partial Cut	218	153	233	1,308
I041	R	L	Imat	A	21.4	75	13.4	170	2,276	0	0	10	228	Partial Cut	228	228	0	911
I041	R	L	S 831P	M	27.0	219	1.8	346	632	3	19	10	63	Partial Cut	63	44	233	253
I041	R	L	S 831P	C	26.3	234	0.9	321	302	3	9	10	30	Partial Cut	30	21	233	121
I041	R	L	S 841M	A	32.0	195	37.6	341	12,798	3	384	10	1,280	Partial Cut	1,280	896	233	5,119
I041	R	L	S 841P	M	30.3	205	0.2	374	79	3	2	10	8	Partial Cut	8	6	233	32
I041	R	L	S 841P	A	30.3	205	4.4	374	1,636	3	49	10	164	Partial Cut	164	115	233	654
I041	R	L	S 831P	A	26.2	235	3.8	329	1,240	3	37	10	124	Partial Cut	124	87	233	496
I041	R	L	Cw841P	A	29.0	247	34.3	350	12,021	3	361	10	1,202	Partial Cut	1,202	841	233	7,212
I041	R	L	Cw841P	C	29.6	246	10.6	363	3,851	3	116	10	385	Partial Cut	385	270	233	2,310
I041	R	L	Cw831P	M	28.1	224	9.2	314	2,901	3	87	10	290	Partial Cut	290	203	233	1,741
I041	R	L	Cw831P	A	28.0	222	8.1	310	2,522	3	76	10	252	Partial Cut	252	177	233	1,513
I041	R	L	Cw831P	C	27.0	229	5.0	315	1,580	3	47	10	158	Partial Cut	158	111	233	948
Total for the Modification VLUs for the TSA as-a-whole							48,096	249	11,972,574		3,035,662		17,842,235		3,036,020	358	0	17,842,235
Total for the Partial Retention VLUs for the TSA as-a-whole							32,070	221	7,083,940		696,031		11,480,221		2,811,753	2,115,722	304	11,480,221
Total for the Retention VLUs in the TSA as-a-whole							6,322	233	1,475,931		41,605		189,939		189,939	148,335	357	1,251,187
Total for all the VLUs in the TSA as-a-whole							86,488	237	20,532,445		3,773,298		12,178,464		6,037,712	2,264,414	60	30,573,643

