

**BRITISH COLUMBIA
MINISTRY OF FORESTS**

Tree Farm Licence 48

Issued to Canadian Forest Products Limited

Rationale for Allowable Annual Cut Determination

effective December 31, 1996

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Chief Forester**

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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 Tree Farm Licence (TFL) 48. The document will also identify where new or better information is required for incorporation into future determinations.

Description of the TFL

TFL 48, also known as the Chetwynd TFL, is held by Canadian Forest Products Ltd. (Canfor) and comprises five supply blocks in the western half of the Dawson Creek Forest District in the Prince George Forest Region. The blocks are clustered around the communities of Chetwynd and Tumbler Ridge, which lie to the west and southwest, respectively, of Dawson Creek. For the most part, the blocks border the Dawson Creek Timber Supply Area (TSA), but they also share boundaries with the Mackenzie, Fort St. John and (for a very short distance) Prince George TSAs. Additionally, a substantial portion of the TFL—67 percent—overlaps the operating area of Pulpwood Agreement (PA) 13, issued to Louisiana-Pacific Canada Ltd.

The northeastern parts of the TFL lie on flat or gently rolling terrain in the Boreal White and Black Spruce biogeoclimatic zone. Further west and south the licence area enters the lee side of the Rocky Mountains, and the more rugged terrain there falls in the Engelmann Spruce-Subalpine Fir, Sub-Boreal Spruce and Alpine Tundra biogeoclimatic zones. This diversity of terrain and climate has led to considerable variation in tree species and productivity. The principal commercial species are white spruce and aspen in the northeast, and white spruce, lodgepole pine, subalpine fir, aspen and cottonwood in the mountainous areas to the west and south.

The communities in the area are Chetwynd (estimated population over 2700), Tumbler Ridge (over 4200), Hudson's Hope (over 900), Saulteau (over 300) and Moberly Lake (approximately 70). Of these, Chetwynd, the site of Canfor's sawmill, is the most economically dependent upon harvesting operations in TFL 48. Other economic activities in the area include mining, hydro-electric power generation, agriculture, trapping, and outdoor recreation.

History of Present AAC

Prior to 1988 the licensee held a forest licence under which it operated in much of the area now covered by TFL 48. Effective December 1, 1988, this licence was converted to a TFL with a land base of 661 365 hectares and an initial AAC of 410 000 cubic metres, a level that remains in effect today.

The original Management and Working Plan (now renamed "Management Plan") 1 has been extended to the end of 1996. A draft Management Plan (MP) 2 with a proposed AAC has been submitted by the licensee. The approval process for that plan is occurring concurrent with this AAC determination.

The current AAC of 410 000 cubic metres is divided as follows:

| Schedule B Small Business Forest Enterprise Program lands | Schedule B licensee-operated lands | Allotted to woodlots | TOTAL |
|---|------------------------------------|----------------------|----------------------|
| 55 350 cubic metres | 348 500 cubic metres | 6150 cubic metres | 410 000 cubic metres |

(There are no Schedule A private lands. Since the last determination, 2870 cubic metres of the allotted woodlot volumes have been issued. See further discussion below, under *woodlots*.)

New AAC Determination

Effective December 31, 1996, the new AAC for TFL 48 will be 514 000 cubic metres, including volumes harvested on Schedule B lands through the Small Business Forest Enterprise Program. This AAC will be partitioned as follows:

- 460 000 cubic metres attributable to coniferous and deciduous trees harvested within coniferous-leading stands; and
- a maximum of 54 000 cubic metres attributable to deciduous and coniferous trees harvested within deciduous-leading stands.

This decision will remain in effect until a new AAC is determined, which must take place by December 31, 2001.

Information Sources Used in the AAC Determination

Information considered in determining the AAC for TFL 48 includes the following:

- "Canadian Forest Products Ltd, Tree Farm Licence 48, Management Plan 2," December 28, 1995 (draft);
- "Statement of Management Objectives, Options and Procedures for Management Plan #2 for TFL 48," October 28, 1993;
- "Canadian Forest Products Ltd, TFL 48, Management Plan #2 Timber Supply Analysis Report," October 1995, prepared by Industrial Forestry Service Ltd.;
- "Information report in support of establishing criteria for determining timber merchantability in TFL 48", September 1992, Industrial Forestry Service Ltd.;
- "Recreation/Landscape Analysis Report for Canadian Forest Products Ltd, Tree Farm Licence #48," December 1994, prepared by Industrial Forestry Service Ltd.;

- "Tree Farm Licence 48 Twenty-Year Strategic Development Plan," revised June 1996, prepared by Canadian Forest Products Ltd;
- "Tree Farm Licence 48 Socio-Economic Overview," December 1995, prepared by Canadian Forest Products Ltd.
- Letter from the Minister of Forests to the Chief Forester, dated July 28, 1994, stating the Crown's economic and social objectives;
- Memorandum from the Minister of Forests to the Chief Forester, dated February 26, 1996, stating the Crown's economic and social objectives with regard to visual resources;
- Technical review and evaluation of current operating conditions through comprehensive discussions with British Columbia Forest Service (BCFS) staff, notably at the AAC determination meeting held in Victoria on February 14, 1996;
- *Forest Practices Code of British Columbia Act*, July 1995;
- *Forest Practices Code of British Columbia Regulations*, April 1995; and
- *Forest Practices Code Timber Supply Analysis*, BCFS and Ministry of Environment, Lands and Parks, February 1996.

Role and Limitations of the Technical Information Used

The *Forest Act* requires me to consider biophysical as well as social and economic information in AAC determinations. A timber supply analysis and the inventory and growth and yield data used as inputs to the analysis formed the major body of technical information used in my AAC determination for TFL 48. 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 answer or 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 TFL 48, I have considered known limitations of the technical information provided. In general I am satisfied that this information provides a suitable basis for my determination. However, it must be noted in particular that the inventory information for the TFL is a subset of earlier data from three larger Public Sustained Yield Units (PSYUs). This information is considerably less reliable than an inventory based on the licence area itself. The resultant uncertainty has influenced my determination to a greater extent than

uncertainty in inventories in other management units where these were based on the specific land base under analysis. This issue will be discussed in further detail below, under *age of inventory* and in "Reasons for Decision."

Statutory Framework

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

Guiding Principles

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, 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 TFL 48. 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 protected areas have been designated 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 ongoing plan implementation decisions are addressed.

The Forest Renewal Plan will fund a number of intensive silviculture activities that have the potential to affect timber supply, particularly in the long term. In general, it is too early for me to assess the consequences of these activities, but wherever feasible I will take their effects into account. The next 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 TFL. 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)(a) of the *Forest Act* and will be respected in the administration of the AAC determined.

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

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

The Role of the Base Case

In considering the factors required under Section 7 to be addressed in AAC determinations, I am assisted by timber supply forecasts provided to me through the work of the Timber Supply Review project for TSAs and, for TFLs, by the licensees.

For each AAC determination a timber supply analysis is carried out, using a data package of information from three categories: land base inventory, timber growth and yield, and management practices. Using this set of data, and a computer simulation model, timber supply forecasts are produced. These include sensitivity analyses of changes in various assumptions around a baseline option, normally referred to as the "base case" forecast, which forms the basis for comparison when assessing the effects of uncertainty on timber supply.

The base case forecast represents only one in a number of theoretical forecasts, and may incorporate information about which there is some uncertainty. Its validity—as with all the other forecasts provided—depends on the validity of the data and assumptions incorporated into the computer simulation used to generate it. Therefore, much of what follows in the considerations outlined below is an examination of the degree to which all the assumptions made in generating the base case forecast are realistic and current, and the degree to which its predictions of timber supply must be adjusted, if necessary, to more properly reflect the current situation.

These adjustments are made on the basis of informed judgement, using current information available about forest management, which—particularly during the period leading up to, and now during, the implementation of the Forest Practices Code—may well have changed since the original data package was assembled.

