APPENDIX VIII

TIMBER SUPPLY ANALYSIS

V.1 Timber Supply Information Package
V.2 Timber Supply Analysis Report
V.3 Chief Foresters Rationale For AAC Determination

APPENDIX VIII

V.1 Timber Supply Information Package

Timberline
Forest Inventory Consultants Ltd.

January 13, 1999

Doug Lang
Pope and Talbot Ltd
PO Box 2000
Nakusp, BC V0G 1R0

Dear Doug:

Enclosed please find the amended version of the Timber Supply Analysis Information Package for Pope and Talbot Ltd., Arrow Lakes [redacted] Licence 23, Management Plan #9. This supercedes the version dated September, 1998. It contains the following amendments:

1. Addition of Schedule A information to Table 6.1

The total Schedule A area (6838 hectares) was determined from the updated GIS coverage for TFL 23. This is 506 hectares less than the area reported in Management Plan 8. The latter was based on tabular records held by Pope and Talbot. After review by Pope and Talbot staff the current GIS areas were deemed to be an accurate representation of Schedule A lands.

2. Corrections to VDYP volumes (Tables 6.1, 6,4, 6,5, 6,6, 6,8, 6,9)

The original tabular values reported in these tables did not include larch volumes. These have been corrected. These corrections have no impact on the timber supply analysis, as the VDYP yield curves employed in the analysis included all merchantable species.

3. Completion of Table 6.9 (Riparian Management Areas)

The breakdown of these areas by classification was not completed at the time the original Information Package was prepared. This summary has since been completed.

As Appendices 1 and 2 (Yield Tables) remain unchanged, the appendices were not included in this amended report.

Sincerely,
TIMBERLINE FOREST INVENTORY CONSULTANTS LTD.

Erik Wang, RPF

cc: Greg Lawrence
MoF, Timber Supply Branch

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POPE & TALBOT LTD.
ARROW LAKES TREE FARM LICENCE 23
MANAGEMENT PLAN #9

TIMBER SUPPLY ANALYSIS
INFORMATION PACKAGE
(Amended Version)

This version includes the following amendments:

- Addition of Schedule A information to Table 6.1;
- Corrections to VDYP volumes (Tables 6.1, 6.4, 6.5, 6.6, 6.8, 6.9); and
- Completion of Table 6.9 (Riparian Management Areas).

Appendices 1 & 2 (Yield Tables) remain unchanged and were therefore not included.

Prepared by:

Pope & Talbot Ltd.
&
Timberline Forest Inventory Consultants Ltd.

December 1998

Reference: 9740014.3.1

Timberline
Forest Inventory Consultants

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1.0 INTRODUCTION

This Information Package has been prepared on behalf of Pope & Talbot Ltd. (P&T) as a source document prior to the completion of the Timber Supply Analysis for TFL 23 Management Plan #9 (MP #9). It serves as a summary of the inputs and assumptions made in preparing for the analysis. The analysis process is a dynamic one and inputs and assumptions may change. Included are inventory and landbase summaries, growth and yield information and management assumptions for timber and non-timber resources related to timber supply. This package follows the suggested format of the Timber Supply Analysis Information Packages for Tree Farm Licensees Version 2.0 (MoF, February 1997).

The analysis includes two options, one of which was identified in the Statement of Management Objectives Options and Procedures (SMOOP), dated May 30, 1997.

Of the several options originally identified in the SMOOP, only the Current Management (Base Case) Option will be analyzed. This will incorporate assumptions associated with the latest Kootenay–Boundary Land Use Plan (KBLUP) Implementation Strategy and the *1998 Forest Development Plan Memorandum of Understanding* (MOU) dated October 30, 1997. As well, key landscape management guidelines identified in the Revelstoke and Area Land Use Planning Minister's Advisory Committee Draft Report will be applied to the portion of the TFL falling within the Columbia Forest District. Therefore, the KBLUP Option also identified in the SMOOP is no longer necessary. As well, the Enhanced Forest Development Option will not be included due to a lack of background information related to targets and guidelines. The Current Management less Shelter Bay Option will be conducted as a sensitivity analysis within the Current Management Option. A calculation of the theoretical timber supply will replace the Gross Operable Landbase Option.

In addition to the Current Management Option, a second option will be included in the analysis. This option employs all of the base case inputs, with the exception of the definition of caribou management zones. In the base case, the zones were those employed in the KBLUP implementation strategy. However, Pope and Talbot have been redefining caribou habitat mapping and range definition using five years of telemetry data and field inventory studies. These redefined zones will be employed in Option 2.

Analysis inputs have been designed to reflect current management practices for TFL 23 and correspond to the approval date of the SMOOP. Management guidelines reflecting Forest Practices Code (FPC) requirements will be included in the Base Case.

Analysis of options will use CASH6, Timberline's proprietary forest estate simulation model. CASH6 is capable of explicitly simulating integrated resource management by regulating forest cover. Spatial resolution may be achieved by using information from the GIS that provides specific information about the location of each component of the landbase with respect to all of its neighbors. Forest cover requirements are applied within various landbase aggregates to reflect adjacency and old growth requirements. The degree of spatial resolution is dependent on the data available and the objectives of the timber supply analysis. This allows an "Integrated Resource Land Base" approach with appropriate contribution of the non-timber resource values of the entire productive forest.

Upon acceptance by the MoF Timber Supply Analyst, the assumptions and methodology provided in this Information Package will be used by P&T to prepare and submit a timber supply analysis to the Timber Supply Analyst and a 20 Year Spatial Feasibility Analysis to the District Manager. A number of alternative harvest flows will be evaluated within the various options and sensitivity analyses in order to gain a complete understanding of the factors that influence timber supply on TFL 23. All analysis results will be provided to the Chief Forester of British Columbia for the allowable annual cut determination.

2.0 PROCESS

Following acceptance, this Information Package will be included as an Appendix to the Timber Supply Analysis Report of TFL 23 MP #9.

The contents of this Information Package reflect inputs from the previous Management Plan (MP #8) process, from public and resource agency review of MP #8 and the SMOOP for MP #9 as outlined in the Management Plan Review Strategy.

Forest inventory and landbase information has been collected in a series of recent field projects and associated mapping updates. This information is maintained in P&T's GIS database. This database has been used to prepare summaries for the Information Package and inputs to the timber supply analysis.

Technical details submitted in this Information Package will be reviewed by MoF Timber Supply, Resources Inventory, and Research Branch staff. In addition, Arrow Forest District, Columbia Forest District and Nelson Forest Region staff, as well as Ministry of the Environment, Lands and Parks (MoELP), will evaluate the assumptions in this Package. Some review has already taken place.

