

**BRITISH COLUMBIA
MINISTRY OF FORESTS**

Tree Farm Licence 10

Issued to International Forest Products Limited

Rationale for Allowable Annual Cut (AAC) Determination

effective December 30, 1996

**Larry Pedersen
Chief Forester**

Table of contents

Objective of this document	3
Description of the TFL.....	3
History of the AAC	3
New AAC determination	4
Information sources used in the AAC determination.....	4
Role and limitations of the technical information used	5
Statutory framework	6
Guiding principles for AAC determinations	6
The role of the base case	8
Timber supply analysis	9
Consideration of factors as required by section 7 of the Forest Act	11
Forest land base contributing to timber harvest	11
- general comments	11
- economic and physical operability.....	11
- environmentally sensitive areas	13
- estimates for roads, trails, and landings	13
- low site	14
- deciduous (broadleaf) stands.....	14
Existing inventory information	15
- age of inventory.....	15
- species profile	15
- age class distribution.....	15
- volume estimates for existing stands	15
Expected rate of growth	16
- site productivity estimates.....	16
- volume estimates for regenerated stands.....	17
- minimum harvestable ages.....	18
Not-satisfactorily restocked areas	20
Impediments to prompt regeneration	20
Intensive silviculture	21
Utilization standards	22
Decay, waste and breakage factors.....	22
Integrated resources management (IRM) objectives	23
- resource inventories and assessments	23
- sensitive soils	23
- archaeological sites	24
- recreation.....	24
- wildlife	25
- riparian areas.....	27
- watershed values	28
- biodiversity.....	28
- adjacency and green-up.....	30
- visual quality objectives.....	31

Twenty-year plan..... 33

Partitioned component of the harvest..... 33

Alternative harvest flows 34

Community dependence on the forest industry..... 35

Timber processing facilities and fibre requirements 35

Minister's letter and memorandum..... 36

Local objectives..... 37

First Nations 37

Non recoverable losses..... 37

Reasons for decision 38

Determination 41

Implementation 42

Appendix 1: Section 7 of the Forest Act..... 43

Appendix 2: BC Ministry of Forests Act, section 4..... 44

Documents attached:..... 44

Appendix 3: Minister of Forests' letter of July 28, 1994

Appendix 4: Minister of Forests' memo of February 26, 1996

Objective of this document

This document is intended to provide an accounting of the factors I have 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 Tree Farm Licence (TFL) 10. The document also identifies priorities where new or better information is required for incorporation into future determinations.

Description of the TFL

Tree Farm Licence 10 is located about 150 kilometres north-west of Vancouver on the mainland coast. The TFL surrounds Toba Inlet and encompasses all watersheds that flow into the upper reaches of the inlet, except the Klite River drainage. The TFL is held by International Forest Products Ltd. (Interfor) and lies within the Sunshine Coast Forest District of the Vancouver Forest Region.

The TFL area is characterized by rugged topography with steep mountainous terrain, deep river valleys and marine coastline along Toba Inlet. The majority of the operable forest lies within the Coastal Western Hemlock biogeoclimatic zone, with a smaller portion in the higher elevation Mountain Hemlock zone.

The total land base of TFL 10 is 229 592 hectares, of which 53 689 hectares (23 percent) are covered by productive forest. The other 175 903 hectares (77 percent) are composed largely of alpine tundra, glaciers and snow fields, rock, lakes, swamp and roads. In the base case of the timber supply analysis, 23 672 hectares (43 percent) of the total productive land base were estimated to contribute to the long-term timber harvesting land base. Therefore, slightly less than 10 percent of the total TFL area falls into the timber harvesting land base. (Note: figures related to the timber harvesting land base in this rationale exclude 455 hectares of marginally operable area that were not in the harvesting land base for the analysis, but were included in land base summaries in the analysis report, and include current not satisfactorily restocked area that is forecast to be restocked during the next few years. Therefore, area figures in the rationale may not match those in the analysis report in all cases.)

History of the AAC

TFL 10, originally known as Forest Management Licence 10, was awarded in 1951 to *Timberland Development Company Ltd.* At that time, under Management Plan (MP) No. 1, the licence area was 12 253 hectares and the company was authorized to harvest 30 677 cubic metres per year. Crown land was added in 1954, increasing the total area to 44 498 hectares. To correspond with the increased area, the AAC was raised to 53 802 cubic metres. By 1980 the AAC had been increased to 219 000 cubic metres, reflecting improved utilization standards, updated inventory information and an expanded total land base of 231 116 hectares. In 1981 *Timberland Development Co. Ltd.* amalgamated with *Wellington Colliery Co. Ltd.*, *Empire Mills Ltd.* and *Canim Lake Sawmills* under the name *Canim Lake Sawmills Limited*. In 1982, the TFL was transferred to *Weldwood of Canada Ltd.*

In 1988 discussions began between Weldwood and the Klahoose First Nation over a new access agreement through the Klahoose Indian Reserve located near the mouth of the Toba River. No agreement was reached and road access by the licensee to the Toba River portion of the TFL has been denied since December 1989. Harvesting activities have been concentrated in the Toba Inlet portion of the TFL since that time.

TFL 10 was transferred to Interfor in February 1995 and subsequently the license agreement was renewed for a 25-year term. No harvesting activities occurred between the time of this transaction and late 1996 when harvesting was initiated.

The AAC for Management Plan (MP) No.6, in place prior to this determination, was 170 950 cubic metres per year. Of this AAC, 18 950 cubic metres was administered under the Small Business Forest Enterprise Program. MP No.6 was originally approved in January 1985 for a five year term but several extensions have been granted to facilitate the current road access discussions with the Klahoose First Nation.

New AAC determination

Effective December 30, 1996, the new AAC for TFL 10, including Schedule A private lands, will be 170 950 cubic metres, maintaining the AAC at the previous level. Of the total AAC, 55 000 cubic metres is partitioned to the Toba Inlet portion of the TFL, and 115 950 cubic metres is partitioned to the Toba River portion. This AAC will remain in effect until a new AAC is determined, which must take place within five years of this determination.

Information sources used in the AAC determination

Information considered in determining the AAC for TFL 10 includes the following:

- Statement of Management Objectives, Options and Procedures for Management Plan No. 7, January 26, 1996;
- TFL 10 Draft Management Plan No. 7, International Forest Products Ltd., August 23, 1996;
- TFL 10 Management Plan No. 7 Timber Supply Analysis Information Package, International Forest Products Ltd. (prepared by Timberline Forest Inventory Consultants), July 3, 1996;
- TFL 10 Management Plan No. 7 Timber Supply Analysis Report and addendum, International Forest Products Ltd. (prepared by Timberline Forest Inventory Consultants), September 19, 1996;
- Twenty-Year Plan for TFL 10, August 23, 1996;
- Public input solicited by the Licensee regarding the contents of Management Plan No. 7;
- Letter from the Minister of Forests to the Chief Forester, dated July 28, 1994, stating the Crown's economic and social objectives;

- Memorandum from the Minister of Forests to the Chief Forester dated February 26, 1996 stating the Crown's economic and social objectives regarding visual resources;
- Technical review and evaluation of current operating conditions through comprehensive discussions with Forest Service and BC Environment staff, notably the AAC determination meeting held in Victoria on October 10, 1996;
- *Forest Practices Code of British Columbia Act*, July 1995;
- *Forest Practices Code of British Columbia Regulations*, April 1995;
- *Forest Practices Code Timber Supply Analysis*, BC Ministry of Forests (BCFS) and Ministry of Environment, Land and Parks. February 1996.

Role and limitations of the technical information used

The *Forest Act* requires me as Chief Forester 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 TFL 10. 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.

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 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 solution to forest management problems such as AAC determination. The 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 TFL 10, I have considered known limitations of the technical information provided, and I am satisfied that the information provides a suitable basis for my determination.

Statutory framework

Section 7 of the *Forest Act* requires the chief forester to consider various factors in determining AACs for TFLs. 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, in respect of which, 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 a range of possible AACs; and
- (ii) redetermining AACs frequently, to ensure they incorporate up-to-date information and knowledge—a principle that 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 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 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. Studies in selected TSAs (*Forest Practices Code Timber Supply Analysis*, BCFS, and BC Environment,

February 1996) 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 timber supply analyses that pre-date the Code, or that are based on information packages that largely 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, it may not always be possible to analyze the full timber supply impact in AAC determinations. 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 overall impact of the land-use decision. Where specific protected areas have been designated by legislation or by order in council, these areas are no longer considered to contribute to timber supply. The legislated requirement for five-year AAC reviews will ensure that future determinations address ongoing plan implementation decisions.

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 AAC determination 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 interest 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 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 TFL 10. It is also 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) 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*.

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 TSAs and, for TFLs, by the licensees.

For each AAC 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, timber supply forecasts are produced. These include sensitivity analyses of changes in various assumptions around a baseline option, normally referred to as the "base case" forecast, which forms the basis for comparison when assessing the effects of uncertainty on timber supply.

The base case forecast represents only one of a number of theoretical forecasts, and may incorporate information about which there is some uncertainty. Its 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 predictions 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 assembled.

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.

Timber supply analysis

The timber supply analysis for TFL 10 was conducted by Timberline Forest Inventory Consultants (Timberline) on behalf of International Forest Products ("the licensee"). Timberline used a proprietary computer simulation model called CASH_FM (Continuous Area Simulation of Harvesting and Forest Management). Based on previous experience in examining results from this model, I accept that the information generated is comparable with information generated by the BC Forest Service simulation model and am satisfied that it is capable of providing a reasonable projection of timber supply.

The timber supply analysis for TFL 10 examined two different management options. The "Current Management Option" is intended to reflect the licensee's current management strategies for TFL 10. This option represents the base case which is discussed above under "The role of the base case."