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

Timber Supply Analysis

For TFL 48 the timber supply analysis was conducted by Industrial Forestry Service Ltd. (IFS) on behalf of the licensee. The computer simulation model used by the analyst was IFSYIELD. While this model differs from the Forest Service simulation model (FSSIM) in several respects, it does incorporate similar processes of forest growth and harvesting under specified management regimes, and provides an acceptable means for projecting timber supply.

A number of management options were modelled and a recommended coniferous "base case" was presented. This harvest-flow projection indicated that a non-declining, even-flow harvest level of 540 800 cubic metres per year could be maintained for 400 years. This proposed base case included the minor deciduous component within coniferous-leading stands, and would represent an immediate 32-percent increase in the current AAC. I have accepted this projection as an appropriate point of reference upon which to base my considerations in this determination.

At the request of BCFS staff, the analyst also modelled harvest scenarios for deciduous-leading stands. In TFL 48, virtually all harvestable deciduous species are broadleaves. The term "deciduous" will be used throughout this rationale. Given the substantial overlap between TFL 48 and the PA 13 operating area, it is important to understand the status of deciduous stands that might be utilized by the pulpwood licensee. An aspen-only harvest, subject to the adjacency constraints imposed by giving first priority to coniferous harvesting in the area, could be maintained for 400 years on a non-declining even-flow level of 38 600 cubic metres per year. If cottonwood stands are also harvested and priority is again given to coniferous harvesting in the area, an overall deciduous harvest of 54 200 cubic metres per year could be maintained for 400 years. If harvesting is not constrained by nearby coniferous harvesting, this combined harvest level would rise slightly to 55 700 cubic metres per year.

The joint aspen-cottonwood profile is appropriate to the needs of the pulpwood agreement, and I regard the constrained harvest-flow projection (54 200 cubic metres per year) as a suitable point of reference for my determination of deciduous volumes that may be harvested.

Consideration of Factors as Required by Section 7 of 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 harvest

- economic and physical operability

As part of the process used to define the timber harvesting land base—i.e., the land base estimated to be economically and biologically available for harvesting—a series of area netdowns were made from the productive forest. These deductions took into account factors such as environmental sensitivity and the presence of deciduous stands and riparian areas, which may render an area undesirable to harvest for economic or ecological reasons. In reviewing this process I am aware that some areas may have more than one classification; e.g., environmentally sensitive areas may also lie in riparian areas. Hence, the figure shown for a given category in the netdown table in the timber supply analysis or mentioned in the AAC rationale does not necessarily reflect the total area with that classification; much of it may have been deducted earlier for other reasons. If the deduction order were changed, the areas taken from the listed categories could also change. I am assured by BCFS staff that, with the following qualifications, the derivation of the timber harvesting land base has accounted appropriately for the respective areas, without overlap or double-counting.

The total land base of TFL 48 is 638 811 hectares, of which 257 915 hectares are considered to form the current timber harvesting land base for coniferous-leading stands—i.e., the land base estimated to be economically and biologically available for harvesting. The deciduous-leading timber harvesting land base covers an additional 29 370 hectares. In determining the coniferous timber harvesting land base, the largest deductions from the productive forest were for high-elevation (above 1370 metres) inoperable stands—51 483 hectares that were not specifically deducted at the time of the last analysis—and areas with less than the minimum site productivity index. District staff regard the elevation cut-off point as reasonable and reflective of current practice.

Although the recently digitized boundary shows the total TFL land base is actually smaller in size than in the 1987 analysis, the current timber harvesting land base is substantially larger than assumed in that analysis. This is mainly due to the inclusion of

forest stands that were previously considered non-commercial or unmerchantable. For example, since 1987, pine utilization has improved from a lower diameter-at-breast-height limit of 17.5 centimetres to 12.5 centimetres; as a result, some pine stands previously considered uneconomical to harvest are now included in the timber harvesting land base. Some low-productivity sites have also been retained in the timber harvesting land base (see below, *low-productivity sites*). A merchantability study was carried out in 1992. With the qualifications outlined in the following paragraph, District staff have accepted the results of the study and used them to review the licensee's assumptions about merchantability in the timber supply analysis. District staff are satisfied that the licensee's performance generally reflects the assumptions in the analysis. Another factor contributing to the larger timber harvesting land base in the current analysis is the inclusion of not-satisfactorily-restocked areas that were previously assumed not to be productive (see below, Not-satisfactorily-restocked areas).

In general, land in TFLs in the province tends to be more productive than land in TSAs, and I therefore consider it reasonable, particularly in view of the licensee's demonstrated performance, to accept a somewhat higher level of merchantability for the TFL than for the adjacent Dawson Creek TSA or for the old PSYUs on which the inventory information for the TFL is based. I also acknowledge that the now digitized TFL boundary permits better definition of the TFL area than in the 1987 analysis.

Nevertheless, for two reasons, in my determination I have viewed with considerable caution the additional timber supply projected by the licensee to be available on the increased timber harvesting land base. First, in view of the age of the inventory information and of the uncertainties introduced by the fact that this information is a subset of data from an area larger than the TFL, I must be cautious about the volume projections themselves, although as noted below under *volume estimates for existing stands*, the projection is not highly sensitive in this regard. The second and potentially more serious risk is that the merchantability standards for the study noted in the previous paragraph were based on the same ageing subset of inventory data for the PSYUs.

The substantial increase in the timber harvesting land base certainly indicates the availability of a timber supply higher than that projected in the 1987 analysis. However, before the full extent of the associated additional timber supply can be reliably assessed, a current inventory, *specific to the TFL 48 land base*, must be completed. The uncertainty in the inventory used in the current timber supply analysis will be discussed in more detail below, under *age of inventory*.

District staff have questioned the adequacy of the reductions from the timber harvesting land base associated with environmentally sensitive areas. This issue will be discussed below, under *environmental sensitivity*. No specific sensitivity analysis was performed to test the impact of changes in the land base that might be introduced by this or other factors. However, the fact that the base case is a non-declining harvest-flow projection suggests some capacity to accommodate reductions to the land base, while still achieving in the short term the harvest level projected in the base case.

In summary, with the qualifications noted, I accept that the economically and physically operable land base as modelled is representative of current and planned management for coniferous-leading stands. In accepting the operable land base as modelled, however, in my AAC determination I have taken into account the uncertainties in the inventory associated with this land base, as noted below in *age of inventory* and this uncertainty has been influential in my determination as discussed under "Reasons for decision".

Land-base assumptions for deciduous-leading stands will be discussed below, under *major deciduous component*.

- *harvesting systems*

Conventional ground-based harvesting systems, which have historically accounted for about 80 percent of the harvest, may be used on approximately 93 percent of the timber harvesting land base. Mixed and high-lead cable (i.e. unconventional) systems have provided the remaining 20 percent of the harvest, although only about 7 percent of the land base is identified as requiring such systems. District and regional staff thus believe unconventional systems are being used on a broader portion of the land base.

In the draft MP 2, the licensee states that unconventional systems will be used on all lacustrine soil slopes over 30 percent and all other soil-type slopes over 55 percent. The timber supply analysis, in contrast, assumed unconventional systems would be used on all slopes greater than 40 percent, regardless of soil type. By further comparison, a 30-percent slope cut-off line was used in the adjacent Dawson Creek TSA.

This variation has implications for timber supply because operability is typically a function of economic factors. If the licensee has assumed that slopes between 30 and 40 percent are accessible to conventional harvesting systems, and if this proves not to be the case, these lands will likely need to provide a somewhat higher economic return to justify the expense of unconventional systems. It could therefore be argued that a reduction in fibre prices might render some of these areas economically inoperable.

The overall impact of the difference in operating assumptions between the analysis and the draft MP 2 is unclear. It is possible the analyst has reclassified some conventional areas as unconventional and some unconventional areas as conventional. For the next determination I hope to see greater consistency between the management plan and the analysis. The contrast with the practice in the Dawson Creek TSA is suggestive of an issue to be monitored, but, by itself, provides no definitive reason to reject the assumptions modelled in the TFL analysis.