Appendix IV

Attributes
of the
Robson Valley TSA
LRMP File

Robson

Resultant Netdown Database Structure

Field	Source Coverage	Field Name	Type	Width	Dec	Code	Description
1		area	f	18	5		Resultant polygon area (m2)
2		perimeter	f	18	5		Resultant polygon perimeter (m)
3		id	b	4			Resultant polygon id #
4		map	c	8			Mapsheet number
5		stand	c	4			Original map polygon number
6	rd	freg	b	4			Forest region
7		fdist	c	1			Forest district
8	oper	oper	c	1			Operability code
9	own	own	b	4			Ownership code
10		schedule	c	1			Ownership sched
11	tsab	tsa	b	4			TSA number
12		sb	c	1			TSB number
13	pcell	pcell	c	4			Planning cell
14	psyu	psyu	b	4			PSYU
15	alr	alr	b	4			ALR code
16	rec	mcode	c	2			Recreation mcode
17		feature1	c	2			Recreation feature 1
18		feature2	c	2			Recreation feature 2
19		feature3	c	2			Recreation feature 3
20		act1	c	1			Recreation activity 1
21		act2	c	1			Recreation activity 2
22		act3	c	1			Recreation activity 3
23		fsig	c	1			Feature significance
24		mcls	c	1			Management class
25		ros	c	1			Rec op spectrum
26	rc	reg	b	4			Forest Region
27		comp	b	4			Compartment
28	aqua	aqua	c	1			Aquatic habitat
29	bakc	backctry	c	2			Backcountry potential
30	bgc	zone	c	4			Biogeo zone
31		subzone	c	2			Biogeo subzone
32		variant	c	1			Biogeo variant
33		phase	c	1			Biogeo phase
34	bscar	bs_carib	c	3			TSR base case caribou habitat
35	bslnd	bs_land	c	2			TSR base case landscape
36	bsogr	bs_oldgr	c	3			TSR base case old growth areas
37	bspct	bs_pcut	c	3			TSR base case partial cut areas
38	bsprs	bs_pres	c	3			TSR base case preservation areas
39	carib	carib	c	1			Local caribou capability
40	goat	goat	c	1			Local Goat habitat
41	griz	griz	c	1			Local Grizzly capability
42	lscpu	lu_name	c	24			Name of each landscape unit
43		lu_no	c	2			Number code for each landscape unit
44	lscpu	lu2_name	c	24			Name of each landscape unit
45		lu2_no	c	2			Number code for each landscape unit
46		bdiv1_c	c	1			Scenario 1 Cons. Biodiversity code
47		bdiv2_i	c	1			Scenario 2 Ind. Biodiversity code
48	ndt	ndtype	b	4			Natural Disturbance type
49	rmzc	rmzcname	c	35			Name of RMZ
50		rmzcletter	i	2			Number code of RMZ (Land Use)
51		rmzcsbz	c	2			RMZ protected status (proposed vs existing)
52	rmzg	rmzgname	c	35			Name of RMZ
53		rmzgletter	i	2			Number code of RMZ (Land Use)
54		rmzgsbz	c	2			RMZ protected status (proposed vs existing)
55	rmzr	rmzrname	c	35			Name of RMZ
56		rmzrletter	i	2			Number code of RMZ (Land Use)
57		rmzrsbz	c	2			RMZ protected status (proposed vs existing)
58	vqo	lsr	c	1			Visual sensitivity rating
59		vac	c	1			Visual absorbtion capability
60		evc	c	2			Existing visual condition
61		vqo	c	2			Visual quality objective
62		vis	c	1			Not visually sensitive or unclassified
63	wrang	wrang	c	1			Winter range
64	ecosc	eco_sec	c	3			Ecosection code (from BC data)
65	bphys	tagid	c	20			Polygon number (unique via appending mapsheet)
66		dec_1	b	4			Decile (percent) of habitat component 1
67		hab_1	c	2			Habitat component 1
68		mod_1	c	1			Modifier of habitat component 1
69		ss1_0	b	4			Percentage of seral stage class 0 for habitat 1
70		ss1_1	b	4			Percentage of seral stage class 1 for habitat 1
71		ss1_2	b	4			Percentage of seral stage class 2 for habitat 1
72		ss1_3	b	4			Percentage of seral stage class 3 for habitat 1