In addition, the analysis examined timber supply impacts resulting from activities aimed at increasing timber yields and harvest levels. The second option—the Enhanced Forestry Option—examined the timber supply impacts of intensive silviculture, forest protection, increased operability, and the use of alternative silvicultural systems on all or portions of the TFL. The licensee grouped these activities into three categories including measures which are currently implementable, activities which are feasible pending verification, and activities requiring development prior to implementation. Only the first category was addressed quantitatively during the timber supply analysis. Currently implementable activities include: use of genetically improved planting stock to increase yields; optimal species selection for managed stands to maximize expected yields; and earlier harvest ages for managed stands.

Sensitivity analysis was also employed to examine the effect on timber supply of varying many of the assumptions and estimates used in the base case. These analyses have assisted me in my determination, as discussed in my considerations below.

For TFL 10, Interfor proposed the Current Management Option as the base case to which further analyses were compared. In this option the initial projected harvest is 171 000 cubic metres per year, which is essentially equal to the AAC of 170, 950 cubic metres in effect prior to this determination. Under this option, with the timber harvesting land base of 23 889 hectares, the initial harvest rate of 171 000 cubic meters per year can be maintained for four decades before declining by 10 percent per decade after decades four through seven, and a further two percent after decade eight, to reach a long-term level of 110 000 cubic metres per year. Although a higher initial harvest level is attainable, 171 000 cubic metres per year meets the licensee's corporate timber supply objectives in the short term without jeopardizing medium-nor long-term harvest flow.

The harvest flow policy used by Interfor in the analysis aimed to:

- achieve a long term stable harvest level
- maximize the short-term harvest level
- limit shifts in harvest level to 10 percent or less per decade
- harvest proportionately from each operability stratum (conventional cable, helicopter)

While the short-term harvest level was not maximized in the base case, an alternative harvest flow was presented in which the a maximum short-term level was maximized. I discuss this harvest forecast below under Alternative harvest flows.

For planning purposes, the TFL has been divided into two units: the Toba Inlet portion—including areas directly accessible from the Toba Inlet foreshore—and the Toba River portion which is currently accessible only through the Klahoose Indian Reserve lands located at the mouth of the Toba River. A key assumption in this analysis regarding timber supply from the Toba River area is that an agreement on access to that portion of the TFL will be reached in the near future. Since 1989 the Klahoose First Nation has denied passage through its reserve effectively preventing road access to about two-thirds of the timber harvesting land base (15 598 hectares). The licensee and the Klahoose have been engaged in discussions regarding forest management in the TFL, with the intent to reach a resolution that will allow access to the Toba River. However, the lack of access to such a large portion of the TFL, could create risks to timber supply, which I discuss under Partitioned component of the harvest, below.

Finally, I am aware that the timber supply analysis originally presented to me at the determination meeting did not fully incorporate the forest cover requirements as outlined in the information package submitted by the licensee. The analysis was repeated using corrected information. I have reviewed the results and note that the differences are very small and do not change the conclusions I reached at the determination. The results of the revised analysis are reflected in the considerations below.

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

Section 7 of the *Forest Act* requires the chief forester to consider various factors in determining AACs for TSAs and TFLs. These factors are listed by subsection and considered immediately below. Section 7 is appended in full as Appendix 1.

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

Forest land base contributing to timber harvest

- general comments

The total area of TFL 10, as reported in the timber supply analysis, is 229 592 hectares. Non-productive areas including lakes, swamps, rock and alpine areas account for approximately 175 903 hectares (77 percent) of the total area. Another two hectares are covered by non-commercial brush. The forest land base considered available for timber production and harvesting is limited because of operability considerations (difficult terrain, inaccessibility), environmental sensitivity, presence of non-merchantable (broadleaf deciduous) species, and protection of riparian areas. The productive land base will also be reduced due to construction of roads, trails and landings to access and harvest timber. In timber supply analysis, assumptions and if necessary, projections must be made about these factors, and appropriate areas must be deducted from the productive forest area, to derive the timber harvesting land base. These factors are described in more detail below.

- economic and physical operability

The timber harvesting land base, as assumed in the base case is only 23 889 hectares or 10 percent of the total TFL area. This reflects the extremely rugged terrain and large area that is unsuitable for forestry activities. In deriving the timber harvesting land base, 20 403 hectares of inoperable areas were deducted from the total productive forest land base based on a new operability classification completed by the licensee and approved by the BCFS in 1996. Stands assumed to be operable in the base case were classified as physically and economically accessible for either conventional cable and ground-based systems, or helicopter yarding methods.

Conventional and helicopter areas make up 76 and 24 percent respectively of the total timber harvesting land base. Conventional areas were defined as those stands with a minimum volume of 350 cubic metres per hectare which are physically and economically

operable for cable and ground-based systems. For helicopter systems, stands with a minimum volume of 400 cubic metres per hectare were assumed to be viable.

The operability classification includes a marginally operable category in which there are 455 hectares. This area was not included in the base case timber harvesting land base, but was included in summary tables in the licensee analysis report. Hence in some cases there are differences between the areas listed in this rationale and those in the analysis report. Marginally operable stands represent the equivalent of two percent of the timber harvesting land base and are characterized by high decay factors and average net volumes of 250-400 cubic metres per hectare. The licensee believes these stands may be accessible in the future by using improved and innovative techniques. I will await demonstrated performance in these areas before concluding they will contribute consistently to timber supply. Since they were not included in the timber harvesting land base, no adjustment is necessary.

District staff are concerned about the low-volume stands included in the helicopter yarding stratum, observing that helicopter operations in stands under 600 cubic metres per hectare are uncommon. However, staff believe that the viability of operations in stands with 500 cubic metres per hectare is fairly certain at this time. I note that stands operable for helicopter with less than 500 cubic metres per hectare represent only 3.6 percent of the timber harvesting land base and 13.6 percent of the total helicopter yarding stratum. The gradual and controlled decline to the long-term timber supply level shown in the base case assumes use of these stands. Given the relatively small area of concern, and the licensee's extensive experience in helicopter logging, I do not find this matter to be of significant concern for this determination. District staff should monitor harvesting performance over the term of MP No.7, particularly in stands classified as operable for helicopter systems, to validate the operability assumptions employed in the base case. Continued contribution of stands classified as operable for helicopter systems to the timber harvesting land base requires demonstrated performance.

I recognize that Interfor is very progressive in the application of helicopter yarding technology. The current five-year development plan proposes a sizable proportion (27 percent) of helicopter harvesting, and the licensee has undertaken helicopter operations in the Sunshine Coast Forest District over the last few years. The licensee has also committed to report on performance by operating class (i.e., conventional or helicopter) in MP No.7 and will provide an interim progress report to the district manager. Based on documented plans, past performance and reporting commitments, I accept the licensee's assumptions for the purposes of this determination. I expect any new information to be included in the next analysis.

- environmentally sensitive areas

A total of 17 273 hectares of TFL 10 is classified as environmentally sensitive because of important wildlife habitat, recreation values, or sensitive soils. Of the total, 12 431 hectares are within the physically and economically operable land base. From this

area, 7150 hectares of ESAs were deducted when deriving the timber harvesting land base, either specifically as ESAs (4119 hectares) or during deductions for riparian zones and deciduous-leading stands. Environmentally sensitive areas are discussed in more detail together with integrated resource management considerations later in the rationale.

- estimates for roads, trails, and landings

Existing roads, trails and landings are identified on the licensee's geographic information system (GIS) database as line features. Interfor is currently preparing a summary of existing road area, but the information was incomplete at the time of the analysis. In lieu of this more specific information, the licensee deducted four percent of the area in stands less than 60 years old to account for existing roads, trails and landings. This deduction was based on the allowance applied in TFL 45, also held by Interfor.

For future roads, trails and landings, Interfor applied a four percent reduction to the area in stands currently older than 60 years after they are first harvested. The licensee suggests this deduction may overestimate the actual area of future roads because of the reduced road densities associated with extensive helicopter operations which are planned for the TFL. Until further information becomes available and experience is gained, I have no basis for evaluating this assertion.

A sensitivity analysis was performed to assess the impact of underestimating allowances for roads, trails and landings. Allowances for existing and future roads were increased from four to seven percent and four to five percent, respectively. The analysis showed a small negative impact on timber supply in the long-term, but no effect on the ability to achieve short-term harvests projected in the base case.

I consider the estimates used as reasonable given the kind of terrain and extensive use of helicopter harvesting systems projected in the TFL, and accept the deductions as suitable for use in this determination. I also note that uncertainty regarding the actual area covered by roads does not affect short-term timber supply.

The licensee has committed to further assessment of allowances for roads, trails and landings and I note the BCFS is currently developing more rigorous procedures to derive these factors. I expect these findings to be incorporated into subsequent analyses.

- low site

No specific deductions were made to account for sites with very low productivity. Stands were considered as being operable based on current volume rather than an assessment of site class. Most low site stands were classified as inoperable, and removed during the deduction for inoperability as low-volume stands. However, according to the timber supply analysis report, the timber harvesting land base contains 112 hectares of stands with site index at 50 years of 2.5-7.5 metres (site class 5) and 2916 hectares of sites with site index from 7.5-12.5 metres (site class 10). Some of the 455 hectares of low-volume

marginal stands excluded from the timber harvesting land base, as discussed under *physical and economic operability*, fall into site classes 5 and 10, reducing the area of low site stands in the timber harvesting land base actually used in the analysis. The low site stands remaining in the harvesting land base are included based on field observations which verify that they can be harvested economically. Given the field checking work in these areas, I find the licensee's approach to low productivity sites to be suitable for the purposes of this determination.