The Information Package has been prepared in consultation with the designated MoF Timber Supply Analyst to ensure that all information necessary to evaluate the timber supply situation of TFL 23 is available to the Chief Forester of B.C.

2.1 Additional Information

Descriptions of any sensitivity analyses not considered this far will be provided in the Timber Supply Analysis Report.

3.0 TIMBER SUPPLY OPTIONS

This section describes the analysis option, or scenario, that will be presented in the Timber Supply Analysis Report.

3.1 Current Management (Base Case) Option

The Current Management or Base Case Option will include:

- Management activity as defined by current operations with emphasis on the last 5 years;
- Implementation of the Forest Practices Code (FPC) as it is being interpreted at the date of SMOOP approval, August 28, 1997;
- Recommended Landscape Units (LUs) defined for TFL 23 with biodiversity emphasis assignments to address landscape level biodiversity;
- A recently updated (December 31, 1997) forest cover inventory;
- VDYP natural stand yields for natural unmanaged stands (> 25 years old);
- TIPSY managed stand yields for all existing (1 – 25 years old) and future managed stands;
- Current close utilization standards;
- Basic silviculture on all sites;
- Genetic gains from tree improvement;
- New Park Areas from KBLUP;
- Special management for important wildlife including mountain caribou;
- Visual quality requirements;
- Consideration for sensitive areas based on recent inventories including terrain (soils) and regeneration problems;
- Revised operability which defines areas requiring aerial harvesting systems;
- inclusion of provincial and federal park lands to height of land for contribution to seral stage requirements; and
- Consideration of uneconomic forest stands and forest health.

Background information used to prepare this Information Package includes:

- Forest Practices Code of British Columbia;
- Biodiversity Guidebook;
- Riparian Management Area Guidebook;
- Memorandum from the Deputy Ministers of MoF and MoELP entitled *Achieving Acceptable Biodiversity Timber Impacts* (97.08.25);
- Memorandum from the Director of MoF Timber Supply Branch entitled *Incorporating Biodiversity and Landscape Units in the Timber Supply Review* (97.12.01);

- *Memorandum of Understanding Between Ministry of Forests and Ministry of Environment Lands and Parks, Regarding Instruction for the Preparation of 1998 Forest Development Plans*, (97.10.02);
- *Kootenay/Boundary Land Use Plan Implementation Strategy* (97.06.01); and
- *Revelstoke and Area Land Use Planning Minister's Advisory Committee Draft Recommendations* (97.10.01).

3.2 Sensitivity Analyses

Sensitivity runs for this option will address any issues that have significant uncertainty associated with them. Sensitivity analyses are grouped into three categories:

- Landbase revisions;
- Growth and yield inputs; and
- Management considerations and forest cover objectives.

Table 3.1 lists proposed sensitivity analyses for the Current Management Option.

Table 3.1 - Current Management Sensitivity Analyses

Issue	Sensitivity Levels to be Tested
Landbase revisions	remove Shelter Bay block
	add marginally economic stands
	remove aerial operable areas
	adjust timber harvesting landbase by +/- 10%
	remove stands with SI50 < 9 m
Growth and yield inputs	Apply OGSI adjustments to managed yields
	adjust existing stand yields by +/- 10%
	adjust future managed stand yields by +/- 10%
	adjust managed stand minimum harvest ages by +/- 10 years
	increase and decrease regeneration delay
Management considerations & forest cover objectives	alter maximum disturbance constraints in IRM, caribou and ungulate winter range zones
	alter caribou thermal and old-growth cover constraints
	alter ungulate winter range thermal constraint
	alter VQO disturbance constraints
	employ full biodiversity constraints in low emphasis landscape units

Section 11.0 provides complete details for each sensitivity analysis for the Current Management Option.

4.0 MODEL

The proprietary simulation model CASH6 (Critical Analysis by Simulation of Harvesting) Version 6 will be used to develop harvest schedules for all options and sensitivity analyses included in the MP #9 timber supply analysis. The model uses a geographic approach to landbase and inventory in order to adhere as closely as possible to the intent of forest cover requirements on harvesting. Maximum disturbance and minimum old growth retention requirements on forest cover and biodiversity seral stage requirements are explicitly implemented.

A variable degree of spatial resolution is available depending on inventory formulation and resource emphasis area definitions. Forest stands in refuges such as environmentally sensitive and inoperable areas that do not contribute to the periodic harvest can be included to better model forest structure and disturbance levels.

In their current implementation forest cover objectives require a control area over which to operate. Common sense indicates that the control area for a constraint set should correspond to a realistic element in the landscape. For example, the requirements associated with visual quality objectives are designed to operate on the scene visible from discrete sets of viewpoints. Pseudo-geography may be employed to translate spatial constraints on harvesting into forest cover and static access constraints. The objective is to identify the "natural" constituency for forest cover constraints. CASH6 contains a hierarchical landbase organization to assist in implementing control areas. Numerous levels of land aggregation are used to define both geographically separate areas and areas of similar management regime. Forest cover constraints can be applied at all levels.

CASH6 will be used to determine harvest schedules that incorporate all integrated resource management considerations. The model has functionality that allows age or height-based green-up using analysis units yield information.

CASH6 will also be employed to model the 20-Year Spatial Feasibility Analysis. This component of MP #9 will be completed as a separate process from the remainder of the timber supply analysis.

5.0 FOREST INVENTORY

All spatial information is controlled to the Terrain Resource Inventory Mapping (TRIM), North American Datum (NAD) 83, base. The updated TFL 23 inventory includes updated forest cover attributes in a digital and spatial format compatible with the provincial inventory database.

The forest cover inventory is updated for disturbance to December 31, 1997. Inventory data has been prepared using ARC/INFO GIS. Use of GIS ensures that spatial relationships between the various inventory attributes are maintained throughout the analysis process. For example existing roads and streams will be buffered to provide specific area reductions from the net harvesting landbase. For analysis purposes the inventory will be assigned to 10-year age classes.

6.0 DESCRIPTION OF LAND BASE

This Section describes the TFL 23 landbase and the methodology used to determine the way in which land contributes to the analysis. Some portions of the productive landbase, while not contributing to harvest, may be available to meet other resource needs.

6.1 Timber Harvesting Land Base Determination

Table 6.1 presents the results of the netdown process to identify the timber harvesting or net operable landbase. For each item in the netdown process, this table lists the total area in the inventory with the netdown item characteristic, as well as the actual area and volume removed in the netdown step. Individual areas may have several netdown attributes. For example, stands within riparian boundaries might also exhibit problem forest type attributes. These areas would have been removed on the basis of this latter attribute, prior to the riparian netdown. Therefore in most cases, the net reduction will be less than the total area in the inventory.