73		ss1_4	b	4		Percentage of seral stage class 4 for habitat 1
74		ss1_5	b	4		Percentage of seral stage class 5 for habitat 1
75		ss1_6	b	4		Percentage of seral stage class 6 for habitat 1
76		dec_2	b	4		Decile (percent) of habitat component 2
77		hab_2	c	2		Habitat component 2
78		mod_2	c	1		Modifier of habitat component 2
79		ss2_0	b	4		Percentage of seral stage class 0 for habitat 2
80		ss2_1	b	4		Percentage of seral stage class 1 for habitat 2
81		ss2_2	b	4		Percentage of seral stage class 2 for habitat 2
82		ss2_3	b	4		Percentage of seral stage class 3 for habitat 2
83		ss2_4	b	4		Percentage of seral stage class 4 for habitat 2
84		ss2_5	b	4		Percentage of seral stage class 5 for habitat 2
85		ss2_6	b	4		Percentage of seral stage class 6 for habitat 2
86		alal_c	b	4		Moose capability rating
87		alal_s	b	4		Moose suitability rating
88		alal_ct	b	4		Moose capability color
89		alal_st	b	4		Moose suitability color
90		ceel_c	b	4		Elk capability rating
91		ceel_s	b	4		Elk suitability rating
92		ceel_ct	b	4		Elk capability color
93		ceel_st	b	4		Elk suitability color
94		odhe_c	b	4		Mule deer capability rating
95		odhe_s	b	4		Mule deer suitability rating
96		odhe_ct	b	4		Mule deer capability color
97		odhe_st	b	4		Mule deer suitability color
98		odvi_c	b	4		White tail deer capability rating
99		odvi_s	b	4		White tail deer suitability rating
100		odvi_ct	b	4		White tail deer capability color
101		odvi_st	b	4		White tail deer suitability color
102		oram_c	b	4		Goat capability rating
103		oram_s	b	4		Goat suitability rating
104		oram_ct	b	4		Goat capability color
105		oram_st	b	4		Goat suitability color
106		ovca_c	b	4		Sheep capability rating
107		ovca_s	b	4		Sheep suitability rating
108		ovca_ct	b	4		Sheep capability color
109		ovca_st	b	4		Sheep suitability color
110		rata_c	b	4		Caribou capability rating
111		rata_s	b	4		Caribou suitability rating
112		rata_ct	b	4		Caribou capability color
113		rata_st	b	4		Caribou suitability color
114		urar_c	b	4		Grizzly bear capability rating
115		urar_s	b	4		Grizzly bear suitability rating
116		urar_ct	b	4		Grizzly bear capability color
117		urar_st	b	4		Grizzly bear suitability color
118		maam_c	b	4		Martin capability rating
119		maam_s	b	4		Martin suitability rating
120		maam_ct	b	4		Martin capability color
121		maam_st	b	4		Martin suitability color
122		caca_c	b	4		Beaver capability rating
123		caca_s	b	4		Beaver suitability rating
124		caca_ct	b	4		Beaver capability color
125		caca_st	b	4		Beaver suitability color
126	mten	min	c	1		Mineral tenure
127	minpt	tract_name	c	10		Name of mineral assessment tract
128		p_area	f	14	0	Area of all polygons belonging to this tract
129		minfile_no	f	14	0	Number of minfile occurences in this tract
130		inventory	f	14	0	Value of metallic minerals in this tract
131		explor_86	f	14	0	Value of past exploration in this tract (1986 dollars)
132		past_prod	f	14	0	Value of past production (1986 dollars)
133		score	f	14	0	Value used to rank metallic minerals
134		rank	f	14	0	Relative Ranking of metallic minerals
135		im_invent	f	14	0	Value of indusrial minerals in this tract
136		im_score	f	14	0	Value used to rank industrial minerals
137		im_rank	f	14	0	Ranking of industrial minerals
138		cum_area	f	14	0	Cumulative area
139	unwtr	unwtr	c	4		Protected watershed number
140		uwcode	c	2		Protected watershed code
141	comwt	lcws_tag	c	10		Community Watershed tag
142		fcode	c	10		Community Watershed featurew code
143	licop	licop1	c	50		Licensee operating area - field 1
144		licop2	c	50		Licensee operating area - field 2
145	nrpat	rpatlevel	c	1		New RPAT level
146		rpatname	c	35		New RPAT name
147	guide	guidecode	b	4		Existing tourism - guides (code keys to table guide.inf)
148	outdr	oa_code1	i	3		Existing tourism - outdoor code 1
149		oa_code2	i	3		Existing tourism - outdoor code 2
150	ski	skicode	b	4		Existing tourism - ski (code keys to table ski.inf)
151	tour	tourcap	i	1		Tourism capability
152	ovrlp	overlap	c	10		Overlap or gap indicator

152	net area				Net Area after exclusions
153	rdarea1				Private land exclusions
154	rdarea2				Non Forest Exclusion
155	rdarea3				Not used in Robson netdown
156	rdarea4				Not used in Robson netdown
157	rdarea5				Not used in Robson netdown
158	rdarea6				Reduction due to n102ncb
159	rdarea7				Reduction due to n102ino
160	rdarea8				Reduction due to economic oper mimic
161	rdarea9				Reduction due to n103esa
162	rdarea10				Reduction due to n104low
163	rdarea11				Reduction due to n105dec
164	rdarea12				Reduction due to n106pft
165	rdarea13				Reduction due to n107imm
166	rdarea14				Reduction due to n108rds
167	rdarea15				Reduction due to n109nsr
168	rdarea16				Reduction due to n110rip
169	rdarea17				Reduction due to n111chh
170	rdarea18				Reduction due to n112pre
171	rdarea19				Not used in Robson netdown
172	rdarea20				Not used in Robson netdown
173	rdarea21				Not used in Robson netdown
174	rdarea22				Not used in Robson netdown
175	rdarea23				Not used in Robson netdown
176	rdarea24				Not used in Robson netdown
177	rdarea25				Not used in Robson netdown
178	f_fc	mapstand	c	12	Original Map/id # for link to Forest Coverage

Appendix V

Assumptions

used to predict

“Volume Gain in 150 Years”

