

**BRITISH COLUMBIA
MINISTRY OF FORESTS**

Cranbrook Timber Supply Area

Rationale for Allowable Annual Cut (AAC) Determination

effective March 1, 1996

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Objective of this document

This document is intended to provide an accounting of the factors considered and the rationale I have employed as Chief Forester of British Columbia in making a determination, under section 7 of the *Forest Act*, of the allowable annual cut (AAC) for the Cranbrook Timber Supply Area (TSA). The document also identifies where new or better information is required for incorporation into future determinations.

Description of the Timber Supply Area

The Cranbrook TSA lies in the south-eastern corner of the province, in the Nelson Forest Region, and is administered from the Cranbrook Forest District office in Cranbrook. The TSA boundaries coincide with those of the district, excluding protected areas. The TSA adjoins the Alberta border to the east and the U.S. border to the south. To the west lies the Kootenay Lake TSA, and to the north, the Invermere TSA.

In total, the TSA covers 1 427 853 hectares, but only 784 814 hectares are considered to be Crown productive forest. Once further deductions are made for inoperability, non-merchantable forest types, environmentally sensitive areas and other factors, the area on which timber harvesting may currently be expected to occur (the current timber harvesting land base) is 445 472 hectares, about 31 percent of the total TSA land base.

There are seven larger protected areas in the Cranbrook Forest District: the Elk Lakes Provincial Park; a portion of the Top of the World Provincial Park; St. Mary's Alpine Provincial Park; a portion of the Purcell Wilderness Conservancy, Akamina-Kishinena Provincial Park, Height of the Rockies, and Gilnockie Provincial Park.

Topographically, the TSA has two rugged mountain features—the Rocky Mountains to the east and the Purcell Mountains to the west—with a broad flat valley which is the southern end of the Rocky Mountain Trench, lying in between. Six biogeoclimatic zones occur in the TSA: the Interior Cedar-Hemlock, Interior Douglas-fir, Montane Spruce, Engelmann Spruce–Subalpine Fir, Ponderosa Pine and Alpine Tundra.

The area is renowned for its diversity and density of wildlife and wildlife habitat. It is part of the Southern Interior Mountains Ecoprovince, which supports 70 percent of the bird species known to occur in the province. Over 40 animals on the red and blue lists of species (endangered, threatened and at risk) published by the Ministry of Environment, Lands and Parks, are found within the Cranbrook TSA.

The principal tree species harvested is lodgepole pine, stands of which cover 50 percent of the timber harvesting land base. Significant amounts of spruce (covering 13 percent), larch (14 percent), Douglas-fir (12 percent) and sub-alpine fir (10 percent) are also harvested. The majority of forest stands are immature; only 17 percent of the timber harvesting land base supports stands over 120 years of age.

The TSA population in the 1991 census was 45 470, 36 percent of whom live in Cranbrook; others live mainly in the communities of Kimberley, Fernie, Sparwood and Elkford. Between 400 and 600 First Nations members live in the TSA. The major bands are the St. Mary's and Tobacco Plains bands, which are affiliated with the Ktunaxa-Kinbasket Tribal Council and have identified traditional territories within the TSA. Three other bands based outside the TSA also have identified traditional territories in the TSA.

The local economy within the Cranbrook TSA is relatively diverse. Mining is the largest employment sector—particularly in the Elk Valley communities of Fernie, Sparwood and Elkford—supporting 27 percent of all direct and indirect jobs in the TSA. The public sector (25 percent) and forestry (13 percent) are the other major employers. Cranbrook is far more dependent upon the forest industry than are the other communities. In addition to harvesting activities, employment is also generated by three major sawmills inside the TSA and a pulp mill in Skookumchuk; the latter is actually in the Invermere TSA but most of its employees live in the Cranbrook TSA.

Cranbrook also depends on tourism, agriculture and ranching. Outdoor recreation is highly valued by the local residents and tourists. Major activities include hunting, angling, golfing, skiing, snowmobiling, back-country hiking and wilderness viewing. Guide-outfitters and other adventure travel operators contribute to the local economy.

History of the AAC

In 1981, the allowable annual cut (AAC) determined for the Cranbrook TSA was 900 000 cubic meters. In 1987, the AAC was adjusted to 873 810 cubic metres to account for an area transferred to the Invermere TSA. Effective January 1, 1990, a one-year increase of 376 000 cubic metres was authorized to harvest timber affected by a mountain pine beetle infestation, for a total of 1 249 810 cubic metres. Upon the expiry of that temporary increase, effective January 1, 1991, a new increment of 284 000 cubic metres was authorized for two years to manage a continuing mountain pine beetle problem, resulting in an AAC of 1 157 810 cubic metres during that period.

Upon expiry of the temporary increase on January 1, 1993, the AAC reverted to 893 810 cubic metres—the pre-1990 AAC plus an increment of 20 000 cubic metres to harvest an unsalvaged portion of the previous temporary increase. This temporary increment expired at the end of 1993, and on January 1, 1994, the AAC returned to its original level of 873 810 cubic metres. Later that year, the area of the former Tree Farm Licence (TFL) 13 was added to the Cranbrook TSA, and on July 19, 1995, the AAC of 27 137 cubic metres for the former TFL was added to the AAC for the Cranbrook TSA, increasing the AAC to 900 947 cubic metres, which remains in effect today.

The Cranbrook AAC is apportioned by the Minister of Forests as follows:

	cubic metres		
	apportioned	*TFL addition	Total
Forest Licences (3)	753 322	25 781	779 103
Timber Sale Licence	5 672	0	5 672
Small Business Forest Enterprise Program	96 816	1 356	98 172
Woodlot Licence	9 000	0	9 000
Forest Service Reserve	9 000	0	9 000
Total	873 810	27 137	900 947

(*The TFL 13 additional volumes are anticipated to be approved by the Minister of Forests as shown)

New AAC Determination

Effective March 1, 1996, the new AAC for the Cranbrook TSA will be 850 000 cubic metres. This will remain in effect until a new AAC is determined, which must take place within five years of this determination.

Information sources used in this AAC determination

Information considered in determining the AAC for the Cranbrook TSA includes the following:

- Forest inventory planning file, British Columbia Forest Service (BCFS), December, 1992;
- Five-year timber harvesting development plans;
- Silviculture history records, BCFS;
- *Cranbrook TSA Timber Supply Analysis*, BCFS, March 1995;
- *Cranbrook Timber Supply Area Socio-Economic Analysis*, Pierce Lefebvre Consulting, Vancouver, March 1995;
- *Cranbrook Timber Supply Area: Timber Supply Review Discussion Paper* BCFS, March 1995;
- *Cranbrook TSA Summary of Public Input*, BCFS;
- *Cranbrook TSA Timber Supply Analysis, Project No 9440019*, (prepared for the Cranbrook TSA Licensees), Timberline Forest Inventory Consultants, June, 1995 ("the licensees' analysis");
- *Relations Between Site Index of Engelmann Spruce, Lodgepole Pine, and Subalpine Fir and the Measures of Site Quality in the ESSF Zone*, Klinka and Wang, UBC, March 1995;
- Cranbrook Forest District Interim Old-Growth Strategy, BCFS, June 1994;
- Cranbrook Forest District Riparian Management Zone Guidelines, BCFS, December 1993;
- *East Kootenay Land-Use Plan*, Government of British Columbia, March, 1995;
- Trench Integrated Renewable Resource Management Plan, BCFS, December 1990

- Letter from the Minister, dated July 28, 1994, stating the Crown's economic and social objectives;
- Technical review and evaluation of current operating conditions through comprehensive discussions with BCFS staff, notably at the AAC determination meeting, Cranbrook, July 26-27, 1995.

Role and limitations of the technical information used

The *Forest Act* requires me to consider biophysical as well as social and economic information in AAC determinations. A timber supply analysis and the inventory and growth and yield data used as inputs to the analysis formed the major body of technical information used in my AAC determination for the Cranbrook TSA. The timber supply analysis is concerned primarily with biophysical factors—such as the rate of timber growth and definition of the land base considered available for timber harvesting—and with management practices. The analysis also indirectly incorporates some economic information such as an operability classification that defines the types of terrain and timber that can be physically and economically accessed given current technology and markets.

However, the analytical techniques used to assess timber supply are simplifications of the real world. There is uncertainty about many of the factors used as inputs to timber supply analysis due in part to variation in physical, biological and social conditions—although ongoing science-based improvements in the understanding of ecological dynamics will help to reduce some of this uncertainty.

Furthermore, technical analytical methods such as computer models cannot incorporate all of the social, cultural and economic factors that are relevant when making forest management decisions. Therefore, technical information and analysis do not necessarily provide the complete answer or solution to forest management decisions such as AAC determinations. This information does, however, provide valuable insight into potential impacts of different resource-use assumptions and actions, and thus forms an important component of the information I must consider in AAC determinations.

In making the AAC determination for the Cranbrook TSA, I have considered known limitations of the technical information provided, and I am satisfied that the information provides a suitable basis for my considerations in this determination.

In particular, I have taken into account a programming error incorporated in the timber supply analysis conducted by the BC Forest Service, concerning excluded forest types, which was identified in the licensees' analysis during the public review process. This is discussed below, under *excluded forest types*.

Statutory framework

Section 7 of the *Forest Act* requires the Chief Forester to consider various factors in determining AACs for TSAs. Section 7 is reproduced in full as Appendix 1.

