

**BRITISH COLUMBIA
MINISTRY OF FORESTS**

Arrowsmith Timber Supply Area

**Rationale for
Allowable Annual Cut (AAC)
Determination**

effective December 30, 1996

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Chief Forester**

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Documents attached :

- Appendix 3: Letter from Minister of Forests, July 28, 1994, to Chief Forester, re social and economic objectives of the Crown.
- Appendix 4: Memo from Minister of Forests, February 26, 1996, to Chief Forester, re social and economic objectives of the Crown—visual resources.
- Appendix 5: Memo from Minister of Forests, September 17, 1996, to Chief Forester, re social and economic objectives of the Crown for Clayoquot Sound.
- Appendix 6: Summary of Public Input

Objective of this document

This document is intended to provide an accounting of the factors considered and the rationale employed in making my determination, under section 7 of the *Forest Act*, of the allowable annual cut (AAC) for the Arrowsmith Timber Supply Area (TSA). The document will also identify where new or better information is required for incorporation into future AAC determinations.

Description of the Timber Supply Area

The Arrowsmith TSA consists of several fragmented areas located in the southern portions of Vancouver Island within the Duncan and Port Alberni forest districts. The TSA is administered from the Port Alberni Forest District and a sub-office in the Duncan Forest District. The TSA is located south of the Strathcona TSA and shares borders with Tree Farm Licences (TFLs) 25, 44, 46, 47 and 54, and also with reserves, parks, municipal and private lands. Compared to the surrounding TFL lands, the TSA provides a comparatively small, albeit important, proportion of the harvest on the southern part of Vancouver Island.

Most of the forested lands within the TSA lie within the Coastal Western Hemlock biogeoclimatic zone, with the bulk of the remainder in the Mountain Hemlock zone at high elevations or the Coastal Douglas-fir zone at lower elevations on the drier east side of Vancouver Island. The eastern side is comparatively drier with gentler topography than the western portions of the TSA.

The southern portion of Vancouver Island, particularly along the east coast, has experienced rapid development over the past few decades and is heavily populated in many areas. The principal communities are Victoria, Nanaimo, Duncan, Port Alberni, Ladysmith and Parksville, and a substantial population living in the surrounding areas. The estimated population for the entire southern portion of Vancouver Island is over 550 000. Although the TSA represents only about 0.2 percent of the province in total area, it lies in close proximity to about 17 percent of British Columbia's total population.

There are 29 First Nations with reserves and/or traditional territories located within the geographic area that includes the Arrowsmith TSA. They represent approximately 13 000 members, of whom about 7000 live on reserves. Four tribal councils and one Treaty Association represent all but three of the First Nations.

Southern Vancouver Island has a growing, diversified economy, with the public sector, forestry and tourism serving as the primary generators of employment. Within the region, employment dependencies vary significantly. The Lake Cowichan, Alberni, Ladysmith and Duncan areas are heavily dependent on the forest sector. Forestry is also important in the Parksville-Qualicum and Nanaimo areas, but is not dominant. Only in Victoria area does the forest sector play a relatively minor role in the overall economy. In addition to

forestry activity, southern Vancouver Island has seen a tremendous growth in tourism activity.

History of AAC

When the Arrowsmith TSA was formed in 1986 from portions of the former Nootka and Quadra TSAs, the AAC was set at 392 890 cubic metres. An additional allocation of 3870 cubic metres was made in 1989 for deciduous species. In 1992, the AAC was increased to 498 250 cubic metres to account for a transfer of land from TFL 46 to the TSA.

In April 1993 government, following its land use decision for Clayoquot Sound, issued two Orders-in-Council (OICs) which cover the Clayoquot Sound area. In response to these OICs and the forest management changes occurring in the Sound the Chief Forester determined temporary AAC reductions totalling 16 000 cubic metres under Part 15 of the *Forest Act* as an interim measure to account for protected areas and anticipated changes to management resulting from the Clayoquot Sound Land Use Decision. The resulting AAC of 482 250 cubic metres remains in effect today

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

Apportionment ¹	Cubic Metres	% of AAC
Coniferous component:		
Forest licences, replaceable	183 110	36.8
Forest licences, non-replaceable	85 430	17.1
Small Business Forest Enterprise Program	179 940	36.1
Timber sale licences	13 724	2.7
Forest Service reserve	1 410	0.3
Unallocated woodlot licences ²	1 016	0.2
Subtotal	464 630	93.2
Allocated woodlot licences ²	13 750	2.8
Coniferous Total	478 380	96.0
Deciduous component:		
Forest licences, non-replaceable	3 870	0.8
Part 15 temporary reduction³	16 000	3.2
Total (coniferous & deciduous)	498 250	100.0
Total (excl. estimated allocated woodlot licences)**	484 500	97.2

1- Based on AACs determined through Section 7 of the *Forest Act*.

2 - Once allocated, woodlot licenses are administered separately from the remainder of the TSA, and their area is excluded from the land base contributing to the AAC determined by the Chief Forester under Section 7 of the *Forest Act*. However, allocated woodlots are included in this table for reference, as an indication of harvestable volume for the area (see *woodlots*).

3 - There is no actual apportionment for the part 15 reduction.

New AAC determination

Effective December 30, 1996, the new AAC for the Arrowsmith TSA will be 400 000 cubic metres. This represents a decrease of 17 percent decrease from the AAC (excluding allocated woodlot licences) of 484 500 cubic metres that was in effect before the Clayoquot Sound Land use decision, or a 14.6 percent decrease from the temporarily reduced (under Part 15 of the *Forest Act* and excluding allocated woodlot licences) AAC of 468 500 cubic metres. This new AAC is partitioned as follows:

- TSA area outside of Clayoquot Sound - 380 000 cubic metres
- Clayoquot Sound portion of the TSA - 13 700 cubic metres
- Predominantly deciduous stands - 6300 cubic metres

This new AAC does not include the 13 750 cubic metres of allocated woodlot licence volume which, as previously noted, are administered outside of this determination. The new AAC will remain in effect until a new AAC is determined, which must take place within five years of this determination.

The AAC is not meant to be an input to planning processes and in particular the Clayoquot Sound partition harvest level should not be construed as an input to local planning processes overseen by the Central Region Board, which are intended to identify the specific areas for harvest on which the actual harvest level achieved will depend.

Having now determined a new AAC for the Arrowsmith TSA under section 7 of the *Forest Act* which has excluded the designated protected areas and has accounted in a general way for new management practices in Clayoquot Sound, I have also made a new order, effective December 30, 1996, repealing the temporary AAC reduction previously ordered under Part 15, related to Orders-in-Council Nos. 718 and 719.

Information sources used in the AAC determination

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

- *Arrowsmith TSA Timber Supply Analysis*, BC Forest Service (BCFS), August 1995;
- *Arrowsmith TSA Socio-Economic Analysis*, A. Fitzgibbon & Assoc., August 1995;
- *Arrowsmith TSA: Timber Supply Review Discussion Paper*, BCFS, August 1995;
- *Arrowsmith TSA Timber Supply Review: Summary of Public Input*, BCFS, 1996 (Appendix 6);
- Information package assembled by the BCFS for the Arrowsmith TSA AAC determination meeting on September 25 and 26, 1996;
- Technical review and evaluation with Forest Service and Environment staff at the Arrowsmith AAC determination meeting in Nanaimo on September 25 and 26, 1996;
- *Forest Practices Code of British Columbia Act*, July 1995;
- *Forest Practices Code of British Columbia Regulations*, April 1995;

- Forest Practices Code guidebooks including *Biodiversity Guidebook* (September 1995), *Coastal Watershed Assessment Procedure Guidebook* (September 1995), *Riparian Management Area Guidebook* (December 1995) and *Community Watershed Guidebook* (October 1996);
- *Forest Practices Code Timber Supply Analysis*, BCFS and BC Environment, February 1996;
- *Procedures for Factoring Recreation Resources into Timber Supply Analyses*, BCFS, December 1993;
- *Clayoquot Sound Land Use Decision — Key Elements*, Province of BC, April 1993;
- *Sustainable Ecosystem Management in Clayoquot Sound, Planning and Practices*, The Scientific Panel for Sustainable Forest Practices in Clayoquot Sound, April 1995;
- Meeting with Clayoquot Sound Central Region Board, June 19, 1996;
- BCFS presentation to Clayoquot Sound Central Region Board, September 16, 1996;
- Letter from Clayoquot Sound Central Region Board to Chief Forester, October 1, 1996;
- *Vancouver Island Land Use Plan*, Province of BC, June 1994;
- *Completing the Protected Area System on Vancouver Island*, Protected Areas Boundary Team, October 1994;
- *Special Features Protected Areas Summary Report*, Land Use Coordination Office, February 1996;
- *Site Index Evaluation in the Vancouver Forest Region*, Laing and McCulloch, Forest Management Services, September 1993;
- Letter from Clayoquot Sound Central Region Board, dated October 1, 1996, to the Chief Forester;
- Letter from the Minister of Forests, dated July 28, 1994, to the Chief Forester, stating the Crown's economic and social objectives (Appendix 3);
- Memorandum from the Minister of Forests, dated February 26, 1996, to the Chief Forester, stating the Crown's economic and social objectives regarding visual resources (Appendix 4);
- Letter from the Minister of Forests, dated September 17, 1996, to the Chief Forester, stating the Crown's economic and social objectives regarding Clayoquot Sound (Appendix 5).
- Memo from John Cuthbert, May 27, 1994, re temporary AAC reductions for the Arrowsmith TSA under section 170 of the *Forest Act*;

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 the Arrowsmith TSA. The timber supply analysis is concerned primarily with biophysical factors—such as the rate of timber growth and definition of the land base considered available for timber harvesting—and with management practices.

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 Arrowsmith TSA I have been provided with a timber supply analysis based on an information package gathered using methodology typical of that used in analyses for most AAC determinations. In using this information I have considered known limitations of the technical information provided. I have also been provided with a BCFS analysis based on one interpretation of certain of the Clayoquot Sound Scientific Panel's recommendations. I am satisfied that, subject to the specific uncertainties and cautions identified throughout this document, the information provided forms a suitable basis for determining a harvest level in accordance with this interpretation.

Statutory framework

Section 7 of the *Forest Act* requires the chief forester to "determine an allowable annual cut before December 31, 1996, and after that determination at least once every five years after the date of the last determination, for...each timber supply area and...each tree farm licence area". This section also requires the chief forester to consider particular factors in determining AACs for timber supply areas and tree farm licences. Section 7 is reproduced in full as Appendix 1.

Guiding principles for conventional AAC determinations under section 7 of the *Forest Act*

It should be noted that the following guiding principles apply to all areas in the Arrowsmith TSA outside of Clayoquot Sound. The "Clayoquot Sound" portion of the decision has been dealt with separately, including a unique set of guiding principles, after the main portion (outside of Clayoquot Sound) has been assessed.

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, as is the case in the Arrowsmith TSA. 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 Arrowsmith TSA falls within the purview of two land use decisions—the Vancouver Island Land Use Plan (VILUP) and the Clayoquot Sound Land Use Decision (CSLUD). In the case of VILUP, implementation decisions have not been made but are currently being developed through the Vancouver Island Resource Targets project. Therefore, in this determination, I can account only for the designated protected areas.

In addition to the CSLUD, the provincial government has accepted the recommendations in the report of the *Scientific Panel for Sustainable Forest Practices in Clayoquot Sound*. Therefore, in accordance with the Minister of Forests' stated social and economic objectives of the Crown in the Clayoquot Sound area (see Appendix 5) I view the ongoing implementation of the Scientific Panel recommendations as a factor I must consider under section 7 of the *Forest Act*. Many aspects of the Scientific Panel recommendations are not known with precision and thus it is very difficult to determine the timber supply implications. However, I will consider, when possible, the decisions that have been made through the implementation process with the aim of ensuring the harvest level does not compromise the implementation of the panel recommendations. In order to attain this goal I have composed a set of guiding principles unique to AAC determinations for areas within Clayoquot Sound. These principles will apply only to the Clayoquot Sound portions of the three management units which have area in Clayoquot Sound. These principles can be found below in the "Clayoquot Sound" portion of this document.

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

With respect to First Nations issues, I am aware of the Crown's legal obligations resulting from the June 1993 Delgamuukw decision of the B.C. Court of Appeal regarding aboriginal rights. The AAC I determine should not in any way be construed as limiting the Crown's obligation under the Delgamuukw decision, and in this respect it should be noted that my determination does not prescribe a particular plan of harvesting activity within the Arrowsmith TSA. 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 AAC determinations

In considering the factors required under Section 7 to be addressed in AAC determinations, I am assisted by timber supply forecasts provided to me through the work of the Timber Supply Review project. For each 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 current management practices. Using this set of information and a computer simulation model (FSSIM), a series of timber supply forecasts is produced, reflecting different decline rates, initial harvest levels, and trade-offs between short- and long-term harvest levels.

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

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

Therefore, much of what follows in the considerations outlined below is an examination of the degree to which all the assumptions made in generating the base case forecast are realistic and current, and the degree to which its 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 information package was assembled.

Thus it is important to remember, in reviewing the considerations that 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 base case projection

An initial base case was developed in the *Arrowsmith TSA Timber Supply Analysis*, BCFS, August 1995. This 1995 analysis indicated an initial harvest level of 469 000 cubic metres per year for the first decade, declining about 10 percent per decade before reaching a medium-term level of 346 000 cubic metres beginning 30 years from now. This medium-term level was maintained until 150 years from now before increasing about 11 percent to the long-term level of 385 000 cubic metres per year.