For this determination, I accept the management system assumptions as modelled, acknowledging that some uncertainty exists, the implications of which for timber supply are exacerbated by uncertainty in the existing inventory (see discussion below, under *age of inventory*.)

- *environmental sensitivity*

The classification of environmentally sensitive areas (ESAs) was completed by Inventory Branch staff in 1982–84, but was based in large part on mapping conducted in the late 1970s. In total, 47 036 hectares were deducted from the productive forest in the timber supply analysis, 42 368 hectares of which were for areas with high soil sensitivity and 4632 hectares for areas with high wildlife sensitivity.

District staff, however, have questioned the decision not to make any specific deductions for the 14 175 hectares identified as moderate wildlife habitat or the 10 105 hectares identified as having a high likelihood of problems with plantability or regeneration. It is usual to make specific allowances for these ESAs in the derivation of the timber harvesting land base, and I share the concern of district staff. Moreover, in light of the age and uncertainty around the 1984 ESA maps, regional and district staff believe, and I agree, that it is likely that these do not now fully capture the limitations on harvesting associated with changing management practices that are, because of the Forest Practices Code and integrated resource management, often more constraining on timber supply than those in effect at the time of the 1984 ESA mapping. The impact of this factor on the productive forest is difficult to quantify, however, given that some ESAs for wildlife and plantability likely overlapped with, respectively, riparian and inoperable areas that were removed later in the netdown process.

In summary, there is a high risk that not all the identified ESAs for wildlife habitat and plantability problems will be approved for harvesting and that the timber harvesting land base will therefore be somewhat smaller than indicated in the base case. The result is a downward pressure of unknown magnitude on timber supply throughout the forecast period, and I have taken this into account in my determination as discussed in "Reasons for Decision".

- *woodlots*

Areas supporting volumes of Crown timber that have been apportioned to woodlots but that have not yet been issued as woodlot licences are considered to contribute the timber supply in AACs determined by the chief forester under Section 7 of the *Forest Act*. In contrast, woodlot volumes that are already issued as licences are not included in the timber supply for AAC determinations by the chief forester; rather, separate AACs for issued woodlot licenses are determined by the regional or district manager.

Under the existing AAC for TFL 48, 6150 cubic metres have been allotted to woodlot licence use, but not all of this has yet been issued as licences. To date, 1081 hectares have been allocated (issued) as woodlot licences and were not included in the timber harvesting land base derived for use in the timber supply analysis. District staff estimate that these lands account for about 2870 cubic metres. Assuming a comparable productivity on other lands, it is likely that the remaining 3280 cubic metres awaiting

allocation will necessitate a further removal of approximately 1200 hectares from the timber harvesting land base. If the allotted volumes awaiting allocation are issued in future to woodlot licences, the associated reduction in the timber supply of the TFL is unlikely to be significant. Given an overall timber harvesting land base of more than 257 000 hectares, the anticipated reduction of 1200 hectares should be accommodated easily without the need to adjust the projected harvest level, but this will be assessed and taken into account in future timber supply analyses. For this determination I am satisfied that reductions for allocated woodlots have been modelled appropriately, and that no adjustment to the projected timber supply is required on this account.

- minor deciduous component

The licensee has historically harvested small amounts of deciduous trees within coniferous-leading stands, but these have not been charged against the AAC. To facilitate administration and tracking of timber supply—particularly now that deciduous species are becoming more economically attractive—I believe it is best to account for these trees within the AAC. Consequently, I approve of the inclusion of the minor deciduous component in the timber supply analysis (see earlier discussion under "Timber Supply Analysis"). That analysis indicated the deciduous component within coniferous-leading stands would provide approximately 10 000 cubic metres of the proposed initial harvest level of 540 800 cubic metres per year.

In summary, the AAC will be based on inclusion of the minor deciduous component in stands and the harvesting of these trees should therefore be monitored as part of the cut control process.

- low-productivity sites

In deriving the timber harvesting land base for the analysis, substantial reductions were made for areas with low site indexes. For spruce-leading stands the minimum site index was 8.01 metres at 50 years; for other species the minimum was 11.01.

Within two categories of spruce-leading stands, however, 18 413 hectares of stands with site indexes of less than 8.01 were retained in the timber harvesting land base. Other stands with similar attributes have previously been harvested, so their inclusion in this analysis has some historical justification. Moreover, given that they cover only 7 percent of the timber harvesting land base, the risk to timber supply in the short term is not significant should future operations in these areas prove less feasible than in the past.

The site index limits used were based on the monitoring of field operations, and I have no cause to believe they are unreasonable for this management unit. District staff have conducted studies of merchantability and attest to performance in these lower-productivity stands. I also note that the minimum site indexes used appear conservative in comparison to those used in the analysis for the adjacent Dawson Creek TSA. There, the minimum indexes for balsam- and spruce-leading stands were 9.5 and 7.5,

respectively, which would support the inclusion in this unit of at least some spruce-leading stands with a site index of less than 8.01.

In conclusion, I regard the minimum site indexes used as suitable for use in this determination.

- major deciduous component

Although the coniferous base case did assume harvesting of the minor deciduous component, it did not assume operations on 75 125 hectares of aspen- and cottonwood-leading stands. Those were modelled in a separate deciduous analysis, discussed earlier under "Timber Supply Analysis." Land base reductions applied in deriving the coniferous timber harvesting land base were also used in deriving the deciduous timber harvesting land base, except that in the latter process coniferous-leading stands were deducted rather than deciduous-leading stands.

These deciduous-leading stands are located primarily in the northern and eastern parts of the TFL and represent a significant source of timber for PA 13, held by Louisiana-Pacific Canada Ltd. The deciduous timber harvesting land base was estimated at 29 370 hectares, of which 22 112 hectares hold aspen-leading stands and 7258 hectares hold cottonwood-leading stands. All of these areas are suitable for conventional ground-based harvesting systems. To date, harvesting of this timber has been done under the Small Business Forest Enterprise Program and through timber sale licences directly awarded to Louisiana-Pacific.

The analysis of deciduous-leading stands indicated that a combined aspen-cottonwood harvest, that acknowledges the priority of harvesting in neighbouring coniferous stands, could be maintained for 400 years at 54 200 cubic metres per year without breaching adjacency requirements. Even if priority were not accorded to the coniferous harvest, a non-declining deciduous harvest would be only marginally higher. An accelerated annual aspen-only harvest of 75 000 cubic metres could be maintained for one decade but would decline thereafter by approximately 10 percent per decade until reaching a long-term harvest level of 38 600 cubic metres per year.

By including these stands in the timber supply contributing to the AAC, the overall timber supply is significantly expanded relative to the coniferous base case. And as with the minor deciduous component, harvesting in these stands should be administered within the AAC. The stands are easily identified and tend to be geographically distinct from the coniferous-leading stands. As such, they could be administered relatively easily under a partition without posing a risk to operations and non-timber values in neighbouring coniferous stands. My decision to create a partition, along with supporting reasoning, follows under "Reasons for Decision."

- roads, trails and landings

Most existing operational roads are classified as non-forest and have been excluded from the productive forest land base. A reduction of 6249 hectares was also applied to the productive land base to account for existing unclassified roads and landings. This represents approximately 2.4 percent of the current timber harvesting land base. Losses to future roads were modelled through a further reduction of 12 715 hectares, approximately 4.9 percent of the current timber harvesting land base.

I have no information that suggests these estimates are unreasonable, and I note that, proportionally, they are larger than those made in the timber supply analysis for the adjacent Dawson Creek TSA. Accordingly, I accept the licensee's estimates as suitable for use in this determination.

Existing forest inventory

- age of inventory

The need for an inventory specific to TFL 48 was identified as a priority by the previous chief forester in 1988. This inventory is scheduled for completion and inclusion in MP No 3. For the current AAC determination, the most recent inventories applicable to TFL 48 were undertaken by the BCFS between 1969 and 1987 on three Public Sustained Yield Units (PSYUs) that formed part of the Dawson Creek TSA. When TFL 48 was issued in 1988 the inventory for the five supply blocks in the TFL was based on data collected from the three PSYUs, which represent a larger land base. Since then, the TFL boundary has been digitized, the inventory updated for disturbance to 1992 and inventory growth projected to January 1, 1993, for use in the current timber supply analysis. Although a few years have elapsed since these updates, the stability of the base case forecast assures me that this delay in particular is not a significant issue for this determination.