Guiding principles for AAC determinations

Rapid changes in social values and in our understanding and management of complex forest ecosystems mean that there is always some uncertainty in the information used in AAC determinations. Two important ways of dealing with uncertainty are (i) minimizing risk, and (ii) redetermining AACs frequently to ensure they incorporate up-to-date information and knowledge. In respect of these: (i) in making AAC determinations I consider the uncertainty associated with the information before me, and attempt to assess the various potential current and future social, economic and environmental risks associated with AACs from a range of possible harvest levels; and (ii) this principle has been recognized in the legislated requirement to redetermine AACs every five years. The adoption of this principle is central to many of the guiding principles that follow.

In considering the various factors that section 7 of the *Forest Act* requires me to take into account in determining AACs, I attempt to reflect as closely as possible operability and forest management factors that are a reasonable extrapolation from current practices. It is not appropriate to base my decision on unsupported speculation with respect either to factors that could work to increase the timber supply—such as optimistic assumptions about harvesting in unconventional areas, or using unconventional technology, that are not substantiated by demonstrated performance—or to factors that could work to reduce the timber supply—such as integrated resource management (IRM) objectives beyond those articulated in current planning guidelines or the Forest Practices Code.

The impact of the Forest Practices Code on timber supply is a matter of considerable public concern. In determinations made before the Code was brought into force, no final standards or regulations were available at the time the BCFS timber supply analyses were conducted. Accordingly, the analyses were unable to assess the impacts of any new constraints on timber production which might be imposed under the Code. In those determinations I did not consider any more stringent restrictions or additional impacts upon timber supply beyond those anticipated to occur due to the application of guidelines current at the time of determination. However, I assumed that the Code would at least entrench the standards exemplified by those guidelines as statutory requirements.

The *Forest Practices Code of British Columbia Regulations* were approved by the Lieutenant Governor in Council on April 12, 1995, and released to the public at that time. The *Forest Practices Code of British Columbia Act* was brought into force on June 15, 1995. Preliminary studies in selected TSAs indicate that under the Code there will be some impacts on timber supply additional to those expected under previous guidelines. In AAC determinations made since the coming into force of the Code, I have viewed with some caution the timber supply projections in the BCFS timber supply analyses for TSAs such as the Cranbrook, which pre-date the Code. At the same time, I am mindful that the full force of the Code may not be felt during

the transition phase of its implementation, and the impacts of specific factors on timber supply may not yet have been assessed on a local basis.

The impact on the timber supply of land use decisions resulting from planning processes such as the Commission on Resources and Environment (C.O.R.E.) process or the Land and Resource Management Planning (LRMP) process is a matter often raised in discussions of AAC determinations. In determining AACs it would be inappropriate for me to attempt to speculate on the impacts on timber supply that will result from land-use decisions that have not yet been taken by government. Thus I do not consider the possible impacts of existing or anticipated recommendations made by such planning processes, nor do I attempt to anticipate any action the government could take in response to such recommendations.

Moreover, even where government has made land-use decisions, such as the East Kootenay Land-Use Plan, it may not always be possible to analyze their timber supply impact in an AAC determination. In most cases, government's land-use decision must be followed by detailed implementation decisions. For example, a land-use decision may require the establishment of resource management zones and resource management objectives and strategies for these zones. Until such implementation decisions are made, it is impossible to properly assess the impact of the land-use decision. However, the legislated requirement for five-year AAC reviews will ensure such decisions are addressed.

The Forest Renewal Plan will fund a number of intensive silviculture activities that have the potential to affect timber supply, particularly in the long term. In general, it is too early for me to assess the consequences of these activities, but wherever feasible I will take their effects into account. The next timber supply review will be better positioned to determine how the Plan may affect timber supply.

Some have suggested that, given the large uncertainties present with respect to much of the data in AAC determinations, any adjustments in AAC should wait until better data are available. I agree that some data are not complete, but this will always be true where information is constantly evolving and management issues are changing. Moreover, in the past, waiting for improved data has created the extensive delays that have resulted in the current urgency to redetermine many outdated AACs. In any case, the data and models available today are superior to those available in the past, and will undoubtedly provide for more reliable determinations.

Others have suggested that, in view of data uncertainties, I should immediately reduce some AACs in the interests of caution. However, any AAC determination I make must be the result of applying my judgement to the available information, taking any uncertainties into account. Given the large impacts that AAC determinations can have on communities, no responsible AAC determination can be made solely on the basis of a response to uncertainty. Nevertheless, in making my determination, I may need to make allowances for risks that arise because of uncertainty.

With respect to First Nations issues, I am aware of the Crown's legal obligations resulting from the June 1993 Delgamuukw decision of the B.C. Court of Appeal regarding aboriginal rights. The AAC I determine for a TSA should not in any way be construed as limiting the Crown's

obligation under the Delgamuukw decision, and in this respect it should be noted that my determination does not prescribe a particular plan of harvesting activity within the TSA and that it is independent of any decision by the Minister of Forests with respect to subsequent allocation of the wood supply. Aboriginal rights will be taken into account as far as possible under section 7(3)(a)(v) of the *Forest Act*, and will be respected in the administration of the AAC determined.

Regarding future treaty decisions, as with other land-use decisions it would be inappropriate for me to attempt to speculate on the impacts on timber supply that will result from decisions that have not yet been taken by government.

Overall, in making AAC determinations, I am mindful of my obligation as steward of the forest land of British Columbia, of the mandate of the Ministry of Forests as set out in section 4 of the *Ministry of Forests Act*, and of my responsibilities under the *Forest Practices Code of British Columbia Act*.

Consideration of factors as required by section 7 of the *Forest Act*

The role of the "base case":

In considering the factors required under section 7 to be addressed in AAC determinations, I am assisted by timber supply forecasts provided to me through the work of the timber supply review project. For each TSA determination a timber supply analysis is carried out, using a data package of information from three categories: land base inventory, timber growth and yield, and management practices. Using this set of data and a computer simulation model (FSSIM), a series of timber supply forecasts is produced. Each forecast is based on the same set of data, and reflects different decline rates, starting harvest levels, and trade-offs between short- and long-term harvest levels.

From this range of forecasts, one is chosen which attempts to avoid excessive changes from decade to decade and significant timber shortages in the future, while ensuring the long-term productivity of forest lands. This is known as the "base case" forecast, which forms the basis for comparison when assessing the effects of uncertainty on timber supply.

Because it represents only one in a number of theoretical forecasts, and because it incorporates information about which there may be some uncertainty, the base case forecast is not an AAC recommendation. Rather, it is one possible forecast of timber supply, whose validity—as with all the other forecasts provided—depends on the validity of the data and assumptions incorporated into the computer simulation used to generate it.

Therefore, much of what follows in the considerations outlined below is an examination of the degree to which all the assumptions made in generating the base case forecast are realistic and current, and the degree to which its theoretical estimates of timber supply must be adjusted, if necessary, to more properly reflect the current situation.

These adjustments are made on the basis of informed judgement, using current information available about forest management, which—particularly during the period leading up to, and now

during the implementation of, the Forest Practices Code—may well have changed since the original data package was produced.

Thus it is important to remember, in reviewing the considerations which lead to the AAC determination, that while the timber supply analysis with which I am provided is integral to those considerations, the AAC determination itself is not a calculation but a synthesis of judgement and analysis in which numerous risks and uncertainties are weighed. Depending upon the outcome of these considerations, the AAC determined may or may not coincide with the base case forecast. But once an AAC has been determined that reflects appropriate assessment of all the factors required to be considered, no additional precision or validation may be gained by attempting a computer analysis of the combined considerations to confirm the exact AAC determined—it would be impossible for any such analysis to fully incorporate the subtleties of the judgement involved.

For the Cranbrook TSA, the BCFS analysis indicated that maintaining the current AAC would cause serious future declines in timber supply. To avoid such declines in the BCFS analysis base case, it was necessary to establish an initial harvest level of 806 000 cubic metres per year for the first decade, 10 percent below the current AAC. From this initial harvest level, the harvest forecast declined at 10 percent per decade for the next 4 decades to an interim level of 559 000 cubic metres per year, about 30 percent below the initial level, where it remained for seven decades, subsequently rising over the next two decades to a long-term level of 633 000 cubic metres per year.

Section 7 (3)

In determining an allowable annual cut under this section the chief forester, despite anything to the contrary in an agreement listed in section 10, shall consider

(a) the rate of timber production that may be sustained on the area, taking into account

(i) the composition of the forest and its expected rate of growth on the area

Land base contributing to timber harvesting

- general comments

The total area of the Cranbrook TSA is approximately 1.4 million hectares. Once non-Crown and non-forest lands are excluded, just over half the TSA—784 814 hectares—is Crown forest land. Of this, the portion that is actually available for timber harvesting is limited by operability, environmental sensitivity, non-merchantable forest types, and by demands on the operable (as well as the inoperable) areas for other forest uses.

- operability

To assess the timber harvesting land base, operability mapping was first completed in 1987 and then revised in 1993 in consultation with licensees. The inoperable area totals 208 832 hectares. After other required deductions from the land base this results in a

current timber harvesting land base of 445 472 hectares. (In the BCFS analysis this was reported as 423 445 hectares; however, an error was found in the deductions which resulted in the re-inclusion of 22 027 hectares; see - *excluded forest types*, below).