After publication of the analysis report, the BCFS corrected errors noted in the analysis and updated certain information. Key changes include:

- a correction to the timber licence land base and reversion schedule;
- the incorporation of additional soil-related environmentally sensitive areas;
- an update of the provincial forest land base (i.e. ownership code changes);
- an update of assumptions used for existing roads, trails and landings;
- the incorporation of inadvertently omitted visual quality prescriptions;

The base case was corrected and updated in a 1996 BCFS analysis which forms the "base case" referred to throughout this rationale. It should be noted that there is a separate section, Clayoquot Sound timber supply analysis base case projection, which describes the base case for the Clayoquot Sound portion of the TSA. The corrected base case indicates an initial harvest level of 479 150 cubic metres per year, followed by declines of about 12 percent per decade before reaching a medium-term level of 277 000 cubic metres per year beginning 50 years from now. This medium-term level is maintained until 140 years from now when the level increases by about 10 percent per decade to the long-term level of 337 000 cubic metres per year. Although the corrections and updates have resulted in less timber harvesting land base, two factors, (i) changes in the timber licence land base and reversion schedule, and (ii) the application of a slightly higher rate of decline, have enabled the initial harvest level to be slightly higher than the 1995 analysis.

In addition, an analysis was run on the Arrowsmith TSA with the Clayoquot Sound area removed (after the corrections and updates). This analysis was necessary for two reasons, (i) my intention to partition the AAC into a Clayoquot Sound and a non-Clayoquot Sound portion, and (ii) to determine if any of the sensitivity analysis utilized as guidance in this determination would give a different result than that seen in the analysis for the entire TSA. The harvest schedule for the Arrowsmith TSA less the area in Clayoquot Sound (referred to as the Main TSA area) shows an initial harvest level 440 800 cubic metres per year, which is 8 percent below the base case. The harvest level then declines by 12 percent per decade before reaching a medium-term level of 248 000 cubic metres beginning 50 years from now. This level is maintained until 140 years from now when the level begins to increase to the long-term harvest level of 296 000 cubic meters, 12 percent below the base case.

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

Clarification of the incorporation of information on Clayoquot Sound in determining an AAC for the Arrowsmith TSA

During the gathering of information for and conducting of the timber supply analysis for the Arrowsmith TSA, it was unclear how ongoing changes in management in Clayoquot sound would be incorporated in an AAC determination for the whole TSA. Standard methods were therefore applied in the analysis to define the land base, forest management assumptions and estimate growth and yield throughout the TSA. However, the Clayoquot Sound area was identified in the analysis as a separate management zone within the TSA. Thus what follows under "Consideration of factors as required by section 7 of the *Forest Act*" examines the entire TSA and where possible notes information specific to Clayoquot Sound. This method of analysis and documentation aids in fulfilling my requirement to examine all of the section 7 considerations for both the Clayoquot Sound area and the Main TSA area within the Arrowsmith TSA. However, the explicit guidance and evaluation which pertain only to the determination of a suitable harvest level for the Clayoquot Sound part of the TSA are documented below in the section "Clayoquot Sound".

The Forest Act, section 7 (3)

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

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

Land base contributing to timber harvesting

- general comments

The total area of the Arrowsmith TSA is approximately 169 000 hectares. Areas that administratively do not contribute to the AAC are first removed from this total land base. In the base case, these areas were identified prior to the July 1995 and 1996 declarations of new protected areas (see below *newly protected areas*), and represent 24 500 hectares (14.5 percent of the land base) which include parks, wilderness areas, ecological reserves, Indian reserves, and federal and private lands. Non-forest and non-productive forest areas totalling 22 100 hectares (13 percent of the TSA) are then deducted, leaving about 122 000 hectares (72 percent) of productive forest land managed by the BC Forest Service (BCFS). However, not all of the productive forest land base contributes to the timber harvesting land base due to a variety of factors discussed below.

The land base contributing to timber harvesting over the long term, as assumed in the base case, is 67 168 hectares, which is 55 percent of the productive forest land of the TSA and 41 percent of the total TSA area. The base case therefore excludes about 45 percent of the productive forest land as follows:

- newly protected areas

In this AAC determination I have assumed no contribution to the timber harvesting land base and thus the timber supply from any protected area which has been designated by legislation or by order in council. Through the VILUP two new protected areas in the Main TSA area, which were not explicitly removed from the timber harvesting land base in the BCFS analysis, have been designated by order in council within the TSA in 1995; they are the Cowichan River and Upper Qualicum parks. The total TSA area within the two parks is 350 and 47 hectares, respectively, and the total estimated area within the timber harvesting land base in the BCFS analysis is about 200 and 40 hectares, respectively.

Further implementation of VILUP has also led to an April 1996 orders in council which established 7 new "special features" parks and ecological reserves from the Arrowsmith TSA. These new protected areas total 840 hectares, 470 hectares of which are estimated to have been in the timber harvesting land base in the BCFS analysis.

In addition, some TSA land has been exchanged for land which is being added to the protected areas system. Recently, an Amendment to TFL 25, through Instrument Number 56, April 10, 1996, transfers 712 hectares of total area from the Arrowsmith TSA to TFL 25 in exchange for both crown and private lands needed for the Juan de Fuca Marine Trail Park (created April 4, 1996 by OIC 454). The amount of timber harvesting land base which must be removed from the BCFS analysis to account for this land exchange is unknown at present. If it is assumed that the TSA proportion of total area to timber harvesting land base is the same as in the area transferred to TFL 25 then there will be a further reduction to the timber harvesting land base of about 285 hectares (0.4 percent). While this reduction in the timber harvesting land base is not well quantified I must still consider it to represent some risk to the timber supply as noted below in my "Reasons for decision."

The protected areas designated by order in council within the Arrowsmith TSA will no longer contribute to the timber supply in the TSA. I therefore must accounted for the removal of 710 hectares of new protected areas, from the timber harvesting land base (1 percent). This represents a downward pressure on short- and long-term timber supply within the TSA and I have taken this into account in my "Reasons for decision."

In addition, as noted below in "Clayoquot Sound" there are 908 hectares of new protected area that have been excluded from the timber harvesting land base and this has been accounted for in the determination of a harvest level for Clayoquot Sound.

- environmentally sensitive areas

Environmentally sensitive areas (ESAs) are mapped as part of the BCFS provincial forest inventory for concerns such as unstable soils and important wildlife habitat. Portions of ESAs were excluded from the timber harvesting land base in the BCFS analysis. The reductions applied to each ESA depended on the nature of the sensitivity (e.g. soils, wildlife, recreation) and its rated sensitivity. For example, 90 percent of highly sensitive (unstable) soils (Es1) and 20 percent of moderately sensitive soils (Es2) were reduced from the land base. As a result, the total ESA reductions applied are 21 979 hectares, which is nearly 50 percent of the total ESA area identified in the inventory file.

Approximately 15 400 hectares of the total ESA reduction (70 percent) is due to sensitive soils. The sensitive soil areas identified are based on terrain mapping and the reductions that were applied were those recommended by the BCFS regional terrain specialist based on harvesting experience in these areas. Some gully areas, which are not mapped, may now be a concern under the Forest Practices Code. However, the BCFS terrain specialist believes the reductions applied to Es2 areas in the analysis should provide sufficient allowance to account for these unmapped gullies and I accept his assessment.

The Arrowsmith TSA offers numerous recreational opportunities and, given its close proximity to major BC population centres, receives high levels of use. The west coast of southern Vancouver Island is well known for its marine (offshore), beach and hiking opportunities. The east coast has a well developed highway and road network used extensively for touring and also provides access for hiking, angling, boating and other activities. At the time of the BCFS analysis, a recent recreation inventory for the TSA was available and was used to determine reductions to the land base for recreation using *Procedures for Factoring Recreation Resources into Timber Supply Analyses*. This resulted in 2258 hectares of the total ESA reduction being removed from the productive forest land base due to sensitive recreation sites and features .

Approximately 1460 hectares of the total ESA reduction is due to high wildlife habitat value. No other specific reductions for wildlife occurred in the analysis. This issue will be discussed further below in *wildlife habitats*.

This reduction for ESAs is based on relatively current mapping and BCFS district staff are satisfied that these reductions reflect current practices in the TSA. I therefore accept the ESA mapping and reduction factors used in the BCFS analysis as appropriate for the purposes of this determination.

- uneconomic and inoperable areas

In the BCFS analysis, reductions to the productive forest land base were made to account for uneconomic and inoperable areas. For the eastern portion of the Port Alberni Forest District (Nanaimo Supply Block) the inoperable areas were identified based on 1988 operability mapping. In the western portion of the Port Alberni Forest District the land base was divided into five operability classes based on characteristics such as slope, topography, difficulty of road access, soil stability, stand size and volume. Some of the key criteria are as follows:

- conventional harvesting zone: must have 400 cubic metres per hectare or greater stand volumes at maturity and less than a 300-metre yarding distance;
- unconventional longline harvesting zone: must have 600 cubic metres per hectare or greater stand volumes at maturity and greater than a 300-metre yarding distance;
- unconventional helicopter harvesting zone: must have 600 cubic metres per hectare or greater stand volumes at maturity within a maximum of 1.5 to 2 kilometres flight distance, depending on forest type;
- uneconomic areas: areas that have 300 cubic metres per hectare or greater stand volumes at maturity but do not meet the criteria for the three operable areas; and
- inoperable areas: either stand volumes less than 300 cubic metres per hectare at maturity or other constraints such as being physically inaccessible.

All areas currently classified as uneconomic or inoperable were entirely excluded from the timber harvesting land base used in the base case to reflect current performance. This resulted in 17 427 hectares being deducted including 12 582 hectares (72 percent) for inoperable areas and 4845 hectares (28 percent) for uneconomic areas. Port Alberni Forest District staff are satisfied that the assumptions for operability are reasonable and reflect current practice.

There are no specific deductions for uneconomic or inoperable areas in the Duncan Forest District portion of the TSA. Most of the terrain and stand conditions in this district are physically and economically suitable for harvesting at maturity, and BCFS staff are satisfied that other land base reductions, such as for non-merchantable (low site) stands, are sufficient to account for inoperability.

I have reviewed the operability assumptions in the BCFS analysis with district staff and believe they represent a reasonable estimate of the uneconomic and inoperable areas for use in this determination.

- non-merchantable stands

Mature stands (greater than 120 years of age) with an average tree height less than 20 metres are considered to contain timber volumes too low to be merchantable. Stands classified as "low-site" in the forest inventory have too low a productive potential to be considered merchantable. In the BCFS analysis, these stands that are not currently harvestable because they either contain low timber volumes or have low productive potential for timber were removed from the productive forest land base. The area removed in the analysis for non-merchantable stands is 4372 hectares.

BCFS district staff believe the base case reflects current practices with respect to merchantability. I consider the method used to account for unmerchantable stands to be reasonable for use in this determination.

- deciduous stands

In the base case, 3832 hectares of predominantly deciduous stands (also called deciduous-leading) were excluded from the productive forest land base. Broad-leaved species are defined in the BCFS analysis as deciduous stands. In 1994, at the time the data package for the BCFS analysis was assembled, there were no licenses issued for the harvest of predominantly deciduous stands.

After assessing the supply of predominantly red alder stands in the TSA, and advertising for applications to harvest these stands, the provincial government awarded a 15-year non-replaceable forest licence to Coast Mountain Hardwoods Inc. (CMH) in May 1996 for 6300 cubic metres per year of red alder. This harvest level was determined through review of CMH's 5-year and 15-year operational plan.

CMH's 15-year plan identified 827 hectares of potentially harvestable stands and CMH believed a higher AAC was warranted. BCFS district staff reviewed each stand and estimated that 289 hectares likely could be harvested. This review assessed whether the stands were truly alder-leading, whether sensitive areas were present, whether a woodlot licence was proposed, and also assessed compliance with Code riparian requirements. The average volume of all the red alder stands in the forest inventory which meet the eligibility criteria of the forest licence was estimated to be 326 cubic metres per hectare. The forest licence harvest level was therefore derived by multiplying this average volume times the 289 hectares which yields an overall 15-year volume estimate of 94 214 cubic metres, or an annual average harvest of nearly 6300 cubic metres.

BCFS district and regional staff are satisfied that these estimates provide a reasonable accounting for the available timber supply from predominantly deciduous stands in the TSA. Since the base case has excluded these stands, I recognize this is an addition to short term timber supply by 6300 cubic metres, and I have taken this into account in my determination as discussed in "Reasons for decision."

- roads, trails and landings

Existing major roads are classified and mapped in the forest inventory file. However, many roads, trails and landings are too small to be classified. Since these disturbances result in unproductive land, reductions were made in the BCFS analysis to account for roads, trails and landings.

To account for existing unclassified roads, trails and landings, the Port Alberni Forest District applied a 7-percent reduction to all stands less than 100 years of age to account for the already roaded portions of the district (about 35 percent in the west and 85 percent in the east). The reduction applied was based on site degradation estimates from a silvicultural audit of harvesting activities from 1989 to 1992.

Duncan Forest District staff estimate that about 80 percent of the operable land base in their portion of the TSA is roaded. For these areas, district staff believe a 3-percent reduction (to stands less than 100 years of age) is reasonable, given the many non-TSA roads, such as public highways and private roads, that provide access to Crown land within this part of the TSA.

These estimates led to a combined 2180-hectare reduction from the productive forest land base in the BCFS analysis to account for existing roads, trails and landings.

To account for losses to future roads, trails and landings in the unroaded operable portions of the TSA, the BCFS analysis applied a reduction of 7 percent in the conventional harvesting zone and 1 percent in the unconventional harvesting zone to stands greater than 100 years of age after the initial harvest of these areas. In the BCFS analysis, the net area eventually removed from the land base to account for future roads, trails and landings was 1508 hectares.

Forest Renewal BC's road rehabilitation program is anticipated to reduce site degradation. If this program continues it could constitute an upward pressure on timber supply by increasing the productive forest land base. This would not affect short-term timber supply, but could represent a gain in the medium- and long-term. This can be assessed in future determinations as better information is gained about the timber supply implications of this program.

In the meantime, for this determination, I am satisfied that the BCFS analysis provides a reasonable accounting for existing and future roads, trails and landings.