Appendix V

Assumptions used to predict
Volume Gain in 150 Years

General Assumptions
No losses to unclassified roads, or future roads or forest practices code
No reductions for unsalvaged losses
Stands Regenerate to themselves
NSR is ignored
At time of next re-entry remaining volume is removed
Original Volume does not increase or decrease over time
Regenerated stand volume is calculated using TIPSY
At time of second re-entry remaining volume is removed (ie 50 – 90%)
At time of 3rd re-entry the original percent removed is used applied to the volume/ha at CA

Volume Gaining in stands that are clear cut
Assume stand vol/ha remains constaint
Assume re-entry period = harvest delay to reach 5 metres
Spruce/Balsam has a harvest delay of 43 years and Culmination age of 180; therefore no second rotation volume is obtained

(total net) = vol at first entry + vol @ 2nd entry + vol @ 3rd entry
number of entries = (150/harvest delay) + 1
immature stands – assume one entry, stand volume 350 m3/ha

TIPSY Assumptions based on VDYP generated site indices

Species	area weighted Site index	Max MAI	Culmination age	CA Volume/ha	Years to reach 5 metres	regen delay	harvest delay
Pine	15.2	2.7	90	247	19	4	23
Spruce/Balsam	9.9	2.0	180	365	39	4	43
Doug fir	16.7	2.4	140	331	19	4	23
Cedar/Hw	12.1	2.1	145	311	24	4	28

Volume Gained in stands that are partial cut

Percent Removed according to Table 1	Leading Species	Volume gained in 150 years: original stand	Volume gained in 150 years: addition vol/ha	Percent Removed according to Table 1	Leading Species	Volume gained in 150 years: original stand	Volume gained in 150 years: addition vol/ha
90	Pine	total volume+	247	45	Pine	total volume+	247
	Spruce/Balsam	total volume+	0		Spruce/Balsam	total volume+	0
	Doug fir	total volume+	298		Doug fir	total volume+	298
	Cedar/Hw	total volume+	280		Cedar/Hw	total volume+	280
85	Pine	total volume+	247	40	Pine	total volume+	247
	Spruce/Balsam	total volume+	0		Spruce/Balsam	total volume+	0
	Doug fir	total volume+	281		Doug fir	total volume+	265
	Cedar/Hw	total volume+	264		Cedar/Hw	total volume+	249
80	Pine	Total volume+	247	35	Pine	total volume+	247
	Spruce/Balsam	Total volume+	0		Spruce/Balsam	total volume+	0
	Doug fir	total volume+	265		Doug fir	total volume+	232
	Cedar/Hw	total volume+	249		Cedar/Hw	total volume+	218
75	Pine	total volume+	247	30	Pine	total volume+	222
	Spruce/Balsam	total volume+	0		Spruce/Balsam	initial volume harvested *4	0
	Doug fir	total volume+	248		Doug fir	total volume+	199
	Cedar/Hw	total volume+	233		Cedar/Hw	total volume+	93
70	Pine	total volume+	247	25	Pine	total volume+	185
	Spruce/Balsam	total volume+	0		Spruce/Balsam	initial volume harvested *4	0
	Doug fir	total volume+	232		Doug fir	total volume+	166
	Cedar/Hw	total volume+	218		Cedar/Hw	total volume+	78
65	Pine	total volume+	247	20	Pine	total volume+	99
	Spruce/Balsam	total volume+	0		Spruce/Balsam	initial volume harvested *4	0
	Doug fir	total volume+	215		Doug fir	total volume+	66
	Cedar/Hw	total volume+	202		Cedar/Hw	total volume+	0
60	Pine	total volume+	247	15	Pine	initial volume harvested *7	0
	Spruce/Balsam	total volume+	0		Spruce/Balsam	initial volume harvested *4	0
	Doug fir	total volume+	199		Doug fir	initial volume harvested *7	0
	Cedar/Hw	total volume+	187		Cedar/Hw	initial volume harvested *6	0
55	Pine	total volume+	247	10	Pine	initial volume harvested *7	0
	Spruce/Balsam	total volume+	0		Spruce/Balsam	initial volume harvested *4	0
	Doug fir	total volume+	182		Doug fir	initial volume harvested *7	0
	Cedar/Hw	total volume+	171		Cedar/Hw	initial volume harvested *6	0
50	Pine	total volume+	247	5	Pine	initial volume harvested *7	0
	Spruce/Balsam	total volume+	0		Spruce/Balsam	initial volume harvested *4	0
	Doug fir	total volume+	166		Doug fir	initial volume harvested *7	0
	Cedar/Hw	total volume+	156		Cedar/Hw	initial volume harvested *6	0