Table 6.1 - Timber Harvesting Landbase Determination – Current Management

Land Classification	Total Area (ha)	Net Reduction				Net Remainder			
		Schedule A		Total		Schedule A		Total	
		Area	Vol	Area	Vol	Area	Vol	Area	Vol
Total Area	**556897**					**6838**	**1360**	**556897**	**77907**
Glacier Park	508			508					
TFL 23						6838	1360	556389	77907
Non-prod/non forest	184555	528	0	184555	0				
Productive Forest						**6310**	**1360**	**371834**	**77907**
Productive reductions:									
New parks	4643	0	0	2083	338				
Non-comm (NCBr)	198	0	0	198	0				
Inoperable	274550	31	5	100719	22797				
Operable									
Conventional								244640	48316
Aerial								24194	6456
Total						**6279**	**1355**	**268834**	**54772**
Soils (Terrain IV,V)	25228	91	34	4764	1392				
Existing roads	5715	142	21	5333	706				
Trails and landings	3118	90	1	2936	37				
Low productivity	180338	22	0	1680	141				
Unmerchantable	28024	2	1	4071	1449				
Deciduous	7407	301	0	5845	0				
Riparian (RRZ,MZ)	34901	453	99	16343	3624				
Parkland	74244	0	0	223	52				
ESA	53684	19	2	2937	621				
NSR	11312	158	0	6165	0				
Total Reductions		1278	158	50297	8022				
Reduced Landbase						**5001**	**1197**	**218537**	**46750**
Additions of NSR		158	0	6165	0				
Current Net Landbase									
Conventional								205198	41511
Aerial								19504	5239
Total						5159 = Sch.A		224702	46750
Less future roads		34	0	1560	0				
Long-term Net Landbase									
Conventional								203638	
Aerial								19504	
Total						**5125**		**223142**	

(=Sch.A + B)

(was 7344)

224702 − 5159 = 219543 Sch. B.

219543 / 224702 = 0.977 Sch. B prorate

6.2 Total Area

The total area of TFL 23 is 556,389 ha. Some of the areas reported above differ from those included in the MP #8 timber supply analysis. A significant number of revisions and additions have been made to the TFL 23 inventory database over the period of MP #8. The majority of the differences can be attributed to the following:

- Revised operability into conventional, aerial and inaccessible types;
- Revised assessment of uneconomic forest types;
- New riparian areas based on additional stream inventories;
- Revised sensitive soils classification (terrain classification);
- New site productivity information; and
- Minor changes to the digital definition of the TFL boundary.

6.3 Non-productive & Non-forest

All land classified as non-forest or non-productive such as lakes, swamps, rock, alpine, *etc.* or non-classified (coded type-identity 8 in the inventory) is excluded from the timber harvesting landbase. Table 6.2 summarizes the non-productive and non-forest land removed from the landbase for the timber supply analysis

Table 6.2 - Non-Productive & Non-Forest Reductions

Classification		Area (ha)
A	Alpine	105012
AF	Alpine forest	5697
C	Cultivated	74
CL	Claybank	1
G	Gravel bar	28
GR	Gravel pit	1
L	Lake	3109
M	Meadow	80
MUD	Mud	5
NP	Non-productive	16829
NPBR	Non-productive brush	34975
NPBU	Non-productive burn	4293
R	Rock	11913
RIV	River	494
SWAMP	Swamp	1287
U	Urban	757
	Total	184555

While not included in this analysis, some of the subalpine and non-commercial forest, could be considered to contribute to forest cover and/or biodiversity requirements. Table 6.3 summarizes these areas by leading species.

Table 6.3 - Subalpine & Non-Commercial Forest Supporting Forest Cover

Leading Species	Area (ha)
Balsam	12310
Western redcedar	98
Douglas-fir	5740
Western hemlock	480
Western larch	579
Lodgepole pine	1142
Western white pine	15
Spruce	1382
Hardwood	118
Aspen	59
Total	21923

6.4 New Parks

The KBLUP identified a number of new parks (protected areas) within TFL 23 that will no longer be available for timber harvesting. A list of the new parks and associated netdown areas is summarized in Table 6.4.

Table 6.4 - New Park Reductions

New Park	Gross Area (ha)		Park Reduction	
	Total	Productive	Net Area (ha)	Volume (1000s m^3)
Gladstone	1321	338	338	70
Syringa	2561	1696	1696	258
Valhalla	761	50	50	10
Total	4643	2084	2084	338

These new parks will be included in the analysis data set to address landscape level biodiversity and some other non-timber concerns including wildlife. These areas will never contribute to the periodic harvest or be included in the assessment of maximum disturbance for a given area.

6.5 Non-commercial Brush

Land classified as being occupied by non-commercial species (coded type identity 5 in the inventory) is excluded. Non-commercial exclusions total 198 ha for TFL 23.

6.6 Operability

A review of the operability classification was undertaken during the period of MP #8. As a result, a more refined classification is now in place. Three classes are now used to define operability on TFL 23:

- Conventional – areas accessible by road that will be harvested using ground-based or conventional yarding equipment;
- Aerial – areas having reduced access that will be harvested with helicopter or long-line yarding equipment; and
- Inaccessible – areas not accessible for harvesting under any of the aforementioned methods due to either economic or physical limitations. Under different economic conditions, some of the timber currently designated inaccessible may be reclassified as aerial. For example many overmature hemlock-balsam stands were not included in the aerial category although there are no physical limitations that would prevent them from being harvested.

All areas classified as inaccessible are removed from the harvestable landbase. Table 6.5 summarizes the distribution of the operability classes on TFL 23 and the reductions associated with inaccessible areas for this option of the analysis.

Table 6.5 - Operability Classification & Reductions

Operability Category	Gross Area (ha)		Operability Reductions[1]		
	Total	Productive	% Reduction	Area (ha)	Volume (1000s m^3)
Conventional	256369	245981	0	0	0
Aerial	25469	24285	0	0	0
Subtotal (operable)	281838	270266	0	0	0
Inoperable	274550	101569	100	100719	22797
Total	556388	371835		100719	22797

[1] Reductions for this stage of the netdown process, excluding productive areas removed in previous steps.

6.7 Soils (Terrain IV and V)

ESAs are designated based on a number of inventory attributes having special management requirements. In the context of timber supply analysis, management constraints are reflected in the designation of high sensitivity ESAs as non-contributing to harvest. Possible high ESA designations considered for TFL 23 include:

- Areas with significant avalanche concerns;
- Actual or potential sensitive or unstable soils; and
- Severe regeneration problems caused by geoclimatic factors.

In TFL 23, sensitive/unstable soil ESAs and sites with regeneration problems have been removed from the timber harvesting landbase. Avalanche concerns are being addressed through operational planning.