- deciduous (broadleaf) stands

In the base case, Interfor assumed that only the coniferous component of forest stands is commercially viable. The licensee identified 3435 hectares of deciduous-leading stands on the productive forest land base of the TFL, and 2970 hectares on the area considered as physically and economically operable. This area was fully deducted when deriving the timber harvesting land, either directly or through overlap with other deductions. When developing yield estimates for the base case, the licensee also deducted any deciduous volumes in coniferous-leading stands.

The licensee intends to explore conversion of some deciduous stands to conifer stands where economically feasible and ecologically justified. BC Environment staff have expressed concern that the proposed conversion may threaten valuable wildlife habitat. I acknowledge these concerns but note that any potential increase in future fibre supply has not been incorporated into this analysis nor considered in my determination. BCFS staff from Vancouver Region are currently developing a deciduous (or "hardwoods") management strategy and I encourage BC Environment staff and the licensee to contribute to this initiative.

Existing inventory information

- age of inventory

The most recent complete inventory of TFL 10 was prepared by Weldwood in 1978. During 1988 and 1989, an inventory of second-growth stands over 10 years of age was completed in various parts of the TFL. Updates for harvesting, silviculture activities and tree growth are current to December 31, 1995.

BCFS staff have noted no areas of concern with the inventory. Accordingly, I am satisfied that the inventory data provide the best available information for my determination. I note that an inventory audit is planned for 1999. The audit will provide a quantitative assessment of the accuracy of the volume predictions, and the findings will be considered in the next analysis and AAC determination for TFL 10.

- species profile

Stands dominated by hemlock and balsam cover 40 percent of the TFL timber harvesting land base. Douglas-fir dominated stands are the next most common (26 percent), followed by western redcedar (22 percent) and hemlock-cedar stands (12 percent).

- age class distribution

Currently there are over 12 million cubic metres of timber volume on the TFL timber harvesting land base, 80 percent of which is old growth (older than 250 years of age). The balance of the volume available for timber harvesting is distributed among stands of various ages, the majority of which are managed second-growth younger than the age of 30. The Toba Inlet and Toba River units display similar age-class distributions.

- volume estimates for existing stands

In the analysis, Interfor assumed that all stands less than 30 years old have been subject to management treatments that control species composition, stocking and competition. BCFS district staff accept this assumption. For stands older than 30 years, volume estimates were generated using the Variable Density Yield Prediction (VDYP) model. VDYP is based on information gathered from a large number of sample plots throughout the province, and is generally accepted in B.C. as an adequate model for projecting volumes in existing natural stands. As a general rule in making AAC determinations, in the absence of statistically valid contradictory evidence for a particular area, I rely on VDYP estimates for existing stand volumes. Localized information was not available for use in the analysis.

Estimates of crown closure are required by the VDYP model. In the case of TFL 10, the licensee estimated the percent crown closure from TRIM-based orthophotos or 1:15 000 scale aerial photographs. For stands between 31 and 40 years old, coastal default crown closure values were used.

Site index, a measure of site productivity, is also needed to project volumes using VDYP. Interfor calculated the area-weighted site index for each species grouping used in the analysis for both mature (older than 141 years) and "thrifty" (31 to 140 years) stands, and applied these in VDYP. Since deciduous trees are not currently utilized by Interfor in TFL 10, the deciduous component of coniferous stands was removed from the volume estimates. The licensee's approach follows accepted procedures and was approved by the BCFS Resources Inventory Branch.

I am aware of no information that suggests the volume estimates for existing stands may be inaccurate. As mentioned in *age of inventory*, the inventory audit planned for 1999 will provide additional information that may help to assess these volume estimates. I believe the information used to derive the volume estimates for existing stands over than 30 years of age to be the best available, and I accept these estimates as suitable for use in this determination.

Expected rate of growth*- site productivity estimates*

Site indexes are indicators of the productivity or growth potential of forests and are derived from inventory data. Site indexes are based on the relationship between tree heights and ages in forest stands. The productivity of a site determines how quickly trees will grow and therefore affects: expectations of the time seedlings will take to reach green-up conditions; the volumes of timber that will grow in regenerated stands; and the time required for stands to reach a merchantable size or harvestable age.

For the base case, site indexes were assigned to stands older than age 30 using inventory site indexes based on site curves that are accepted by the BCFS. Stands under 30 years of age were assigned coastal default site indexes.

Results of provincial site productivity studies show that site indexes determined using information from existing old-growth stands underestimate the actual growth potential of sites for some species in some areas. If site indexes are underestimated, volumes in regenerated stands could be higher, minimum harvestable ages could be lower, and green-up conditions could be reached earlier than projected.

Due to lack of information specific to TFL 10, no adjustments to site index were applied in the base case to account for the possibility that site productivity has been underestimated. However, the licensee believes that old-growth site indexes underestimate site productivity, and hence that the volumes projected to grow in managed regenerated stands after harvesting of old-growth stands are also underestimated. For a sensitivity analysis, the licensee, in consultation with the BCFS Research Branch, developed site index adjustments based on site index information on 30-140 year-old ("thrifty") stands, for which site indexes are generally considered to be more reliable than from old-growth stands. The thrifty site indexes were then adjusted downwards by 20 percent to account for possible differences in inherent site productivity between thrifty stands and remaining old-growth sites, for example, due to the possibility that past harvesting has concentrated on better sites. The final site index increases applied in the sensitivity analysis ranged from 2.6 metres for Douglas-fir to 6.8 metres for hemlock-cedar stands. Regenerated stand timber yields, green-up ages and minimum harvestable ages were adjusted based on the adjusted site indexes. The sensitivity analysis showed a long-term harvest level 23 percent higher than in the base case, as well as some additional timber supply in the medium term. The sensitivity analysis did not show any effects on short-term timber supply.

BCFS Research Branch staff did not accept the adjusted site indexes as a more accurate reflection of actual site productivity and I agree with their assessment. Although studies in other areas of the province generally show that site index is underestimated by old-growth inventory information, none of these studies applies specifically to TFL 10. I acknowledge the potential for higher site productivity to affect medium-term timber

supply through effects on green-up age, which I discuss further under *adjacency and green-up* below. However, such potential has not been quantified at the present time. I accept that long-term timber supply may be higher than projected in the base case, but the currently available evidence is not sufficient to support an expectation that medium- or particularly short-term timber supply will be higher than projected in the base case.

I note the licensee has expressed an interest in exploring methods for assessing old-growth site index on TFL 10 before the next analysis. I fully support this initiative. I recognize that the long-term timber supply may prove to be higher than projected, which I have reflected in "Reasons for Decision."

- volume estimates for regenerated stands

Volume estimates for regenerated stands were derived using the Table Interpolation Program for Stand Yields (TIPSY) growth and yield model. All existing stands less than 30 years old and all stands regenerated after future harvesting are assumed to be managed. Mixed species curves were produced by combining pure species curves according to the estimated proportions of species in stands. The site index of the leading species was applied to secondary species with no adjustment.

For the analysis, Interfor estimated that 20 percent of harvested stands will regenerate naturally and 80 percent will be planted. As a result, the licensee applied two sets of TIPSY yield tables—one for naturally-regenerated stands and one for planted stands. All yield tables were reviewed and approved by BCFS Research Branch staff for use in the analysis.

Operational Adjustment Factors (OAFs) are applied to TIPSY yield predictions to compensate for the loss of timber productivity due to such factors as openings in stands (OAF1), as well as age-dependent losses to factors such as insects, disease and decay which can affect waste and breakage (OAF2).

When deriving OAFs, the licensee proposed that volume estimates for managed stands should be within 20 to 30 percent of those generated by the VDYP model for natural stands. For Douglas-fir stands on TFL 10, OAF1 was estimated as 15 percent, and OAF2 as 5 percent. For all other species the licensee assigned a value of 15 percent for both OAF1 and OAF2. Research Branch staff have reviewed and approved all assigned OAFs and suggest the upwards adjustment of OAF2 factors reflects a prudent, conservative approach. I note that the OAF2s for species other than Douglas-fir are higher than those applied in other coastal areas, and acknowledge that the volumes projected for managed stands may be conservative. Any potential timber supply implications would overlap with those due to site productivity changes, which I have discussed above. Further, I note that uncertainty in regenerated stand yields affects medium- and long-term timber supply only, as reflected in the sensitivity analysis on site productivity discussed above.

The methods used to derive timber yield estimates for regenerated stands generally followed standard practice and are reasonable. I accept the volume estimates used in the base case as suitable for use in this determination, and note that uncertainty affects primarily medium- and long-term timber supply. However, given that the approach was more conservative than generally applied elsewhere in the province, I am asking the licensee to review their procedures prior to the next analysis and provide a more detailed rationale for their selection of OAFs.

- minimum harvestable ages

Minimum harvestable age is an estimate of the age at which a forest stand has grown to a harvestable condition. For the base case, minimum harvestable ages for both existing and regenerated stands were assumed to occur at the youngest age after which average annual timber growth, or mean annual increment (MAI), increases by less than 0.05 cubic metres per hectare per year. Therefore, the youngest age at which a stand may be projected for harvest is just prior to achievement of its maximum average timber production. Minimum harvestable ages range from 70 to 160 years, depending on tree species and site productivity.

In specific circumstances minimum harvestable ages were adjusted. When stands are not projected to reach 300 cubic metres per hectare at the ages based on maximum MAI, minimum harvestable age was assigned as the age at which the stands are projected to reach 300 cubic metres per hectare. If stands do not achieve 300 cubic metres per hectare by 160 years of age, minimum harvestable age was assumed to be 160 years. A sensitivity analysis showed that a 10-year reduction to minimum harvestable ages only affects the medium-term harvest forecast.

The method used to estimate minimum harvestable ages is reasonable, employing criteria related both to maintaining long-term productivity and to estimated economic thresholds (minimum stand volume). The resulting ages are comparable to those used in timber supply analysis for other coastal areas. I accept the methodology, and the minimum harvestable ages employed in the analysis as suitable for this determination.