Appendix VI

Timber Supply Analysis

Data Package

In Support of the Evaluation of Available Merchantable Volumes in Areas Subject to Visual Quality Objectives

Data Package

In Support of the
Evaluation of Available Merchantable Volumes in Areas Subject to Visual Quality Objectives

The inventory file used in this analysis is the Robson Valley Land and Resource Management Plan (LRMP) file. Since the completion of the Timber Supply Review (TSR) for the Robson Valley in September 1994, the description of the land-base has changed due to such things as:

- the incorporation of updated inventory
- the inclusion of additional Caribou Habitat Areas
- the use of a Geographic Information System (GIS) to assist in digitally defining the operable (harvestable) land-base
- changes to merchantability assumptions resulting from the inclusion of previously excluded stands of timber (i.e.,. mature cedar and hemlock)
- the legislation of the Forest Practices Code Act of B.C. (FPC)
- the resource management zones and land-base management direction which has evolved through the efforts of the participants of the LRMP (including Protected Areas)

OPERABLE LAND-BASE DETERMINATION:

Tables A1, A2, and A3 describe the “gross” and “net” area for the entire Robson Valley TSA and for the Visual Landscape Units which were analysed in this project. The “net operable” land-base was provided in a field within the LRMP file and its determination was separate from this project. The net operable land-base field within the LRMP data base was adjusted by a factor of 0.927 to account for losses in area due to Forest Practices Code wildlife tree patch, riparian habitat and biodiversity requirements. The adjustment is consistent with the reduction used in the Robson Valley LRMP timber supply analysis.

Table A1 Robson Valley TSA Gross to Net Summary

Classification	Total TSA	Scenic Areas (R, PR, & M VQOs only)	
	Area (ha)	Area (ha)	% of Total TSA
Total Land-base	**1,459,059**	**310,839**	**21**
Less: Non-Crown	264,171	6,439	2
Non-Forest	693,628	119,420	17
Reductions to Crown Forest			
Non-Commercial Cover	1,739	759	44
Inoperable	59,068	26,345	45
Economic inoperable	62,376	14,659	24
ESAs	78,576	24,859	32
Low Site	24,543	3,963	16
Deciduous	13,560	6,871	51
Mature Problem Forest Types	8,971	2,644	29
Immature Problem Forest Types	475	307	65
Existing Roads	3,199	1,887	59
NSR	1,555	886	57
Riparian	2,471	1,017	41
Sensitive Caribou Habitat	25,868	8,553	33
VQO Preservation	167	135	80
RPAT Protected Areas	14,954	3,358	22
FPC and Biodiversity (7.3% reduction)	14,873	6,478	44
Total Reductions	**312,393**	**102,719**	**33**
Current Timber Harvesting Land-base	**188,868**	**82,261**	**44**

Table A2 Gross and Net Operable Area by Zone (Base case Scenario 1)

Zone	Gross Forested Area (ha)	Net Operable Area (ha)
Retention	19,766	5,990
Partial Retention	68,531	30,322
Modification	104,961	45,948
Total	193,258	82,260

Table A3 Gross and Net Operable Area by Zone (Partial Cut Scenario 2)

Zone	Gross Forested Area (ha)	Net Operable Area (ha)
Retention	12,893	3,867
Partial Retention	47,013	20,396
Modification	69,857	27,816
Partial Cut	63,495	30,181
Total	193,258	82,260

Table A4 Analysis Units - Scenario 1 and 2

Management Zone	Analy. Unit	Species Group	Type Group	Scenario 1		Scenario 2	
				Area Weighted Site index	Years to meet Green-up	Area Weighted Site index	Years to meet Green-up
Modification	1	Pine	28-31,34	12.68	22.3	13.3	21.3
	2	Spruce/Balsam	18-26	9.15	41.8	8.56	44.5
	3	Douglas Fir	1-8	14.21	21.8	14.87	20.9
	4	Cedar/Hemlock	9-17	11.93	23.8	12.72	22.6
Partial Retention	5	Pine	28-31,34	17.00	16.6	17.10	16.5
	6	Spruce/Balsam	18-26	10.86	35.6	9.83	39.1
	7	Douglas Fir	1-8	18.43	17.0	16.90	18.5
	8	Cedar/Hemlock	9-17	12.64	22.7	14.36	20.4
Retention	9	Pine	28-31,34	15.40	18.3	15.77	17.9
	10	Spruce/Balsam	18-26	12.30	31.6	9.52	40.3
	11	Douglas Fir	1-8	15.11	20.6	14.08	22.1
	12	Cedar/Hemlock	9-17	12.82	22.4	15.49	19.2
Partial Cut	13	All	1-34	n/a	n/a	14.04	n/a
Modification	14	All non-merch.	1-34	n/a	n/a	n/a	n/a
Partial Ret.	15	All non-merch.	1-34	n/a	n/a	n/a	n/a
Retention	16	All non-merch.	1-34	n/a	n/a	n/a	n/a