Soils reductions are based on the recent terrain classification exercise. Regeneration difficulties are typically encountered on sites at higher elevation and sites with excessively shallow soils. Areas with potentially sensitive or unstable soils were identified as having a Terrain classification of IV or V and slopes greater than 75%. These are summarized in Table 6.6.

Table 6.6 - ESA Distribution & Reductions

ESA Description	Gross Area (ha)		ESA Reductions [1]		
	Total	Productive	% Reduction	Area (ha)	Volume (1000s m^3)
Soils (terrain class IV and V, slope > 75%)	25228	14044	100	4764	1392
Regeneration (ESAp)	53684	32583	100	2937	621
Total	78912	46627		7701	2013

[1] Reductions for this stage of the netdown process, excluding productive areas removed in previous steps.

6.8 Roads, Trails & Landings

6.8.1 Existing Roads

Existing roads were captured as line features in the GIS data to determine area reductions from the operable landbase. These represent permanent access road areas that will not be returned to productive forest based on current practices. As a full classification of all current roads was not available, a weighted-average road width was developed using the distribution of road classes documented in the previous management plan #8. This average road width was then used in the GIS to generate buffers around the current road line features, in order to arrive at a total area reduction for existing roads. The detailed breakdown of this existing road allowance compilation is included in Table 6.7.

Table 6.7 - Existing Roads

Road Classification & R/W Width (m)		Total km (MP#8)	Weighted average width (m)	Area reduction (ha) [1]	
				productive	Net
2 – lane gravel	14	137			
1 – lane gravel	10	2845			
Unimproved logging spur	10	311			
Total		3293	10.2	5715	5333

[1] Reductions for this stage of the netdown process, excluding productive areas removed in previous steps.

Some roads, landings and other road-related disturbance (gravel pits) have also been removed as non-productive areas. Fill slopes are typically classified as productive and are reforested after road development and harvesting. No reduction for these areas is necessary.

6.8.2 Existing Trails and Landings

Based on current forest practices on TFL 23, skid trails and landings are considered temporary access structures to be brought back into production, and therefore maintain their productive contribution to produce timber. Future trails are rehabilitated after harvesting and either planted or regenerated artificially. Therefore no additional losses are attributed to these future disturbances. In addition, the increased use of cable and aerial harvesting systems has reduced the number of skid trails constructed during harvesting operations.

Existing trails and landings are often too small to be captured in the GIS data and are removed by making landbase reductions to areas where harvesting has taken place. To reflect legacy landing and trail areas that will not be returned to productive status, 4% of the total area harvested in the past was removed from the productive forest landbase. For the Current Management Option the area reduction associated with these areas is 2,936 ha.

6.8.3 Future Roads

The roads proposed in the existing 20-year strategic development plan will complete development of the access network for TFL 23. The total length of the proposed roads within the harvestable landbase is 1,493 km. Based on the average width of 10.2 metres developed for existing roads, a total of 1,553 ha of area should be removed to account for this future reduction in harvestable area. This was accomplished in the CASH6 analysis by removing 4% of the area harvested in the first 20 years of the analysis. Using this mechanism, a total of 1,560 ha were removed.

6.9 Uneconomic & Low Productivity Forest

Sites may have low productivity either because of inherent site factors (nutrient availability, exposure, moisture, etc.) or because they are insufficiently stocked with merchantable tree species. Sites that are currently occupied by non-merchantable stands may be productive with other species or following silviculture treatments.

Uneconomic and low productivity stands are defined as follows:

- Leading deciduous;
- Overmature hemlock stands on slopes > 50%
- Overmature balsam stands;
- Any sites with an inventoried site index less than 8.0.

Table 6.8 summarizes the area, by leading species, removed as low productivity and uneconomic forest types.

Table 6.8 - Uneconomic & Low Productivity Forest Stands

Leading Species	Gross Productive		Reductions[1]	
	Area (ha)	Volume (1000s m^3)	Area (ha)	Volume (1000s m^3)
Cottonwood	1611	0	1562	0
Aspen	873	0	862	0
Hardwood	3529	0	3424	0
Balsam	3115	775	3106	776
Western redcedar	175	0	168	0
Douglas-fir	94	.5	91	.6
Western hemlock	1796	719	1790	723
Larch	14	0	14	0
White pine	27	.5	26	1.0
Lodgepole pine	76	2.5	76	2.4
Spruce	476	87	475	87
Total	11786	1584.5	11594	1590

[1] Reductions for this stage of the netdown process, excluding productive areas removed in previous steps.

6.10 Riparian Reserve & Management Zones (RRZs & RMZs)

Forest Practices Code stream, lake and wetland classifications were used to establish riparian reserve and management zone widths. Formal stream inventories have been undertaken on roughly one-quarter of TFL 23. The balance has not been inventoried. A methodology was established to:

- determine an estimate of Riparian Reserve areas on surveyed streams, and
- determine an estimate of Riparian Reserve areas on un-surveyed streams.

In the GIS data set all inventoried streams, lakes and wetland features were buffered the appropriate width using 100 percent of the riparian reserve zone width and 50 percent of the riparian management zone width. Once all inventoried streams were buffered, an average buffer width of 39 metres for classes S1-S4 was calculated.

For unclassified streams, polygons of slopes up to 20 percent were created. Based on Forest Practices Code definition, streams contained within these 20% polygons were assumed to be fish-bearing. These streams were given a 39 metre buffer and the area reserved from harvest.

Table 6.9 - Riparian Management Area Reductions

RMA Classification	Width (m) (RRZ+RMZ)	Length (m)	Gross Area (ha)		RMA Reductions[1]	
			Total	Productive	Area (ha)	Volume (1000s m^3)
Streams						
S1 (20 – 100m)	60		63	46	33	7
S2	40		1427	766	552	123
S3	30		170	119	86	19
S4	15		1	0	0	0
S5	0		0	0	0	0
S6	0		0	0	0	0
Unclassified	39		28223	18475	13328	2958
Wetlands						
W1	30		404	300	216	48
Lakes						
L1	30		1393	989	714	159
L3	15		357	113	82	18
Designated			2785	1823	1315	292
Total			34825	22631	16326	3624

6.11 Wildlife Tree Patches

After other netdowns are complete additional reductions to the productive forest may be required to provide sufficient reserves of productive timber for wildlife at the site-specific level. These small reserves are also referred to as wildlife tree patches (WTPs). In order to identify the net harvestable area requiring WTP reserves, all areas removed from the productive forest landbase were identified in

the GIS. All of these forest components were then given a 250-metre buffer to reflect half of the maximum acceptable distance between wildlife tree patches according to FPC Biodiversity Guidebook. Harvestable areas not included within these buffers were deemed to be subject to WTP reserves. Table 6.10 summarizes percentage reservations based on Table 20(a) of the Biodiversity Handbook.