District staff submit that as timber prices increase, it may be possible in future for some of the areas currently deducted from the timber harvesting land base to be profitably harvested and reforested. However, district staff also note, after examining current operational performance, that while some harvesting is occurring outside areas currently considered as operable, in some cases harvesting is not reaching the expected bounds of operability. Since it has not been demonstrated that it is reasonable to expect performance on areas which consistently exceed the currently identified bounds of operability, I accept that the current operable land base assumptions as used in the BCFS analysis are appropriate for use in this determination.

- reductions for environmentally sensitive areas

Mapping of environmentally sensitive areas (ESAs) was reviewed and updated as part of the 1990 to 1991 re-inventory. The majority of the area removed in the BCFS analysis for ESAs was for areas with potential regeneration problems, high recreation values, or soil and slope instability. Based on the area reductions required in the TSA, a reduction factor of 90 percent was applied to areas with high sensitivity and 50 percent to areas with moderate sensitivity.

The licensees' analysis questions the 50 percent reduction, as other TSAs have a lower reduction factor for moderate sensitivity (for ESAs). The licensees' analysis submits that the figure of 40 360 hectares removed in the BCFS analysis is much higher than that for other, similar TSAs in the Nelson Forest Region.

The methodology for ESA deductions in this analysis was consistent with that in the previous two analyses for the Cranbrook TSA. District staff consider this to be a reasonable representation of current practice in the TSA, and advise me that as a result of recent terrain hazard mapping, more areas than were assumed in the BCFS analysis are now being classified as having environmentally sensitive soil. In view of this, while there may be some uncertainty regarding the accuracy of the deductions made in the BCFS analysis for ESAs for sensitive soils, I consider that it would be inappropriate at this time to assume that the overall figure for ESA deductions should be reduced. I am therefore prepared to rely on the 1990-1991 ESA mapping, as incorporated into the BCFS analysis, as adequate for use in this determination. However, district staff should re-examine the extent of environmentally sensitive areas prior to the next timber supply analysis, and I anticipate that this issue will be clarified prior to the next AAC determination.

- roads, trails and landings

The BCFS analysis incorporated a total deduction of 4.5 percent of the timber harvesting land base for existing roads, and 4.5 percent for future roads. The licensees' analysis took

a different approach, removing 9 percent of the area of stands aged under 20 years, and a further 9 percent when older stands were harvested. This latter approach could provide some additional short-term flexibility in timber supply, but the BCFS figures appear more consistent with the existing extent of road development in the TSA. Accordingly, I am satisfied that no adjustment to the initial harvest level projected in the BCFS analysis is required on this account.

- excluded forest types

Based on past harvesting performance, forest types which have not been harvested were excluded or partially excluded from the timber harvesting land base. Excluded forest types include deciduous, non-merchantable forest stands and some sites with low productivity.

Licensees submit that some of the non-merchantable types, as currently defined, will eventually contribute to the timber harvesting land base in the TSA. Although harvesting has not occurred in the excluded forest types, the possibility for rehabilitation of some sites was recognized in the BCFS analysis by the assumption that over the next 10 years 1130 hectares of brush areas would be converted to productive forest land. While there may be further opportunities in this respect, until more details are available to accurately assess the contributing areas and associated interactions with forest cover requirements, I am unwilling to speculate on an enlargement to the timber harvesting land base from additional harvesting in currently excluded forest types.

However, the licensees' analysis identified an error in the BCFS analysis with respect to reductions in mixed Douglas-fir and yellow pine forest types. This error resulted in the incorrect exclusion, in the BCFS analysis, of 22 000 hectares from the timber harvesting land base. BCFS staff agree with the licensees' finding and acknowledge that the timber harvesting land base is in fact larger by 22 000 hectares than reported in the BCFS analysis. In response to this finding BCFS staff undertook a complete re-analysis to identify the additionally available timber supply. This supplementary analysis examined the consequences of including the 22 000 hectares under various harvest flow assumptions, including the following.

In one projection, the initial harvest level was reduced by only 5 percent below the current AAC instead of the 10 percent reduction projected in the base case. In this case, the harvest rate could still decline at 10 percent per decade, to a mid-term level of 582 000 cubic metres, i.e. 12 percent below a new long-term level of 661 000 cubic metres. In another case, the initial harvest level was kept at that projected in the base case, with a decline rate of 10 percent per decade. This raised the mid-term level to 603 000 cubic metres, 9 percent below a new long-term level of 661 000 cubic metres. When the initial harvest level was set at the current AAC, declining at 10 percent per decade, the mid-term level fell to 545 000 cubic metres, i.e. 18 percent below the long term level of 661 000 cubic metres. For the purposes of this determination, as discussed below, under "Reasons for decision" I have accepted the first alternative discussed here as the most appropriate at

this time, and have assumed an upward pressure of approximately 5 percent on the initial harvest level projected in the BCFS base case.

- Engelmann Spruce–Subalpine Fir parkland

The parkland component of the Engelmann Spruce–Subalpine Fir (ESSF) biogeoclimatic zone (formerly called alpine tundra) totalling 4198 hectares was excluded from the timber harvesting land base in the BCFS analysis. This was because licensees have harvested less than 30 hectares of this area in the past 10 years, and even this has been only as parts of blocks harvested in the non-parkland ESSF zone.

Licensees are concerned that the mapping of the biogeoclimatic data used to exclude the ESSF parkland was not of a suitable scale, in that it was too general for the purposes of reducing the timber harvesting land base. They submit that, due to the scale of mapping, harvestable forest stands were removed in the ESSF parkland reduction. However, BCFS staff advise me that the converse is equally likely, i.e. that the mapping also resulted in the inclusion in the timber harvesting land base of some unharvestable areas.

Since much of the ESSF parkland is on poor sites on higher elevations—the licensees' analysis reports that 1 percent of the area excluded is on good sites, 36 percent is on medium sites and 63 percent is on poor sites—and since there has been so little past harvesting in this area in any case, it would be inappropriate to include any of the parkland in the timber harvesting land base until harvesting has been demonstrated as successful on these sites. For the present determination I am satisfied that no adjustment is required to the land base reduction for ESSF parkland in the BCFS analysis.

Existing forest inventory

- general comments

The Cranbrook TSA was inventoried during 1990 and 1991, and forest cover attributes were updated to 1992, with the exception of the former TFL 13 land base. Although the forest inventory is current for the TSA, the former TFL land base has not been updated since 1979. Consequently 1671 hectares of timber harvesting activity are not accounted for in the BCFS analysis.

An analysis of the removal of the contributing volume from the 1671 hectares indicated no impact to harvest levels for approximately four decades. A small impact in the fifth decade resulted in a harvest level lower than the projected base case by approximately 5 000 cubic metres per year.

Another concern raised by district staff was that although the inventory information is current for most of the TSA, on approximately 4000 to 5000 hectares of lodgepole pine

stands that were infested with the mountain pine beetle the timber volumes were not adjusted to reflect the loss to insect damage. As with the TFL volumes discussed above, analysis of the removal of up to one third of the volume in these stands indicated no impact on the initial harvest level.

I have directed district staff to update the TFL forest cover and the areas of insect attack prior to the next determination. For the purposes of this determination I have made no adjustment on this account to the short-term timber supply projected in the BCFS base case.

- volume estimates for existing stands

The BCFS analysis used the Variable Density Yield Prediction (VDYP) growth and yield model to predict volume estimates for existing stands. VDYP is based on information gathered from a large number of sample plots, and is generally accepted in British Columbia as an appropriate model for projecting volumes in existing stands. Therefore, as a general principle in AAC determinations, in the absence of statistically valid contradictory evidence for a particular area, I rely on VDYP estimates for existing stand volumes.

The BCFS analysis shows that the projected timber supply in the Cranbrook TSA is highly sensitive to variation in the estimates of volumes in existing stands, and this was raised as a critical factor in the *Cranbrook Timber Supply Area: Timber Supply Review Discussion Paper*. To examine the accuracy of the existing volume estimates used in the analysis, district staff reviewed the scaled and cruised volumes on approximately 2000 hectares harvested over the last five years. The recorded volumes from scale and cruise records averaged approximately 233 cubic metres per hectare. In comparison, the volumes estimates in the BCFS analysis were approximately 235 cubic metres per hectare—a very small difference.

A subsequent comparison in the East Kootenay Rocky Mountain Trench indicates that the volumes may be overestimated on approximately 8000 hectares that were not sampled in the original comparison. However, these findings are not statistically valid and are not conclusive at this time. A volume-ratio sampling audit is required, and is already scheduled for 1996. If the results of this audit indicate that volumes in existing stands have been significantly overestimated, then studies should be undertaken to resolve any uncertainty prior to the next AAC determination. For the purposes of this determination, in the absence of statistically valid contradictory evidence, I am satisfied that it is appropriate to rely on the volumes as projected by VDYP in the BCFS analysis.

- operational adjustment factors

Where necessary, Operational Adjustment Factors (OAFs) are applied to the volume estimates and yield predictions in BCFS timber supply analyses in order to account for

the loss of timber productivity due to particular operational conditions, such as openings in stands, pests, and decay, waste and breakage.

On existing and regenerated stands of lodgepole pine, and of larch and Douglas-fir mix, an average reduction factor of 15 percent was applied to volume estimates in the BCFS analysis to account for residual trees left standing after harvesting, to provide for seed trees, stand structure, wildlife trees and coarse woody debris. The 15-percent reduction applied in the BCFS analysis was in addition to the 20-percent reduction (15 percent for stand openings and 5 percent for decay, waste and breakage) applied to regenerated stands. A harvest prescription requiring 15-percent stand retention applies to over 50 percent of the timber harvesting land base.