However, of all the components essential to a reliable timber supply analysis, a current, area-specific inventory is perhaps the most critical. Staff experience with other management units suggests the use of inventory data consisting of a subset of data from a larger area could introduce potentially serious problems of unreliability. In the case of TFL 48 the risk is offset somewhat by the perception of district staff that the TFL lands are generally more productive than those in the adjacent Dawson Creek TSA, from which the inventory was in part derived. This is also consistent with the general situation in the province, where TFL lands are on average more productive than TSA lands. Nevertheless, while I have no specific information that would cause me to reject the inventory used in this analysis, I have noted earlier that the uncertainty it introduces is sufficient to cause me to view with great caution the significant increase in timber supply projected in the current analysis. I note also that while district staff consider this area to be more productive than the adjacent Dawson Creek TSA, they also observed that the productivity of the TFL may be somewhat overestimated in the analysis. In my view this is anecdotal and unproven, but is also a further indication of professional judgements about inherent uncertainty in the inventory.

In view of the associated implications for the timber supply in the TFL, it is urgent that the current level of uncertainty in the inventory be reduced. An inventory audit for the TFL is currently planned for completion in 1997, but is not available at this time to provide any guidance with respect to this uncertainty. As noted under "Implementation of decision", I am directing the licensee to complete a comprehensive inventory for TFL 48, as per the commitment in the draft MP 2, in time for incorporation into the next timber supply analysis. This exercise will also address the ESA mapping problems discussed above, under *environmental sensitivity*.

For the current determination I have taken the uncertainty in the inventory information into account as discussed under "Reasons for Decision".

- age-class structure

Due to the historical prevalence of fires, very few coniferous-leading stands exceed 160 years of age. Approximately 26 percent of the coniferous-leading timber harvesting land base holds stands older than 140 years of age, and 40 percent holds stands older than 120 years of age. The balance of the coniferous land base is relatively evenly distributed among the younger age classes.

In contrast, the historical absence of any large-scale deciduous commercial harvesting means there are now very few aspen-leading stands under 40 years of age. Consequently, aspen harvesting should proceed at a rate that ensures sufficient merchantable second-growth stands exist by the time the currently mature aspen has been removed and I have taken this into account in establishing a partition for deciduous-leading species.

- species profile

The coniferous-leading long-term timber harvesting land base covers over 245 000 hectares and is divided almost evenly between spruce- (51 percent of the land base) and lodgepole pine-leading stands (46 percent), with only a minor component of subalpine fir-leading stands (3 percent). The deciduous-leading timber harvesting land base is much smaller, at 29 370 hectares of aspen- (22 112 hectares) and cottonwood-leading (7258 hectares) stands.

- volume estimates for existing stands

Volume estimates for existing coniferous-leading stands were developed using the Variable Density Yield Prediction (VDYP) model and a methodology approved by Inventory Branch. VDYP is based on information gathered from a large number of sample plots, and is generally accepted in British Columbia as an appropriate model for projecting volumes in existing stands. However, as noted above in *age of inventory*, the inventory information for this TFL, being an ageing subset of data for a larger area, is subject to uncertainty which extends also to the volumes projected by VDYP from that information.

The licensee believes the volume estimates for lodgepole pine stands are understated. District staff agree that the volumes from some pine stands may exceed those estimated in the VDYP tables. The discrepancy cannot be statistically confirmed, however, until the completion of an inventory audit scheduled for 1997, or the completion of the new inventory to be undertaken by the licensee.

A sensitivity analysis indicated the uncertainty around existing volumes does not pose a high risk to timber supply in the short term. The base case could still be maintained for 70 years in the event existing volumes are shown to be 10 percent lower than assumed in the base case. Even a 20-percent reduction would not require a reduction from the base case until after two decades from now. In either case, the long-term harvest level would remain unchanged. Accordingly, I believe there is no undue risk in accepting the existing stand volume estimates for the period of this determination. The new inventory data that will be available for the next timber supply analysis will ensure a greater level of confidence in the existing stand volume estimates.

Expected rate of growth

- site productivity estimates

Area weighted site indexes were calculated for each analysis unit using the BCFS "Freddie" model for all stands greater than 35 years of age and provincial default site indexes for stands younger than 35 years of age. The analyst assumed each stand would retain its original site index following harvest even though the leading species may have changed.

In other management units BCFS staff suspect the use of old-growth site indexes to predict growth in regenerated stands may lead to an underestimation of the productivity of regenerated stands. The significance of the issue has prompted a province-wide study employing over a thousand paired-plot samples in an attempt to determine the relative accuracy of the current site indexes for four major species—Coastal Douglas-fir, hemlock, spruce and lodgepole pine.

I note that the base case harvest projection is insensitive in the short term to reductions in regenerated volumes (see discussion below, under *volume estimates for regenerated stands*) and to a five-year increase in green-up ages. For this reason, I am satisfied that the use of the modelled site indexes poses no undue risk to timber supply for the period of this determination. Accordingly, I accept them as suitable for this determination. Any improvements in information from the ongoing paired-plot studies will be incorporated in the next analysis.

- volume estimates for regenerated stands

Volume estimates for all coniferous-leading stands currently younger than 21 years of age with a history of harvesting were developed using the Table Interpolation Program for Stand Yields (TIPSY) growth and yield model. Older stands were modelled using VDYP until harvest, following which they were assumed to regenerate as managed stands modelled by TIPSY. All yield curves and operational adjustment factors (OAFs) were reviewed and approved by BCFS Research Branch staff for use in the analysis. (See also Decay, waste and breakage below.)

There is no indication that regenerated stand volumes will be less than estimated in the base case. Even if this does occur, a sensitivity analysis indicated the base case could still be maintained for two decades if regenerated volumes were reduced by 20 percent; the long-term harvest level would, however, drop by 20 percent. Given the minimal risk to timber supply in the short term, I am satisfied that regenerated volumes have been modelled appropriately for this determination.

- minimum harvestable ages

Minimum harvestable ages for both existing and regenerated stands are considered to be the lesser of culmination age or regional priority age. For existing stands the minimum harvestable age ranged from 98 to 160 years, with an area-weighted average of about 119 years. For regenerated stands, the range was from 78 to 141 years, with an area-weighted average of about 112 years.

I find these ranges and averages reasonable and have no cause to question their suitability for use in this determination.

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

Regeneration delay

The regeneration delay periods used in the analysis were two years for planted stands and seven years for naturally regenerated stands. The modelled proportions were 66 percent planted and 34 percent naturally regenerated. I note, however, that in the draft MP 2, the licensee has committed to planting all harvested areas and has projected that 90 percent of all such areas will be reforested within two years.

District staff believe the modelled figures may underestimate the true delay periods in some areas but have no documented evidence to substantiate their concerns. During the term of the next management plan they intend to monitor delay periods in the field to ensure they meet Silviculture Prescription requirements and to determine if they are consistent with the periods modelled in the analysis.

There are thus two possible influences on the base case. If the licensee achieves its management plan objectives, there may be a slight upward pressure on timber supply in

the medium and long terms, relative to that projected in the base case. On the other hand, if district staff are correct in their beliefs, timber supply may be less than modelled over those time periods. To provide more certainty in this issue, I encourage district staff to undertake the proposed monitoring, which should lead to the use of verified regeneration delay periods in the next timber supply analysis.

For this determination small changes in regeneration periods are not a significant issue. The regeneration delay period does affect the time required by forest stands to reach green-up, but a sensitivity analysis showed that a five-year delay in reaching green-up would not change timber supply in the short term. Thus I accept the regeneration delay periods modelled in the analysis as suitable for use in this determination.