- timber licence reversions

Timber licences (TLs) are old tenure arrangements that give a licensee exclusive rights to harvest merchantable timber within the licence area. Once these areas have been harvested, all future harvesting rights revert to the Crown and future harvests from the area will then contribute to the harvest for the TSA which contains the timber licence area. Accordingly, in the BCFS analysis, timber licences in the Arrowsmith TSA are assumed to be included in the timber harvesting land base only after harvesting of the existing stand takes place.

According to the forest inventory file the total area of TLs not yet harvested in the Arrowsmith TSA is 9092 hectares, however only 7090 hectares are considered operable. Thus in the BCFS analysis, it was assumed that 7090 hectares of timber licence area would be harvested and then revert to the timber harvesting land base. BCFS district staff estimate, using inventory records, that the timber harvesting land base in the unreverted TLs consists of 4290 hectares of mature or not-satisfactorily-restocked (NSR) areas, while the remaining 2800 hectares consists of forests between 1 and 30 years of age.

In May 1996 the district staff evaluated the timber licence reversion schedule and this updated schedule was incorporated into the base case completed at that time. This reversion schedule for TLs with mature stands is applied over the period between 11 and 60 years from now when the current TL harvesting is projected to be completed and the land thereby reverted to the TSA. This reversion schedule is slower than the historical rate of harvest in TLs since 1987. This slower rate is assumed in the analysis to reflect reduced harvesting within Clayoquot Sound and more restrictive development plan approvals in 1994.

The forest industry's submission expressed concern about the reversion schedule assumed in the 1995 BCFS timber supply analysis (note that the 1996 BCFS analysis reflects changes to the reversion schedule). Because there is some uncertainty about the rate of harvest within TLs, the BCFS undertook a sensitivity analysis to determine the impact of accelerating or delaying the reversion of TL areas with mature stands or NSR by 10 years. The analysis shows no sensitivity to these reversion schedule changes in the first five decades and only negligible impact on timber supply (about 1 percent) in the medium term.

Although there is uncertainty in the reversion schedule within the TSA, particularly in Clayoquot Sound, the sensitivity analysis indicates that some uncertainty does not introduce risk to short-term timber supply. I therefore accept the base case assumptions as modelled for use in this determination. As new information becomes available regarding TL reversion, this can be accounted for in future determinations.

- *woodlots*

As discussed under "History of the AAC", allocated (issued) woodlots are administered separately from the remainder of the TSA, and their AAC is excluded from the AAC determined by the Chief Forester under Section 7 of the *Forest Act*. In 1994, when the base case was developed, there were 1327 hectares of issued woodlots with a total AAC of 9750 cubic metres; this area was removed from the land base. Since 1994, three new woodlots have been issued totalling 823 hectares. The AAC determined for two of the woodlots, totalling 521 hectares, is 1500 cubic metres, and an AAC of 2500 cubic metres is estimated for the third woodlot. These three new allocated woodlots represent a downward pressure on short term timber supply within the TSA of almost 1 percent, as their AAC administration now falls outside of Section 7 of the *Forest Act*. I have taken this into account in my "Reasons for decision."

- *other factors affecting the size of the land base*

Definition of the base case timber harvesting land base incorporated reductions for:

- 26 hectares of non-commercial brush,
- 175 hectares for the Cowichan Lake Research Station,
- 634 hectares for Camper Creek (as Crown land is being transferred from the TSA to TFL 46 as part of a land exchange),
- 71 hectares for Parkinson Creek Park,
- 234 hectares for several experimental plots (where the nature of the research is expected to preclude harvesting volumes being available for processing),
- 85 hectares for the new Island highway, and
- 2448 hectares for riparian areas.

I discuss the appropriateness of the reductions for riparian areas below under *riparian habitats*. BCFS staff have reviewed the other reduction factors with me and I accept them as appropriate for this decision.

Existing forest inventory

The Arrowsmith TSA timber harvesting land base mainly consists of stands dominated by Douglas-fir, cedar and hemlock. Less common are stands dominated by balsam (true firs), spruce and pine. Overall, there is an almost even split between stands younger and older than the *minimum harvestable age* (see that section below). Younger stands dominated by Douglas-fir are more common in the eastern portions of the TSA, while older stands dominated by western red cedar and western hemlock are more common on the west side. The east/west split of younger and older stands has implications for distribution of harvest, commercial thinning potential and landscape-level biodiversity, and these issues are discussed elsewhere in this rationale.

- age of inventory

The entire Arrowsmith TSA was re-inventoried in 1988. Inventory updates for depletion due to harvesting were completed in 1992/93 and growth was projected to 1994 for the BCFS analysis. The base case also employed more recent information where available including: (i) a 1992 re-inventory of the Toquart River watershed, and (ii) 1994 inventories of portions of some TFLs that were recently converted to TSA status.

- volume estimates for existing mature stands

In the BCFS analysis, existing mature stand volumes were estimated and projected using forest inventory attributes and the Variable Density Yield Prediction (VDYP) model. This is a generally accepted yield model based on many sample plots throughout B.C. The deciduous volumes, including alder, in all stands were excluded from existing yield tables.

The field work for an inventory audit for the TSA was undertaken in 1996 and the results have not been analyzed yet. A preliminary review of results by BCFS staff suggest that the average mature stand volumes as projected by VDYP from inventory information appear to be reasonably consistent with the mean ground measurements obtained from plots sampled in the TSA. In addition, an audit was undertaken on the Toquart River watershed re-inventory. This study found that volumes estimated using VDYP and the re-inventory were not statistically different from the ground measured volumes.

I am unaware of any information that suggests that the volume estimates for mature stands used in the BCFS analysis are unreasonable. Should the TSA inventory audit conclude, when completed, that volumes have been over-or-underestimated, then this can be addressed in the next determination. In the meantime, I accept the BCFS analysis assumptions for this factor as appropriate for use in this decision.

Expected rate of growth

- site productivity estimates

Inventory data includes estimates of site productivity expressed as "site index". Site index is a function of stand age and height. The productivity of a site largely 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 age at which those stands will satisfy mature forest cover requirements and reach a merchantable size (minimum harvestable age).

In the BCFS analysis, site indexes based on the existing mature stand characteristics were applied to the regenerating stands following harvest. I am aware that site indexes determined from both young stands (less than 30 years) and old stands (over 150 years) may not accurately reflect potential site productivity. In particular, findings in other areas of BC show that data from older stands may result in underestimation of site productivity for regenerated stands. A provincial project is examining this issue and is expected to provide information to help assess site indexes.

A 1993 consultant's report, *Site Index Evaluation in the Vancouver Forest Region*, evaluated site indexes in the Fraser and Strathcona TSAs and indicated that the productivity of regenerated stands can be significantly higher than indicated by the site index for the existing stands on the same site. BCFS Duncan district staff have observed volumes harvested from second-growth forests within the TSA which are considerably higher than yields predicted based on site index from the existing mature stands.

I note that if site indexes have been underestimated for regenerated stands, projections about the time required to reach green-up, the volumes in regenerated stands, and minimum harvestable ages could be affected; however, there would be no effect on the volume estimates for existing stands. I have no statistically reliable information upon which to base any adjustment to site indexes. However, I believe that it is likely that the site productivity is underestimated for regenerated stands.

When the results of the provincial project and the inventory audit for the TSA have been completed, these findings can be used to improve the estimates of site productivity for use in the next analysis and determination. In the meantime, I accept the BCFS assumptions regarding site productivity as the best available information for use in this determination.

- *volume estimates for regenerated stands*

The BCFS uses the Table Interpolation Program for Stand Yields (TIPSY) to estimate regenerated stand volumes for managed stands. Volume predictions using TIPSY are based on management of stocking density, full site occupancy and absence of significant brush competition. In the BCFS analysis, TIPSY was used for all regenerated stands and existing stands less than 30 years old.

TIPSY projections are initially based on ideal conditions, assuming full site occupancy and the absence of pests and diseases in the stand. Therefore, Operational Adjustment Factors (OAFs) are applied to account for losses of timber volume due to such factors as openings in stands that reflect unproductive areas like small swamps and rock outcrops (OAF1), as well as age-dependent factors such as pests, disease, decay, waste and breakage (OAF2). For most stands, the BCFS analysis used standard reductions of OAF1, 15 percent and OAF2, 5 percent. For Douglas-fir stands, an OAF2 reduction of 16.9 percent was used; this was based on a review by BCFS staff specialists of stands affected by root rot and their effect on harvestable yields. The OAFs used in the BCFS analysis are based on the best available information and I have no evidence before me to suggest that these estimates are not reasonable for use in this decision.

TIPSY uses the site index estimates derived from existing stands to generate regenerated stand volumes. As previously discussed under *site productivity estimates*, this introduces some uncertainty in estimating volumes for regenerated stands. To examine this uncertainty, sensitivity analysis assessed the timber supply implications of both increasing or decreasing volume estimates for regenerated stands by 10 percent. The analysis showed no impact on the short-term timber supply; however, there was a 6 percent medium-term and 10 percent long-term increase and decrease, respectively.

I have examined the assumptions used in the BCFS analysis to estimate regenerated stand volumes and find them to be appropriate. I am also mindful that some uncertainty in this factor does not introduce risk to short-term timber supply. Therefore I accept the BCFS assumptions regarding this factor as reasonable for the purposes of this determination.

- *minimum harvestable ages*

Minimum harvestable age is the age at which stands reach a harvestable condition. In the BCFS analysis, the two forest districts used different criteria to define this age; each was primarily based on local knowledge and experience, and district staff report that in each case the ages used reflect current practice. The minimum harvestable ages used in the BCFS analysis varied considerably ranging from 45 years to 169 years.

In the Duncan Forest District, where second-growth stands are predominant, minimum harvestable age was defined as the age at which a stand reaches a height of 30 metres.

In the Port Alberni Forest District, minimum harvestable ages were defined as follows:

- in the eastern portion of the TSA: the age at which a stand reaches a minimum diameter of 25 centimetres and a minimum volume of 300 cubic metres per hectare;
- in the western portion in the conventional harvesting zone: the age in which a stand's volume reaches 400 cubic metres per hectare; and
- in the western portion in the unconventional harvesting zone: the age at which a stand's minimum volume reaches 600 cubic metres per hectare.

For both districts, in stands which do not attain a height of 30 metres, an age was chosen beyond which no appreciable growth is expected to occur.

BCFS district staff indicated to me that the minimum harvestable ages assumed in the BCFS analysis are supported by actual harvest performance. Sensitivity analysis suggests that, even if there is some uncertainty in this factor, it does not significantly affect short term timber supply in this TSA and therefore does not introduce a great deal of risk to this decision. I therefore accept the BCFS assumptions as appropriate for the purposes of the determination.

- (ii) **the expected time that 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 has become restocked with a specified minimum number of acceptable well-spaced seedlings. The BCFS analysis assumed an average regeneration delay of 2 to 3 years. Current practice achieves a regeneration delay of 1 to 2 years in eastern portions of the TSA. In the western portion of the TSA the regeneration delay achieved ranges from 2 to 6 years, averaging 3 years for most planted areas. BCFS district staff are satisfied that the regeneration delay assumptions in the base case reasonably reflect current practice. BCFS staff discussed with me a number of impediments to regeneration in the Arrowsmith TSA and indicated that these situations have been reasonably accounted for in the base case. I am therefore satisfied that regeneration delay has been appropriately modelled for the purposes of this determination.

Not-satisfactorily-restocked area

The forest inventory file includes 1317 hectares of not-satisfactorily-restocked (NSR) area. This includes 1120 hectares of current NSR and 197 hectares of backlog NSR. BCFS staff report that approximately 650 hectares per year are harvested in the TSA, therefore the current NSR estimates are in keeping with the regeneration delay assumptions used to define the base case. The small area of backlog NSR within the TSA is considered to be uneconomical to plant and therefore the BCFS analysis assumed it would be regenerated over a 30-year period based on natural restocking. I find the BCFS analysis treatment of NSR to be reasonable for this determination as it reflects current practice.

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

Silvicultural treatments

-silvicultural systems

Clearcutting is the silvicultural system assumed in the base case and is practiced on most areas harvested in the Arrowsmith TSA. The size of cutblocks within the TSA have been decreasing and are now generally much smaller than the maximum of 40 hectares normally allowed under the Code. The average cutblock size in the TSA is now 12 to 15 hectares, with blocks as small as 2 to 5 hectares in some areas. In the Clayoquot Sound area, the 'variable-retention' system recommended by the Scientific Panel is expected to be practiced on most of the land base (see below, "Clayoquot Sound").

For the last three years, both districts have been pioneering alternative silvicultural systems such as clearcutting-with-reserves and seed tree cuts — and, to a much lesser extent, shelterwood and selection systems. Clearcutting-with-reserves is becoming a common practice in eastern portions of the TSA. In the west, reserves are frequently found, however, they are normally associated with environmental concerns such as riparian areas and gullies which are addressed elsewhere in this determination. BCFS district staff believe that small opening sizes and alternative silvicultural systems are the only way that many of the urban interface areas within the TSA can be harvested in a manner acceptable to the public.

On average, in a "clearcut with reserve" about 10 trees per hectare are reserved, although not all are potential crop trees. Because the harvesting practice of clearcutting with reserves is now common in the TSA, BCFS staff estimated that these silviculture-related reserves represent approximately 1 percent of the available timber supply, and I have accounted for this reduction in my determination, as discussed in "Reasons for decision."

- incremental silviculture

The BCFS analysis did not assess the timber supply implications of any incremental silvicultural practices. Currently, these practices, including juvenile spacing (375 hectares per year), fertilization (550 hectares per year), pruning (550 hectares per year) and commercial thinning (350 hectares per year), are occurring within the TSA in both forest districts.