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

Regeneration delay

Regeneration delay is the period between harvesting and the time at which an area is occupied by a specified minimum number of acceptable, well-spaced trees.

Interfor's stated regeneration strategy includes planting stands within one year of harvesting and employing natural regeneration on high-elevation, north-facing, lower productivity sites.

In the base case, a four-year delay was assumed for planted stands and a six-year delay for naturally-regenerated stands. District staff accept these assumptions but note that the standard regeneration delay for planted sites in the biogeoclimatic subzones in TFL 10 is three years. Licensee staff increased the estimated delay to account for any regeneration establishment problems (see also Impediments to prompt regeneration, below). Although this assumption may be conservative, I find it acceptable, noting that there has been little opportunity to refine estimates of regeneration delay given the licensee's short operating history on the TFL, and that the estimates are comparable to those for other similar coastal areas. A sensitivity analysis showed that reducing the estimates of regeneration delay by one year has no impact on the timber supply forecast.

Given the licensee's limited experience on the TFL, and since the analysis suggests that timber supply has very little sensitivity to change in the regeneration delays, I accept the delay periods used in the base case as suitable for use in this determination.

Not-satisfactorily restocked areas

Not-satisfactorily restocked (NSR) areas are those where timber has been removed through harvesting or natural causes, and where a stand of suitable species and stocking has yet to be established. Areas where the standard regeneration delay has not elapsed are considered "current" NSR. Where a suitable stand has not been regenerated and the site was harvested prior to 1987, the classification is "backlog" NSR. The licensee expects to reforest all NSR areas on TFL 10 within three years.

Current licensee records indicate that there are 102 hectares of current NSR area on the TFL 10 timber harvesting land base. Fifty-seven hectares occur in the Toba Inlet portion and 45 hectares in the Toba River portion. I note, however, that stocking conditions in the Toba River portion of the TFL are in doubt because regeneration surveys have not been done since road access to that area was denied. It is important that the licensee and BCFS staff work to make arrangements for access to the Toba River area to allow prompt surveys and other forestry work needed to provide reliable silvicultural information for the area and ensure silvicultural investments are not lost.

The best available information on NSR areas was used in the analysis. Although I note the uncertainty regarding the stocking status of areas in the Toba River portion, any changes would affect timber supply primarily in the medium to long term, rather than in the short term. Consequently, I will make no adjustments to account for uncertainty regarding NSR areas for this determination. However, I re-iterate the need for prompt survey work in the Toba River area.

Impediments to prompt regeneration

As mentioned above under Regeneration delay, the licensee increased the regeneration delay estimates to account for any impediments to regeneration which may not be accounted for in the inventory. No impediments to regeneration were identified by the licensee in the ESA inventory, but spruce weevil (*Pissodes strobi*) is known to damage Sitka spruce plantations along the Toba River. This pest significantly impedes regeneration by affecting leader growth of Sitka spruce stands. Repeated attacks can substantially reduce growth rate and wood quality. Licensee records indicate that there are only 153 hectares of spruce-leading stands younger than 40 years old on the timber harvesting land base of TFL 10 (0.6 percent of the timber harvesting land base), and that only 12 hectares of these stands contain high concentrations (over 80 percent) of spruce.

I note that spruce has not been planted in the TFL since 1982, and that the licensee has no plans to plant this species in the future, except in very limited circumstances. While I acknowledge that damage by the spruce weevil may have a negative impact on timber supply, the potential for impact appears small given current management on the TFL. For this determination I accept the licensee's regeneration assumptions as modelled.

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

Intensive silviculture

The licensee provided information on the potential to affect the base case timber supply forecast in the short- and long-term through an Enhanced Forestry Option. Opportunities to increase timber supply were grouped into three categories: currently implementable; feasible pending verification; and, requiring development prior to implementation.

Currently implementable activities include using genetically-improved planting stock (genetic gain) on sites harvested in the future, selecting optimal species to maximize volume production and reducing minimum harvestable ages. Volume gains in regenerated stands due to genetic improvement were estimated to range from two to five percent depending on species. Regeneration of hemlock and balsam was proposed for areas where Douglas-fir grew previously. Interfor estimated that minimum harvestable ages could be 10 years lower for genetically-improved stock than in the base case.

The potential impacts of these currently implementable activities were examined in a sensitivity analysis (Enhanced Forestry Option). The timber supply impacts of enhanced activities were obscured because other assumptions were varied from base case levels in the sensitivity analysis. Site indexes were adjusted as discussed under *site productivity estimates* with green-up and minimum harvestable ages redefined accordingly, and yields were reduced to account for retention of wildlife trees, as discussed under *biodiversity*. The Enhanced Forestry Option harvest forecast is similar to that resulting from site index adjustments alone, suggesting that the expected genetic gains likely offset the impacts of wildlife tree retention, but otherwise the impacts of the enhanced treatments are not as significant as the gains attributable to site index adjustments.

I accept that increased timber volumes may result from use of genetically-improved planting stock, which would lead to increased timber supply in the long term. It is also likely that genetic improvements will lead to faster green up. However, faster green-up due to genetically-improved stock has not been documented or quantified, nor was it modelled in the sensitivity analysis. Therefore, no estimates of potential effects were provided. Until evidence of the effects on green-up rates of using genetically-improved stock is available, I cannot reasonably incorporate any corresponding adjustments to timber supply in AAC determinations. A similar conclusion applies to both selecting species to maximize volume production and reducing minimum harvestable ages. Until the activities have been implemented and yield improvements documented, I will not assume they constitute current performance. In addition, analysis indicates that changes to timber supply would apply in the medium to long term.

The licensee views commercial thinning as feasible pending verification, but has no plans for thinning operations at this time. Similarly, the licensee believes fertilization strategies require further development, and has not identified any areas for fertilizer application. According to MP No.7, the licensee intends to develop a strategy for applying intensive silviculture, and demonstrating the timber supply opportunities that can be realized.

I acknowledge that Interfor has indicated a serious interest in exploring the potential for yield increases of intensive silviculture. However, in the absence of a comprehensive strategy or proven application of these activities on the TFL, I have made no adjustments to account for potential timber supply increases in this determination. Many of these opportunities may be realized in the future, and I encourage Interfor to develop an implementation strategy before the next determination, recognizing the need to work with BC Environment staff to identify any concerns regarding wildlife habitat and other environmental values. These matters will be reviewed further in the next AAC determination for TFL 10.

- (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

The standard of timber utilization defines the species, dimensions and quality of trees that must be removed from a site during harvesting operations. The base case reflects current utilization standards. For existing mature and old-growth stands (120 years or older), all trees with diameter at chest height greater than 17.5 centimetres must be harvested and removed from the site. Standards also require that no stumps be taller than 30 centimetres and that all stems down to a top diameter of 15 centimetres be removed. Corresponding standards for existing younger stands (less than 120 years old) and all future regenerated stands include a 12.5-centimetre diameter at chest height, a maximum 30-centimetre-high stump, and a 10-centimetre diameter top.

While harvesting activity has only recently been initiated in the licence area since the TFL was reassigned to Interfor, I am satisfied with the assumptions used in the base case, noting they are consistent with current practice on coastal B.C.

Decay, waste and breakage factors

The VDYP model used in estimating volumes for existing, unmanaged stands incorporates estimates of the volume of wood lost to decay, waste and breakage. Interfor's timber supply analysis used the standard Metric Diameter Decay, Waste and Breakage factors for Forest Inventory Zone B approved by Resources Inventory Branch. I accept the factors and find them suitable for use in this determination. As discussed under *volume estimates for regenerated stands* above, operational adjustment factors were applied to regenerated stand volume estimates in part to account for losses of timber to decay, waste and breakage. These estimates constitute the best available information and I accept them for use in this determination.

- (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 resources 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 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. Accordingly, the extent to which IRM objectives for various forest resources and values affect the timber supply must be considered in AAC determinations.

- resource inventories and assessments

Non-timber resource inventories including visual landscape, recreation and environmentally sensitive areas (ESAs) were completed in 1995 and 1996. Wildlife and fisheries inventories were also compiled during that period. BCFS staff have approved visual landscape and recreation inventories; approval of other non-timber resource inventories is pending. Grizzly bear habitat zones outlined for the analysis were based on assessments made by Interfor's wildlife habitat staff. The fisheries inventory was based on a stream gradient analysis using operational data.

Inventories for the Toba River portion of the TFL are based on aerial photography and information available before road access through the Klahoose Indian Reserve was restricted in 1989.

BC Environment staff suggest that a number of the inventories, particularly for wildlife, are outdated. I note that the licensee agrees that some of the information warrants revision and is pursuing funding from Forest Renewal BC to begin the work. I discuss inventory information as it applies to specific values in the following sections.

- sensitive soils

Full terrain mapping is available for the Toba Inlet portion of the TFL. Terrain mapping for the Toba River portion is based on aerial photos. Soils ESAs are classified as either extremely fragile or unstable, or moderately unstable and sensitive to disturbance.

In the base case analysis, 90 percent of each area with extremely fragile or unstable soils, and 40 percent of each moderately sensitive area was deducted when deriving the timber harvesting land base. The 40 percent deduction applied to moderately sensitive soils ESAs also accounts for gully management considerations. Some areas classified as environmentally sensitive were also removed indirectly during deductions of riparian areas (which were deducted prior to ESAs) or deciduous-leading stands (which were deducted after ESAs). Overall, 991 hectares of extremely fragile or unstable areas fall within the physically and economically operable land base, and 900 hectares were deducted. Of the 3281 hectares moderately unstable area within the operable land base, 1487 hectares were deducted. This methodology was reviewed and accepted by BCFS

staff and I am satisfied that the management of areas with sensitive soils has been represented appropriately.