Table 6.10 - Wildlife Tree Patch Reductions

luno	beclabel	prod. area (ha)	net area (ha)	net logged (ha)	% of net that is logged	% of prod that is net	net> 250 m	ratio net250 / net	WTP (%) Gross	WTP (%) net
1	ESSFwc 4	4606	871	301	35	19	87	0.10	2.4	0.2
1	ICH mw 2	5812	4660	1731	37	80	2051	0.44	8.7	3.8
1	ICH mw 3	245	177	113	64	72	58	0.33	10.6	3.5
1	ICH wk 1	3194	2015	1148	57	63	504	0.25	9.0	2.3
1 (Ledge) Total		13856	7724	3293	43	56	2700	0.35	6.8	2.4
2	ESSFwc 4	4416	1922	686	36	44	442	0.23	4.9	1.1
2	ICH mw 2	2126	1368	401	29	64	342	0.25	6.4	1.6
2	ICH mw 3	9117	6727	3664	54	74	2893	0.43	9.8	4.2
2	ICH wk 1	1279	638	432	68	50	134	0.21	8.8	1.8
2 (Bannock) Total		16938	10655	5184	49	63	3811	0.36	8.2	2.9
4	ESSFwc 4	3154	599	7	1	19	30	0.05	0.0	0.0
4	ICH mw 3	4761	3812	849	22	80	1487	0.39	7.2	2.8
4	ICH wk 1	1549	46	0	0	3	0	0.01	0.0	0.0
4 (Blanket) Total		9464	4457	856	19	47	1517	0.34	3.6	1.2
10	ESSFwc 1	4427	3772	743	20	85	1697	0.45	7.5	3.4
10	ESSFwc 4	4433	3255	401	12	73	1074	0.33	5.6	1.8
10	ICH dw	13742	8594	745	9	63	1117	0.13	4.1	0.5
10	ICH mw 2	10079	7792	1160	15	77	1792	0.23	6.2	1.4
10 (Johnson) Total		32681	23412	3050	13	72	5681	0.24	5.5	1.3
11	ESSFwc 1	2388	1861	454	24	78	577	0.31	7.2	2.2
11	ESSFwc 4	3076	2214	611	28	72	554	0.25	7.0	1.7
11	ICH dw	5006	3560	266	7	71	819	0.23	4.9	1.1
11	ICH mw 2	4173	2644	717	27	63	634	0.24	6.0	1.5
11	IDF unn	727	363	121	33	50	58	0.16	5.3	0.9
11 (Cayuse) Total		15370	10643	2170	20	69	2642	0.25	6.0	1.5
18	ESSFwc 1	3274	1833	293	16	56	422	0.23	4.2	1.0
18	ESSFwc 4	8720	2775	179	6	32	361	0.13	0.8	0.1
18	ICH dw	5725	3547	522	15	62	674	0.19	4.7	0.9
18	ICH mw 2	9624	7066	1243	18	73	1908	0.27	6.1	1.6
18 (Gladstone) Total		27343	15220	2237	15	56	3364	0.22	4.0	0.9
20	ESSFwc 1	7428	5441	2732	50	73	1143	0.21	9.3	2.0
20	ESSFwc 4	11434	6474	2347	36	57	1036	0.16	6.3	1.0
20	ICH dw	1014	779	100	13	77	413	0.53	6.0	3.2
20	ICH mw 2	26493	20244	5496	27	76	4656	0.23	7.4	1.7
20	ICH wk 1	798	567	111	20	71	176	0.31	6.1	1.9
20 (Barnes-Whatshan) Total		47168	33504	10787	32	71	7423	0.22	7.3	1.6
21	ESSFwc 1	2929	1816	265	15	62	345	0.19	4.7	0.9
21	ESSFwc 4	6762	2509	312	12	37	351	0.14	2.0	0.3
21	ICH mw 2	8987	6563	502	8	73	1575	0.24	5.1	1.2
21 (Woden) Total		18678	10888	1079	10	58	2271	0.21	3.8	0.8
26	ESSFwc 1	1409	829	362	44	59	108	0.13	7.3	0.9
26	ESSFwc 4	1830	464	41	9	25	9	0.02	0.4	0.0
26	ICH mw 2	28870	22160	6684	30	77	6870	0.31	7.7	2.4
26 (Vipond) Total		32109	23453	7086	30	73	6987	0.30	7.3	2.2
27	ESSFwc 1	5475	3931	1388	35	72	1219	0.31	7.7	2.4
27	ESSFwc 4	10440	4640	1098	24	44	696	0.15	3.8	0.6
27	ICH mw 2	19947	15414	5286	34	77	5857	0.38	8.2	3.1
27	ICH wk 1	6619	4133	1503	36	62	1033	0.25	6.9	1.7
27 (Fosthall) Total		42480	28117	9275	33	66	8805	0.31	6.9	2.2
29	ESSFwc 1	6613	2229	178	8	34	424	0.19	1.2	0.2
29	ESSFwc 4	14408	1797	69	4	12	180	0.10	0.0	0.0
29	ICH mw 2	22552	16944	3307	20	75	4575	0.27	6.5	1.7
29	ICH wk 1	9645	4871	771	16	51	1120	0.23	3.6	0.8
29 (Halfway) Total		53218	25842	4325	17	49	6299	0.24	3.5	0.9

Table 6.10 (continued)

Luno		beclabel	prod. area (ha)	net area (ha)	net logged (ha)	% of net that is logged	% of prod that is net	net> 250 m	Ratio net250 / net	WTP (%) gross	net
	30	ESSFwc 1	4675	2259	171	8	48	429	0.19	2.6	0.5
	30	ESSFwc 4	9466	1685	35	2	18	118	0.07	0.0	0.0
	30	ICH mw 2	4063	3369	1413	42	83	977	0.29	9.5	2.8
	30	ICH vk 1	2281	1311	318	24	57	315	0.24	5.2	1.2
	30	ICH wk 1	11223	7619	1935	25	68	1524	0.20	6.3	1.3
30 (Trout) Total			31709	16244	3873	24	51	3363	0.21	4.5	0.9
	31	ESSFvc	665	3	0	0	0	0	0.00	0.0	0.0
	31	ESSFwc 1	2579	1005	137	14	39	151	0.15	2.3	0.3
	31	ESSFwc 4	6741	972	59	6	14	39	0.04	0.0	0.0
	31	ICH mw 2	1498	1067	494	46	71	213	0.20	8.7	1.7
	31	ICH vk 1	8352	3712	853	23	44	965	0.26	3.7	1.0
	31	ICH wk 1	3829	1619	173	11	42	178	0.11	2.3	0.3
31 (Fish) Total			23664	8377	1715	20	35	1546	0.18	2.6	0.5
Grand Total			364678	218537	54929	25	60	56408	0.26	5.5	1.4

Column 3. Total productive area
Column 4. Net harvestable area
Column 5. Net harvestable area with logging history
Column 6. % of available (harvestable) area which has been logged
Column 7. % of productive area which is available (harvestable)
Column 8. Net area > 250 metres from unharvestable stands
Column 9. Ratio of net area > 250 m / total net area
Column 10. Gross WTP area from Table 20(a) based on Columns 6 and 7
Column 11. Net WTP area (reduced by Column 9 ratio)

Overall, the summary indicates that it will be necessary to leave approximately 1.4% of stand volumes in cutblocks, to provide for wildlife tree patches. The balance can be accommodated outside of the harvestable landbase. In the analysis, all of the yield tables were reduced by 1.4% to account for this.