Because incremental silviculture is being employed within the TSA, BCFS staff conducted developmental growth and yield modeling to aid in an assessment of the sensitivity of the timber supply to these practices. While this work is considered developmental and not meant to replace the information used in the base case I am impressed with the research done to date and feel that this represents some optimism for the timber supply in this TSA.

One of the sensitivity analysis completed looked at commercial thinning and fertilization on all Douglas-fir stands within the TSA where these treatments appear beneficial; although I note that this represented a much larger treated area than is currently being practiced. This sensitivity analysis indicated no effect on short term timber supply, and minor harvest level changes in the medium term (2000 cubic metres lower) and long term (4000 cubic metres higher). In this sensitivity analysis, commercial thinning shifts part of the harvest to the eastern zone where second-growth stands are of suitable age rather than concentrating the harvest to western portions of the TSA where older stands are present. From an operational perspective this may be beneficial in order to more evenly disperse the level of harvesting within the TSA.

Incremental silvicultural practices could also work, to offset currently projected losses for root rot damage (OAF2), and could assist in managing visual quality and other non-timber objectives. This could result in medium- and long-term timber supply gains. A sensitivity analysis which explored the benefits of commercial thinning combined with changes to the guidelines for visual quality zones indicates no effect in the short term, but shows a significant 27 000 cubic metre (nearly 10 percent) gain in the medium term harvest level and an 11 000-cubic metre (3 percent) gain in the long term.

Another important consideration with respect to incremental silvicultural practices is that they could result in improved value of recoverable timber products independent of any timber supply benefits, for example pruning. Clear plans and further modeling of incremental silviculture practices is needed before the next determination in order to project the timber supply implications with higher confidence.

Although there is uncertainty with respect to the amount of incremental silviculture which may occur within the TSA and in the resulting timber supply impacts in the medium and long term, I am satisfied, based on sensitivity analysis, that the assumptions underlying the BCFS base case analysis do not introduce a risk of any significant over- or underestimation in the projected short-term timber supply.

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

Utilization standards

Utilization standards define the maximum allowable stump height, and the minimum breast-height (dbh) and top diameters used to calculate merchantable timber volumes. The BCFS analysis assumed 30-centimetre stump height, 17.5-centimetre dbh and 15-centimetre top diameter. The Vancouver Forest Region utilization policy has the same requirements for stands greater than 120 years of age, but changes the top diameter for harvestable stands less than 120 years of age to 10 centimetres. These policy requirements are specified in licence and cutting permit documents, and are being practiced within the TSA.

I recognize that the correct application of the Vancouver Forest Region utilization policy for immature stands represents only a very minor change, in the projected volumes on the existing stands less than 120 years of age, of less than one-half of a percent.

Decay, waste and breakage

The VDYP model used to project existing stand volumes incorporates estimates of the volume of wood lost to decay, waste or breakage. Decay losses are built into the volume estimates, and standard waste and breakage factors were applied in the BCFS analysis when developing the VDYP yield curves. These estimates of losses have been developed for different areas of the province based on field samples. For regenerated stands, as previously discussed (see *volume estimates for regenerated stands*), OAF2 reductions account for anticipated decay, waste and breakage. I accept the base case assumptions as these represent the best available information for 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 resource management objectives

The Ministry of Forests is required by the *Ministry of Forests Act* to manage, protect and conserve the forest and range resources of the Crown and to plan the use of these resources to ensure production and harvesting of timber and the

realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated. Accordingly, the extent to which integrated resource management (IRM) objectives affect the timber supply must be considered in AAC determinations.

- forest cover

In order to protect forest resource values such as wildlife and water quality, forest cover objectives are developed that prescribe the "green-up" stand conditions that should exist on a reforested site before timber on adjacent areas may be harvested. The forest cover objectives also describe a maximum amount of area allowed at any time to be below the green-up age. This provides for a distribution of harvested areas and retained forest cover across the landscape in keeping with overall management objectives.

The BCFS analysis incorporates several different management zones on the timber harvesting land base. The majority of the TSAs timber harvesting land base (52 percent) is in the general IRM zone. The forest cover objective developed for this zone allows no more than 25 percent of the timber harvesting land base to be under the cover of stands that are shorter than a green-up height of 3 metres. This objective is commonly referred to as a "four-pass" harvesting regime.

About 3 percent of the TSAs timber harvesting land base is in the unconventional (longline or helicopter) harvesting zone in which a "five-pass" harvesting regime is assumed; allowing no more than 20 percent of the area to be under the cover of stands that are shorter than the 3-metre green-up height.

About 45 percent of the TSAs timber harvesting land base are in various *visual quality* zones (see that section below).

Sensitivity analysis of changes in management assumptions revealed that timber supply is affected by changes in forest cover requirements and green-up ages. For example, if green-up ages were 5 years longer, the initial harvest levels would drop to 369 000 cubic metres (20 percent below the base case). If green-up ages were 5 years shorter, this would not affect short term timber supply, but would increase timber supply in the medium and long term by 11 and 5 percent, respectively.

Another sensitivity analysis examined shifting the adjacency forest cover requirements in the IRM zone by changing from a 4-pass to either a 3-pass or 5-pass harvesting regime. For a 5-pass regime, the initial harvest level would drop to 436 000 cubic metres (9 percent below the base case). There was not short-term change to the harvest level under a 3-pass regime.

I am satisfied that the base case adjacency forest cover assumptions are appropriate for the IRM zone. I discuss below the appropriateness of the base case forest cover assumptions for other considerations such as visual quality.

- *biodiversity*

Biological diversity, or biodiversity, is 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. A major consideration in managing for biodiversity at the landscape level is leaving sufficient and appropriately located mature forests for species dependent on, or strongly associated with, old-growth forests. At the stand level, retention of wildlife tree patches and coarse woody debris are the major biodiversity concerns. Current implementation of the Code calls for immediate consideration of stand-level biodiversity.

The Code was not in effect when the BCFS analysis was undertaken for this TSA, and the base case does not explicitly account for the management of stand- or landscape-level biodiversity. However, much of the 55 000 hectares (45 percent) of productive Crown forest area located outside the timber harvesting land base is available to help support biodiversity objectives, such as those for mature and old-growth forests. Also, several of the management guidelines within the timber harvesting land base used in the base case likely contribute to meeting biodiversity objectives.

Stand-level biodiversity practices, such as the retention of wildlife tree patches, individual live trees and coarse woody debris were not modelled in the base case. The retention of wildlife tree patches and individual live trees was common practice in the Arrowsmith TSA even before the Code came into effect. This practise is even more fully employed today. The *Biodiversity Guidebook* currently recommends the leaving of a higher percentage of wildlife tree patches because landscape-level biodiversity objectives have not been developed in the TSA. The percentage recommended for any given stand depends on the level of past harvesting without wildlife tree patch retention and the percentage of the biogeoclimatic subzone that is available for harvest.

BC Environment staff reviewed current stand-level biodiversity practices in the TSA based on the Code, the *Forest Practices Code Timber Supply Analysis* report and other information, and estimated the short- and long-term impacts on the volume available for timber harvesting to represent a 3 percent reduction. I reviewed these estimates with BC Environment and BCFS staff, and I find them to be a reasonable indication of the extent to which the base case has over-estimated the timber supply with respect to current stand-level biodiversity practices. I have taken this into account in my determination as discussed in "Reasons for decision."

Landscape-level biodiversity objectives include provisions to retain mature and old-growth forests and, where appropriate, to establish Forest Ecosystem Networks (FENs). These objectives have not yet been established in the Arrowsmith TSA nor are any mature or old-growth forest cover requirements assumed in the base case. Cooperative work is underway between BC Environment and the BCFS in the TSA to establish these objectives.

BC Environment staff undertook a study of mature and old-seral-forest conditions within the TSA and considered potential assignments of biodiversity emphasis options consistent with the *Biodiversity Guidebook*. This study noted that, in general, the western portion of the TSA (within Natural Disturbance Type, NDT 1) has mature and old-seral forests in sufficient abundance to meet the guidelines and hence there does not appear to be any concern relative to this area. However, in eastern portions of the TSA (within NDT 2) where more harvesting has historically taken place, existing mature and old-forest conditions are already well below the guidelines. For example, there are only 15 hectares (less than 0.5 percent) of old-growth Coastal Douglas-fir forests in NDT 2 yet the guideline for the low biodiversity emphasis option is to maintain at least 9 percent in older forests. BC Environment staff are therefore, concerned about the ability to maintain biodiversity because of the extent of past harvesting, particularly in eastern portions of the TSA. While I share some of this concern, I note that the *Biodiversity Guidebook* allows the recommended guidelines to be reached in more than one rotation in situations such as occurs in the eastern portions (NDT 2 areas) within the TSA.

I recognize that the development and implementation of landscape-level biodiversity objectives within the TSA may result in downward pressure on timber supply, the magnitude of which cannot be estimated at this time. I understand that work is underway to develop landscape-level biodiversity objectives in the TSA, and when completed, this can be incorporated into the next determination.

- riparian habitats

Riparian habitats occur along streams and around lakes and wetlands. The Code requires the establishment of riparian reserves that exclude timber harvesting, and riparian management zones that restrict timber harvesting in order to protect these important habitats. Based on application of the Coastal Fisheries/Forestry Guideline the BCFS analysis, which was carried out prior to the proclamation of the Code, accounted for the protection of riparian and stream values by deducting 2448 hectares from the productive forest land base. However, given the Code riparian regulations and guidebook that are now in effect, the BCFS analysis does not adequately account for current riparian habitat requirements.

BC Environment staff, working with BCFS staff, estimated the additional timber harvesting land base required to implement Code riparian provisions, relative to the base case, to be 5 percent. This was estimated through a review of topographic and fish inventory maps for the Arrowsmith TSA, and by comparison to riparian impact assessments undertaken in the Soo and Strathcona TSAs and TFL 46 (where incremental impacts ranged from 3 to 6 percent).

While there is an absence of a definitive study in the Arrowsmith TSA, based on the experience in other nearby areas, and on the review conducted by staff, I have accounted for a downward pressure on timber supply of 5 percent in my determination to account for Code riparian provisions, as noted in "Reasons for decision."

- wildlife habitats

Southern Vancouver Island, where the Arrowsmith TSA is located, contains a great diversity of fish and wildlife species and habitats. Native mammals include black-tailed deer, Roosevelt elk, black bear, wolf, cougar, Vancouver Island marmot, beaver, pine marten, wolverine and many other species. Native birds associated with older forests include marbled murrelets, goshawks, great blue herons and pileated woodpeckers. The Code defines "wildlife" to include vertebrates (mammals, birds, reptiles and amphibians), fish, crustaceans and molluscs, and threatened or vulnerable invertebrates or plants.

The biodiversity and riparian provisions of the Code are intended to provide for the needs of most wildlife species. However, some wildlife require special additional provisions in order to ensure their protection. At present a *Managing Identified Wildlife Guidebook* is being prepared which will provide Code direction on the management of "red- and blue-listed" species (i.e. species considered to be "at risk"). There are 19 such species in the Arrowsmith TSA according to a recent list developed by BC's Conservation Data Centre.

As noted above in *environmentally sensitive areas* the BCFS analysis deducted 1460 hectares from the productive forest land base to account for wildlife based on ESA classifications. The forest cover provisions for the IRM zone reflect current management for deer and elk. However, the base case assumptions do not include any special additional provisions for red- and blue- listed species. For species that are considered old-growth dependent and "at risk," such as the marbled murrelet and Keen's long-eared myotis, additional management guidelines may impact timber supply.

In summary, considerations for wildlife will largely be accommodated through biodiversity and riparian management under the Code. However, the base case did not address the management of red- and blue- listed species and therefore may have underestimated the timber supply impacts of wildlife considerations. I am aware that this represents an unquantified downward risk to timber supply in the short- and long-term.

- watershed hydrology

The BCFS analysis did not include a community watershed zone. At the present time, a total of 3558 hectares of the Arrowsmith TSA lies within designated community watersheds on the east coast. BCFS staff estimate that about 2450 hectares (69 percent) of the community watershed area is in the timber harvesting land base which represents around 3 percent of the TSAs timber harvesting land base.

Watershed assessment procedures have been developed to help forest managers understand water-related issues and to recognize the possible hydrologic implications of proposed forest-related development. These procedures are intended for community watersheds and high fish value watersheds where problems are known or suspected and where there has been considerable development.

In addition, road rehabilitation and watershed restoration work under Forest Renewal BC may mitigate some watershed concerns. However, experience is necessary to determine if rehabilitation and restoration efforts are in fact reducing the impacts from harvesting in watersheds.

In addition to community watersheds, many other watersheds are important within the TSA for their fisheries values. The majority of these are on the west coast and are characterized by steep slopes, the presence of potentially unstable terrain, high drainage densities, high precipitation, and high road densities. This combination of characteristics renders these west coast watersheds particularly sensitive to the impacts of forest harvesting activities. However, given the sensitivity of these areas it is likely that a proportion of this area is already removed from the timber harvesting land base. In addition, the watershed assessments are not complete for these watershed, thus I cannot draw any conclusions about the effects of managing these watersheds for fisheries values.

Until watershed assessments are undertaken, mitigation measures better known, and the acceptable level of risk determined for community watersheds, impacts on timber supply cannot be estimated. As the timber supply impacts of watershed hydrologic considerations are better known, they can be considered in future determinations.

- *visual quality*

Managing visual quality is important for recreation and tourism values in parts of the TSA, particularly for readily-viewed areas near major population centres and along major highway and marine corridors. Recent studies have shown that, on average, harvested areas which are visually sensitive must have trees which are at least 5 metres tall before they appear "greened-up".

Based on current management, the BCFS analysis has approximately 45 percent of the timber harvesting land base located in one of three visual zones (retention, partial retention and modification) where a 5-metre visually effective green-up height is assumed. The maximum area allowed to be "disturbed" (less than visually effective greened-up height) for each visual quality zone follows provincial guidelines as recommended in *Procedures for Factoring Recreation Resources into Timber Supply Analyses*.