Analysis Units 14-16 depict the excluded forest land-base. This area contributes to the forest cover constraints.

FUTURE ROADS TRAILS AND LANDINGS

All existing stands currently over 40 years of age were reduced by 5.7 percent the first time that they are harvested. No reduction will be made for stands < 40 years of age.

UTILIZATION

Yield Tables are calculated using a harvest utilization level of 12.5 cm dbh for leading lodgepole pine stands and 17.5 cm dbh for all other timber types.

MINIMUM HARVEST AGES

The minimum harvest age applied to all analysis units will be the lessor of regional priority cutting age or culmination age. These ages are depicted in Table A4. Since some of the analysis units are not species specific, the resultant species distribution which is derived through VDYP will be applied to determine the area-weighted harvest age.

Table A5 Minimum Harvest Age By Species

Analysis Unit / Species	Culmination Age		Regional Priority Harvest Age
	Scenario 1	Scenario 2	
1 Modification Pine	125	115	81+
2 Modification Spruce / Balsam	195	205	101+
3 Modification Douglas Fir	145	145	111+
4 Modification Cedar / Hemlock	145	135	111+
5 Partial Retention Pine	85	85	81+
6 Partial Retention Spruce / Balsam	165	175	101+
7 Partial Retention Douglas Fir	95	115	111+
8 Partial Retention Cedar / Hemlock	135	125	111+
9 Retention Pine	95	85	81+
10 Retention Spruce / Balsam	145	185	101+
11 Retention Douglas Fir	135	145	111+
12 Retention Cedar / Hemlock	135	115	111+

BASIC SILVICULTURE AND REGENERATION ASSUMPTIONS

Operational adjustment factors (OAFs) of 15% and 5% will be applied to the WinTIPSY OAFs 1 and 2 respectively, in the calculation of managed stand yield tables.

Table A6 Regeneration Assumptions

AU	Original Leading Species	Zone	Regenerated Species and Percent	Percent Planted	Site Index		Regen. Delay (years)	Initial Stocking (stems/ha)
					Scenario 1	Scenario 2		
1	Pine	M	Pl 76 Sp 18 Fd 6	100 100 100	12.68 12.57 11.64	13.33 12.34 13.17	4 4 4	1400 1400 1400
2	Spruce/Balsam	M	Sp/B 97 Fd 3	100 100	9.15 11.49	8.56 11.06	4 4	1400 1400
3	Douglas Fir	M	Fd 79 Sw 21	100 100	14.2 12.82	14.87 13.73	4 4	1400 1400
4	Cedar Hemlock	M	Sw 90 Cw 5 Hw 5	100 100 100	11.93 11.93 11.93	12.72 12.72 12.72	4 4 4	1400 1400 1400
5	Pine	PR	Pl 75 S 18 Fd 7	100 100 100	17.0 16.3 16.6	17.10 16.44 16.7	4 4 4	1400 1400 1400
6	Spruce/Balsam	PR	S 90 Pl 10	100 100	10.86 11.96	9.83 11.02	4 4	1400 1400
7	Douglas Fir	PR	Fd 60 S 20 Pl 20	100 100 100	18.43 18.95 18.55	16.90 16.49 17.32	4 4 4	1400 1400 1400
8	Cedar Hemlock	PR	Sw 90 Cw 5 Hw 5	100 100 100	12.64 12.64 12.64	14.36 14.36 14.36	4 4 4	1400 1400 1400
9	Pine	R	Pl 85 Sw 8 Df 7	100 100 100	15.4 14.59 15.11	15.77 15.00 15.46	4 4 4	1400 1400 1400
10	Spruce/Balsam	R	Sw 90 Pl 10	100 100	12.30 13.29	9.52 10.73	4 4	1400 1400
11	Douglas Fir	R	Df 75 Pl 25	100 100	15.11 15.4	14.08 14.30	4 4	1400 1400
12	Cedar Hemlock	R	Sw 90 Hw 5 Cw 5	100 100 100	12.82 12.82 12.82	15.49 15.49 15.49	4 4 4	1400 1400 1400
13	all	PC	S 80 Pl 5 Df 10 C 5	100 100 100 100	n/a	14.04 14.89 15.10 14.04	4 4 4 4	1400 1400 1400 1400