7.0 INVENTORY ORGANIZATION

In order to reduce the complexity of the forest description for the purposes of timber supply analysis simulation, aggregation of individual forest stands is necessary. However, it is critical that this aggregation does not obscure either the biological differences in forest stand productivity or differences in management objectives and prescriptions. It is important to note that aggregation of the landbase will be consistent in all options and sensitivity analyses. This is to ensure that differences in results reflect differences in management decisions and not inventory aggregation.

Grouping stands into analysis units on the basis of similar species composition, site productivity and silviculture regime captures similarities in growth and response to silvicultural treatments.

Unique management characteristics are modeled by grouping areas into two CASH6 forest cover groups:

- Landscape level biodiversity will be modeled on the KBLUP recommended LU-BEC/NDT (LandscapeUnit-BiogeoclimaticClassification/NDT) aggregates. Old growth requirements (based on biodiversity emphasis assignments) from the FPC Biodiversity Guidebook will be assigned to each LU-BEC/NDT in order to address landscape level biodiversity. Old growth seral stage modeling details are outlined in the recent correspondence from MoF/MoELP (Appendix IV).
- Resource emphasis areas (REAs) are aggregates of area with similar non-timber resource concerns. These include visual sensitivity, wildlife habitat, community and domestic watersheds, and timber emphasis areas. Maximum disturbance (based on green-up requirements), minimum mature and old growth forest cover objectives will be assigned to each REA forest cover group to address needs of the resource.

REAs are aggregated within each landscape unit to reflect operational management of the resource. Where REA classifications overlap, areas must meet all overlapping forest cover objectives before harvesting.

7.1 Landscape Units

Landscape units for TFL 23 have been recommended as part of the ongoing KBLUP process. Based on discussions with MoF district staff, several minor Landscape Units were aggregated with neighboring units to simplify the analysis. 13 resultant LUs are associated with the TFL. BEC/NDT is based on MoELP-Nelson Region 1:250,000 Biogeoclimatic mapping and NDT definitions provided in the FPC Biodiversity Guidebook. Seral stage objectives applied at the LU-BEC/NDT level are intended to address biodiversity (seral stage) representation and ensure that an acceptable distribution of age classes is maintained. Table 7.1 summarizes the distribution of LU-BEC/NDTs on TFL 23, including KBLUP biodiversity emphasis assignments for LUs 10-31, which fall within the Arrow District. As biodiversity emphasis assignments have not been finalized for the Columbia District (LUs 1-4) weighted average biodiversity seral stage requirements were employed for these areas, assuming the following deployment:

high emphasis:	10%
intermediate emphasis:	45%
low emphasis:	45%

Table 7.1 - LU - BEC/NDTs

Landscape Unit	BEC	NDT	Biodiversity Emphasis[1]	Area (ha)		
				Total	Gross Productive	Net Operable
1	AT p	5	average	462	0	0
1	ESSFwc 1	1	average	52	0	0
1	ESSFwc 4	1	average	4606	1244	871
1	ESSFwcp4	5	average	2	0	0
1	ICH mw 2	2	average	5812	5214	4660
1	ICH mw 3	3	average	245	231	177
1	ICH wk 1	1	average	3194	2695	2015
1 (Ledge) Total				14373	9384	7724
2	AT p	5	average	199	0	0
2	ESSFwc 4	1	average	4416	2554	1922
2	ICH mw 2	2	average	2126	1697	1368
2	ICH mw 3	3	average	9117	8503	6727
2	ICH wk 1	1	average	1279	924	638
2 (Bannock) Total				17137	13678	10655
4	AT p	5	average	882	0	0
4	ESSFwc 4	1	average	3154	712	599
4	ICH mw 3	3	average	4761	4232	3812
4	ICH wk 1	1	average	1549	48	46
4 (Blanket) Total				10346	4992	4457
10	ESSFwc 1	1	int	4427	4153	3772
10	ESSFwc 4	1	int	4433	3647	3255
10	ICH dw	3	int	13742	10311	8594
10	ICH mw 2	2	int	10079	8896	7792
10 (Johnson) Total				32681	27007	23412
11	ESSFwc 1	1	int	2388	2121	1861
11	ESSFwc 4	1	int	3076	2655	2214
11	ESSFwcp4	5	int	67	10	0
11	ICH dw	3	int	5006	4069	3560
11	ICH mw 2	2	int	4173	3221	2644
11	IDF unn	4	int	727	495	363
11 (Cayuse) Total				15437	12570	10643
18	ESSFwc 1	1	low	3274	2117	1833
18	ESSFwc 4	1	low	8720	3295	2775
18	ESSFwcp4	5	low	532	34	0
18	ICH dw	3	low	5725	4033	3547
18	ICH mw 2	2	low	9624	7840	7066
18 (Gladstone) Total				27875	17320	15220

Table 7.1 (continued)