If site indexes are underestimated (see *site productivity estimates*), then the time to reach visually effective green-up heights of 5 metres will be less than assumed in the BCFS analysis. This would not change the short-term timber supply however it may increase the mid- and long-term harvest levels depending on the extent to which green-up ages are shortened.

The Minister's memo of February 26, 1996 (see Appendix 4), asks that pre-Code constraints applied to timber supply in order to address visual quality be re-examined when determining AACs in order to ensure that they do not unreasonably restrict timber supply. Together with BCFS staff, I therefore examined in considerable detail the base case assumptions regarding visual quality. BCFS staff indicated that the visual zones, allowable disturbance area, and green-up ages needed to reach visually effective green-up heights are reasonable given the high visual sensitivity of much of the TSA.

In the meantime, I accept the BCFS analysis for visual quality is reasonable for use in this determination, as it reflects current management practices within the Arrowsmith TSA.

- *cultural heritage resources*

Cultural heritage values include archaeological values that pre-date European influence and more recent historic values. Sites of archaeological or traditional use are located throughout the TSA. Requirements for these areas were not specifically modelled in the BCFS analysis; however, many of these sites are already protected by guidelines or have been removed from the land base for other forest values, such as riparian habitat. Through the consultation process under the Aboriginal Rights Policy, First Nations are requesting that many proposed cutblocks be deferred until an Archaeological Impact Assessment and Cultural

Heritage Resource Inventories are completed. This situation mainly occurs on the western portion of the TSA where old-growth harvesting is prevalent.

District staff note that historically there has been extensive use by First Nations' of many areas of the Arrowsmith TSA; as a result, archaeological features are abundant throughout the TSA. In particular, many culturally modified trees have been identified. These trees have been altered by aboriginal peoples as part of their traditional use of the forest resource. Culturally modified trees (CMTs) are protected by the Conservation Heritage Act, and they and the areas immediately adjacent to them are not likely to contribute to the timber harvesting land base. It is likely that an increasing number of archaeological sites will be encountered in the TSA as inventories are now also finding CMTs at higher elevation where trees may have been modified to stake First Nations' territories. At this time, I have insufficient information to enable me to quantify any associated impacts on timber supply. I nevertheless recognize there will likely be an impact from protecting the areas around CMTs and I have allowed for this in my determination as an unquantified downward pressure on short-term timber supply, as noted in "Reasons for decision." In the meantime, as noted in "Guiding Principles...", I fully expect that areas of cultural or archaeological significance, and traditional uses, will be considered by the District Manager in his administration of the AAC determined.

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

Other information relating to capability to produce timber

- Vancouver Island Land Use Plan

The Vancouver Island Land Use Plan (VILUP) was approved by the provincial government in June 1994, after the assumptions that support the BCFS analysis were developed. Several new protected areas have been created as a result of the VILUP the impacts of which have been accounted for above in newly protected areas.

Through the VILUP, a total of 14 800 hectares of the TSA are classified as Low Intensity Area (LIA). Currently, the VILUP is being further implemented through the Vancouver Island Resource Targets (VIRT) process. This process is also identifying Enhanced and General Management Zones.

In addition, an expansion of two existing parks is under negotiation as part of the VILUP. About 60 hectares of the TSA may also be removed for the Juan de Fuca Marine Trail Park, and 30 hectares may be removed for Mt. Wells Regional Park. Additional "special features" protected areas that include private land may also involve the TSAs crown land for land exchange purposes.

In keeping with my guiding principles, until such implementation decisions are made, it is impossible to properly assess the overall impact of the land-use decision. The legislated requirement for five-year AAC reviews will ensure that future determinations address ongoing plan implementation decisions.

- *TSA fragmentation*

The historic development of southern Vancouver Island has resulted in a complex and fragmented distribution of land ownership and forest tenures. Many of the fragmented parcels of the Arrowsmith TSA on the east coast are part of the interface with urban and rural development which results in demands to retain green space for recreation and the protection of other non-timber values. In addition, many of the fragmented parcels are adjacent to TFL or private managed forest lands which are not managed as part of the TSA. This leads to planning difficulties as the area may not be available for harvest as assumed in the timber supply model due to green-up and adjacency requirements as influenced by the harvesting of adjacent non-TSA lands.

BCFS district staff believe this land fragmentation is a factor that warrants separate consideration in the timber supply review for the Arrowsmith TSA. Even after accounting for the non-timber values previously described in this rationale, such as biodiversity and visual quality, district staff consider this to have an important incremental impact on timber supply.

To address this concern, district staff recognized and assessed individually the 71 fragments located in the eastern portion of the TSA—these ranged in size from less than 1 hectare to 4227 hectares, with a mean fragment size of 360 hectares. The 71 fragments totalled 25 546 hectares. Each fragment was assessed to determine the management regime that appeared to best fit each parcel. This resulted in about 25 percent of the total area of the fragments being shifted to a more restrictive management regime. The main change was that a number of parcels located in the IRM zone, where a 4-pass harvesting regime was assumed in the base case, were assessed as needing a 5-pass harvesting regime due to the delay in time, of availability of these parcels. Sensitivity analysis indicates these changes results in a 3-percent impact on short-term timber supply.

In another sensitivity analysis, a 10-year deferral was applied to all fragments now assumed to be under a 5-pass harvesting regime, and 481 hectares were assumed to not contribute to the timber supply to account for extremely sensitive areas. When combined with the management regime changes noted above these deferrals result in a total 4-percent impact on short-term timber supply.

BCFS district staff believe that the shift in management regime and removal of some parcels from the contribution to timber supply best reflects current practices within the TSA. It is not within my authority to exclude these areas from the TSA, but I do acknowledge that they are unlikely to contribute to short-term timber supply. I am impressed by the thoroughness of their assessment, in that each parcel was individually evaluated and I accept the sensitivity analyses that show a 3- to 4-percent downward pressure on short-term timber supply due to the TSA fragmentation issue. I have accounted for this in my determination, as noted in "Reasons for decision."

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

Harvest flow alternatives

The nature of the transition from harvesting old-growth forests to harvesting second-growth forests is a major consideration in determining AACs for areas with a significant old-growth component, such as the Arrowsmith TSA. In the short term, the presence of relatively large volumes of older wood permits harvest levels above long-term levels without jeopardizing the future stability of timber supply. In keeping with the objectives of good forest stewardship, AACs in British Columbia have been and continue to be determined so as to ensure that current and mid-term harvest rates will be compatible with a smooth and orderly transition towards the usually (but not always) lower long-term harvest rates. Thus, timber supplies should remain sufficiently stable that there will be no inordinately adverse impacts on current or future generations. To achieve this, the rate set 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.

As discussed above under "The role of the base case," the 1996 corrected base case, used for this rationale, projected an initial harvest level of 479 150 cubic metres per year being maintained for 10 years followed by a 12-percent per decade decrease to a medium-term level of 277 000 cubic metres reached in 50 years from now. Beginning 140 years from now, the harvest level gradually increases to a long-term level of 337 000 cubic metres per year.

Many other harvest flow patterns are possible, and the BCFS analysis included several alternative harvest flows. Two alternatives looked at changing the rate of decline. The use of a 15 percent rate of decline did not change the initial or long-term harvest levels, but the medium-term level was reached sooner (in 40 years) and was 4 percent higher (287 000 cubic metres). The use of a 10 percent rate of decline immediately reduced the initial harvest level by 4 percent to 460 000 cubic metres; also, the medium-term level was reached 10 years later (at 60 years from now), but with no change to the long-term harvest level.

Two additional alternatives were predicated on starting with, and attempting to maintain, the long-term harvest level for as long as possible. One alternative maintains the long-term harvest level for 80 years, but this resulted in erratic and disruptive medium-term levels, dropping as low as 235 600 cubic metres before reaching the long-term level in 150 years from now. The final alternative was an attempt to smooth out these irregular medium-term fluctuations. In this projection the long-term level (also the initial harvest level for this alternative) could be maintained for 50 years before dropping to a medium-term level of 296 200 cubic metres, which could be maintained until 140 years from now.

The *Arrowsmith TSA Socio-Economic Analysis* (SEA) examines the economic, social (communities and First Nations), environmental and outdoor recreation implications of two potential harvest levels (Scenarios 1 and 2) and I have considered this information in my determination.

The SEA uses as a reference point the TSAs average harvest level for 1991 through 1994, of 417 000 cubic metres. The SEA estimates that this harvest level supports 363 person-years of forest sector employment ("direct" employment) within the TSA and 560 person-years of direct employment province-wide, and would generate \$23 million per year in provincial government revenues.

Scenario 1 in the SEA is the 1995 base case described in the *Arrowsmith TSA Timber Supply Analysis*, which has an initial harvest level of 469 000 cubic metres (52 000 cubic metres above the 1991-94 average). In order to illustrate a range of impacts, the SEA also presents Scenario 2, with an initial harvest level of 385 000 cubic metres (32 000 cubic metres below the average harvest level), which is based on the long-term level defined in the 1995 BCFS analysis.

Relative to the 417 000 cubic-metre level, the SEA indicates that Scenario 1 would support for the first decade about 45 more person-years of direct employment within the TSA and about 70 more province-wide. Scenario 1 would also generate nearly \$3 million per year in additional provincial government revenue for the first 10 years. Scenario 2 is estimated to support, for the first decade, 28 fewer person-years of direct employment within the TSA and 43 fewer province-wide, and to generate about \$1.8 million less in provincial government revenues per year. The SEA also examines the possible longer term implications associated with the two harvest flow scenarios.

I have examined the harvest flow alternatives presented for this TSA, as well as the socio-economic implications of the two scenarios described in the SEA and I have been mindful of this information in my decision. I am satisfied that the base case harvest flow pattern reasonably balances short- and long-term socio-economic objectives under the base case management regime. I have therefore relied on the base case as a starting reference point in my "Reasons for decision."

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

Timber processing facilities

The SEA report indicates that in 1994 58 percent of the Arrowsmith TSAs fibre was processed by southern Vancouver Island mills. A small portion, about 5 percent, was transported to processing facilities on northern Vancouver Island. The remaining 37 percent was shipped to BC's lower mainland for processing. The discussion below further describes the flow of the TSAs harvest in 1994 to various timber processing facilities.

About 50 percent of the TSAs harvest is through the Small Business Forest Enterprise Program (SBFEP) and a Timber Sale Licence where the timber is processed by local mills on southern Vancouver Island.

International Forest Products (Interfor) obtains about 33 percent of the TSAs harvest through a replaceable forest licence. The sawlogs are sent to Interfor's sawmilling and remanufacturing facilities on the lower mainland where harvest from the Arrowsmith TSA accounts for about 4 percent of their overall mill fibre requirements. Pulp logs were sent to either the Gold River or Port Alice pulp mills.

Coulson Forest Products receives about 20 percent of the TSAs harvest from a forest licence (50 500 cubic metres) and a SBFEP sale (30 500 cubic metres). The SBFEP sale supplies about one-third of the fibre requirements of Coulson's recently established mill in Port Alberni. The timber harvested from the forest licence is processed on the lower mainland.

The Toquaht First Nation develops about 6 percent of the TSAs harvest through a temporary non-replaceable forest licence. A sawmill on the Macoah reserve processed about 25 percent of this volume, a small amount was sold locally, and the remaining volume was acquired by Interfor and sent to the lower mainland. Toquaht plans to eventually process 50 percent of their licence volume at the Macoah sawmill.

In general, the timber harvested in the TSA represents a small portion of a much larger pool of wood harvested from many sources (other TSAs, TFLs, and private land) which collectively provide fibre for various timber processing facilities throughout Vancouver Island and elsewhere on the Coast, such as in the lower mainland area. For example, only about 8 percent of the wood harvested on southern Vancouver Island is from the TSA (i.e. most wood is harvested from private land and TFLs).

- (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

Economic and social objectives

The Minister has expressed the economic and social objectives of the Crown for the province (letter and memorandum to Chief Forester attached as Appendices 3 and 4), and I understand these to apply to the Arrowsmith TSA. They are consistent with the objectives stated in the Forest Renewal Plan and include good 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.

In addition, in a letter dated September 17, 1996 (see Appendix 5), the Minister of Forests, recognizes the unique and complex history of forest management in the Clayoquot area. The minister expresses as an economic and social objective of the Crown a confirmation of government's intention that timber harvesting continue to be a forest management objective for the Clayoquot area and that this management be carried out in accordance with the Forest Practices Code and the recommendations of the Scientific Panel. I have taken this to mean the Scientific Panel's recommendations need to be considered in this determination. I have addressed this in the section of this rationale entitled "Clayoquot Sound".

The Minister stated in his letter, dated July 28, 1994 (Appendix 3), that "any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long run sustainability." He placed particular emphasis on the importance of long term community stability and the continued availability of good forest jobs. To this end, he asked that the Chief Forester consider the potential impacts on timber supply of commercial thinning and harvesting in previously uneconomical or inoperable areas. The latter would likely require the use of alternative harvesting systems, and to encourage this the Minister suggested consideration of partitioned AACs.

As discussed in the section on *incremental silviculture*, district staff conclude there is considerable potential for commercial thinning in the foreseeable future in eastern portions of the TSA with second-growth forests. However, the sensitivity analysis which assessed the timber supply implications of increased incremental silvicultural practices, including commercial thinning, illustrated that this does not increase short-term timber supply but does provide flexibility in harvest scheduling.

The operability classification (see *uneconomic and inoperable areas*) for the TSA is based on terrain factors and assumes the use of unconventional longline and helicopter systems, and I consider it to provide a reasonable appraisal of harvesting opportunities for this determination. I have no information to suggest that harvesting can occur in areas assumed in the BCFS analysis to be uneconomic or

inoperable. However, should these assumptions change, the new information can be accounted for in future determinations.