- archaeological sites

An overview assessment of potential archeological values has not been done for the TFL 10 area. I am aware that funding is being sought for an archaeological overview assessment. The licensee states that during their research they found no information on archaeological sites. At this time, I have no information to suggest whether or to what extent timber supply in the TFL may be affected by archaeological values. Results of any assessments will be considered in future AAC determinations.

- recreation

The licensee completed a recreation inventory of biophysical, cultural and historical features in April 1996. The inventory meets BCFS recreation standards. In total, 487 hectares of the TFL are classified as having high recreation value; 433 hectares fall within the physically and economically operable land base. It was assumed that protection of high-value recreation features would, on average, involve a 90 percent removal these areas from the timber harvesting land base. After all land base deductions, only three hectares of high value recreation ESAs remained in the timber harvesting land base. Twenty-five percent of the 3281 hectares in the operable land base identified as having moderate recreation value was removed from the land base specifically as ESAs. After all deductions, 1794 hectares of moderate value recreation ESAs remained in the timber harvesting land base.

I acknowledge that wildlife viewing and guided fishing has increased somewhat in the TFL, but overall the area is not a popular recreation destination because of its rugged terrain, isolation and challenging access. One significant recreation feature is the Brem River which is particularly well known for its steelhead fishery and is used by guided angling tours. Interfor has indicated that their staff biologist will examine the river and prepare a plan to enhance fish habitat and numbers.

The licensee has developed a recreation analysis and management strategy report. Interfor has committed to review the recreation analysis report, and evaluate the need for development of a recreation plan during the term of MP No.7. Given recent completion of the recreation inventory and incorporation of related ESA land base deductions in the base case, together with commitments for further work during the next few years, I am satisfied that the licensee has taken recreation concerns into account appropriately for the purposes of this determination.

- wildlife

The TFL supports a number of regionally significant large mammal species including grizzly and black bear, mountain goat, black-tailed deer, cougar and wolf. The habitat

requirements of grizzly bear are of particular importance and the Toba River portion of the TFL supports high numbers of this species. Existing wildlife inventories were consolidated in 1995/96 and have been submitted to the BCFS and BC Environment for review.

Important habitat for goats covers a total of 1025 hectares of which 696 hectares lie within the physically and economically operable land base (about two percent of the operable area). Ninety percent of this area was removed as an ESA deduction, and some area was also deducted as riparian buffers and deciduous-leading stands, leaving 62 hectares available for harvesting. BC Environment staff note that forest development activities during the winter may stress mountain goats forcing them into less suitable habitat. Interfor has developed a strategy for conducting harvest operations near goat habitat as part of MP No.7 but this strategy has not been accepted by BC Environment. In addition, BC Environment staff indicate the 90 percent deduction of goat habitat ESAs may be insufficient since existing information is outdated and more goat habitat may be identified.

The licensee examined the impact of uncertainty regarding management for goat habitat by performing a sensitivity analysis in which only 10 percent of the goat habitat was deducted from the land base, and a forest cover requirement was applied to the remaining area allowing a maximum of 20 percent of the area to be covered by stands younger than 20 years old, and requiring that at least 40 percent of the area be in stands over 100 years old. These assumptions were formulated by Interfor's staff biologist, but have not been accepted by BC Environment staff. The analysis shows a moderate increase in medium- and long-term timber supply due to the change in treatment of goat habitat. This sensitivity analysis may provide useful information for future discussions regarding wildlife habitat management in the TFL; however, uncertainties surrounding the wildlife inventory and management regimes preclude any adjustments to timber supply at this time.

A total of 60 hectares were identified as important grizzly habitat of which 59 hectares are within the physically and economically operable land base. All of this area was excluded when deriving the timber harvesting land base. In addition, grizzly bear management zones were identified comprising 4141 hectares, or about 17 percent, of the timber harvesting land base. One zone was established for primary denning habitat (alpine areas and avalanche tracks—6.3 percent of timber harvesting land base) and the other zone was located in valley bottoms (11 percent of timber harvesting land base). In the base case analysis, forest cover requirements developed by Interfor's biologist were applied that set limits on the maximum area that may be younger than green-up age, and the minimum area that must be retained in older age stands to achieve thermal and old-growth objectives. BC Environment staff believe that the land base deductions for grizzly bear habitat are inadequate and that improved inventory information will show that more area should be deducted. They also believe the management zones delineated for grizzly are inadequate, and that further assessments are needed to identify critical wildlife habitat in the TFL.

To assess the timber supply implications of uncertainty regarding management of grizzly bear habitat, the licensee provided sensitivity analyses in which the old-growth requirement in the grizzly bear management zones is reduced to 50 percent and increased to 100 percent (the base case assumption is that at least 75 percent of the zone must be in stands older than 250 years). The analyses show minor impacts to timber supply in the long-term only.

To summarize the above discussion, about 2 percent of the operable land base was deducted for goat habitat, and 17 percent of the timber harvesting land base is subject to forest cover requirements for grizzly bear habitat. I recognize the concerns expressed by BC Environment staff regarding the land base deductions and management regimes for goats and grizzly bear. However, in the absence of better inventory information, I believe it is reasonable to accept the land base deductions and management measures as represented in the analysis. I also note the insensitivity of short-term timber supply to uncertainty in wildlife habitat management suggested by sensitivity analysis. I encourage the licensee and BC Environment staff to work cooperatively to secure resources to update this work before the next determination. However, in the absence of more up-to-date information, I accept the assumptions made for use in this determination.

Reduced stocking on regenerated sites is a final concern related to wildlife habitat management. BC Environment staff note that stocking standards are an important consideration for managing grizzly bear habitat, particularly on moist sites and floodplain areas in the Toba River portion of the TFL. Low stocking densities may reduce timber supply by reducing regenerated stand volumes. If stocking levels are lowered to below 600-800 stems per hectare, timber production in stands is usually reduced because trees do not fully occupy the site. Below 500 stems per hectare the impact on stand volume may be significant. I acknowledge that some areas in the TFL will be managed for lower stocking to provide grizzly bear forage. However, at this time I have no specific information before me that quantifies the area proposed for management at reduced densities, nor information on appropriate target densities for these areas. Given the uncertainties and the implications of reduced stocking density in grizzly bear habitat areas, I expect the licensee to work with BC Environment staff to identify the applicable areas of reduced stocking and provide more explicit information for use in the next analysis and determination. For the present determination, I accept that this factor represents an unquantified risk to long-term timber supply and have considered this in "Reasons for decision".

- riparian areas

Riparian areas occur next to the banks of streams, lakes and wetlands and include both the area dominated by continuous high moisture content and the adjacent upland vegetation that exerts an influence on it. No detailed inventories of riparian areas are available for TFL 10.

The licensee estimated riparian management areas along streams and around lakes and wetlands using map-based gradient analysis, information from operational field plans, and field knowledge. The Code requires no-harvest riparian reserves and riparian management zones where forest cover requirements apply. For the timber supply analysis, forest cover requirements for riparian management zones were converted into equivalent land base deductions, and combined with the reserves into riparian buffers which were deducted during derivation of the timber harvesting land base.

For streams, six stream classes (S1-S6) consistent with the *Riparian Management Area Guidebook* were used. A 60-metre wide reserve zone was assigned to S1 riparian areas. S2, S3 and S4-S5 areas were assigned 40-, 35- and 8-metre wide reserve zones respectively. The S3 buffer width was increased by five metres from the 30 metres derived from the guidebook to account for the possibility that some S3 creeks may in fact be S2 creeks. A 10-metre wide reserve zone was used for all wetlands and lakes regardless of class, which the licensee suggested would compensate for not deducting land to account for management zones. The licensee deducted a total of 2735 hectares (5.1 percent) from the productive forest land base.

BC Environment staff expressed concern about the methodology used to estimate riparian areas. They asserted that the gradient analysis method likely underestimates stream lengths. For S5 and S6 streams, BC Environment staff suggest that the calculation of representative riparian reserves did not account adequately for best management practices for valley-bottom streams.

While I acknowledge the BC Environment concerns, I believe that the licensee has appropriately modelled the management practices as defined in the *Riparian Management Area Guidebook*. I note that the deductions for riparian areas (5.1 percent of forest area) are comparable with those made in other coastal areas for which analysis has been done (*Forest Practices Code Timber Supply Analysis*). I accept the estimates used as suitable for this determination. Regardless of the assumptions made for the analysis, the licensee will still be required to meet the standards of the Code. I expect that inventory information will be improved, and required management practices refined for the next analysis and determination.

- *watershed values*

As discussed above under *recreation*, the Brem River is a high value steelhead stream and popular with anglers. I note that BC Environment staff have identified this watershed, as well as the Nor River drainage as high priorities for coastal watershed assessment procedures (CWAPs). One public submission in response to the licensee's statement of management objectives, options, and procedures included reference to the need for a CWAP. A CWAP is a tool to help forest managers understand the type and extent of problems related to water and terrain stability that exist in a watershed, and to examine the potential implications of future harvesting.

I note that there are no designated community watersheds in TFL 10.

I will not speculate on the outcome of watershed assessments, but expect any new information from assessments to be incorporated into the next analysis. For this determination, I will make no adjustments to account for watershed management issues.

- *biodiversity*

Biological diversity, or biodiversity, refers to the full range of living organisms in all their forms and levels of organization, and includes the diversity of genes, species and ecosystems, and the evolutionary and functional processes that link them. The Forest Practices Code requires planning and management for biodiversity in a given management unit at landscape and stand levels. Landscape-level biodiversity objectives involve ensuring that forests contain a full range of seral stages (forests at different stages of development), old-growth patches, and forested corridors (i.e., forest ecosystem networks or FENs). Provisions for stand-level biodiversity ensure maintenance of structural diversity and habitat for wildlife through retention of wildlife tree patches, leave trees and coarse woody debris.