Landscape Unit	BEC	NDT	Biodiversity Emphasis[1]	Area (ha)		
				Total	Gross Productive	Net Operable
20	ESSFwc 1	1	Int	7428	7041	5441
20	ESSFwc 4	1	int	11434	8936	6474
20	ESSFwcp4	5	int	297	101	0
20	ICH dw	3	low	1014	1004	779
20	ICH mw 2	2	low	26493	25275	20244
20	ICH wk 1	1	low	798	667	567
20 (Barnes-Whatshan) Total				47465	43025	33504
21	ESSFwc 1	1	int	2929	2034	1816
21	ESSFwc 4	1	int	6762	2841	2509
21	ESSFwcp4	5	int	177	0	0
21	ICH mw 2	2	int	8987	7937	6563
21 (Woden) Total				18855	12812	10888
26	ESSFwc 1	1	low	1409	937	829
26	ESSFwc 4	1	low	1830	524	464
26	ESSFwcp4	5	low	22	0	0
26	ICH mw 2	2	low	28870	27155	22160
26 (Vipond) Total				32131	28616	23453
27	ESSFwc 1	1	int	5475	4756	3931
27	ESSFwc 4	1	int	10440	6388	4640
27	ESSFwcp4	5	int	39	0	0
27	ICH mw 2	2	low	19947	19588	15414
27	ICH wk 1	1	low	6619	5208	4133
27 (Fosthall) Total				42519	35939	28117
29	ESSFwc 1	1	high	6613	2805	2229
29	ESSFwc 4	1	high	14408	2400	1797
29	ESSFwcp4	5	high	1206	22	0
29	ICH mw 2	2	int	22552	20779	16944
29	ICH wk 1	1	int	9645	6727	4871
29 (Halfway) Total				54424	32733	25842
30	ESSFwc 1	1	high	4675	2725	2259
30	ESSFwc 4	1	high	9466	2327	1685
30	ESSFwcp4	5	high	2456	74	0
30	ICH mw 2	2	high	4063	3943	3369
30	ICH vk 1	1	high	2281	1591	1311
30	ICH wk 1	1	high	11223	9294	7619
30 (Trout) Total				34165	19953	16244
31	ESSFvc	1	low	665	3	3
31	ESSFvcp	5	low	44	0	0
31	ESSFwc 1	1	low	2579	1095	1005
31	ESSFwc 4	1	low	6741	1103	972
31	ESSFwcp4	5	low	718	9	0
31	ICH mw 2	2	low	1498	1348	1067
31	ICH vk 1	1	low	8352	4871	3712
31	ICH wk 1	1	low	3829	2377	1619
31 (Fish) Total				24426	10805	8377
Total				371834	268834	218537

To address landscape level biodiversity, parks within TFL 23 will be included in the assessment of seral stage distributions within the appropriate LU-BEC/NDT. Only areas that are within the recommended LUs for TFL 23 will contribute to landscape level biodiversity. These park areas will not contribute to the green-up requirements of timber emphasis areas but may contribute to the mature and old growth requirements for wildlife habitat.

7.2 Resource Emphasis Areas

The use of forest cover requirements allows management objectives for non-timber resources to be included in timber supply analysis simulations. For forest level modeling purposes, areas requiring the same management regime, that is having the same forest cover objectives, are grouped into REAs. Within an REA, specific forest cover rules are implemented. REAs defined for the TFL are based on forest management to address timber and non-timber resources. Within each REA, measures are required to protect certain values. REAs are based on VQOs, critical wildlife habitat, community and domestic watersheds and IRM resource emphasis. A number of instances of a given REA may occur in different locations throughout the TFL. However, for analysis purposes, REA areas of the same classification are grouped by landscape unit, but are separated from similar classifications in other landscape units. REAs are summarized in Tables 7.2 (a-g).

Table 7.2(a) - Resource Emphasis Areas – Caribou

Landscape Unit	BEC	Area (ha)		
		Productive	Operable	Net
29 Halfway	ESSF	20803	5103	3959
29 Halfway	ICH	15155	11986	9303
30 Trout	ESSF	15074	4970	3908
30 Trout	ICH	15265	13282	11100
31 Fish	ESSF	2735	1101	974
31 Fish	ICH	684	439	398
		69716	36881	29642

Table 7.2(b) - Resource Emphasis Areas – Caribou – Operable [1]

Landscape Unit	Area (ha)		
	Productive	Operable	Net
29 Halfway	22921	4055	3472
30 Trout	15661	3594	2853
31 Fish	2355	476	400
	40937	8125	6725

[1] This zone incorporates productive forest areas which lie outside the 1994 operability line. In these areas, at least 70% of the productive forest must be maintained in age classes 8 and 9. The rationale for this is explained in Section 10.2.1.3.

Table 7.2(c)- Resource Emphasis Areas – VQO

Landscape Unit	Area (ha)		
	Productive	Operable	Net
18 Gladstone	1347	1347	1241
20 Barnes-Whatshan	1330	1269	1060
21 Woden	1273	913	751
26 Vipone	13763	11105	9012
27 Fosthall	1766	1750	1468
29 Halfway	5670	4470	3600
	25149	20854	17132

Table 7.2(d) - Resource Emphasis Areas – Community Watershed

Landscape Unit	Area (ha)		
	Productive	Operable	Net
11 Cayuse	192	165	118
18 Gladstone	1845	1324	1136
29 Halfway	116	116	99
30 Trout	533	343	272
	2686	1948	1625

Table 7.2(e) - Resource Emphasis Areas – Domestic Watershed

Landscape Unit	Area (ha)		
	Productive	Operable	Net
2 Bannock	932	889	698
4 Blanket	1677	287	273
10 Johnson	12754	11636	10210
11 Cayuse	8158	7683	6465
18 Gladstone	7814	4000	3554
20 Barnes-Whatshan	398	397	331
21 Woden	820	584	490
26 Vipond	2484	1762	1485
29 Halfway	7476	5231	4283
30 Trout	3331	2203	1980
31 Fish	1163	767	680
	47007	35439	30449

Table 7.2(f) - Resource Emphasis Areas – Ungulate Winter Range

Landscape Unit	BEC	Area (ha)		
		Productive	Operable	Net
1 Ledge	ICH	3508	3329	2944
2 Bannock	ICH	6863	6379	5234
4 Blanket	ICH	1853	1616	1424
10 Johnson	ICH	4662	3340	2751
11 Cayuse	ICH	4335	3488	3059
11 Cayuse	IDF	714	483	358
18 Gladstone	ICH	4111	3308	2953
20 Barnes-Whatshan	ICH	1096	1048	837
21 Woden	ICH	135	131	50
26 Vipond	ICH	5602	4902	3623
27 Fosthall	ICH	355	336	256
29 Halfway	ICH	2719	2690	2138
31 Fish	ICH	89	89	84
		36042	31139	25711

Table 7.2(g) - Resource Emphasis Areas – IRM

Landscape Unit	Area (ha)		
	Productive	Operable	Net
1 Ledge	10866	6055	4779
2 Bannock	10107	7151	5289
4 Blanket	7011	3195	2859
10 Johnson	16035	12580	10932
11 Cayuse	3821	2458	2028
18 Gladstone	15071	9398	8204
20 Barnes-Whatshan	45298	40919	31792
21 Woden	17004	11400	9673
26 Vipond	15132	14328	11940
27 Fosthall	40741	34182	26642
29 Halfway	8603	6973	5589
30 Trout	3093	1154	728
31 Fish	20385	8665	6489
	213167	158458	126944

7.3 Analysis Units

Aggregation of forest stands is necessary to facilitate forest level modeling and reporting. Stands with similar biological (species composition and site productivity), management and silviculture regimes are grouped to reduce complexity. This must be balanced with creating small enough groups to allow accurate modeling of stand yields. It is also important to ensure that analysis units are consistent between various options of the timber supply analysis so that aggregation is not the reason for differences between analysis results.