The Minister's July 28, 1994, letter suggested that the Chief Forester should consider important local social and economic objectives that may be derived from the public input in the timber supply review process. The Port Alberni and Duncan forest districts actively solicited public input through direct mail of the three timber supply review documents (the timber supply analysis, the SEA, and the discussion paper) to several organizations, businesses and interest groups; through open houses in five TSA city centres (38 people attended) and an information display; and through briefings provided to government agencies and MLAs.

The BCFS received 3 written submissions and 2 completed response forms that were part of the discussion paper. A major forest company commissioned a consultant to review the assumptions and methodology in the *Arrowsmith TSA Timber Supply Analysis* and to test alternative analysis assumptions. Appendix 6 provides a summary of the public input. I have reflected on this public input in my determination and wherever possible have tried to respond to the input throughout this document.

As previously discussed, based on public input and BCFS re-examination of the 1995 timber supply analysis, a 1996 BCFS analysis was undertaken which resulted in the corrected base case used in this rationale. Because the 1996 analysis and results were not significantly different from the original 1995 analysis, the need for additional public review was not considered necessary.

I recognize the many uncertainties associated with the timber supply analysis process which some have used to suggest the initial AAC should be lowered in some units, while others suggest the AAC should be maintained. However, in accordance with my "Guiding principles for AAC determinations," I have applied my judgement to the available information, taking uncertainties into account.

The employment and community impact issues are discussed in detail in the SEA, and I am familiar with the possible implications associated with different harvest levels (see above discussion under Harvest flow alternatives).

The Minister's memorandum of February 26, 1996, asks that pre-Code constraints applied to timber supply in order to meet visual quality objectives be re-examined when determining AACs in order to ensure that they do not unreasonably restrict timber supplies. As discussed under *visual quality*, together with district staff I have reviewed in detail the current practices in the TSA, relative to the BCFS analysis, and find them to be accounted for reasonably for the purposes of this determination.

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

Abnormal infestations and major salvage programs

Estimates for unsalvaged losses account for epidemic (abnormal) infestations and factors not recognized in yield estimates where losses are not recovered through salvage harvest programs. Timber volume losses due to insects and diseases that normally affect stands (endemic losses) are accounted for in inventory sampling for existing timber yield estimation or through other methods. Losses associated with second-growth stands are addressed with OAF 2 factors applied as discussed under *volume estimates for regenerated stands*.

A total annual allowance of 3062 cubic metres for all non-recoverable (unsalvaged) losses was made in the BCFS analysis comprised of 1062 cubic metres due to fire and 2000 cubic metres due to wind damage. These losses were estimated based on district records. Estimated annual losses are deducted from the gross harvested volume to determine the projected net volumes that can be harvested over time. In general, existing access in the TSA allows for relatively high recovery (salvage) of most fire- and wind-damaged stands.

The BCFS analysis reflects the best available estimate of unsalvaged losses and I accept these assumptions as reasonable for use in this determination.

Clayoquot Sound

Description of the Clayoquot Sound area

Clayoquot Sound supports industries which include forestry, fishing, fish processing, mining, and tourism—particularly recreational activities associated with Pacific Rim National Park. In recent years, the integration of appropriate forms and levels of development with the natural values present in the Clayoquot area has aroused a high level of public debate and participation in comprehensive planning processes. This led to the 1993 CSLUD, and to the establishment of the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound (the Scientific Panel) to define appropriate forest practices for the area. The CSLUD designated portions of the TSA for protected areas, special management areas and general integrated management areas.

Clayoquot Sound has an extensive First Nations cultural history, and the TSA includes traditional territories claimed by several First Nations as noted above in "Description of the TSA". The Clayoquot Sound portion of the TSA is covered by the Interim Measures Agreement of March 1994, extended in April 1996, between the provincial government and hereditary chiefs of the Nuuchah-nulth Central Region Tribes. This agreement established the joint First Nations-provincial

Central Region Board to oversee development in the Clayoquot area, and the planning of operations in the Clayoquot portion of the TSA must now be reviewed and coordinated through this board.

Guiding principles for AAC determinations for areas including portions of Clayoquot Sound

A major consideration in determining an appropriate AAC for the TSA is the inclusion of part of the TSA in the area now covered by the provincial government of British Columbia's CSLUD of April 1993.

Clayoquot Sound is a complex of mountains, valleys, ocean inlets, lakes, rivers, islands and forests, and in recent years plans to integrate resource use with conservation of natural values in the area have attracted international attention. At the World Conservation Congress in Montreal in October, 1996, the World Conservation Union (IUCN) passed a resolution supporting the designation of Clayoquot Sound as an International Biosphere Reserve (IBR) under the 'Man and the Biosphere' program of the United Nations Educational Scientific and Cultural Organization (UNESCO). The provincial government has expressed conditional support for this designation, noting that many of the land-use and management components already established for Clayoquot Sound also satisfy the requirements of a UN IBR designation. At this time it is not possible to assess whether the IBR status will be confirmed, but it appears likely that such a designation would include full recognition of the very innovative forest management practices currently planned for the area. These currently planned practices have been derived under the following circumstances.

After many years of public participation and consultation regarding land and resource use planning in the area, the government's 1993 CSLUD assigned particular areas of the sound to three land-use categories—protected areas, special management areas, and general integrated management areas. Details of these areas as defined by the CSLUD are documented elsewhere, for instance in *Clayoquot Sound Land Use Decision—Key Elements*, April 1993, Province of British Columbia.

On October 22, 1993, with the objective of defining world-class, sustainable forest practices for the area, the provincial government announced the formation of the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound (the Panel).

In the interim before any of the Panel's findings could become available, to account in a general way for the estimated impact of the CSLUD on the timber supply of the TSA, in May 1994 the chief forester determined a temporary AAC reduction of 16 000 cubic metres under Part 15 of the *Forest Act*, as noted above in "History of

the AAC". The rescindment date for the orders in council related to this Part 15 temporary reduction was set at January 1, 1998.

The signing in March 1994 of the Interim Measures Agreement between the provincial government and hereditary chiefs of the Nuu-chah-nulth Central Region Tribes led to establishment of the Clayoquot Sound Central Region Board (the Board) as part of a joint management process between First Nations and provincial government appointees, to oversee development in Clayoquot sound, including implementation of the CSLUD. In April 1996, continuation of the Board in this role was formalized in the signing of the Clayoquot Sound Interim Measures Extension Agreement, which replaced the March 1994 agreement.

On May 30, 1995, the Panel submitted to government a three-volume report containing more than 120 recommendations on forest practices and First Nations issues. On July 6, 1995, the provincial government issued a joint news release between the Ministry of Forests and the Ministry of Environment, Lands and Parks, announcing acceptance of the Panel's report and government's intention to fully implement the report's recommendations.

In a letter to me as chief forester dated September 17, 1996 (see Appendix 5), the Minister of Forests, recognizing the unique and complex history of forest management in the Clayoquot area, expressed as an economic and social objective of the Crown a confirmation of government's intention that timber harvesting continue to be a forest management objective for the Clayoquot area and that this management be carried out in accordance with the Forest Practices Code and the recommendations of the Panel.

In considering how to approach determining the AAC for the Arrowsmith TSA (which will also apply to TFL 44 and TFL 54, since these also include land within the CSLUD) I have noted the Panel's recommendation R7.1 in *Report 5* (pp. 153 and 246), which reads:

"Adopt an ecosystem approach to planning, in which the primary planning objective is to sustain the productivity and natural diversity of the Clayoquot Sound region. The flow of forest products must be determined in a manner consistent with objectives for ecosystem sustainability. This entails abandoning the specification of AAC as an input to local planning."

and recommendation R7.10 (pp 247), which reads:

"Recognize that the rate (percentage of area cut per unit time) and geographical distribution of timber harvesting are more important determinants than is the volume removed when wood harvest is planned. *After* analysis of resources and development of area-based plans, determine the anticipated annual volumes of timber to be cut for watershed planning units."

and the July 6, 1995 government news release which addresses these recommendations by stating:

"harvesting levels will be based on watershed planning, rather than on a predetermined annual allowable cut".

With respect to the last statement in the Panel recommendation R7.1, "abandoning the specification of AACs as an input to local planning", in British Columbia AACs are already intended to be outcomes of, rather than inputs to, local planning. Nevertheless, this recommendation has been interpreted by some to mean that no AAC at all should be determined for areas managed according to the Panel's recommendations. However, recommendations R7.1 and R7.10 do contemplate determining a flow of timber products and anticipated annual volumes of timber to be cut for watershed planning units, *after* the analysis of resources and development of area-based plans. I understand these recommendations to mean that the flow of timber or rate of harvest should be ecosystem based and I agree that it will be much easier to determine the appropriate rate after more resource information is gathered and watershed level planning is complete. In this respect, over time the AAC will become a reflection of the planning process. However, while I acknowledge and respect the Scientific Panel's report and the ongoing implementation of the recommendations, as noted above in British Columbia AACs are statutorily required for all TFLs and TSAs. In particular, as noted above in "Statutory framework" I am required by section 7 of the *Forest Act* to complete this determination before December 31, 1996.

In determining the AAC for the Arrowsmith TSA I am required by section 7 to consider the timber supply from the whole land base, including the appropriate areas of Clayoquot Sound (excluding protected areas). Thus my current AAC determination must include an assessment of a harvest level for the entire TSA, including the portion which lies in Clayoquot Sound. However, as discussed further below, the harvest level determined is not a substitute for local planning in Clayoquot Sound, but is instead established as a maximum level of harvesting activity. The timing and placement of the harvest will be subject to detailed watershed plans which are under development, as well as to the implementation of the other recommendations of the Panel as overseen by the Central Region Board.

In view of my obligation to consider the contribution to the timber supply from the Clayoquot area in determining AACs for TFLs 44 and 54, and the Arrowsmith TSA, and in view of the Central Region Board's ongoing work in implementing the CSLUD and the Panel's recommendations, I and my staff discussed this situation with the Board. My aim in this was to investigate how the legal requirement for AAC determinations for the TSA and TFLs, which includes an assessment of harvest levels from areas in Clayoquot Sound, could best be reconciled with the Board's work. It is my intention that my determinations acknowledge and respect

the CSLUD and the Panel's recommendations without prejudice to future management implementation decisions by the Board.

After discussions with the Board, I have identified a means of estimating the timber supply that may reasonably be expected from the area within Clayoquot Sound in order to satisfy my obligations under section 7 to determine the necessary AACs. It was necessary for me to make assumptions based on an interpretation of certain of the Panel's recommendations in order to accomplish this. It is acknowledged that the method used does not model the results of fully implementing the Panel's recommendations—which would clearly not be possible at this time—but does provide figures which I believe more closely represent the outcome of forest management in Clayoquot Sound than would a regular timber supply analysis that did not attempt to take the Panel's recommendations into account.

During the discussion, the Board was concerned that if even if I could find a reasonable method for determining an anticipated level of timber harvesting in Clayoquot Sound, such a level should not become a target on which to base forest planning or management in the Clayoquot area. I would therefore like to clarify that in establishing allowable harvest levels in the Clayoquot area it is my intent that the levels determined should be viewed as upper limits, and I recognize that the *actual* harvest levels attained on the ground are expected to continue to be defined through appropriate planning and consultation, as recommended by the Panel and implemented by the Board. As with all AACs, I do not expect the harvest level determined by me to be used as an *input* to planning. To this end, as noted below in "Implementation of decision", I have instructed the licenses and BCFS district staff to continue to work closely with the Board to ensure that within the AAC I have determined, all timber harvesting in the Clayoquot area is a result of, and conforms to, appropriate local planning and forest practices as recommended by the Panel.

In assessing the timber supply capability of the Clayoquot area, I note that the extensive recommendations in the Panel's report represent a complex and significantly different approach to forest management for the area. At this time many details remain uncertain regarding the interpretation in operational activities of the forest management principles underlying the Panel's recommendations. While the full implications for timber supply in the area are therefore also uncertain and difficult or impossible to predict by conventional modeling, I believe it is nevertheless possible to arrive at a reasonable *calculated estimate* of the available timber supply based on a generalized interpretation of certain of the Panel's recommendations.

There are two recommendations by the Panel which I have found relevant to such an assessment. The first is R3.1 (page 81-82 and 237 of *Report 5*), which specifies that in any watershed larger than 500 hectares in total area, the area cut in a five-year period should be limited to no more than 5 percent of the watershed area, and

that for primary watersheds of 200 to 500 hectares in total area, the area cut should be limited to no more than 10 percent of the watershed area within a 10-year period. Page 62 of *Report 5* discusses a one-percent watershed-based rate of cut as follows:

"A watershed-based rate-of-cut of 1 % per year, while not unequivocally supported by data, appears to meet the needs of ecosystem management with regard to hydrology, habitat, and long-term sustainable wood supply. The rate of 1% per year appears appropriate as derived from hydrological considerations above, but also incorporates concerns about temporal distribution of seral stages for biological diversity and temporal distribution of wood supply for socioeconomic stability. The rate is consistent with the ecological desirability of ensuring harvested areas support a range of seral stages with a variety of different-aged forest habitats for wildlife, plants, and other organisms. It also is consistent with principles of sustainable ecosystem management where the intent is to provide a level of harvestable products that can be sustained over the long term (the sustainable long-term timber supply will be lower than historical annual cut levels in Clayoquot Sound)."

The second recommendation, noted at pp 63 and 170-171 of *Report 5*, specifies that at least 40 percent of the forest in a watershed-level planning unit (i.e. all reserves plus forest retained in harvestable areas) should be in age classes 8 and 9 (i.e. over 141 years of age).

Taking these recommendations and the other considerations specified in R3.1 into account, it is possible to establish an estimate of the annually harvestable area in the Clayoquot Sound portion of the Arrowsmith TSA, based on the assumption of limiting the harvest to one percent per year of the area while ensuring maintenance of at least 40 percent of the forest in each watershed at greater than 141 years. By assuming an average volume of timber per hectare, the annually harvestable area so derived may then be converted into an annual harvestable volume of timber.