In TFL 10, neither landscape units nor biodiversity emphasis options have been established. Therefore, management for landscape-level biodiversity was not represented in the base case. Stand-level biodiversity also was not considered in the base case. However, for a sensitivity analysis, the biodiversity guidebook was used to estimate the percent of cutblock area required in wildlife tree patches. Based on the age-class distribution of the TFL, the proportion of the productive forest land base available for harvest, and the fact that landscape-level objectives have not been defined, an estimated average of 10 percent of each cutblock is required for retention. The licensee assumed that 75 percent of the requirement could be met by stands outside the timber harvesting land base (consistent with the *Biodiversity Guidebook*), inferring a wildlife tree retention requirement of 2.5 percent of the timber harvesting land base (25 percent of 10 percent). The licensee performed a sensitivity analysis by reducing projected volumes for existing and regenerated stand yields. The sensitivity analysis indicated a 2.5 percent reduction to the long-term timber supply only, with no effects in the short term. While timber supply may be stable enough to absorb the retention of wildlife trees without effects in the short term, retaining wildlife trees still reduces the inventory available for harvest over all time frames, which could affect flexibility to absorb other downward pressures. The downward pressures exerted by management for stand-level biodiversity on available timber inventory and timber supply are discussed in "Reasons for decision".

In the analysis the licensee did not explicitly represent management for landscape-level biodiversity. However, the projected distribution of age classes resulting from the base case harvest forecast was compared to four landscape-level biodiversity emphasis scenarios. These differed in the percentage of area that would be in low, intermediate and high biodiversity emphasis classes. The scenarios ranged from 100 percent in low biodiversity emphasis to 70 percent in high and 30 percent in low emphasis biodiversity

classes. Seral stage requirements described in the biodiversity guidebook were weighted by the percentage in each emphasis category to derive the minimum percentage of area in each seral stage that would be required under each emphasis scenario. The age-class distributions for each decade resulting from the base case harvest forecast met all seral stage requirements of the most restrictive emphasis scenario (70 percent high, 30 percent low) described above, except for old-growth in the CWH subzone in the Toba Inlet portion, which falls into NDT2 (ecosystems with infrequent stand-initiating events). The area in old growth in this subzone was forecast to be deficient for several decades in the medium term. However, BCFS staff suggest that this old-growth requirement could likely be met by shifting harvest priority to areas with more abundant old-growth. Clearly, careful planning will be required to ensure landscape-level biodiversity objectives are achieved.

BC Environment staff have expressed concerns with the licensee's interpretation of the Biodiversity Guidebook and do not support the methodology used for assessing landscape-level biodiversity requirements. They contend a single emphasis option should be applied to the Toba River and Toba Inlet areas, and argue that seral stage representation should be applied to the area within each landscape unit, not over the TFL as a whole. BC Environment staff also indicate they will seek designation of the Toba River drainage as a high biodiversity emphasis area due to the presence of important grizzly bear habitat. BC Environment believe that up-to-date inventories for non-timber values are critical to good biodiversity planning.

I acknowledge all of the concerns raised by BC Environment staff. However, at this time there is no landscape-level biodiversity plan for TFL 10, and consequently, landscape units and biodiversity emphases have not been assigned. I also note that wildlife tree requirements were determined based on landscape units not being defined, resulting in higher impacts on available inventory from wildlife tree retention than would occur if landscape-level objectives existed. At this time, incorporating an adjustment to timber supply to account for landscape-level biodiversity would be speculative. I do recognize the urgency for a landscape biodiversity plan for the TFL given the resource values in the area and possible future shortages of some seral stages in some areas. As soon as landscape-level biodiversity planning has been completed, and emphasis options assigned, I request that the licensee perform analysis to ascertain the timber supply implications of the planned management regime. Depending on the outcome, I may redetermine the AAC before expiry of the maximum five-year period outlined in the *Forest Act*.

To conclude this discussion of landscape-level biodiversity, in the absence of landscape unit designations and defined biodiversity emphasis options for TFL 10, the licensee's approach in the timber supply analysis—representing fulfillment of wildlife tree requirements—is consistent with obligations described by the Forest Practices Code *Biodiversity Guidebook*. I will await results of landscape-level biodiversity planning and related analysis, and will examine the timber supply implications at that time. For the

purpose of this determination, I will make no adjustments to account for landscape-level biodiversity, but re-iterate the need for prompt planning in "Implementation".

- adjacency and green-up

In order to protect non-timber values such as wildlife and water quality where specific requirements related to those values do not apply, current harvesting practices limit the size and shape of cutblocks, and prescribe minimum green-up conditions that must be met before adjacent areas may be harvested. Green-up time refers to the period following harvesting needed for a regenerated stand to reach a specified height. Adjacency and green-up requirements provide for distribution of harvested areas and retained forest cover across the landscape. Cutblock adjacency guidelines are commonly expressed in terms of the number of harvesting entries, or "passes" required for harvesting operations to cover an area while meeting IRM objectives.

In the analysis, a four-pass system was represented, whereby at least 75 percent of the IRM zone must be covered by trees at least three metres tall at any given time. The IRM zone covers about 70 percent of the timber harvesting land base. A sensitivity analysis was performed to assess the impact of applying both three-pass and five-pass systems. No impact on timber supply resulted from these adjustments.

Weighted average green-up ages were determined for each management zone using the average site index for each analysis unit, together with FREDDIE, the BCFS site index estimation model. Ages were generated for both the base case and adjusted site indexes. For both the Toba Inlet and Toba River portions of the TFL, the licensee estimated green-up is achieved in 14 years, with a range of 12-15 years, based on a three-metre green-up requirement. Interfor provided a sensitivity analysis in which green-up ages in all management zones were both increased and decreased by two years relative to the base case assumption of 14 years. A slight increase in timber supply over the medium term resulted from decreasing the green-up age by two years.

Interfor examined 29 harvested areas on the TFL and found that on average it took 10 years for regeneration to achieve three metres and 14 years to achieve five metres (the green-up requirement for visually sensitive areas). Although the licensee did not apply these results to the base case analysis, Interfor contends that these field measurements better reflect the actual period required to reach green-up heights. I note that if substantiated these assumptions would increase timber supply in the medium term and potentially buffer downward pressures on timber supply. For this determination, I accept the ages used in the base case as the best available information, as they are based on standard methods and available inventory data.

I accept that the adjacency and green-up requirements were suitably represented, noting that the modelled four-pass system is employed in other coastal units.

- visual quality objectives

The *Forest Practices Code of British Columbia Act* specifies that one of the forest resources to be managed in B.C. is the recreation resource which includes a "scenic or wilderness feature or setting that has recreational significance or value." In order to manage scenic features, visual landscape foresters in B.C. have developed procedures for identifying and managing visually sensitive areas. These procedures incorporate both physical and social factors—including visual sensitivity ratings based on topography, slope and other biophysical considerations, and the number of viewers and their perceptions—and provide recommended visual quality objectives (VQOs) for these visually sensitive areas. The objectives limit the amount of visible disturbance that is acceptable in these areas.

To meet objectives for visual quality, constraints are placed on timber harvesting, road construction and other forest practices in sensitive areas. These constraints are expressed in terms of forest cover requirements which relate to "visually effective green-up" (i.e., the stage at which regeneration is perceived by the public as visually satisfactory), and to the maximum allowable percentage of a landscape that can fail to meet the prescribed green-up conditions at any time.

In TFL 10, a visual landscape inventory and analysis using BCFS standards was completed and accepted in March 1996. The inventory covered the Toba Inlet marine corridor as well as the main haul roads in the lower Brem and Tahumming drainages. Interfor did not assess the upper parts of these drainages due to lack of road access. The licensee did not conduct a complete landscape inventory of the Toba River portion of the TFL because they did not want to jeopardize road access discussions with the Klahoose First Nation. However, due to the remoteness of this area BCFS district staff do not anticipate that it will contain substantial visually sensitive area, and suggest that forest cover requirements related to adjacency considerations (discussed above) should be sufficient to address visual sensitivity in this area. I will accept this assessment for this determination, however, the licensee should consult with BCFS district staff about the need for more comprehensive assessment of visual sensitivity in the Toba River area.

In the base case, forest cover requirements were applied to 2859 hectares of visually sensitive areas within the timber harvesting land base (12 percent). Using standard procedures for incorporating visual resource information into timber supply analysis, the licensee determined forest cover requirements for retention, partial retention and modification VQO categories for use in the base case.

The base case incorporated estimates of average visual green-up ages based on a height requirement of five metres. These ages ranged from 17-22 years in the VQO zones. As mentioned under *adjacency and green-up*, a sensitivity analysis showed only a slight increase to medium-term timber supply when green-up ages for all zones were decreased by two years.

Modification and partial retention VQOs apply to the bulk of the visually sensitive area. Given the current age-class distribution, forest cover requirements for the VQOs employed in the base case do not present significant limitations to short-term timber supply. In view of the Minister of Forests direction regarding visual quality objectives (see Minister's letter and memorandum), there is little probability that more restrictive forest cover requirements would apply in the area. For the purposes of this determination, I am satisfied that management of visually sensitive areas have been represented appropriately.

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

Twenty-year plan

The purpose of a 20-year plan is to show whether or not the harvests projected in the base case over the next 20 years are spatially feasible.

Because road access through the Klahoose Indian Reserve to the Toba River portion of the TFL is currently not available, the licensee submitted two 20-year plans for TFL 10: one with operations limited to the Toba Inlet area (limited access) and one with operations occurring on the entire TFL (full access). Existing forest development plans were incorporated into the accessible (Toba Inlet) portion. BCFS coast planning guidelines, VQOs, ESAs and draft Forest Ecosystem Networks (FENs) were accounted for in the plans. FENs were not specifically modelled in the timber supply analysis.