Table A7 Forest Management Practices

Zone		Green-up Height (metres)	Harvest Delay (years)[1]		Age Group Constraint [2] (%)
			Scenario 1	Scenario 2	
Modification		5	37	34	26
Partial Retention		5	29	30	11
Retention		5	27	28	3
Partial Cut	Scen2a	n/a	n/a	30	n/a
	Scen2b	n/a	n/a	30	50% AG2
	Scen2c	n/a	n/a	30	n/a

Note: 1 Harvest Delay is the weighted average by analysis unit calculated using WinTIPSY.

2 Age Group Constraint is the percent area required to be less-than or greater-than the harvest delay. For the modification, partial retention and retention zones, this is the maximum amount of area within the zone that can be less than the harvest delay. For the partial cut zone, this is the minimum amount of area that must be greater then the harvest delay.

PARTIAL CUTTING - ALL ZONES

Partial cutting in scenario 2, was accomplished in a manner as described in the TSR (Section A.1.1 page 44). The stands that are allocated to partial cutting will be modelled as 30% of stand removal in a first entry followed by a stand MAI contribution thereafter. The MAI for the partial cut zone was calculated using WinTIPSY at culmination age and was determined to be 2.75 m3/ha/year (inclusive of a 4 year regeneration delay) . With a thirty-year delay between entries, this equates to 82 m3/ha realized at each additional entry.

UNSALVAGED LOSSES

The current, total non-recoverable losses in the Robson Valley TSA was estimated at 55,000 m3/year. The current net forested land-base is 188,868 hectares. The net operable area in modification, partial retention, and retention VLUs is 82,260 ha or 43.6 percent of the area within the TSA. This percent is applied to the current NRLs of 55,000 to achieve a resultant estimated loss of 24,000 cubic metres per year.

YIELD TABLES FOR EXISTING STANDS

Yields for existing stands were calculated using a batch version of VDYP.

YIELD TABLES FOR MANAGED STANDS

Yields for managed stands is calculated using WinTIPSY version 3.1a.

Calculation of Age Group 1 Constraints Using Green/Operable Ratios

The rationale for deriving Age Group 1 constraints on the Visual Landscape Units within Robson Valley was determined using the Recreation Branch Technical Report 1993:1 *Procedures for Factoring Recreation into Timber Supply Analyses*. The calculations used in this determination are detailed below:

VQO		**VAC**			
Modification	high	medium	low	total	**original area-**
	25	20.5	16		**weighted VQO**
area (ha)	15919.08	30754.21	2893.06	49566.35	**21.68260**
Green	Gross Area =	95174.22			
Operable	Net Area =	49566.35		**G/O Ratio =**	**1.92014**
	dispersed	0.1		4.16336	
	clustered	0.25		7.91452	
	clumped	0.65		14.09369	
				26.17157	**Max. Denuded**

VQO Partial		**VAC**			
Retention	high	medium	low	total	**original area-**
	15	10	6		**weighted VQO**
area (ha)	2863.35	18869.73	10975.46	32708.54	**9.09549**
Green	Gross Area =	63549.62			
Operable	Net Area =	32708.54		**G/O Ratio =**	**1.94291**
	dispersed	0.1		1.76717	
	clustered	0.25		3.34590	
	clumped	0.65		5.91207	
				11.02514	**Max. Denuded**

VQO		**VAC**			
Retention	high	medium	low	total	**original area-**
	5	3	1		**weighted VQO**
area (ha)	284.76	3124.85	3053.18	6462.79	**2.14327**
Green	Gross Area =	17714.39			
Operable	Net Area =	6462.79		**G/O Ratio =**	**2.74098**
	Dispersed	0.1		0.58747	
	clustered	0.25		1.00224	
	clumped	0.65		1.39313	
				2.98284	**Max. Denuded**

Appendix VII

Acknowledgements

Appendix VII

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