The appropriateness of using my assumptions regarding the Panel's recommendations as a guide in this determination was discussed with the Central Region Board. With the acknowledgement that this approach does not model the results of fully implementing the Panel's recommendations, with the reservation noted above concerning the use of harvest levels in planning, the Board has advised me that they believe these assumptions will provide a more reasonable basis for my assessment of the timber supply in the Clayoquot area than would a conventional timber supply analysis that did not take into account the Panel's recommendations.

Application of the Scientific Panel's recommendations in timber supply analysis

The Scientific Panel's recommendation R3.1 referred to in the previous section could be interpreted in several ways, i.e. as permitting the total of harvesting one percent of: (a) the total area; (b) the productive forest area, or (c) the timber harvesting land base, by watershed.

Two factors have been persuasive in my decision to adopt the timber harvesting land base, rather than the productive forest or the entire gross land base in each watershed, as a basis for calculating the harvestable area. First, the timber harvesting land base is the only alternative that takes into account some of the historic environmental and economic limitations on harvesting. While it is not possible to account for all of the Panel's recommendations at this time I am aware that many of the recommendations will result in significant limitations on the amount of timber that can be harvested in any year. In particular the traditional timber harvesting land base will likely be smaller than that assumed under previous management guidelines. Therefore while the Panel recommendations on the rate of cut by watershed appear to apply to the total area in the watershed I believe that the combined impacts of the many recommendations of the Panel will result in a much smaller harvest level than would be indicated by 1 percent of the total area.

Second, application of the rate of cut recommendations to either (a) or (b) would in fact lead to a harvest level higher than the current contribution to the AAC from the TSA areas in Clayoquot Sound, based on management prior to the Panel's recommendations, which have not been met for a number of years. I have considered this to be inconsistent with the principles underlying the Panel's recommendations, particularly in view of the Panel's statement (pp. 62 of *Report 5*) that "the sustainable long-term timber supply will be lower than historical annual cut levels in Clayoquot Sound".

In contrast, application of the one-percent-rate-of-cut recommendations to (c) the timber harvesting land base in each watershed resulted in a harvest level that avoided the inconsistencies with the principles underlying the Panel's recommendations and takes into account many of the actual environmental and economic limitations to harvesting.

I therefore decided to use one percent of the timber harvesting land base in each watershed as a basis for assessing the timber supply for areas in Clayoquot Sound. BCFS staff discussed the three interpretations with the Board, and the Board agreed with my view that the application of the one-percent limit to the timber harvesting land base best reflects the overall intent of the Panel's recommendations.

This interpretation enables me, in my AAC determination for the Arrowsmith TSA contribution from the Clayoquot Sound area, to include an assessment of a maximum harvest level which considers the CSLUD and the Panel's recommendations.

Timber supply analysis for Clayoquot Sound

While the information shown in this document under "Considerations of factors as required by section 7 of the *Forest Act*" have been of great benefit, under the special circumstances of Clayoquot Sound Land Use Decision, the actual timber supply analysis was replaced, for the purposes of my considerations in the Clayoquot Sound portion of the determination, by a BCFS area-based calculation based on the assumptions described in the previous section. In my determination of the Clayoquot Sound area contribution I have utilized the BCFS area-based, watershed-level analysis as a "base case" against which to test assumptions, as with any base case applied conventionally in a section 7 determination.

A base case forecast typically 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 analysis used to generate it. Therefore, much of what is typically found in the considerations outlined in rationale statements for conventional AAC determinations under section 7, 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. In this AAC determination, this principle has been applied in examining the assumptions in the area-based analysis. However, due to the specific nature of the analysis, only one of the factors examined required an adjustment to the timber supply projected in the area-based calculation. Based on my acceptance of a 5 percent further reduction to account for riparian management the timber harvesting land base in the Clayoquot Sound area was reduced 5 percent before the area-based calculation was completed.

To the extent possible, and as I have considered it appropriate, this area-based analysis has functioned in this portion of the determination as a "base case" harvest level against which to test certain assumptions about forest management. The methodology for the BCFS area-based analysis are described in the following section.

Clayoquot Sound timber supply analysis base case projection

As discussed above, the analysis which provided a basis for the assessment of timber supply in the Clayoquot Sound portion of the Arrowsmith TSA differed substantially from that which is conventionally employed in timber supply analyses in other areas of British Columbia, in that it was designed specifically for use with

requirements interpreted from certain of the Panel's recommendations for Clayoquot Sound.

This base case analysis was carried out as follows. First the total area of productive forest in the Clayoquot Sound portion of the TSA was identified. Next, areas normally excluded from harvesting for reasons such as inoperability, environmental sensitivity and riparian reserves etc., were deducted from the productive forest, to derive the timber harvesting land base. A GIS-based overlay of 302 watersheds in Clayoquot Sound was then superimposed on the TSA area. All watersheds in the Clayoquot Sound portion of the TSA were identified (80 in total), the forested area in each watershed was assigned to ten-year age classes based on stand age, and the area in the timber harvesting land base in each watershed was determined, including a 5 percent reduction to account for riparian management as noted above in Integrated resource management objectives, riparian habitats

Based on my assumptions about the Panel's recommendations, a calculation was applied to the timber harvesting land base as follows. To ensure that old-growth forests cover 40 percent of each watershed at all times, any contribution required from the timber harvesting land base, in addition to areas already excluded from harvesting for other reasons, was subtracted. (That is, the 40-percent old-growth forest requirement was assumed to be satisfied by forest cover contributions from the total productive forest land base, rather than from the timber harvesting land base alone.) One percent of the remaining timber harvesting land base area was then calculated. To account for the influence of the last ten years of harvesting, it was assumed that the area less than ten years old was evenly distributed in ten one-year age classes. Thus ten percent of the area in the watershed with forest cover less than ten years old, was subtracted from the one percent area calculation. Based on the BCFS analysis, none of the watersheds in the TSA portion of Clayoquot Sound with less than 40 percent old growth actually contribute to the harvestable area derived for this AAC determination

The area of the Arrowsmith TSA within Clayoquot Sound (excluding all protected areas) covers approximately 15 550 hectares. The current timber harvesting land base covers 5505 hectares. Applying the one-percent-per-year harvestable area on a watershed basis, reduced by ten percent of the area in the watershed less than ten years old, in conjunction with the minimum 40-percent old-growth forest cover requirement—which was a limiting factor on timber supply in only 19 of the 80 watersheds—results in a figure of approximately 19 hectares that could be harvested annually.

In order to convert this area figure into an annually harvestable volume, an area-weighted average figure for the volume per hectare on the timber harvesting land base was obtained from the VDYP curves as discussed above in *volume estimates for existing stands*. The average harvestable volume so obtained is about

716 cubic metres per hectare, which leads to an estimated annual allowable harvest volume of 13 700 cubic metres for the Clayoquot Sound portion of the Arrowsmith TSA.

Social and economic objectives of the Crown for Clayoquot Sound

As noted above the Minister of Forests has expressed the social and economic objectives of the Crown for the *province* in two documents addressed 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). The Minister has also expressed the social and economic objectives of the Crown for the *Clayoquot Sound area* in a letter to me as chief forester, dated September 17, 1996 (attached as Appendix 5). In my considerations for this AAC determination for the Clayoquot Sound portion of the TSA, I have been mindful of the information in each of these documents. However, in view of the more specific nature of the objectives for Clayoquot Sound as expressed in the Minister's most recent letter, I have placed more weight on these specific objectives than on the more general expressions for the province in the other two documents.

In particular, as noted elsewhere in this rationale document, in his recent memo the Minister has stated that government recognizes the complex and unique circumstances and history surrounding the development of forest management policy for the Clayoquot Sound, and has accepted the recommendations of the report of the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound. The Minister confirmed government's intentions that timber harvesting continue to be one of the forest management objectives for the Clayoquot area and that management of the area be carried out in accordance with both the Forest Practices Code and the recommendations of the Scientific Panel. The Minister specifically expressed the Crown's intention that these objectives should be taken into consideration in AAC determinations for areas including Clayoquot Sound.

For this reason the methodology for obtaining a "base-case" analysis of the timber supply in Clayoquot Sound has differed from that for all other management units in the province to date. Instead of a computer-generated, volume-based projection of timber supply over time based on data from a range of inputs, the base case analysis for the Clayoquot Sound portion of the TSA was produced from an area-based, watershed-level interpretation of specific recommendations by the Scientific Panel, as discussed in Application of the Scientific Panel's recommendations in timber supply analysis and Clayoquot Sound timber supply analysis base case projection. While the harvest level so obtained is not a representation of the result of a complete modeling of all the Panel's recommendations—which would not be possible in the current absence of operational experience—the result does more closely represent forest management in accordance with the Panel's recommendations than would a conventional, volume-based analysis. In this way I have attempted to consider as fully as possible government's objective regarding the Panel's recommendations.

The Minister's memorandum addressed the effects of visual resource management on timber supply, and asked that the pre-Code constraints that were 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 when considered in conjunction with other Code requirements. Again, all planning, including visually sensitive areas, will be overseen by the Central Region Board, which I understand has recently received a report from the Clayoquot Sound Scenic Corridors Committee, as noted above, in *visually sensitive areas*.

- local objectives

Both the Minister's letter and memorandum encouraged the chief forester to consider important local social and economic objectives that may be derived from the public input. In the case of the Clayoquot Sound portion of the Arrowsmith TSA, I note the long history of public participation in local planning processes which preceded government's 1993 Clayoquot Sound Land Use Decision, and the now ongoing public representation in planning through the Central Region Board.

Reasons for decision

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

I have divided the AAC for the Arrowsmith TSA into three components, the Main Arrowsmith TSA area (the area outside of Clayoquot Sound) the area in Clayoquot Sound, and Deciduous stands. I will address each separately.

Main Arrowsmith TSA area

The base case was corrected and updated in a 1996 BCFS analysis and this is the "base case" referred under "Considerations of factors as required by section 7 of the *Forest Act*" in this rationale. The corrected base case, which is for the entire TSA, indicates an initial harvest level of 479 150 cubic metres for the first decade, declining about 12 percent per decade before reaching a medium-term level of 277 000 cubic metres beginning 50 years from now. This medium-term level is maintained until 140 years from now before increasing about 10 percent per decade for 20 years to the long-term level of 337 000 cubic metres.

This base case analysis included the Clayoquot Sound area, however as this section indicates this portion of the decision is only for the area in the TSA outside of Clayoquot Sound. In order to assess this portion of the TSA properly a timber supply analysis was completed which excluded Clayoquot Sound. This analysis was necessary for two reasons, (i) to supply a harvest forecast to use as a reference point for the non-Clayoquot Sound portion of the determination, and (ii) to determine if any of the sensitivity analysis utilized as guidance in this determination would give a different result than that seen in the analysis for the entire TSA.

The harvest forecast for the Arrowsmith TSA less the area in Clayoquot Sound shows an initial harvest level 440 800 cubic metres per year, 8 percent below the base case. The harvest level then declines by about 12 percent per decade before reaching a medium-term level of 248 000 cubic metres beginning 50 years from now. This level is maintained until 140 years from now when the level begins to increase to the long-term harvest level of 296 000 cubic meters, 12 percent below the base case. All the following factors which change the timber supply should be noted in context of this harvest forecast.

For the area of the TSA outside of Clayoquot Sound, my considerations have identified factors that indicate the timber supply may be higher or lower than projected in the base case, due to changes in practices or information since the completion of the BCFS analysis.

Factors which indicate the timber supply may be lower than projected in the base case and which maybe quantified with some reliability are as follows:

- *Vancouver Island Land Use Plan new protected areas*: a 1-percent timber supply impact due to the estimated 710 hectares that must be removed from the timber harvesting land base to account for recently designated parks and ecological reserves;
- *woodlots*: nearly a 1 percent impact based on 1500 cubic metres that have been recently issued in two woodlot licences totalling 521 hectares, and an additional 302-hectare woodlot licence has been issued with an allowable harvest I expect to be approximately 2500 cubic metres;
- *silvicultural systems*: about a 1 percent impact on the timber supply is expected in the short term due to the current practice of clearcutting-with-reserves in many parts of the TSA;
- *stand level biodiversity*: there will be a 3-percent impact on timber supply in the short term due to retention of wildlife tree patches and individual live trees;

- *riparian habitats*: there is an estimated 5-percent additional impact to account for Code riparian provisions including riparian reserves and riparian management zones;
- *TSA fragmentation*: a 3- to 4-percent reduction in short-term timber supply will result from the management regimes anticipated for the many fragmented parcels located on the eastern portion of the TSA.

There are two factors which indicate the timber supply may be lower than projected in the base case but which are not currently subject to reliable quantification:

- *cultural heritage resources*: management considerations for culturally modified trees and other cultural heritage sites are likely to reduce the timber supply;
- *Juan de Fuca Marine Trail Park*: a portion of the TSA has been transferred to TFL 25 in order to obtain land needed to finish this park. I am aware that these lands no longer contribute towards the timber harvesting land base, however, I am unable to quantify this resulting decrease in the timber harvesting land base. Nevertheless, given the small area involved this does not introduce unacceptable risk into this decision.

There is also some uncertainty associated with other factors such as landscape level biodiversity and wildlife habitat requirements, both of which may well have a timber supply impact. In addition, there will likely be further land base reductions due to both new protected areas in the TSA that have not yet been designated and to land exchanges associated with new protected areas.

I have noted no upward pressures on the coniferous short-term timber supply that could reasonably offset some of the downward pressures at this time. However, if site productivity estimates have been underestimated, this could serve to buffer some of the downward pressures on timber supply in the mid- and long-term within this TSA.

Overall, considering the combined downward and upward pressures, and accounting for uncertainty, I have reasoned as follows.