Impediments to prompt regeneration

In the analysis 10 105 hectares were identified as highly susceptible to problems with plantability or regeneration. Although classified as environmentally sensitive, none of these areas were excluded in deriving the timber harvesting land base, which, as noted earlier, under *environmental sensitivity*, was therefore likely overestimated to some extent. This will restrict the timber supply from that projected in all forecast periods, and I have taken this into account in my determination, as discussed under "Reasons for Decision".

Not-satisfactorily-restocked areas

There are 20 957 hectares of not-satisfactorily-restocked (NSR) areas on the TFL inventory file, of which 3868 hectares were excluded from the timber harvesting land base. The remaining 17 089 hectares were then deducted in the analysis. Of these, 13 063 hectares were backlog NSR—defined by the licensee as lands not reforested within the regeneration delay time frame—and 2286 hectares were current NSR. The combined total of 15 349 hectares for these two categories was then added back to the timber harvesting land base in the analysis. The difference between this total of 15 349 and the 17 089 originally deducted represents 1740 hectares of untreatable NSR lands on steep slopes.

The analysis projected the 13 063 hectares of backlog NSR to be regenerated at a rate of 400 hectares per year over a 33-year period. District staff believe this could be a reasonable estimate, in light of current plans and activity levels, but are concerned at the lack of information on many of these sites. The licensee is in the midst of conducting silvicultural surveys of its NSR lands and is expected to reclassify many of them to "restocked" or, possibly, "untreatable." There is, therefore, still considerable uncertainty surrounding the exact status and area of the backlog sites. On the other hand, there is no better or more definitive information than the assumptions used in the analysis.

By the next determination I anticipate the survey work will be complete and that this issue will be more clearly defined. In the meantime, I will accept the assumptions used in

the analysis as suitable for this determination, since the uncertainty associated with this factor acts primarily to affect the long-term timber supply projection, and will not affect the short term.

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

Incremental silviculture

To date, the licensee has carried out very little incremental silviculture, and this level of activity was modelled in the analysis. Canfor has, however, proposed to undertake an annual conversion of 100 hectares of aspen-leading stands to conifers. A sensitivity analysis indicated that, if carried out for a period of 100 years, this practice could increase the even-flow coniferous harvest level by 16 500 cubic metres per year, or 3 percent above the base case. The nature of the flat-line harvest forecast would allow the impact of this future activity to be felt in the short term.

I note that this proposal could have implications for the aspen harvest carried out to meet the requirements of PA 13, although this is not an issue for this AAC determination. For this determination, I note that any potential timber supply impacts associated with species conversion will not be taken into account until such practice is approved and becomes standard practice.

Commercial thinning

Commercial thinning is not carried out at present, and no allowance for such activity was made in the analysis. On the basis of the information presented to me, I agree that there is little opportunity for commercial thinning at this time.

(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 and compliance

The standard Interior close utilization standards were assumed in the analysis: i.e. all wood above a diameter of 17.5 cm at breast height (12.5 cm for pine and deciduous), up to a top diameter of 10 cm and down to a stump height of 30 cm is charged against the AAC. I am satisfied these reflect current practice and have been accounted for within the accepted yield tables.

In the draft MP 2, the licensee has projected the use of closer utilization standards for spruce than those modelled. If this becomes standard practice over the term of MP 2 it will be reflected in future determinations. For the present determination, I accept the current standards and assumptions as modelled.

Decay, waste and breakage

Special waste and breakage factors for existing stands were approved by BCFS Inventory Branch staff and used in the analysis. The VDYP base tables used to determine growth and yield already include allowances for decay. I have no reason to question this procedure or the factors used and I accept them as suitable for use in this determination.

For regenerated stands, OAFs were used to account for losses to decay, waste and breakage. While there is a good deal of uncertainty about the level of losses in future stands, I acknowledge an attempt was made to recognize that such losses will occur. In the absence of better information or refuting evidence, I accept the use of these factors for this unit.

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

Integrated Resource Management (IRM) objectives

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

Data collection and the completion of the information package on which the analysis was based took place before the introduction of the Forest Practices Code and well before the finalization of the various guidebooks. The management practices assumed in the analysis thus fail to meet the new requirements in several instances. Where applicable, these will be discussed in the following sections.

- visually sensitive areas

Canfor has undertaken a landscape inventory and identified 81 554 hectares (12.8 percent of the total land base) that the licensee and BCFS staff have jointly agreed are visually sensitive. More than half these areas lie outside the productive forest or were excluded from the timber harvesting land base for various reasons—for example, areas with stands considered non-commercial, unmerchantable or environmentally sensitive. As well, 944 hectares of areas with a Preservation visual quality objective (VQO) were netted out entirely. Remaining in the timber harvesting land base are 3161 hectares with a Retention VQO, 14 767 hectares with a Partial Retention VQO, and 15 754 hectares with a Modification VQO. The total of 33 682 hectares—approximately 13 percent of the current timber harvesting land base—represents a significant emphasis on visual management that was absent at the outset of Management and Working Plan 1 in 1988.

Further direction on this issue may be forthcoming with the anticipated completion later this year of the Dawson Creek LRMP. The risk to timber supply associated with a change in management assumptions was tested by a sensitivity analysis. This projected the potential impact of elevating visual management areas to the next more constraining category—i.e. Modification VQOs became Partial Retention; Partial Retention became Retention; etc.—and of increasing by 5 years the age required to reach green-up height. The base case initial harvest level would remain unaffected for 40 years, but would decline thereafter by 7.8 percent to a lower long-term harvest level of 498 800 cubic metres.

On this basis, and bearing in mind the Minister's memorandum on visual management and AAC determinations (see discussion below, under Minister's letter and memorandum), I am satisfied that this issue holds minimal risk to timber supply in the short and medium terms. In any case, until different VQOs are formally established I must defer to those currently in effect. For this determination, then, I am satisfied that the visual management regime modelled is appropriate for my consideration and that no adjustment to the projected timber supply is required on this account.

- *wildlife*

The principal wildlife species of concern in TFL 48 are grizzly bears, caribou (in high-elevation areas), martens, fishers and wolverines. Management to preserve habitat for these species was modelled in the timber supply analysis through forest cover requirements (see discussion below, under *forest cover requirements*) and through the assumption that area outside the timber harvesting land base would provide suitable habitat. As noted earlier, under *environmental sensitivity*, no moderate wildlife ESAs were removed from the timber harvesting land base. Canfor is also undertaking a habitat inventory, in cooperation with staff of the Ministry of Environment, Lands and Parks (MELP), to help determine wildlife management options for the future. MELP staff have expressed concerns about the need to maintain suitable wildlife habitat, particularly in natural disturbance type 1 areas (see below, under *biodiversity*.)

In all likelihood, at least some of the 14 175 hectares of moderate wildlife ESAs left in the timber harvesting land base will need to be excluded in order to meet Forest Practices Code requirements. The impact of removing some or all of these lands was not tested by a sensitivity analysis. However, given the large size of the current timber harvesting land base—257 915 hectares—and the fact that some wildlife ESAs undoubtedly overlapped with the 8224 hectares of riparian habitat removed later in the process, I find it reasonable to assume that this factor, in isolation, would not affect timber supply significantly in the short term. If deductions are required for wildlife habitat—either as a result of Forest Practices Code requirements or at the direction of the Dawson Creek LRMP—I am confident they can be accommodated by a moderate reduction in the harvest level at some future determination. However, as noted earlier, under *environmental sensitivity*, this factor in conjunction with plantability ESAs constitutes a downward pressure on timber

supply across all time frames. This issue will be discussed further, under "Reasons for Decision."

- riparian areas

During the definition of the timber harvesting land base, reductions for riparian areas were made representing a total of approximately 3 percent of the current timber harvesting land base. These were made after other reductions, some of which—e.g., ESA reductions for high value wildlife habitat—may have included riparian areas. The 3-percent reduction was not based on any mapping or specific Forest Practices Code requirements, but was the best estimate of regional and district staff.

Recent work in the adjacent Dawson Creek TSA has identified necessary reductions, also after deductions for ESAs, of 2.2 percent and 5.8 percent respectively to the deciduous and coniferous timber harvesting land bases, to account for riparian reserve and management area requirements under the Code. Regional and district staff now suspect further reductions may be needed in TFL 48 but have no evidence specific to this management unit to substantiate their concerns.