Licensees suggest that, based on a study by Crestbrook Forest Industries of 28 cutblocks covering 398 hectares, the residual stand volume was only 7 percent of the original net volume, not 15 percent. District staff agree that actual residual volumes may be lower than assumed in the BCFS analysis; a BCFS field examination shows that the actual volumes being left on site are closer to 10 percent. Nevertheless, district staff advise me that in view of the 15-percent prescription, the actual residual volumes are likely to rise from the current level.

This is the first TSA or TFL for which I have reviewed an OAF applied to account specifically for residual volumes. These volumes must be accounted for in AAC determinations, but the present difference between the 15-percent of original volume as prescribed and adjusted for, and the 7-to-10-percent actually left on site, indicates some uncertainty in the current application of the prescription, and a need for further study before the next determination in order to better quantify both the objectives of this practice and the volumes involved. In this respect the *Forest Practices Code of British Columbia Biodiversity Guidebook* will provide direction in developing stand- and landscape-level requirements.

For the present determination, since both the district and licensee submissions indicate that the actual residual volumes experienced in current practice are 10 percent or less, compared to the 15-percent adjustment applied in the BCFS analysis, I conclude it is necessary to recognize a small upward pressure on the projected base case, and I have taken this into account in my determination, as discussed below, under “Reasons for decision”.

Expected rate of growth

- volume estimates for regenerated stands

The BCFS analysis used the Table Interpolation Program for Stand Yields (TIPSY) model to project volumes for future regenerated stands. TIPSY volumes were on average 22 percent higher than those generated by VDYP for existing stands. This increase is largely due to initial stocking and density control.

The East Kootenay Environmental Society raised the concern that increases in future timber supplies from silvicultural activities are not yet proven. The society also raised the point that the quality and value of future wood may be inferior to that of current high-value wood.

While I recognize that the society's first concern may have some application to the very long term, since we do not have hundreds of years experience in managing forest stands in British Columbia, nevertheless systematic measurements from currently existing managed stands do indicate that appropriate silvicultural treatments result in improvements in timber supply. There are also current examples of premium prices being paid for quality second-growth Douglas-fir. With respect to uncertainty in future timber volumes, a BCFS sensitivity analysis shows that if the regenerated volumes are lower by 10 percent than those projected in the BCFS analysis using TIPSy, there is no impact on projected harvest levels for the first four decades. This is because the timber supply for the next four decades consists mainly of existing stand volumes (projected using VDYP) and it is only in the fifth decade that volume gains from future regenerated stands start to affect timber supply.

Therefore, uncertainties in projections of regenerated stand volumes are not significant in the short term for this AAC determination. In a number of other TSAs, I have received the opposite concern, that in fact the BCFS analysis underestimates the projection of future regenerated stand volumes due to underestimations in site index (see - *site productivity estimates*, below). If the projected volumes are lower or higher, then the steady long-term harvest level may be adjusted, but potential volume adjustments remain speculative at this time.

- *site productivity estimates*

Inventory data includes site indexes determined from the ages and heights of trees, that are used to estimate and classify the productivity (i.e. growth potential) of tree-growing sites. The licensees' analysis noted that the BCFS analysis uses the same site index for regenerated stands as for existing stands, and claimed that the site productivity of regenerated stands is therefore underestimated. The licensees' analysis suggests that site indexes should be estimated from site indexes for thrifty stands (defined as 35 to 150 years of age, or 125 in the case of pine-leading stands) thereby reducing the negative bias from the slower-growing old-growth stands. However, the licensees' analysis concludes that, given the age-class structure of the Cranbrook TSA, which is generally in younger stands, with no abundance of old growth, the use of site indexes for thrifty stands results in only a relatively small site index increase over the BCFS analysis.

The licensee's analysis also points out that the BCFS analysis procedures did not recognize the "special-site" coding in the inventory data base. Special-site coding is applied to particular areas where site estimates have been revised to reflect improved

information. BCFS staff agree that, had the special-site coding been used, the overall effect would be to increase the total existing stand volumes by up to 2 percent.

BCFS staff acknowledge that site indexes could be underestimated to some degree for lower elevation areas (on more productive sites) and in the assignment of special sites. This, in combination with other factors—reduced minimum harvestable ages, and reduced green-up ages, both discussed below, and higher regenerated volumes (discussed above)—could result in an increase in timber supply. However, because of the lower productivity on higher elevation sites (over 1800 metres), district staff adjusted the minimum harvestable age to reflect lower productivity (see - *minimum harvestable ages*, below).

In conclusion, the attribution of site indexes from thrifty younger stands to all stands has been raised a number of times during the timber supply review and it is a provincial concern which the BCFS is examining. In general, without further evidence I cannot consider such attribution to be a reasonable extrapolation. In any case, due to the age-class structure in this TSA, any consequent effect on timber supply would be very small. However, the increase in existing stand volumes arising from the application of special-site coding does provide a small increase in the current timber supply projected in the BCFS base case, and I have accounted for this in my determination.

- *aggregation procedures*

Inventory information consists of a very large number of records from relatively small map areas known as polygons. Each polygon has a record which includes information on trees species, heights and ages, and the site on which they grow. For timber supply analysis, this data is aggregated by combining the records into analysis units so as to describe a smaller number of many polygons.

Concern was raised in the licensees' analysis regarding the aggregation procedures in the BCFS analysis. However, no significant impact on the projected timber supply was identified, and I am satisfied that the aggregation procedures used in the BCFS analysis are suitable for use in this determination.

- *minimum harvestable ages*

Minimum harvestable age is the time required for stands to grow to a harvestable condition. In the BCFS analysis, minimum harvestable ages were based on a volume-per-hectare requirement, which usually results in harvest ages lower than culmination age and is reflective of current harvesting practices. The minimum harvestable ages are defined by tree species and ecological considerations (particularly the susceptibility of lodgepole pine to mountain pine beetle attack) and range from 50 to 100 years on most sites. Exceptions are Douglas-fir, ponderosa pine or lodgepole pine on poor- and low-productivity sites, and all high-elevation sites. For these exceptions a minimum average

diameter at breast height (dbh) of 28 centimetres was specified, resulting in harvest ages ranging from 100 to 200 years. The 28-centimetre minimum dbh corresponds to a log size similar to that achieved on the lower elevations and more productive sites.

Licensees were concerned that the specification of a minimum 28-centimetre dbh in the BCFS analysis resulted in minimum harvestable ages much higher than culmination age. The licensees' analysis examined the impact of establishing the minimum harvestable age at culmination age, and found that this increased the timber supply in the sixth decade. This is mainly attributable to the high elevation zone and some low sites which contribute approximately 10 percent (39 000 hectares) of the timber harvesting land base.

A recent report, *Relations Between Site Index of Engelmann Spruce, Lodgepole Pine, and Subalpine Fir and the Measures of Site Quality in the ESSF Zone*, (Klinka and Wang, 1995) provides evidence supporting the district staff's concern that a harvestable condition will not be achieved on the higher elevations by the time culmination age is reached.

A BCFS sensitivity analysis of the impact of decreasing all the minimum harvestable ages by 20 years indicates no change in the base case until the fifth decade. In the sixth decade the harvest level no longer decreases but remains constant for another five decades. If the minimum harvestable ages are increased by 20 years, under a non-declining harvest rate, a decrease of 30 percent from the initial base case harvest level is projected.

The Licensees' analysis used different volume projections, thrifty site indexes, and reduced culmination ages, and thus reduced minimum harvestable ages. Using these assumptions, the licensees' analysis projected an initial harvest level for one decade at the current AAC, 10 percent above the BCFS base case.

From this I am mindful that it may be possible that actual minimum harvestable ages may be lower than assumed in the BCFS analysis. However, for two reasons I must be cautious in considering any increase in timber supplies from decreased minimum harvestable ages. First, there is uncertainty in the validity of assuming higher site indexes from thrifty stands, and secondly, minimum harvestable ages are based on management objectives which include assessments of the future marketability of particular products. For the present determination I am satisfied that the minimum harvestable ages assumed in the BCFS analysis reflect current management practices, and I have made no adjustment respecting lower harvestable ages.

- (ii) **the expected time that it will take the forest to become re-established on the area following denudation;**

Regeneration delay

In the BCFS analysis, regeneration delays of four to seven years were assumed, depending on artificial or natural regeneration methods. District staff examined the records from the silviculture database and concluded that the assumed regeneration delays

are reasonable, although some areas achieve stocking before the expected four or seven years. This would indicate some increase in future timber supplies if these and other areas continue to achieve stocking before the expected regeneration delay. However, about 9 percent of the timber harvesting land base is above 1800 metres in elevation. At these higher elevations, forest stands are often difficult to establish and growth is slow. To account for higher elevation difficulties, the BCFS analysis increased minimum harvestable ages (see - *minimum harvestable ages*, above). For this determination I am satisfied that regeneration delays were adequately modelled in the BCFS analysis.

Not-satisfactorily-restocked areas

All backlog and current not-satisfactorily-restocked (NSR) areas totalled about 44 000 hectares and were assumed to be restocked within the first decade in the BCFS analysis. Since the time of the analysis, approximately 15 000 hectares have been reclassified from NSR to satisfactorily-restocked (SR). I am therefore satisfied that the impact on the timber supply has been properly reflected for the purposes of this AAC determination.