As noted above I take guidance from the timber supply analysis which assessed the impact on the harvest level in the TSA of not including a timber supply contribution from the forest lands within Clayoquot Sound. This analysis indicates an initial harvest level for the remainder of the TSA of 440 800 cubic metres. Cumulatively, the downward factors, whose range of potential impact can be quantified with some degree of confidence, can be expected to lower the short-term timber supply in the base case projection by about 14 percent. This translates

into an adjusted initial harvest level of 380 000 cubic metres for TSA lands outside of Clayoquot Sound. There are no quantified or unquantified upward pressures to offset this decrease. In addition, the decision is complicated by the uncertainty around other factors whose magnitude is unknown such as culturally modified trees. Overall, I believe an AAC of 380 000 cubic metres is an appropriate level at this time.

Deciduous-leading stands

As noted above in *deciduous stands* the district has done an analysis and examination of the amount of deciduous timber (predominantly alder) available for harvest over the next 15 years. I am satisfied that this analysis has accounted for forest management issues such as the Code, visual quality objectives, and growth and yield issues and is of a quality that I may utilize it as base for my decision on a harvest level for deciduous-leading. I am satisfied that it is possible to maintain a harvest level of 6300 cubic metres per year at least until the next determination which must take place within 5 years.

Clayoquot Sound

To ensure that the Clayoquot Sound portion of the AAC does not affect areas outside the Clayoquot within the TSA, I believe this harvest level should be partitioned.

A portion of the area in the Arrowsmith TSA is in the area covered by the provincial government's April 1993 Clayoquot Sound Land Use Decision. The provincial government's July 6, 1995 acceptance of, and commitment to fully implement, the Scientific Panel's recommendations for sustainable forest management in Clayoquot Sound, were subsequently confirmed to me in the Minister of Forests' letter of September 17, 1996, as a formal expression of social and economic objectives of the Crown. Given these clear expressions of the Crown's objectives I have placed significant weight in this portion of my determination on the Crown's stated objective that the Clayoquot area be managed according to the recommendations of the Scientific Panel.

As a direct result, the methodology I have adopted in this portion of the determination is fundamentally different from that applied in AAC determinations for all other management units in the province outside the Clayoquot area, including the remainder of the Arrowsmith TSA. While I have examined in detail all those factors required by section 7 of the *Forest Act* to be considered, I have not done so by testing the current validity of a computer-generated timber supply projected over a period of hundreds of years, as is the conventional approach to AAC determinations in this province. Rather, I have used a methodology for examining timber supply which is as consistent as possible, given currently available information, with specific recommendations of the Panel which bear a

direct relationship with the amount of timber that may be harvested from watershed areas within Clayoquot Sound.

In employing this methodology, I have attempted to reconcile the provincially legislated requirement to determine an AAC for the Arrowsmith TSA under section 7 of the *Forest Act* with government's expressed intention to implement the Scientific Panel's recommendations for the area, given that these include the recommendation to "determine the anticipated annual volumes of timber to be cut for watershed planning units", "*after* analysis of resources and development of area-based plans"(from recommendation R7.10).

I acknowledge from the outset that this determination is being made *before*, rather than after, completion of local planning for the area, expressly in order to meet the legal requirements of section 7. For that reason I have noted in my considerations that the AAC I determine is intended to provide an indication of the maximum harvest level that might be attained in accordance with my interpretation of certain of the Panel's recommendations, understanding that the actual harvest level achieved in the area will result from planning processes overseen by the Central Region Board.

As noted in Application of the Scientific Panel's recommendations in timber supply analysis and "Timber supply analysis base case", the BCFS area-based analysis of the harvestable area by watershed was based on an interpretation of the harvesting restrictions prescribed in the Panel's recommendations. I noted there that it would have been possible to interpret these restrictions as applying to the gross area in each watershed, the productive forest in each watershed, or the net operable timber harvesting land base in each watershed.

I believe that the Panel's recommendations are likely to result in a more constrained, rather than increased, timber supply—particularly in view of hydriparian harvesting restrictions in the general IRM zone. The Panel itself has noted (*report 5*, page 62) that its recommendations will result in a lower sustainable timber supply than the historical levels. If the BCFS watershed-based analysis, were to result in a projected harvest level higher than a conventional timber supply forecast, it would be unreasonable to expect that such a result could be consistent with the intention of the Panel's recommendations.

The application of the one-percent restriction to the gross area of each watershed would result in an even higher harvest level than would be attained in a conventional timber supply analysis. Also the application of the Panel's recommendations to either suggested land base other than the timber harvesting land base would result in an intensity of harvesting activity in Clayoquot Sound higher than historical harvest levels. For these reasons I have concluded that the only reasonable assumption I can make is to apply my interpretation of the Panel's recommendations regarding rate of cut to the timber harvesting land base, as was done in the BCFS watershed-based analysis.

I have carefully examined the methodology employed in the BCFS area-based analysis as described above in Clayoquot Sound timber supply analysis base case projection, and I consider this to be a reasonable means of deriving the annual harvestable area and the average volume per hectare for the Clayoquot Sound portion of the TSA.

From all the foregoing considerations and reasoning, I conclude that the BCFS area-based, watershed-level analysis provides a reasonable indication of the volume of timber that may be expected to be harvested from the Clayoquot Sound portion of the Arrowsmith TSA under the described interpretation of the Panel's recommendations. My considerations have identified no reason to vary the results of the analysis, and I therefore find the resulting annual volume of 13 700 cubic metres to be a suitable harvest level for the Clayoquot Sound partition within the AAC at this time.

Determination

Effective December 30, 1996, the new AAC for the Arrowsmith TSA will be 400 000 cubic metres, which represents approximately a 17 percent decrease from the AAC (excluding allocated woodlot licences) of 484 500 cubic metres. This is however, a 14.6 percent decrease from the temporarily reduced (under Part 15 of the *Forest Act*) AAC of 468 500 cubic metres. This new AAC is partitioned as follows:

- TSA area outside of Clayoquot Sound - 380 000 cubic metres
- Clayoquot Sound portion of the TSA - 13 700 cubic metres
- Predominantly deciduous stands - 6300 cubic metres

This new AAC does not include the 13 750 cubic metres of allocated woodlot licence volume which, as previously noted, are administered outside of this determination. The new AAC will remain in effect until a new AAC is determined, which must take place within five years of this determination.

The Clayoquot Sound partition within the AAC should not be construed as an input to local planning processes overseen by the Central Region Board, which are intended to identify the specific areas for harvest on which the actual harvest level achieved will depend.

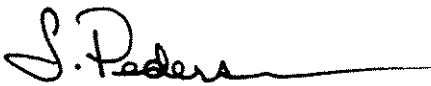
Having now determined a new AAC for the Arrowsmith TSA under section 7 of the *Forest Act* which has excluded the designated protected areas and has accounted in a general way for new management practices in Clayoquot Sound, I have also made a new order, effective December 30, 1996, repealing the temporary AAC reduction previously ordered for the Arrowsmith AAC under Part 15, related to Orders-in-Council Nos. 718 and 719.

Implementation of decision

There is some uncertainty in a number of important factors that have a potentially significant impact on timber supply that need to be better clarified, to the extent possible, before the next determination. Many of these factors are related to the continued implementation of land use decisions and the Forest Practices Code. They include:

- further clarification of the management practices within Clayoquot Sound and how they affect timber supply;
- establishing landscape-level biodiversity objectives and developing a long-term plan to meet those objectives, particularly in eastern portions of the TSA;

In addition, during the term of this current management plan, BCFS staff should continue to work closely the Central Region Board to ensure that all timber harvesting in the Clayoquot Sound area is a result of, and conforms to, appropriate local planning and forest practices as recommended by the Scientific Panel.

A handwritten signature in black ink, appearing to read 'L. Pedersen', followed by a long horizontal flourish line.

Larry Pedersen
Chief Forester

December 18, 1996

Appendix 1: Section 7 of the *Forest Act*

The B.C *Forest Act* Section 7 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: Section 4 of the *Ministry of Forests Act*

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: Letter from Minister of Forests, July 28, 1994, to Chief Forester, re social and economic objectives of the Crown.

Appendix 4: Memo from Minister of Forests, February 26, 1996, to Chief Forester, re social and economic objectives of the Crown—visual resources.

Appendix 5: Memo from Minister of Forests, September 17, 1996, to Chief Forester, re social and economic objectives of the Crown for Clayoquot Sound.

Appendix 6: Summary of Public Input



File: 10100-01

JUL 28 1994

John Cuthbert
Chief Forester
Ministry of Forests
595 Pandora Avenue
Victoria, British Columbia
V8W 3E7

Dear John Cuthbert:

Re: Economic and Social Objectives of the Crown

The *Forest Act* gives you the clear responsibility for determining Allowable Annual Cuts, decisions with far-reaching implications for the province's economy. The *Forest Act* provides that you consider the social and economic objectives of the Crown, as expressed by me, in making these determinations. The purpose of this letter is to provide this information to you.

The social and economic objectives expressed below should be considered in conjunction with environmental considerations as reflected in the Forest Practices Code, which requires recognition and better protection of non-timber values such as biodiversity, wildlife and water quality.

The government's general social and economic objectives for the forest sector are made clear in the goals of the Forest Renewal Program. In relation to the Allowable Annual Cut determinations you must make, I would emphasize the particular importance the government attaches to the continued availability of good forest jobs and to the long-term stability of communities that rely on forests.

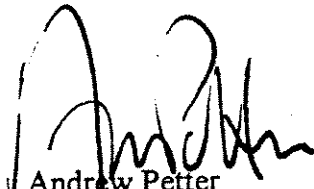
Through the Forest Renewal Plan, the government is taking the steps necessary to facilitate the transition to more value-based management in the forest and the forest sector. We feel that adjustment costs should be minimized wherever possible, and to this end, any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability.

.../2

In addition to the provincial perspective, you should also consider important local social and economic objectives that may be derived from the public input on the Timber Supply Review discussion papers where these are consistent with the government's broader objectives.

Finally, I would note that improving economic conditions may make it possible to harvest timber which has typically not been used in the past. For example, use of wood from commercial thinnings and previously uneconomic areas may assist in maintaining harvests without violating forest practices constraints. I urge you to consider all available vehicles, such as partitioned cuts, which could provide the forest industry with the opportunity and incentive to demonstrate their ability to utilize such timber resources.

Yours truly,



Andrew Petter
Minister



File: 16290-01

February 26, 1996

To: Larry Pedersen
Chief Forester

From: The Honourable Andrew Petter
Minister of Forests

Re: **The Crown's Economic And Social Objectives Regarding Visual Resources**

Further to my letter of July 29, 1994, to your predecessor, wherein I expressed the economic and social objectives of the Crown in accordance with Section 7 of the *Forest Act*, I would like to elaborate upon these objectives as they relate to visual resources.

British Columbia's scenic landscapes are a part of its heritage and a resource base underlying much of its tourism industry. They also provide timber supplies that are of significant economic and social importance to forest industry dependent communities.

Accordingly, one of the Crown's objectives is to ensure an appropriate balance within timber supply areas and tree farm licence areas between protecting visual resources and minimizing the impact of such protection measures on timber supplies.

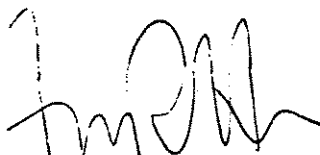
As you know, I have directed that the policy on management of scenic landscapes should be modified in light of the beneficial effects of the Forest Practices Code. In general, the new policy should ensure that establishment and administration of visual quality objectives is less restrictive on timber harvesting. This change is possible because alternative harvesting approaches as well as overall improvement in forest practices will result in reduced detrimental impacts on visually sensitive areas. Also, I anticipate that the Forest Practices Code will lead to a greater public awareness that forest harvesting is being conducted in a responsible, environmentally sound manner, and therefore to a decreased public reaction to its visible effects on the landscape. In relation to the Allowable Annual Cuts determinations that you make, please consider the effects that the new policy will have in each Timber Supply Area and Tree Farm Licence.

.../2

Larry Pedersen
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In keeping with my earlier letter, I would re-emphasize the Crown's objectives to ensure community stability and minimize adjustment costs as the forest sector moves to more value-based management. I believe that the appropriate balance between timber and visual resources will be achieved if decisions are made consistent with the ministry's February 1996 report *The Forest Practices Code: Timber Supply Analysis*.

Finally, in my previous letter I had asked that local economic and social objectives be considered. Please ensure that local views on the balance between timber and visual resources are taken into account within the context of government's broader objectives.



Andrew Petter
Minister of Forests



File: 10100-01

September 17, 1996

Larry Pedersen
Chief Forester
Ministry of Forests
595 Pandora Avenue
Victoria, British Columbia
V8W 3E7

Dear Larry Pedersen:

Re: Social and economic objectives of the Crown in the Clayoquot Sound area

The government of British Columbia recognizes that the circumstances and history surrounding the development of forest management policy for the Clayoquot Sound area are complex and unique in British Columbia. In particular, government has accepted the recommendations of the report of the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound.

Since these circumstances are specific to the Clayoquot Sound area, it is appropriate to express social and economic objectives of the Crown for this area specifically, in addition to the more generally applicable objectives expressed in the letter dated July 28, 1994, and the memo dated February 26, 1996, from the Minister of Forests to the Chief Forester.

In that respect, first, I confirm that it is government's intention that timber harvesting continue to be one of the forest management objectives for the Clayoquot area. Second, it is government's intention that management of the area be carried out in accordance with both the Forest Practices Code and the recommendations of the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound.

Larry Pedersen
Page 2

These intentions should be read as an expression of the socio-economic objectives of the Crown for the Clayoquot Sound area, for consideration in the determination of allowable annual cuts for those management units which include parts of Clayoquot Sound.

Yours truly,

A handwritten signature in cursive script, reading "David Zirnelt". The signature is written in dark ink and is positioned above the printed name and title.

David Zirnelt
Minister of Forests