For the purposes of this determination, from the findings in the adjacent TSA and from the geographic and ecological similarity between the TSA and this TFL, I am mindful that the land base deduction applied in the analysis for TFL 48 may not completely account for riparian management, although the exact magnitude of the necessary deduction has not been specifically analyzed for the TFL. Therefore, while the Dawson Creek findings do not provide precise information for the TFL area, in my judgement, it is reasonable to conclude from them that a further riparian deduction of approximately two percent or slightly greater could be required in the TFL, and I have taken this into account in my determination, as noted in "Reasons for Decision". For the next determination I expect riparian reserve area and management zone requirements under the Code to be modelled specifically for the TFL.

- community watersheds

The Pine River flows through the southern part of the TFL and provides the water supply for Chetwynd. In recognition of the drainage's importance to that community, the Dawson Creek LRMP is considering a proposal to reclassify it as a community watershed. Until it is formally designated as such, however, I must accept its current status as part of the general IRM zone in the timber harvesting land base. Any changes arising from LRMP directives on this issue will be addressed at the next AAC determination.

- recreation

Prior to receiving the licence in 1988, Canfor has worked to maintain and develop recreation opportunities. In 1994 it completed an inventory of recreationally significant areas throughout the TFL. Approximately a third of the total land base—over 200 000 hectares—is considered to have moderate or high recreational values. To account for management of specific recreation areas, 9432 hectares were removed from the productive forest in the timber supply analysis. The remainder is managed either through special management practices or is assumed to be sufficiently protected by normal management practices.

I am satisfied that the analysis has taken this factor into account appropriately and have no reason to believe any adjustments to the base case will be necessary.

- areas of cultural or archaeological significance

TFL 48 lies within the traditional use areas of the West Moberly and Sauleau First Nations. Both are signatories to Treaty 8, and both have expressed a desire for greater consultation in resource management decisions in the licence area. In particular, they have voiced concerns over harvesting proposals for the Dowling Creek area, which is of spiritual significance to both bands. Unless and until this area is formally removed from the timber harvesting land base, however, I have no authority not to include it in my considerations. Nonetheless, I encourage the parties involved in their efforts to resolve the situation, and hope that the status of the area will be clarified before the next AAC determination. For now, I have no information to suggest the postponement of operations in this area will affect timber supply elsewhere on the unit.

The Ministry of Small Business, Tourism and Culture is currently commissioning an archaeological overview assessment for the Dawson Creek LRMP, with the results expected later this year. The next AAC determination will be in a position to address any concerns and actions that arise from that assessment.

- 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. Under the Forest Practices Code, biodiversity in a given management unit is assessed and managed at the landscape and stand levels. Landscape-level biodiversity objectives involve maintaining forests with a mix of ages, patches of old-growth, and forested corridors (i.e. forest ecosystem networks, or FENs). Provisions for stand-level biodiversity ensure maintenance of structural diversity and habitat for wildlife through the retention of wildlife tree patches, leave trees and coarse woody debris.

Biodiversity considerations at both levels were modelled indirectly in the analysis through land base reductions (e.g. riparian and wildlife ESAs) and forest cover requirements, although the sum total of these approaches does not reflect the licensee's full obligations under the Forest Practices Code. As yet, no mapping of FENs has been undertaken in TFL 48, so these could not be modelled.

The leaving of wildlife tree patches was also not explicitly modelled in the analysis, although the licensee has experimented with this practice in the past and has indicated in the draft MP 2 that it will continue to leave some deciduous trees standing for this purpose. This is in any event now a requirement of the Forest Practices Code. Studies elsewhere in the Prince George Forest Region indicate an average land-base reduction of 3 percent will be needed to account for wildlife tree patches alone. No data specific to this unit are available, but the regional findings suggest at least some degree of downward pressure on timber supply.

Due to the prevalence of the Engelmann Spruce-Subalpine Fir biogeoclimatic zone, much of TFL 48 is classified as "natural disturbance type" (NDT) 1, according to the Biodiversity Guidebook. The rare occurrence of major stand-initiating events such as fires and windstorms in this ecosystem allows forests to develop a relatively high level of complexity and connectivity. Consequently, they also represent important wildlife habitat. Pending the development of specific landscape-level biodiversity objectives for these areas, the district and the licensee have agreed that NDT 1 areas be managed for an intermediate biodiversity emphasis. (The three options identified in the Biodiversity Guidebook are "lower," "intermediate" and "higher.") In contrast, NDT 2 and 3 areas experience major stand-initiating events on a more frequent basis, leading to relatively less complex stand structures and a correspondingly lower management emphasis on biodiversity.

The implications for timber supply are that management options in NDT 1 areas will generally be more constraining than in other areas. Province-wide, provisions for biodiversity requirements under the Code, including the retention of wildlife tree patches, are expected to reduce harvest levels in the short term by a range of 2–4 percent. The findings of a recent analysis in the adjacent Dawson Creek TSA support an impact in this order of magnitude from stand-level biodiversity measures.

The foregoing discussion on NDTs and the expectation that wildlife tree patches alone will account for an estimated 3-percent reduction region-wide suggest the need for some land base deductions and forest cover requirements beyond those employed in the analysis. I am further persuaded in this by the recent analysis work in the Dawson Creek TSA, which because of geographic and ecological similarity, can reasonably be expected to apply in a similar order of magnitude to this TFL.

To some extent the Code requirements at the landscape level may be offset by the fact that some landscape-level biodiversity objectives may be met through structures on

adjacent TSA lands; e.g., the presence of forest ecosystem networks (FENs) in the Dawson Creek TSA may lessen the need for similar networks on TFL lands.

The Dawson Creek LRMP is expected to release its landscape-level biodiversity recommendations within the next year. In the draft MP 2, the licensee has committed to incorporating any guidance from the LRMP and to implementing landscape-level biodiversity objectives once those are established. Accordingly, the impact on timber supply arising from the biodiversity provisions of the Code should be more apparent by the time of the next determination. For now, however, I accept that landscape-level biodiversity measures represent an unquantified downward pressure on timber supply throughout the forecast period. Furthermore, I anticipate an impact from the expected implementation of stand-level measures as discussed above. I have taken biodiversity measures into account in my determination as discussed under "Reasons for Decision".

- forest cover requirements

Outside visually sensitive areas, a maximum of 33 percent of the land base is permitted to be less than the green-up height of three metres at any time. Within the visually sensitive areas—discussed earlier, under *visually sensitive areas*—the green-up height is five metres and the maximum area disturbances are as follows: Retention zone—2 percent; Partial Retention zone—12 percent; and Modification zone—25 percent. These requirements were modelled in the timber supply analysis.

Timber supply in this management unit is largely insensitive to changes in green-up or forest cover requirements. A sensitivity analysis projected that a five-year increase in the age required to meet the green-up height—a less constraining sensitivity test than that described earlier in *visually sensitive areas*—would not require any change to the base case initial harvest level for 170 years at which point a 5.3-percent reduction to the long-term harvest level is projected. Accordingly, I am satisfied that the possibility of changes to the current forest cover requirements poses little risk to timber supply over the period of this determination.

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

Harvest profile

No coniferous harvest profile was requested or provided. Harvest priority is given first to stands that provide the highest productivity, then to older stands. This policy was modelled in the analysis but is constrained in practice by the forest cover requirements within each management zone. However, I do not expect this difference to be sufficient to affect the projected initial harvest level.

Partitioned component of the harvest

There is currently no partition in the AAC for this TFL. As noted earlier, however, under *major deciduous component*, I believe an opportunity and ample justification exist to regulate the harvest of deciduous-leading stands within the framework of a partition. This issue will be discussed in more detail below, under "Reasons for Decision."