(iii) silvicultural treatments to be applied to the area;

Incremental silviculture

Spacing: The Cranbrook TSA has an aggressive intensive silviculture spacing program with the objective of improving the quality of forest stands and the diameter of trees. Although no special consideration was made in the BCFS analysis for spacing, the volume estimates used in the analysis assume stocking levels are controlled. Juvenile spacing is carried out on over 1500 hectares per year in the TSA to meet these silviculture requirements.

Fertilization: District staff annually fertilize over 500 hectares and anticipate volume gains of 15 cubic meters per hectare for each fertilizer treatment. The total volume implications of this treatment are 7500 cubic metres of additional immature growth per year. The fertilization program was begun in the 1980s, but the associated volume gains were not reflected in the BCFS base case. This exerts upward pressure on the medium- to long-term timber supplies.

Commercial thinning

Commercial thinning may be used to alter the timing and availability of timber in the short and long terms. Approximately 40 percent of the forests in the timber harvesting land base in the Cranbrook TSA are 30 to 80 years old and may be candidates for commercial thinning. However, to date, very little commercial thinning has occurred in the Cranbrook TSA. Commercial thinning has the potential to supply some additional timber in the short term but before this can be considered in an AAC determination, further studies are required to identify candidate forests for commercial thinning and to assess the impact of this practice on the projected short- and long-term timber supply.

- (iv) the standard of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area;**

Utilization standards and decay, waste and breakage

The BCFS analysis assumed utilization standards of 17.5 centimetres diameter at breast height (dbh) for all species other than pine (which is harvested at 12.5 centimetres dbh), a 30-centimetre stump height, and a 10-centimetre top diameter. Licensees are experimenting with harvesting and processing smaller piece sizes than have previously been considered feasible and economical. The biological effects of removing this additional amount of organic material must be evaluated before this practice is widely implemented. The standard ministry assumptions for decay, waste and breakage were applied in the BCFS analysis. I am satisfied that the accounting for timber utilization and the allowance for decay, waste and breakage as applied in the BCFS analysis appropriately reflect predominant current practice in the TSA.

- (v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production;**

Integrated Resource Management (IRM) objectives

The Ministry of Forests is required by the *Ministry of Forests Act* to manage, protect and conserve the forest and range resources of the Crown and to plan the use of these resources to ensure production and harvesting of timber and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated. Accordingly, the extent to which IRM objectives constrain the timber supply must be considered in AAC determinations.

- cutblock adjacency

In order to protect non-timber resources such as wildlife, water quality and aesthetics, current harvesting practices limit the size and shape of cutblocks, and prescribe minimum green-up requirements for adjacent cutblocks. This provides for a distribution of harvested areas and retained forest cover across the landscape, and as such, it takes into account the impact of several forest management objectives. Cutblock adjacency guidelines are commonly expressed in terms of the number of harvesting entries, or "passes", required to remove the mature timber from the timber harvesting land base.

In the timber emphasis zone, which covers 60 percent of the timber harvesting land base, a three-pass harvesting regime—with a maximum of 35 percent of the area permitted to be less than three metres tall—was assumed in the BCFS analysis.

District staff submit that because of past harvesting patterns, cutblock locations, cutblock sizes and local topography, more than three passes will be required in the timber emphasis zone.

A BCFS sensitivity analysis shows that if a four-pass harvesting pattern were assumed in the timber emphasis, riparian and caribou zones, the projected initial base case harvest level would need to be reduced by 26 percent in the short term to prevent major future shortfalls. Under other harvest flow conditions, a smaller initial reduction to about 700 000 cubic metres could be achieved, but only with a further, and unacceptable, reduction to 525 000 cubic metres in the second decade.

It has not been demonstrated to my satisfaction that a minimum of four passes is needed throughout the timber emphasis, riparian and caribou zones. Although I acknowledge that more than three-passes may be required in some parts of the TSA, I do not think that more than three passes are required to reflect harvesting practices in most parts of the TSA. After examining a number of similar TSAs in the province, I note that there is a range from one to four harvesting passes; on average three passes are assumed in many of the BCFS analyses.

Further study of cutblock adjacency requirements in the Cranbrook TSA is required prior to my next AAC determination for this TSA. For this determination, based on past harvesting patterns, I accept that more than the three passes assumed in the BCFS analysis will be required in some parts of the TSA to achieve the combined IRM objectives. This represents a downward influence on the projected initial base case harvest level, which I have accounted for in this determination (see "Reasons for decision", below).

- green-up requirements

The green-up requirement is the time required for an area to reach a desired condition, usually with respect to height, after harvest. Adjacent stands cannot be harvested until this condition has been satisfied. The BCFS analysis assumed that all zones, except visual quality, watershed, riparian and forage zones, require approximately 23 to 29 years (including regeneration delays) to reach a green-up height of three metres.

The licensees' analysis suggests that there is significant uncertainty regarding green-up and that licensees are finding green-up can be achieved within 15 years after harvesting. The licensees' analysis states that the green-up periods assumed in the BCFS analysis are too long because regeneration delays are included. Also, the BCFS analysis did not account for improved yields from managed-stand yield projections, which reduced green-up periods over the long term. Based on field observations, BCFS district staff submit that in 15 years some stands may meet "free-growing" requirements, but that to achieve a green-up height of three metres takes up to 29 years when averaged across all sites.

I note that the green-up requirements for the Cranbrook TSA are comparable to other TSAs in the province with similar biophysical features. Also, the Forest Practices Code provides clear direction on requiring a height of three metres, as opposed to free-growing status, to achieve green-up requirements. For this determination, therefore, I am satisfied that the green-up requirements were adequately modelled in the BCFS analysis.

Nevertheless, I have requested that district staff examine green-up heights as achieved in the field prior to the next AAC determination.

- visual quality objectives

Forest resources managed by the BCFS include recreation resources. "Recreation resource" is defined in the *Forest Practices Code of British Columbia Act* to include "scenic or wilderness features or settings that have recreational significance or value". In order to manage scenic features, visual landscape foresters in British Columbia, in collaboration with specialists in other parts of the world, have developed procedures for identifying and managing visually sensitive areas. These procedures incorporate both biophysical and social factors—including visual sensitivity ratings based on topography, slope and other biophysical factors, and social factors such as numbers of viewers and their perceptions—and provide recommended visual quality objectives (VQOs) for visually sensitive areas. These objectives limit the amount of visible disturbance that is acceptable in such areas.

In the Cranbrook TSA, 7 percent of the timber harvesting land base is subject to forest cover limitations for VQOs. To reflect this constraint, the BCFS analysis assumed that at any time only 10 to 20 percent of this area may be maintained in forest stands of less than six metres in height.

In the licensees' analysis, concern was raised that although the VQO constraints are based on both the operable and inoperable land base, adjacent parks are not considered as contributing to visual quality objectives in the BCFS analysis. District staff point out that parks are geographically separated from VQO areas and therefore cannot contribute to VQO requirements.

District staff add that back-country areas were not included in the VQO zones as mapping of these areas was not complete at the time of the BCFS analysis but will be included in the next timber supply analysis.

A BCFS sensitivity analysis of the effects of increasing or decreasing the forest cover requirements by five percent for VQOs showed no impact on the short-term timber supply. Although this does not reflect a potential increase in the size of the VQO area, it does indicate that the timber supply is not highly sensitive to uncertainties regarding visual quality assumptions. I am therefore satisfied that the BCFS analysis has adequately accounted for VQOs in this determination. Nevertheless, every effort should be made to incorporate the outstanding landscape inventories into the timber supply analysis prior to the next AAC determination.

- stand-level biodiversity

Provisions for stand-level biodiversity—to provide structural diversity and habitat for wildlife through the retention of tree patches and leave trees—have become standard

practice in the Cranbrook TSA. This was directly accounted for in the BCFS analysis by operational adjustment factors (see above, - *operational adjustment factors*).

Requirements for stand-level biodiversity also overlap with the forest cover requirements associated with riparian areas, community watersheds, and the visual quality and caribou zones. In view of the operational adjustment factors applied, and of these overlaps, I am satisfied that requirements for stand-level biodiversity were adequately accounted for in the BCFS analysis.

- *landscape-level biodiversity*

Landscape-level biodiversity is provided through the retention of forested corridors and larger patches of older forests. Implementation of landscape-level biodiversity is of considerable concern to the forest industry and to the public. Many rare and endangered wildlife species are dependent on old-growth forests.

In the BCFS analysis, in most zones in the TSA a minimum of between 3 and 25 percent of the area of the zone was required to be maintained in forests over 140 years of age to account for old-growth objectives. The East Kootenay Environmental Society submits that the BCFS analysis did not adequately account for spatial requirements of forest ecosystem networks (FENs), and maintains that more area is required to protect biodiversity values.

FENs were not current practice at the time of completing the BCFS analysis for the Cranbrook TSA. District staff agree that now that the Forest Practices Code and the *Forest Practices Code of British Columbia Biodiversity Guidebook* are being implemented, additional constraints for landscape-level biodiversity are required. A preliminary study of the impact on timber supply from implementing the biodiversity guidelines indicates that provisions for landscape-level biodiversity will impose potentially significant constraints on timber supply additional to those accounted for in the BCFS analysis. However, implementing landscape-level biodiversity will require further planning over the next few years before the associated timber supply impacts can be fully quantified. In this AAC determination I have accounted for some risk to the timber supply from provisions for landscape-level biodiversity, (see below, "Reasons for decision"); the actual net impacts will be quantified by analysis for incorporation into the next determination.