Because of time constraints, the plans were prepared before the timber supply analysis was completed. As a result the harvest levels projected in the analysis do not equate precisely with harvests in the 20-year plans. The projected harvest over the next 20-years in the base case is 171 000 cubic metres per year, while 170 000 cubic metres per year, very close to the base case level, was tested in the 20-year plan. For the Toba Inlet portion the base case and 20-year plan harvest levels were 55 000 and 57 800 cubic metres per year, respectively.

The 20-year plan for the entire TFL shows a spatially feasible harvest schedule is attainable. There appears to be considerable flexibility in harvest scheduling largely due to the abundant supply of old growth. However, the lack of agreement on conditions of access to areas along the Toba River through the Klahoose reserve presents a significant risk that projected timber supplies may not be accessed on 66 percent of the timber harvesting land base. The feasibility of mainline reconstruction through riparian areas in the Toba River portion is also a potential constraint to harvesting. I request that the licensee clarify what steps are being taken to remove the uncertainty around future access to timber supply.

Spatial 20-year plans indicate that the harvest level projected in the base case can be achieved in the short term. However, I am concerned about the failure to agree on conditions of access to the Toba River area. As discussed in the following section, I will partition the harvest to ensure operations do not become overly concentrated in the currently accessible portion should access continue to be a problem.

Partitioned component of the harvest

AACs are sometimes partitioned among areas within TFLs and TSAs to ensure harvesting is evenly distributed across different types of forest, terrain, or distinct areas.

The AAC for TFL 10 has been partitioned since 1992. The chief forester assigned a partition to the TFL in response to ongoing road access discussions with the Klahoose First Nation. Due to lack of agreement on conditions of road access through the Klahoose reserve, no

harvesting has occurred in the Toba River portion of the TFL since December 1989. Harvesting operations have been concentrated within the Toba Inlet portion of the TFL. The annual allowable harvest levels for the Toba Inlet and Toba River portions prior to this determination were 68 380 and 102 570 cubic metres per year, respectively.

In recognition that access to part of the TFL may continue to be problematic, and to ensure that harvesting is not concentrated in accessible areas in an attempt to achieve a harvest level for the entire TFL, I believe that a partitioned AAC is appropriate for this area.

A partition was not represented in the base case; however, the licensee provided a base case harvest forecast for the Toba Inlet portion alone. This analysis showed that a harvest level of 55 000 cubic metres per year is attainable in the Toba Inlet portion for forty years. In addition, in deriving the Enhanced Forestry Option discussed above, separate harvest forecasts were generated for both of the portions, and summed. The harvest projections were based on assumptions that 32 percent of the harvest would initially come from the Toba Inlet portion and 68 percent from the Toba River portion. After 30 years from now when timber supply begins to decline to the long-term level, the proportions harvested were modified to 34 percent (Toba Inlet) and 66 percent (Toba River) to reflect the proportional contribution by the timber harvesting land base. In all harvest forecasts submitted, harvesting was modelled to ensure management zone objectives were achieved in both portions of the TFL.

Although the harvest level applied to the Toba Inlet portion in the base case analysis (55 000 cubic metre per year) represents a significant reduction from the current partitioned harvest level for that area, it is approximately proportionate to the contribution of that area to the timber harvesting land base. I accept the assumptions used to model the partition and have fully accounted for this information in "Reasons for decision".

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

Alternative harvest flows

The nature of the transition from harvesting old growth to harvesting second growth is a major consideration in determining AACs in many parts of the province. In the short term, the presence of large volumes of older wood permits harvest levels above long term levels without jeopardizing 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 medium-term harvest levels will be compatible with a smooth transition toward the usually (but not always) lower long-term harvest level. Thus, timber supply should remain sufficiently stable so 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.

In addition to the base case harvest forecast, Interfor provided an alternative harvest forecast applying the same land base, timber yield and management assumptions that were used in the base case. The alternative forecast shows an initial harvest level of 219 000 cubic metres per year followed by a decline of 10 percent per decade (same as in the base case) to the long-term harvest level of 110 000 cubic metres per year 70 years from now. The alternative forecast shows that a higher initial harvest rate is possible if lower medium-term harvests are accepted. Interfor contends the base case harvest flow (171 000 cubic metres per year) more closely meets corporate timber supply objectives while not jeopardizing medium and long-term productivity. I also believe that the base case harvest flow provides more capability to deal with risks and uncertainties that may reduce timber supply in the future.

For this determination, I accept the base case forecast as a suitable reference on which to base my determination.

Community dependence on the forest industry

There are no permanent communities immediately adjacent to the TFL. Operations are camp based, and are administered by Interfor from its Campbell River office. No harvesting operations occurred between early 1995 when the licence was transferred to Interfor (and for a number of years prior to that time) and late 1996 when harvesting was re-initiated. Historically, most of the forest workers have been residents of Campbell River and Powell River. Mill workers employed at plants that will process fibre from the TFL live mainly in the Vancouver area and in Squamish.

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

Timber processing facilities and fibre requirements

Interfor currently operates seven sawmills on the B.C. coast. Total annual fibre consumption is about 3.1 million cubic metres. The licensee supplies about 87 percent (2.7 million cubic meters) of its total mill requirements and purchases the balance from other operators. The licensee plans to transport logs harvested from the TFL to the company's various lower mainland operations near Vancouver.

(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

Minister's letter and memorandum

The Minister has expressed the economic and social objectives of the Crown for the province in two documents to the Chief Forester: a letter dated July 28, 1994 (attached as Appendix 3), and a memorandum dated February 26, 1996 (attached as Appendix 4). I understand both documents to apply to TFL 10. 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 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 I 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 I consider partitioned AACs.

The application of partitions has been discussed above in Partitioned component of the harvest and I have considered this below in my "Reasons for Decisions". Also as noted above, under Incremental silviculture, Interfor has considered commercial thinning opportunities to be feasible pending verification, as part of an enhanced forestry program. The licensee has had little opportunity to conduct operations to generate any performance information, and no immediate operations are planned. With regard to operability, as incorporated into the base case, the licensee proposes that approximately 24 percent of the timber harvesting land base will be harvested using helicopter yarding techniques. This proportion is significant and reflects Interfor's considerable experience and innovation. I acknowledge that the licensee is recognized as a leader in applying this technology to the rugged conditions of the mainland coast.

The Minister's memorandum addresses the effects of visual resource management on timber supply. It asks that pre-Code constraints applied to timber supply in order to meet VQOs be re-examined when determining AACs in order to ensure they do not unreasonably restrict timber supply. As noted earlier, under *visual quality objectives*, the licensee has completed a visual landscape inventory of the Toba Inlet portion of the TFL using BCFS standards. The base case analysis showed that existing VQOs do not constrain timber supply. Much of the area that has not been inventoried for visual quality is remote and adjacency constraints will likely be sufficient to meet most VQOs. I am satisfied that visual quality management on TFL 10 has been addressed suitably in the base case, and is in concert with the Minister's memorandum.

Local objectives

The Minister's letter suggests that the Chief Forester should consider important social and economic objectives that may be derived from the public input in the timber supply review where these are consistent with government's broader objectives. Two submissions were received from the public in response to the licensee's draft statement of management of objectives, options and procedures.

One submission dealt specifically with restoration of salmon habitat and past logging practices in Toba Inlet. I note that all licensee operations in the TFL will be subject to the requirements of the Forest Practices Code, including those near fish-bearing water courses. The second submission raised a number of general concerns including employment, alternative harvesting methods, silvicultural systems, wildlife inventories and watershed assessment procedures. I have attempted to address such concerns at various places in the considerations above where they are relevant to the determination of the AAC, and am mindful of the views brought forward.

First Nations

Three First Nations have identified traditional territory in the vicinity of TFL 10: the Klahoose, the Homalco and the Kwakiutl. Interfor has committed to consult with First Nations peoples on resource-related issues including fisheries, wildlife, forests, water and soils. As noted under *archaeological sites*, funding is being sought for an archaeological overview assessment of the TFL. I also expect the licensee to continue discussions with the Klahoose First Nation regarding road access through their reserve to the Toba River portion of the TFL.

7(3)(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

Non recoverable losses

Non-recoverable losses are timber volumes that are destroyed or damaged by natural causes such as fire and disease and not recovered through salvage operations. I acknowledge that there is considerable uncertainty surrounding the estimates of such losses. Empirical data on non-recoverable losses was not available for TFL 10. Therefore, an annual allowance of 0.11 cubic metres per hectare (2700 cubic metres) was deducted from all projected harvest levels. The licensee based this estimate on assumptions used in the adjacent Sunshine Coast TSA which has similar topography and experiences similar climatic conditions.

I find this to be a reasonable approach, recognizing that it is based on review of information on nearby areas. However, I request that the licensee work to compile information specific to this TFL that will assist in future analyses and determinations. In the absence of more comprehensive information, I am satisfied that the approach used is suitable for this determination.

Reasons for decision

In reaching my decision on an AAC for TFL 10, I have considered all of the factors presented above and have reasoned as follows:

The base case indicates that a harvest of 171 000 cubic metres could be maintained for forty years before declining to the long-term harvest level of 110 000 cubic metres per year by eighty years from now. The initial harvest level modelled is essentially the same as the current AAC of 170 950 cubic metres.

In reviewing the information for this determination, I have identified a number of factors that indicate that the actual timber supply in the TFL may be either greater or less than projected in the base case. Some of these factors can be quantified and their impacts assessed with some reliability. However, most of the factors influence timber supply by adding an element of risk or uncertainty to the decision but they cannot be reliably quantified at this time. These latter factors must be accounted for in the determination more generally.