20-Year Plan

Dawson Creek District staff requested additional maps with overlays to supplement the 20-Year Plan originally submitted by the licensee. The original plan showed the proposed AAC could be implemented on the ground, but district staff were concerned that the layout of cutblocks would disrupt wildlife corridors. This additional information has since been provided and the plan has now been approved by district staff. I am satisfied that it is suitable for use in my determination.

Dawson Creek LRMP

As part of the Dawson Creek Forest District, TFL 48 falls within the purview of the Dawson Creek LRMP process now underway. The participants are expected to present their final land-use recommendations to government later this year. Among the issues under discussion is the proposal to manage the Pine Pass-Mount Lemoray area of interest as a wilderness preserve. Although 29 497 hectares of this area lie in TFL 48, only 3466 hectares form part of the timber harvesting land base. A sensitivity analysis projected a flat-line harvest of 532 800 cubic metres per year if this area is protected, 8000 cubic metres below the base case.

Although the land-use plan ultimately approved by government may markedly change management practices in TFL 48, I believe it would be inappropriate for me to speculate on what those changes might be or try to take into account the potential impacts they might have on timber supply. (See earlier discussion under "Guiding Principles.") Nonetheless, I am conscious that, as far as possible, my AAC decision for this management unit should not restrict the range of options available to the LRMP. For this reason alone, inordinately large changes to the AAC—changes that are likely to create a situation at odds with the objectives of the land-use plan ultimately approved—should be avoided.

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

Harvest flow

No alternative harvest-flow projections were provided for a combined aspen-cottonwood harvest. An alternative projection for an aspen-only harvest indicated that an accelerated harvest rate of 75 000 cubic metres per year could be maintained for one decade before declining over seven decades to the long-term harvest level of 38 600 cubic metres per year. The licensee also modelled several accelerated coniferous harvest-flow projections,

beginning as high as 25 percent above the base case. Each forecast subsequently declined at a moderate rate to the long-term harvest level, which remained unchanged.

In 1995 the licensee reviewed the timber supply analysis undertaken in support of the original Management and Working Plan 1, approved in 1988. The review utilized updated inventory statistics, updated growth and yield data, current harvest simulation models and a geographical information system to assist in land base determinations, but maintained the same management and harvesting assumptions used at the time of the original analysis. The results indicated a current harvesting land base of 196 833 hectares, 28 percent larger than assumed before, and a higher long-term harvesting level of 420 520 cubic metres per year. Although not strictly applicable to this determination, because of the differences in management and harvesting assumptions, this exercise does underline the stability and resiliency of timber supply in the unit.

Given the inherent planning advantages of and economic stability provided by a non-declining harvest flow, I accept the base case projection as a suitable point of reference for my determination.

Community dependence on forest industry

The licensee owns and operates a large sawmill in Chetwynd, employing approximately 180 people. A second major sawmill in Chetwynd, owned by West Fraser Mills Ltd., receives its fibre from sources outside TFL 48. Louisiana-Pacific, the holder of PA 13, owns and operates a Chemi-Thermal-Mechanical Pulp (CTMP) mill in Chetwynd, which employs over 170 people.

These figures clearly indicate a significant degree of dependence upon the forest industry in Chetwynd, and I have taken this into account in my determination.

Difference between AAC and actual harvest

Since the licence was awarded in 1988, the actual harvest in any given year has fluctuated markedly. Nonetheless, the annual average over the eight-year period is estimated to be about 97 percent of the AAC. Accordingly, I have no concerns about the licensee's historical ability to achieve the allowable harvest level.

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

Timber processing facilities

The licensee's sawmill in Chetwynd processes in excess of 700 000 cubic metres annually, of which roughly half is provided by Canfor's TFL 48 harvest. The plant has been upgraded extensively in recent years, and further investment is planned to improve utilization of residue and lower quality timber. Approximately 270 000 cubic metres of

chips are produced by the plant, all of which are sent to Canfor's pulp and paper complex in Prince George.

Louisiana-Pacific's CTMP mill in Chetwynd has a processing capacity of approximately 450 000 cubic metres annually of deciduous fibre—primarily aspen with a cottonwood component of about 6–7 percent. The TFL 48 harvest, to date, has provided only 50–60 000 cubic metres of this. The balance stems predominantly from purchases from private lands, supplemented with Crown timber from the Dawson Creek TSA.

Clearly, the CTMP mill is far less dependent upon the TFL 48 harvest than is the sawmill. Nonetheless, I am aware that the volume provided by the TFL may prove difficult to source elsewhere, particularly if demand in the northeast part of the province for deciduous fibre increases in future as expected.

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

Minister's letter and memorandum

The Minister has expressed the economic and social objectives of the Crown for the province in two documents to the Chief Forester: a letter dated July 28, 1994 (attached as Appendix 3), and a memorandum dated February 26, 1996 (attached as Appendix 4). I understand both documents to apply to TFL 48. They are consistent with the objectives stated in the Forest Renewal Plan and include forest stewardship, a stable timber supply, and allowance of time for communities to adjust to harvest level changes in a managed transition from old-growth to second-growth forests, so as to provide for continuity of employment.

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

As noted above, under Commercial thinning, the licensee has not engaged in commercial thinning in this management unit, and made no allowance in the timber supply analysis for commercial thinning. An opportunity does exist, however, to create a partition to regulate harvesting in major deciduous stands. This issue will be discussed further, under "Reasons for Decision."

The Minister's memorandum addressed the effects of visual resource management on timber supply. It asked that pre-Code constraints applied to timber supply in order to

meet VQOs be re-examined when determining AACs in order to ensure they do not unreasonably restrict timber supply. As noted earlier, under *visually sensitive areas*, I have no reason at this time to expect timber supply to be constrained from the projected level in the short or medium terms by visual resource management measures.

Local objectives

Canfor received public input during the presentation of the draft MP 2 at four open houses held Dec. 12–15, 1995, in Dawson Creek, Tumbler Ridge, Hudson's Hope and Chetwynd. Attendance over the four days was estimated at 69 people, but only a few left brief comments on the guest registry, and only three questionnaires were filled out and returned. Later that month the Ministry of Small Business, Tourism and Culture submitted a letter to the licensee describing the archaeological overview assessment being conducted on TFL 48 (discussed above, under *areas of cultural or archaeological significance*). My office also directly received a letter from a Hudson's Hope resident expressing views on the AAC determination for the unit.

The Dawson Creek LRMP process is expected to forward its final land-use recommendations to government later this year for the lands within the Dawson Creek Forest District. Once available, those recommendations will constitute a comprehensive gauge of public objectives for the district land base, including the TFL 48 lands. It is premature at this time, however, to speculate on what those recommendations might be.

In reaching my determination I have reviewed and taken into consideration the public input received.

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

Unsalvaged losses

The major cause of unsalvaged losses is fire, with over 44 000 cubic metres of estimated annual losses modelled in the analysis. Insects and windthrow account for the balance of the 56 000 cubic metres assumed to be lost each year.

At 10 percent of the proposed harvest level, the estimated total losses are higher than the provincial average. Nonetheless, district staff agree they reflect local conditions and the licensee's actual experience. On this basis, and in the absence of contradicting information, I accept these estimates as suitable for use in this determination.

Reasons for Decision

In reaching my decision on an AAC for TFL 48, I have considered all of the factors presented above and have reasoned as follows.

- coniferous-leading stands

The timber supply analysis projects that the current coniferous AAC of 410 000 cubic metres could be increased immediately to a long-term harvest level of 540 800 cubic metres and maintained there for at least 400 years. This projected 32-percent increase was made possible primarily by the inclusion in the timber harvesting land base of substantial areas of stands previously classified as unmerchantable.

There are no factors identified that indicate timber supply may be significantly higher than projected in the analysis. Three factors, however, indicate that the timber supply may be lower than projected.

1. The derivation of the timber harvesting land base did not include specific deductions for category 2 ESAs for sensitive soils and wildlife habitat and category 1 ESAs for plantability;
2. the riparian requirements of the Forest Practices Code are expected to exceed those modelled in the analysis; and
3. the biodiversity requirements of the Forest Practices Code are expected to exceed those modelled in the analysis.