- *community watersheds*

In the Cranbrook TSA, in areas identified by the Ministry of Environment, Lands and Parks as being licensed community watersheds, management guidelines allow a maximum of 25 percent of the area to be under cover of stands that have not reached green-up conditions. Hydrologic green-up for these areas is assumed to be nine metres. In addition, the Cranbrook Forest District Interim Old-Growth Strategy requires that at least 10 percent of the area within the community watershed zone be covered by stands older than 140 years. These requirements were accounted for in the BCFS analysis.

Integrated Watershed Assessment Procedures, in conjunction with implementation of the Forest Practices Code, may result in the need for higher forest cover constraints. Where appropriate these will be taken into account in the next AAC determination, when their associated timber supply impacts have been assessed.

- *riparian habitat*

In the BCFS analysis, the assumptions used to define the riparian habitat zone for streams and lakeshores were based on the *Cranbrook Forest District Riparian Management Zone Guidelines*. The riparian zone covers about 20 percent of the timber harvesting land base; at any one time a maximum of 35 percent of this zone may be under forest cover less than nine metres in height, while a minimum of 25 percent of the zone must be older than 120 years. The application of these cover constraints to the riparian zone in the BCFS analysis resulted in an impact on timber supply equivalent to that of a land base deduction of 5.2 percent of the timber harvesting land base.

District staff consider that the Forest Practices Code may be more restrictive with respect to riparian areas than were the previous guidelines, in that although the total riparian management area under the Code (i.e. reserve zone plus management zone) will likely be very close in size to the riparian management zone under the guidelines, the Code requires actual reserve zones which the guidelines did not.

However, I have reviewed preliminary studies of timber supply impacts of Code requirements for riparian management, and the equivalent 5.2 percent reduction applied through cover constraints in the BCFS analysis is very similar to the findings in these studies. From this I am satisfied that implementation of the Code is unlikely to result in any significant additional restriction on timber supply from that already accounted for in the BCFS analysis.

In the licensees' analysis, concern was raised that the BCFS analysis may have been too restrictive with respect to riparian management because the riparian areas were handled as a single broad zone, and were not spatially located. The licensees' analysis recommends that prior to the next analysis, the riparian areas should be located on maps. On the other hand, the East Kootenay Environmental Society submission recommended that, based on their local experience in the TSA, the riparian areas accounted for in the BCFS analysis are not adequate, although no supporting data were offered.

In view of the results of the preliminary studies and of the net impact on timber supply from accounting for the extensive riparian zone—which covers 20 percent of the TSA—I am satisfied that no further accounting for riparian management is required for this determination. However, I agree with licensees that it is preferable to locate specific riparian management areas by appropriate stream classification and stream length. Prior to the next determination, riparian areas should be spatially referenced to ensure adequate accounting in the BCFS analysis.

- caribou habitat

The management of threatened caribou habitat is an important consideration in forest management in the Cranbrook TSA. Critical elements of caribou habitat include forest cover for snow interception, visual cover and lichen forage. To account for critical habitat areas in the BCFS analysis, the Ministry of Environment, Land and Parks (MELP) identified a caribou habitat zone of about 14 000 hectares. Within the zone, at any one time, a maximum of 35 percent of the area is permitted to be less than three metres in height and at least 12 percent of the area must be older than 140 years. The zone covers about 3 percent of the timber harvesting land base and was believed to be adequate because much of the land base not contributing to the timber harvesting land base—about 70 percent of the total area—contributes to caribou habitat and provides forest cover.

Based on more recent research information, MELP submits that current management practices, as accounted for in the BCFS analysis, do not adequately protect caribou habitat. They are concerned that the caribou habitat zone needs to be larger by approximately 30 percent, that some (not quantified) habitat areas require a no-harvest regime, that the old-growth requirement needs to be increased from 12 percent of 140-year-old stands to 50 percent of 120-year-old stands, and that corridors of old growth and mature forests need to be established.

The East Kootenay Land-Use Plan (EKLUP) is currently refining land-use decisions for the area and a component of the plan will provide government's direction on caribou habitat management. The plan will incorporate some caribou habitat into special management zones and will provide caribou management guidelines. Any future changes to the land base or additional management guidelines will likely have an impact on timber supply in the mid-to-long term in the Cranbrook TSA.

Until the formal land-use decisions are implemented (see Land-use planning, below), I cannot speculate on the likelihood or magnitude of any further timber supply implications that might arise from the land-use plan. Therefore, although this factor may present some risk to the timber supply, in this AAC determination I am unable to account for any further provisions for caribou habitat beyond those incorporated in the analysis.

- forage requirements

In the BCFS analysis, the assumptions used to define the forage management zone for domestic range and wildlife were based on the Trench Integrated Renewable Resource Management Plan. The forage zone covers about four percent of the timber harvesting land base and for about half of this zone, at any time a minimum of three percent of the

forests must be older than 140 years, while in the other half a minimum of six percent must be older than 120 years.

Portions of the Rocky Mountain Trench are managed for increased harvesting in the short-term with reduced volume yields in the long-term to reflect areas dedicated to increased forage rather than timber production. The BCFS analysis accounted for this increased harvesting in the forage zone. However, range and wildlife supporters are concerned that harvesting is not occurring at adequate levels and in fact, they have observed that forests are encroaching in the Rocky Mountain Trench.

The Interior Lumber Manufacturer Association submits that both harvesting and fires can be used to increase grasslands. Another submission, by the East Kootenay Environmental Society suggests that more area should be withdrawn from the timber harvesting land base for grassland habitats.

At present it is anticipated that the EKLUP and the Trench Integrated Renewable Resource Management Plan will provide further direction on acceptable uses for forage areas. I cannot speculate on the likelihood or magnitude of any further timber supply implications that might arise from these plans. The assumptions in the BCFS analysis provide the best information available at this time, and I have made no further adjustment in this AAC determination with respect to forage.

(vi) any other information that, in his opinion, relates to the capability of the area to produce timber;

Land-Use Planning

On March 13, 1995, the provincial government announced the East Kootenay Land-Use Plan (EKLUP) which identified new protected areas, such as Gilnockie Park, to be established.

As noted under "Guiding principles for AAC determinations", government's land-use decisions generally must be followed by detailed implementation plans. This is the case with the EKLUP. Although the land-use decision has been announced, all the details are not yet complete. Three zones have been identified—Integrated Resource Management, Enhanced Resource Development and Special Resource Management—and a process is now underway to develop targets and resource objectives. This process will also help clarify the requirements for biodiversity under the Forest Practices Code and significant wildlife habitat requirements within the context of the EKLUP.

Until the necessary decisions are made and implemented, it is impossible to fully assess the overall timber supply impacts of this land-use decision. For example, the impacts of some aspects of the land-use decision, such as protected areas, may be offset by the objectives of the Enhanced Resource Development Zone. Therefore, although some areas have recently been designated as protected areas, until the entire plan is completed and

approved by Cabinet I cannot speculate on the overall effects that the plan may have on timber supply.

However, as noted under "Guiding principles for AAC determinations", where recent land-use decisions are not able to be taken into account in the current round of analysis, the legislated requirement to revisit AAC determinations will ensure that these decisions will be addressed within five years. Moreover, if at any time during the implementation of the EKLUP it becomes apparent that the new AAC for the Cranbrook TSA is no longer consistent with the Plan, I am prepared to reassess the timber supply and redetermine the AAC before the five-year period required under the *Forest Act*.

(b) the short and long term implications to the Province of alternative rates of timber harvesting from the area;

Harvest flow alternatives

The nature of the transition from harvesting old growth to harvesting second growth is a major consideration in determining AACs in TSAs that have an old-growth component, such as the Cranbrook TSA. In the short term, the presence of older forests permits harvest levels above the long-term harvest level without jeopardizing the future timber supply. In keeping with the objectives of good forest stewardship, AACs in British Columbia have been and continue to be determined to ensure that current and mid-term harvest levels will be compatible with a smooth transition toward the usually (but not always) lower long-term harvest level. Thus, timber supplies should remain sufficiently stable that there will be no inordinately adverse impact on current or future generations. To achieve this, the AAC determined must not be so high as to cause later disruptive shortfalls in supply, nor so low as to cause immediate social and economic impacts that are unnecessary to maintain forest productivity and future harvest stability.

The BCFS analysis shows that the original abundance of mature forests which historically allowed harvest levels well above the long-term harvest level no longer exists. In this situation harvest levels must decline towards the long-term harvest level to avoid serious timber supply shortfalls in the future. Under current management the harvest level in the base case forecast declines at about 10 percent per decade for the next four decades, to a level about 30 percent below the initial harvest level, which remains steady for seven decades before rising about 12 percent to the steady long-term harvest level. (The re-analysis performed as a result of discovery of the erroneous deduction of 22 000 hectares of the land base [see above, *excluded forest types*] confirmed the basic trends of the BCFS base case, with a small addition to the timber supply throughout the forecast period, which I have taken into account as explained below in "Reasons for decision".)