The only factor which exerts a quantifiable restriction on the projected timber supply is the impact of leaving wildlife tree patches to contribute to stand-level biodiversity requirements. I acknowledge that trees retained to meet objectives for riparian areas and other values will likely also provide wildlife trees, but on balance specific retention of wildlife trees will reduce the timber supply. Based on current timber inventory conditions on the TFL, the absence of landscape-level biodiversity objectives and an assumption that 75 percent of wildlife tree requirements can be met outside the timber harvesting land base, the Forest Practices Code *Biodiversity Guidebook* indicates that 2.5 percent of cutblocks should be retained for wildlife trees. This will reduce timber volumes available for harvest over all time frames by a similar percentage. Sensitivity analysis suggests that retention of 2.5 percent of the inventory for wildlife trees will affect only long-term timber supply. Sensitivity analysis of volume estimates for regenerating stands indicates that a 10 percent reduction to future stand yields will cause the decline in the harvest projection to begin one decade earlier than in the base case harvest forecast. A similar result applies if existing stand yields are 10 percent lower than in the base case. Given that wildlife tree patches will cover significantly less than 10 percent of the harvesting land base, I am confident there will be no downward pressure on timber supply until the medium term because of retention of wildlife trees.

The use of reduced stocking levels to improve forage for grizzly bear exerts an unquantified restriction on long-term timber supply. Stocking levels below 600 stems per hectare reduce long-term timber yields, and it is conceivable that in some areas, densities below 500 stems per hectare may be required to maintain or enhance forage for bears. No specific areas were identified, and specific management practices and effects on yields have not been examined in detail. Since lower stocking will affect regenerated stand yields, any impacts on timber supply will be in the medium to long term.

I also acknowledge concerns regarding the condition of current wildlife habitat inventories, the fact that management for landscape-level biodiversity was not incorporated into the analysis, and the land base deductions for riparian areas in the base case. I have discussed these issues at some length in related sections above (*wildlife, biodiversity and riparian areas*). While I acknowledge that non-timber inventories require updating, I conclude that the best available information was used in the analysis. The analysis suggests that timber supply is sufficiently robust to absorb short-term risks to timber supply of potential increases in land base deductions and other wildlife

management measures. Updated information should be collected and made available for the next AAC determination.

I recognize that management for landscape-level biodiversity was not incorporated into the base case. However, at this time there is no landscape-level biodiversity plan for TFL 10, and consequently landscape units and biodiversity emphases have not been assigned. To incorporate an adjustment to timber supply to account for landscape-level biodiversity would be speculative. Furthermore, many land base deductions were applied in deriving the TFL timber harvesting land base, and it is likely that these areas will contribute significantly to the attainment of landscape-level biodiversity objectives. However, I recognize the urgency for a landscape-level biodiversity plan for the TFL given the resource values in the area and the potential for future shortages of some seral stages in some areas. As soon as landscape-level biodiversity planning has been completed and emphasis options assigned, I request that the licensee perform analysis to ascertain the timber supply implications of the planned management regime. Depending on the outcome, I may redetermine the AAC before expiry of the maximum five-year period outlined in the *Forest Act*.

As discussed in the section on riparian areas, I believe the methods used by the licensee are consistent with the Code. The reduction applied in this TFL (5.1 per cent) is similar to the reductions derived for and used in analyses of other comparable coastal units. Improved information on the stream lengths and classes could assist in future analyses and AAC determinations.

In summary, retention of wildlife trees will reduce the timber inventory available for harvest over all time frames by approximately 2.5 percent, while reduced stocking to promote forage for grizzly bears on parts of the timber harvesting land base will likely reduce timber supply in the medium and long terms, but to an unknown extent. The current state of non-timber inventories and the need for clarification of landscape-level biodiversity objectives, while not exerting firm downward pressures, suggest some caution is appropriate when examining timber supply in the TFL.

Some unquantified factors exert upward pressures on timber supply as projected in the base case. The first and largest factor which suggests timber supply may be greater is the licensee's contention that site indexes used in the analysis underestimate actual site productivity. Based on study results from elsewhere in the province I acknowledge this possibility, in which case regenerated stand volumes may be higher, and minimum harvestable ages and green-up ages may be lower than projected. In particular I believe that it is reasonable to expect that long-term timber supply is higher than projected. Faster green-up and lower minimum harvest ages may provide additional timber volume in the medium term that could increase flexibility during the decline to the long-term harvest level. However, as noted above in my considerations, until definitive information is available for this TFL, I am hesitant to assume that potential for higher site productivity will increase short-term timber supply. Consequently, in determining the AAC I have not assumed any contribution to short-term timber supply arising from the likelihood that site productivity is higher than estimated in the base case. I strongly encourage the licensee to undertake a statistical evaluation of site productivity to reduce the uncertainty associated with

current estimates, especially given the substantial increases in medium- and long-term timber supply associated with changes in site index.

In the Enhanced Forestry Option, the licensee presented a number of potential opportunities aimed at enhancing timber supply for TFL 10. Sensitivity analysis suggests some gains are possible in the medium- and long-terms due to use of genetically-improved planting stock, enhancements in species choice for planting, and reduction of minimum harvest ages (however, I note that most of the gains shown in the analysis of the option are attributable to potential site index increases). While I expect many of the enhancement activities are feasible, no specific plan is in place outlining the type or extent of these activities, or how they will fully accommodate non-timber values such as wildlife habitat. If the activities outlined in the Enhanced Forestry Option are implemented, it is possible that medium- and long-term timber supply will be higher. However, in the absence of a comprehensive strategy or proven performance I cannot consider the suggested activities as part of current performance at this time. At any rate, effects would occur in the medium- and long-terms and therefore, do not affect this determination.

Finally, the licensee provided some information based on field observations that green-up rates may be faster than estimated for the analysis. A sensitivity analysis shows a small medium-term increase in timber supply if green-up ages are reduced. Although I acknowledge the possibility that an upward pressure may exist, potential impacts on timber supply may overlap with effects of higher site productivity which I have discussed above. Further field study to verify the faster green-up rate could assist in providing evidence of the effects of higher site productivity, as well as empirical data on green-up ages for use in future timber supply analysis.

Considered together, the upward influences described above, although unquantified, give me cause to believe that the long-term harvest level is very likely higher than described in the base case. The upward pressures do not counteract the downward pressure in the short-term due to wildlife tree retention. The potential effect in some areas of reduced stocking for grizzly bear habitat management on regenerated stand yields, and the uncertainties associated with non-timber inventories and landscape-level biodiversity also suggest some caution is appropriate when viewing timber supply in the short and medium terms. However, the timber supply analysis indicates that there is sufficient flexibility in timber supply to absorb the downward pressures so that the initial harvest level indicated in the base case is achievable for at least the term of MP No.7.

From the foregoing reasoning, it is my determination that a timber harvest level that accommodates objectives for all forest resources during the next five years, that provides for requirements of the Forest Practices Code as they are currently implemented, that ensures longer-term integrated resource management objectives can be met, that meets provincial objectives and that avoids disruptive shortfalls in future timber supply, can best be achieved in this TFL at this time by maintaining the AAC at 170 950 cubic metres.

In recognition that access to the Toba River portion of the TFL may continue to be problematic, and to ensure that harvesting is not concentrated in accessible areas in an attempt to achieve a

harvest level for the entire TFL, I believe that a partitioned AAC is appropriate for this area. The partition will be based on timber supply analysis and 20-year plans submitted for the Toba Inlet portion of the TFL, which suggested, respectively, that annual harvests of 55 000 cubic metres and 57 800 cubic metres could be maintained from that area over at least the next 20 years. Based on these results, I believe that 55 000 cubic metres is a suitable annual harvest level for the Toba Inlet portion. I also expect the licensee to continue discussions with the Klahoose First Nation regarding road access through the reserve to the Toba River portion of the TFL.

Determination

Effective December 30, 1996, the new AAC for TFL 10, including Schedule A private lands, will be 170 950 cubic metres, leaving the AAC unchanged from the previous level. Of the total AAC, 55 000 cubic metres is partitioned to the Toba Inlet portion of the TFL, and 115 950 cubic metres is partitioned to the Toba River portion. This AAC will remain in effect until a new AAC is determined, which must take place within five years of this determination.

Implementation

In the period following this determination and leading to the subsequent determination I expect the licensee to perform the following:

1. Initiate a monitoring program to verify the viability of proposed helicopter operations in lower-volume stands which are included in the operable land base;
2. Continue the assessment of site productivity, particularly regarding adjustments to old-growth site indexes needed to reflect actual site productivity;
3. Review procedures for defining operational adjustment factors (OAFs) used in estimating regenerated stand yields, and provide a more detailed rationale for their selection;
4. Identify areas and stocking levels required to maintain and enhance grizzly bear habitat in the TFL;
5. Develop a plan for the management of landscape-level biodiversity, including designated landscape units and biodiversity emphases.
6. Work with BC Environment staff to update non-timber resource inventories particularly for wildlife habitat.

I expect BCFS staff and the licensee to work together and submit any findings on the above items as soon as available. Should the information suggest significant changes to the timber supply situation for this TFL, I am prepared to revisit the AAC determination before expiry of the five-year period specified in the *Forest Act*.

Other requirements have been noted in my Management Plan approval letter.



Larry Pedersen
Chief Forester
December 11, 1996

Appendix 1: Section 7 of the *Forest Act*

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.

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.

Documents attached:

Appendix 3: Minister of Forests letter of July 28, 1994 to the chief forester re: Economic and Social Objectives of the Crown.

Appendix 4: Minister of Forests memorandum of February 26, 1996 to the chief forester re: The Crown's Economic and Social Objectives Regarding Visual Resources.