The uncertain status of almost 25 000 hectares of ESAs, roughly 10 percent of the timber harvesting land base, is a concern. District staff anticipate that many wildlife ESAs and areas with plantability or regeneration problems will not be approved for harvesting once operational plans are submitted by the licensee. As well, staff concur that the existing ESAs do not fully capture the limitations on harvesting associated with changing management practices that are, because of the Forest Practices Code and integrated resource management, often more constraining on timber supply than those in effect at the time of the 1984 ESA mapping. Given the current state of assumptions and data in the analysis, it is impossible at this time to quantify the potential impact associated with this factor. At the very least, however, I regard it as a compelling argument not to grant the full AAC increase requested by the licensee.

A 5.8-percent coniferous land base reduction for riparian areas was indicated in the Dawson Creek TSA. A reduction of three percent was incorporated in the TFL48 analysis. While the exact magnitude of the full reduction required for the TFL is not directly indicated, I am satisfied that a further reduction in the TFL in the order of magnitude of approximately two percent or slightly greater will be required.

Further reductions in the timber harvesting land base to account for biodiversity requirements under the Forest Practices Code can be expected in TFL 48, as in many other management units in the province during the current round of AAC determinations. This is understandable, given that the data package and subsequent timber supply analysis were completed before the final

version of the Biodiversity Guidebook was available. The management practices assumed in the timber supply analysis will almost certainly need to change in order to achieve future biodiversity objectives at the stand and landscape levels. As noted earlier, under *biodiversity*, I am unwilling to speculate on the magnitude of the impact that managing for landscape objectives will have on timber supply. Nonetheless, I am persuaded that they represent sufficient risk to preclude an increase in the AAC to the level indicated in the base case projection. Furthermore, I am also aware that in the absence of landscape-level objectives, there are increased requirements to implement stand-level measures, largely through the implementation of a wildlife tree strategy. This means that less volume will be harvested than projected in the base case. As noted in the section on biodiversity, this is estimated to represent approximately a three-percent reduction in the timber supply.

There are two other factors that do not represent specific upward or downward pressures on timber supply but that introduce further uncertainty to this determination. These are the reliability of the inventory information and the land-use recommendations expected later this year from the Dawson Creek LRMP.

The more significant of these to this determination is the reliability of the inventory information. Although the need for a new inventory was identified in 1988, the current inventory is still based on a subset of data from a larger area of three PSYUs and dating as far back as 1969; it is urgently in need of replacement by a current inventory. The inventory audit currently planned for completion in 1997 cannot provide any additional certainty in time for this determination. The effects of the associated uncertainties on timber supply are not clear at this point, but as noted in my considerations, these may derive from implications for merchantability and harvesting systems as well as for volumes. As also noted, I am satisfied that the current timber harvesting land base is larger than that derived in the 1987 analysis, but in view of the uncertainty in inventory information, in my AAC determination I am not prepared to accept the full associated increase in timber supply projected by the licensee.

Regarding uncertainty in the forthcoming Dawson Creek LRMP, the fact that the base case indicates a 32-percent increase, to a harvest level that is a point of reference for the LRMP process, is of concern to me—more so than would be the case in a management unit where the base case projected continuation of the existing harvest level. To sanction such a large increase at this time could create a management situation that could be at odds with biodiversity or other objectives recommended by the LRMP, or, worse, could compromise the outcome of some aspects of the process. I believe it is important not to prejudge those recommendations or the land-use decisions that will ultimately be approved by government. Accordingly, in assessing the appropriateness of a higher AAC, I must be careful to ensure that the harvest level determined will provide the flexibility necessary to accommodate a wide range of objectives and recommendations that may emerge from the LRMP process. The implications for timber supply can then be reviewed during the term of MP 2 and addressed in the next AAC determination.

Finally, there is the issue of community stability. The Minister has expressed the Crown's objective of minimizing AAC reductions consistent with maintaining the long-term productivity of B.C.'s forests. In my judgement, it is consistent with this objective also to avoid any sudden

large AAC increase that is based on information which incorporates uncertainties that, when resolved, could conceivably lead to the need for a future reduction. A sudden, 32-percent increase in AAC in this TFL at this point would encourage substantial additional hiring and infrastructure development within a very short time period, which could potentially lead to the need for abrupt social readjustment and restricted forest management flexibility in the event that a subsequent reduction were eventually required. Therefore, until the uncertainty around the inventory, the LRMP recommendations and the biodiversity requirements is further resolved, I am persuaded of the need for considerable caution in approving a large harvest level increase for this TFL.

My review of the downward pressures discussed earlier has satisfied me that the long-term harvest level is at some point between the existing AAC and the 540 800 cubic metres indicated in the base case. In view of the risks associated with the substantial uncertainties identified, at this time I have decided to raise the AAC to 460 000 cubic metres, a volume that will also include all deciduous trees harvested in coniferous-leading stands. Although substantially less than the harvest level suggested in the base case projection, this increment still represents a 12-percent increase to the existing AAC. This should encourage greater economic activity, with minimal risk of an ensuing reduction in the near future. I am also confident that it will not compromise options for meeting any changing management objectives that might arise during the term of this AAC. If the next analysis shows a higher base case that is compatible with those changes, and is supported by reduced uncertainty in the areas identified, this will be taken into account in the next AAC determination.

- deciduous-leading stands

The primary deciduous species harvested are aspen and, to a much lesser degree, cottonwood. To date, the volumes harvested for processing in Louisiana-Pacific's CTMP mill in Chetwynd have averaged approximately 50–60 000 cubic metres annually, divided between coniferous- and deciduous-leading stands. Harvesting has been carried out under the Small Business Forest Enterprise Program and through direct awards to Louisiana-Pacific.

Historically, deciduous volumes have not been charged against the AAC. The changing administrative environment around meeting sustainability objectives, however, has given rise to the need to account for and regulate the deciduous harvest through the AAC process. Given the geographic discreteness of the deciduous-leading stands in this unit, I believe they can be managed within the framework of a partition. Earlier, under *major deciduous component*, I noted that a sensitivity analysis indicated a sustainable harvest level of 54 200 cubic metres per year was feasible under a management system that accorded harvesting priority to adjacent coniferous stands. This non-declining harvest level also approximates the average annual deciduous harvest used to satisfy the requirements of PA 13. As such, I am satisfied that it represents an appropriate level for a partition. For ease of administration I have rounded the harvest level to 54 000 cubic metres.

Determination

It is my determination that a timber harvest level that accommodates objectives for all forest resources during the next five years, that ensures longer-term IRM objectives can be met, that reflects current management practices, and that minimizes disruptive shortfalls in future wood supply, can best be achieved in this TFL at this time by establishment of an AAC of 514 000 cubic metres, including volumes harvested on Schedule B lands through the Small Business Forest Enterprise Program. This AAC will be partitioned as follows:

- 460 000 cubic metres attributable to coniferous and deciduous trees harvested within coniferous-leading stands; and
- a maximum of 54 000 cubic metres attributable to deciduous and coniferous trees harvested within deciduous-leading stands.

Implementation of decision

This determination comes into effect on December 31, 1996, and will remain in effect until a new AAC is determined, which must take place within five years of this determination.

During the term of MP 2, the licensee must complete a comprehensive inventory of the TFL lands.

A handwritten signature in black ink, appearing to read "L. Pedersen". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Larry Pedersen
Chief Forester

October 15, 1996

Appendix 1: Section 7 of the *Forest Act*

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

Allowable annual cut

7. (1) The chief forester must determine an allowable annual cut before December 31, 1996, and after that determination at least once every 5 years after the date of the last determination, for

- (a) the Crown land in each timber supply area, excluding tree farm licence areas and woodlot licence areas, and
- (b) each tree farm licence area.

(1.1) If, after the coming into force of this subsection, the minister

- (a) makes an order under section 6 (b) respecting a timber supply area, or
- (b) amends or enters into a tree farm licence to accomplish the result set out under section 33.1 (1) (a) to (d),

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

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

(1.11) If

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

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

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

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

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

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

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

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

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

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

Appendix 2: 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.

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