The BCFS analysis included sensitivity analyses in which the initial harvest level, its duration, and the subsequent rate of decline were adjusted. One sensitivity analysis examined the consequence of maintaining the current AAC as an initial harvest level for one decade. However, harvesting at this higher level over the first decade reduced the amount of timber available for future harvests, resulting in greater reductions—in the

order of 27 percent below the long-term level—between decades 5 and 12. Basing an AAC on this supply forecast would imply a higher future degree of social adjustment than in the base case, as the harvest level falls substantially below the long-term harvest level.

Another BCFS sensitivity analysis examined the consequences of achieving a non-declining harvest level. In this analysis, the initial harvest level had to be reduced to about 600 000 cubic metres per year, roughly 33 percent below the initial base case harvest level. Basing an AAC on this supply forecast would imply an extremely high, immediate impact with little allowance for social adjustment.

A socio-economic analysis (SEA) report for the Cranbrook TSA was prepared for the BCFS by Pierce Lefebvre Consulting, and I have considered this report in my determination. The SEA describes the economic importance of the TSA's forest industry, both to local communities and to the province as a whole, and discusses the possible implications for the economy, the community, and the environment associated with a number of different timber harvest forecast scenarios.

One scenario reflected the base case harvest forecast (a 10-percent immediate reduction) and another reflected the impact of an immediate reduction of 15 percent in the timber harvesting level. Both scenarios would involve employment and community impacts. However, the reduction of 10 percent per decade as projected in the base case shows a more gradual and smaller impact in each of the next four decades.

A number of public submissions raised concerns about the SEA. The East Kootenay Environmental Society was concerned that the SEA did not adequately account for the area's relatively diverse economy and therefore exaggerated the social and economic impacts associated with reducing harvest levels. The SEA does acknowledge and discuss the fact that the Cranbrook TSA is economically diverse; however, other factors such as the expected job losses from the Sullivan mine closure, which are also addressed in the SEA, must be taken into account in assessing the socio-economic impacts of harvest reductions.

A few submissions received from the public claim that the SEA contains insufficient recognition of the forest sector economies. The Interior Lumber Manufacturers' Association (ILMA) submitted a critique of the SEA. The ILMA questioned the SEA's projections of government revenues as the SEA did not include the stumpage rates set in April 1994 in conjunction with the Forest Renewal Plan. It is safe to assume that those projections now underestimate the immediate impacts on revenues accruing to the province, but the degree of difference cannot be estimated reliably for long periods into the future. Following a review of the SEA, the critiques and the comments received through the public input process, I am satisfied that the SEA was conducted appropriately and provides reliable socio-economic analysis pertinent to this determination.

The BCFS analysis indicates to me that an appropriate balance between minimizing both short-term economic disruption and future supply shortfalls would be achieved by some

initial reduction in harvest level followed by a decline period to a stable level. The BCFS analysis base case and similar forecasts provide useful information for achieving this purpose, and I have discussed this further below under "Reasons for Decision".

- (c) **the nature, production capabilities and timber requirements of established and proposed timber processing facilities;**

Timber processing facilities

Three of the larger timber processing facilities are owned by the two major licensees in the TSA. These two licensees rely on the TSA for about 62 percent of the wood supply for their mills. Other large timber processing facilities include a wood preserving plant and a cedar pole operation.

There are a number of smaller processing facilities in the area which rely heavily on wood from the Small Business Forest Enterprise Program (SBFEP) in the TSA. Private land and other sources outside the TSA provide the remaining timber supply required.

The SEA points out that mill capacity in the TSA exceeds timber supply. Although it is often difficult to predict mill closure thresholds due to timber shortages, licensees have expressed concern that mill closures are possible if timber supplies are significantly reduced.

- (d) **the economic and social objectives of the Crown, as expressed by the minister, for the area, for the general region and for the Province;**

Minister's letter

The Minister has expressed the economic and social objectives of the Crown for the province (letter dated July 28, 1994, attached as Appendix 3), and I understand these to apply to the Cranbrook TSA. They are consistent with the objectives stated in the Forest Renewal Plan and include forest stewardship, a stable timber supply, and allowance of time for communities to adjust to harvest level changes in a managed transition from old-growth to second-growth forests, so as to provide for continuity of employment.

The Minister also stated in his letter that "any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability." He placed particular emphasis on the importance of long-term community stability and the continued availability of good forest jobs. To this end he asked that the Chief Forester consider the potential impacts on timber supply of commercial thinning and harvesting in previously uneconomical areas. The latter would likely require the use of alternative harvesting systems, and to encourage this the Minister suggested the consideration of partitioned AACs.

The employment and community impact issues are discussed in detail in the SEA, and I am familiar with the varying impacts of different harvest levels (see above discussion

under Harvest flow alternatives). The use of commercial thinning has been discussed in Commercial thinning, above, where I have noted the potential benefits of commercial thinning and the need for study before any associated impacts on timber supply can be considered in an AAC determination.

Operability was discussed in Land base contributing to timber harvesting above. There I concluded that, while it may be possible in the future to harvest and reforest more of the areas deducted from the timber harvesting land base, until performance has been demonstrated with respect to increased operability, the assumptions used in the BCFS analysis appropriately reflect the operable land base in the TSA.

- local objectives

The Minister's letter encourages me to consider important local social and economic objectives that may be derived from the public input in the timber supply review. I am mindful of the many views which were brought forward in the public input received. I have considered this input thoroughly in my determination, and where possible I have attempted in this rationale to respond briefly to many of the views expressed.

A number of submissions discussed concerns that are not relevant to the timber supply review process, such as changing the tenure system, and making more wood available to small manufacturers and to the woodlot program. These suggestions are all constructive points; however, they do not fall into the considerations that I am required to take into account in AAC determinations under section 7 of the *Forest Act*.

- (e) **abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.**

Non-recoverable losses

To account for losses due to insects, disease, fire and damage by wind, the BCFS analysis assumed an annual volume of 139 000 cubic metres per year is not recoverable.

Licensees submit that the volume actually lost is only half that assumed in the BCFS analysis, due to a well-developed road system and an active salvage program. After reviewing the non-recoverable losses, District staff advise me that the reductions in the BCFS analysis are overestimated by approximately 39 000 cubic metres per year and that they will be monitoring non-recoverable losses on an ongoing basis. The results of the monitoring will be incorporated into the next determination.

Based on the review by District staff, I accept that the methodology of the BCFS analysis for determining volume losses due to fires, wind damage, and insects and disease (additional to those incorporated in the inventory data base), has satisfactorily accounted for non-recoverable losses, with the exception of the 39 000 cubic metre overestimation. This overestimation represents a small increase in the timber supply throughout the

forecast period and I have accounted for this in my determination as discussed below, under "Reasons for decision".

Reasons for decision

In reaching my decision on an AAC for the Cranbrook TSA, I have considered all of the factors presented above and have reasoned as follows.

As outlined above in Harvest flow alternatives, the BCFS analysis for the Cranbrook TSA indicates that the current AAC could be maintained as an initial harvest level for one decade. However, harvesting at this higher level over the first decade would reduce the amount of timber available for future harvests, resulting in a greater required reduction—in the order of 27 percent below the long-term level—between decades 5 and 12. Basing an AAC on this timber supply forecast would imply a higher future degree of social adjustment than in the base case, as the harvest level would fall substantially below the long-term harvest level.

Given the inevitability in this TSA of an imminent decline in harvest levels toward a lower long-term harvest level, and the associated need to accommodate changes in socio-economic activity, in my view it would be inequitable to postpone all impacts to the future, particularly when the timber supply would thus be used up more quickly, reducing future control over the rate of decline. In my view it is more equitable to distribute the necessary adjustments in both immediate and future declines. For this reason I am satisfied that for this TSA at this time it is appropriate to consider some immediate harvest level reduction, as projected in the BCFS base case.

However, my considerations in this determination have identified several reasons why it would not be appropriate at this time to establish the AAC at the particular initial harvest level projected in the BCFS base case. Several factors—some of which may overlap—indicate that the timber supply is in some respects greater, and in some respects lower, than projected in the base case forecast. In considering the overall timber supply implications of these factors, I am mindful that there may be overlaps and that the individual timber supply impacts may not be entirely cumulative. At the same time, as noted in "Guiding principles", I am also aware that further and as yet unquantified impacts on timber supply may be expected due to the implementation of the Forest Practices Code and the EKLUP.

Factors identified as limiting the timber supply relative to the base case projection include the following:

- The former TFL 13 land base (now within the Cranbrook TSA) has not been updated for forest cover disturbances since 1979. Consequently approximately 1671 hectares of timber harvesting activity were not accounted for in the BCFS analysis. An analysis of the removal of the contributing volume from the 1671 hectares indicates a small impact in the fifth decade, with the harvest level lowered by 5000 cubic metres per year; however, this had no effect on the projected short-term timber supply.

- Approximately 4000 to 5000 hectares of lodgepole pine stands that are infested with residual mountain pine beetle were not labelled with an insect attack history and consequently the inventory volumes were not reduced to reflect the damage. A review of the impact of removing up to one third of the volume on these stands shows similar results to the above discussion on TFL volumes, with no impact in the short-term.
- Changes in cutblock adjacency requirements (i.e. the need for more than three harvest passes in some areas) to meet IRM objectives and in the management practices required to meet landscape-level biodiversity objectives will likely have a downward influence on timber supplies, including in the short term. MELP's concerns respecting caribou habitat may also further constrain timber supply, but this cannot be accounted for until implementation of the EKLUP is complete.

Offsetting these limiting influences are a number of factors which suggest the timber supply may be higher than projected, as follows:

- The BCFS analysis procedures did not recognize the "special site" index. Application of the appropriate coding would increase the estimates of total existing stand volumes by up to 2 percent, resulting in a small increase in the projected short-term timber supply.
- Based on both the district and licensee submissions, there is evidence that the reduction factor of 15 percent applied in the BCFS analysis to appropriate forest stands to account for the residual volumes of trees left standing after harvest for such purposes as seed trees, wildlife trees, etc., exceeds the current practice of leaving up to 10 percent, and indicates a small increase in the initial harvest level projected in the base case.
- The licensees' analysis pointed out that 22 000 hectares of excluded forest types were incorrectly removed from the timber harvesting land base used in the BCFS analysis. BCFS analysis indicates that the additional timber supply contributed by the inclusion of this area permits an initial harvest level approximately 5 percent higher than projected in the BCFS base case.
- Reductions for non-recoverable losses were overestimated in the BCFS analysis by approximately 39 000 cubic metres per year, which exerts a small upward influence on the initial projected base case harvest level.
- Fertilization is projected to have an upward influence on the medium- to-long-term timber supply, but will not affect the short-term supply.

In examining the restrictive and augmenting influences on the timber supply for the Cranbrook TSA, I find that those factors exerting an immediate upward influence on the initial harvest level projected in the base case are: special site index adjustments; a lower operational adjustment factor to account for residual trees; additional areas from previously excluded forest types; and lower non-recoverable losses. The downward factors offsetting these upward influences in the

short term are the need for more than three harvest passes to meet IRM objectives in some areas, and the change in practices required to meet landscape-level biodiversity objectives.

Assessment of the overall impact on timber supply from the downward influences is subject to uncertainty in the outcome of interactions between the various components of the EKLUP and the implementation of the Forest Practices Code. It is reasonable to expect that the impacts of some of the downward influences will overlap rather than simply accumulate in a directly additive way. It is also reasonable to expect that the total net impact on timber supply from the combined downward influences is in the same order of magnitude, and thus sufficient to approximately counteract, the combined upward influences exerted by adjustments for special site indexes, residual tree volumes and reduced non-recoverable losses.

However, I do not consider it reasonable to conclude further that the magnitude of the downward influences will be sufficiently great as to also offset the upward influence on the initial harvest level produced by the correction of the erroneous deduction of 22 000 hectares of excluded forest types. This additional supply must be accounted for, and having considered the alternatives shown by analysis to be available for this accounting (see above, - *excluded forest types*), and particularly in view of the social and economic objectives of the Crown, expressed by the Minister of Forests (see letter attached as Appendix 3), regarding the desirability of minimizing AAC reductions consistent with maintaining long-term forest productivity, I have determined that it is appropriate to adjust the initial harvest level of 806 000 cubic metres per year projected in the BCFS base case upward by approximately 5 percent, to reflect the additional timber supply provided by the inclusion of the previously erroneously excluded forest types.

The harvest level I have determined to meet the objectives of good forest stewardship for this area thus requires an immediate reduction of approximately 5 percent from the existing AAC. As such, this determination will have an impact on established patterns of socio-economic activity in the Cranbrook area. As confirmed in the Minister of Forests' letter, setting out the socio-economic objectives of the province, in AAC determinations the long-run sustainability of the forests of the area must be a paramount concern, and I have taken this into account in the harvest level I have determined.

As discussed in Land-Use Planning above, I have not attempted to predict or to take into account the overall timber supply implications of the EKLUP. Although the plan and the land-use decision have been announced, all relevant details are not complete at this time. A process is currently under way to identify and define objectives and to develop resource targets in the EKLUP. Until outstanding decisions are made and implemented, I cannot speculate on the overall effect of the plan on timber supply.

It is therefore my determination that a timber harvest level that accommodates objectives for all forest resources during the next five years, that provides for anticipated constraints during the initial implementation of the Forest Practices Code, that ensures longer-term IRM objectives can be met, that meets provincial objectives and avoids severe curtailment of locally established socio-economic activity based on timber harvesting, and that avoids disruptive shortfalls in future

wood supply, can best be achieved in this TSA at this time by establishment of an AAC of 850 000 cubic metres.

Determination

Effective March 1, 1996, the new AAC for the Cranbrook TSA will be 850 000 cubic metres.

Implementation of Decision

This determination comes into effect on March 1, 1996, and will remain in effect until a new AAC is determined, which must take place within five years of this determination.

In the period following this determination and leading up to the subsequent determination, I am directing BCFS staff to examine several issues:

1. review the designation of, and management practices for, environmentally sensitive areas;
2. update forest inventories for the area previously covered by TFL 13 and for insect- and disease-attacked areas;
3. complete volume-ratio sampling to provide an indication of any significant discrepancies in estimates of existing stand volumes;
4. investigate the residual stand volumes left on site after harvesting and review the practice with respect to the achievement of specific objectives;
5. identify candidate forests for commercial thinning and assess the impact of this practice on the projected short- and long-term timber supply;
6. examine the cutblock adjacency requirements in the Cranbrook TSA;
7. evaluate alternative analytical approaches to assessing the timber supply implications of uneven-aged silvicultural systems and mixed species management;
8. clarify the timber supply implications from riparian area management, stand-level biodiversity, old-growth retention, forest ecosystem networks and mature forest cover retention.



Larry Pedersen
Chief Forester

January 30, 1996

Appendix 1: BC *Forest Act*, section 7

Section 7 of the *Forest Act* reads as follows:

Allowable annual cut

7. (1) The chief forester must determine an allowable annual cut before December 31, 1996, and after that determination at least once every 5 years after the date of the last determination, for
- (a) the Crown land in each timber supply area, excluding tree farm licence areas and woodlot licence areas, and
 - (b) each tree farm licence area.

- (1.1) If, after the coming into force of this subsection, the minister
- (a) makes an order under section 6 (b) respecting a timber supply area, or
 - (b) amends or enters into a tree farm licence to accomplish the result set out under section 33.1 (1) (a) to (d),

then, with respect to that timber supply area or tree farm licence area, as the case may be, the chief forester is not required to make the determination under subsection (1) of this section before December 31, 1996, or within 5 years after the last determination, but is required to make the determination

- (c) within 5 years after the order under paragraph (a) or the amendment or entering into under paragraph (b), and
- (d) after the determination under paragraph (c), at least once every 5 years after the date of the last determination.

- (1.11) If
- (a) the allowable annual cut for the tree farm licence is reduced under section 7.1 (3), and
 - (b) the chief forester subsequently determines, under subsection (1) of this section, the allowable annual cut for the tree farm licence area,

the chief forester must determine an allowable annual cut at least once every 5 years from the date the allowable annual cut under subsection (1) of this section is effective under section 7.1 (6).

(1.12) If the allowable annual cut for the tree farm licence area is reduced under section 7.1 (3), the chief forester is not required to make the determination under subsection (1) or (1.1) of this section at the times set out in subsection (1) or (1.1) (c) or (d), but must make that determination within one year after the chief forester determines that the holder is in compliance with section 7.1 (2).

- (1.2) [Repealed 1994-39-2.]

(1.3) In determining an allowable annual cut under this section the chief forester may specify portions of the allowable annual cut attributable to

- (a) different types of timber and terrain in different parts of Crown land within a timber supply area or tree farm licence area,
- (b) different types of timber and terrain in different parts of private land within a tree farm licence area, and
- (c) gains in timber production on Crown land that are attributable to silviculture treatments funded by the Province, the federal government, or both.

(2) The regional manager or district manager shall determine a volume of timber to be harvested under a woodlot licence during each year or other period of its term, according to the licence.

(3) In determining an allowable annual cut under this section the chief forester, despite anything to the contrary in an agreement listed in section 10, shall consider

- (a) the rate of timber production that may be sustained on the area, taking into account
 - (i) the composition of the forest and its expected rate of growth on the area;

- (ii) the expected time that it will take the forest to become re-established on the area following denudation;
 - (iii) silvicultural treatments to be applied to the area;
 - (iv) the standard of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area;
 - (v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production; and
 - (vi) any other information that, in his opinion, relates to the capability of the area to produce timber;
- (b) the short and long term implications to the Province of alternative rates of timber harvesting from the area;
 - (c) the nature, production capabilities and timber requirements of established and proposed timber processing facilities;
 - (d) the economic and social objectives of the Crown, as expressed by the minister, for the area, for the general region and for the Province; and
 - (e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

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Appendix 2: BC Ministry of Forests Act, section 4

Section 4 of the *Ministry of Forests Act* (consolidated 1988) reads as follows:

Purposes and functions of ministry

4. The purposes and functions of the ministry are, under the direction of the minister, to
- (a) encourage maximum productivity of the forest and range resources in the Province;
 - (b) manage, protect and conserve the forest and range resources of the Crown, having regard to the immediate and long term economic and social benefits they may confer on the Province;
 - (c) plan the use of the forest and range resources of the Crown, so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated, in consultation and cooperation with other ministries and agencies of the Crown and with the private sector;
 - (d) encourage a vigorous, efficient and world competitive timber processing industry in the Province; and
 - (e) assert the financial interest of the Crown in its forest and range resources in a systematic and equitable manner.

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Documents attached:

Appendix 3: July 23, 1994 letter from Honourable Andrew Petter, Minister of Forests, to former chief forester John Cuthbert, re: economic and social objectives of the Crown

Appendix 4: Summary of Public Input.