7.3.1 Analysis Units 1 - 39 (VDYP Natural Stands)

Analysis units 1 – 39 describe existing immature and mature stands that will be assigned to VDYP natural stand yield tables in the analysis. A standard approach of aggregating stands into species groups based on inventory type group (ITG) was used. Aggregation of ITGs is based upon similarity in species growth and silvics.

Site index breakpoints for the site classes defined for analysis units 1-79 are provided in Table 7.3. These break points are chosen to balance the area in each class while keeping the spread in site index in each class to a minimum. This is of concern since the relationship between site index and volume is not linear. Table 7.3 summarizes the stand attribute definitions for natural stands that will be modeled on VDYP NSYTs. Analysis units 1-39 represent stands between the ages of 26 and 140. Analysis units 41-79 represent stands greater than age 140. This separation was made to facilitate the application of site index adjustments for old growth stands.

Table 7.3(a) - VDYP Analysis Unit Descriptions – Thrifty (age 26-140)

Analysis Unit		Net Area	Avg. SI50	CC	Species Composition	ITG	SI50 Range
1	FDCW-G	3155	23.4	59	Fd69 Cw14 Pl12 Lw5	1,2,4,5,6,8	>21
2	FDCW-M	10719	18.5	58	Df69 Cw12 Pl11 Lw8	1,2,4,5,6,8	15-21
3	FDCW-P	1583	13.6	59	Fd76 Cw10 P9 Lw5	1,2,4,5,6,8	<15
4	FDHW-G	2473	22.9	63	Fd58 Hw27 Cw11 Lw4	3	>21
5	FDHW-M	7041	18.1	57	Fd56 Hw28 Cw11 Lw5	3	15-21
6	FDHW-P	568	13.8	69	Fd65 Hw29 Cw4 Lw2	3	<15
7	FDLW-G	2726	23.2	63	Fd57 Lw30 Pw8 Pl5	7	>21
8	FDLW-M	11336	18.2	60	Fd58 Lw32 Pw6 Pl4	7	15-21
9	FDLW-P	561	13.9	59	Fd61 Lw26 Pw9 Pl4	7	<21
10	CWHW-G	320	24.1	66	Cw59 Hw22 Fd14 Se5	9,10,11	>22
11	CWHW-M	3212	19.1	45	Cw54 Hw28 Fd15 Pw3	9,10,11	17-22
12	CWHW-P	1222	14.5	59	Cw62 Hw19 Fd13 Bl6	9,10,11	<17
13	HWBL-G	369	22.5	67	Hw65 Ep14 Bl12 Se9	12,15,16,17	>20
14	HWBL-M	1172	16.9	51	Hw70 Se11 Bl11 Cw8	12,15,16,17	15-20
15	HWBL-P	190	13.0	60	Hw87 Bl6 Se5 Pw2	12,15,16,17	<15
16	HWFD-G	1966	21.1	65	Hw55 Fd24 Cw12 Lw9	13	>19
17	HWFD-M	4576	17.5	67	Hw52 Fd28 Cw11 Lw9	13	16-19
18	HWFD-P	2554	13.8	71	Hw53 Fd24 Lw13 Pw10	13	<16
19	HWCW-G	1833	21.3	67	Hw60 Cw31 Fd7 Lw2	14	>19
20	HWCW-M	7015	17.8	36	Hw51 Cw36 Fd6 Se7	14	16-19
21	HWCW-P	2749	12.9	60	Bl56 Cw34 Pw5 Fd5	14	<19
22	BLSE-G	2090	19.7	53	Bl63 Se30 Pl4 Lw3	18,19,20	>17
23	BLSE-M	5755	15.0	42	Bl66 Se29 Hw2 Pl3	18,19,20	12-17
24	BLSE-P	1268	10.4	64	Bl75 Se19 Ep4 Pl2	18,19,20	<12
25	SECW-G	206	25.2	59	Se63 Hw18 Cw16 Pl3	21,22,23,25,26	>21
26	SECW-M	931	17.1	48	Se77 Hw9 Cw8 Bl6	21,22,23,25,26	15-21
27	SECW-P	226	12.2	45	Se67 Pl16 Hw9 Bl8	21,22,23,25,26	<15
28	SEBL-G	474	22.8	53	Se62 Bl35 Lw1 Hw2	24	>20
29	SEBL-M	1815	16.5	40	Se58 Bl38 Cw2 Pl2	24	17-20
30	SEBL-P	298	11.6	53	Se56 Bl40 Pl3 Pw1	24	<17
31	PLLW-G	1138	21.5	63	Pl93 Fd3 Lw2 Bl2	28,30,31,32	>20
32	PLLW-M	3728	18.4	62	Pl93 Fd3 Bl2 Lw2	28,30,31,32	17-20
33	PLLW-P	1955	15.2	63	Pl90 Bl5 Fd3 Lw2	28,30,31,32	<17
34	PLFD-G	4050	22.6	62	Pl53 Fd20 Lw17 Pw10	27,29	>20
35	PLFD-M	5774	18.6	61	Pl62 Fd20 Lw17 Pw1	27,29	17-20
36	PLFD-P	3141	15.2	57	Pl62 Fd18 Lw17 Pw3	27,29	<17
37	LWFD-G	3672	23.0	62	Lw59 Fd24 Pl11 Hw6	33,34	>21
38	LWFD-M	6306	18.9	61	Lw62 Fd25 Pl9 Hw4	33,34	17-21
39	LWFD-P	2411	15.0	62	Lw60 Fd27 Pl9 Hw4	33,34	<17
Total		112578					

Table 7.3(b) - VDYP Analysis Unit Descriptions – Mature (age 141+)

Analysis Unit		Net Area	Avg. SI50	CC	Species Composition	ITG	SI50 Range
41	FDCWXG	46	22.3	63	Fd57 Cw18 Lw13 Se12	1,2,4,5,6,8	>21
42	FDCWXM	1776	18.2	63	Fd83 Cw8 Pl6 Lw3	1,2,4,5,6,8	15-21
43	FDCWXP	3457	12.7	56	Fd85 Cw7 Pl6 Lw2	1,2,4,5,6,8	<15
44	FDHWXG	127	21.8	57	Fd51 Hw29 Pw11 Cw9	3	>21
45	FDHWXM	886	17.4	66	Fd54 Hw34 Lw7 Cw5	3	15-21
46	FDHWXP	1509	13.0	62	Fd60 Hw33 Cw5 Bl2	3	<15
47	FDLWXG	42	21.5	62	Fd58 Lw23 Pw14 Hw5	7	>21
48	FDLWXM	2062	18.4	59	Fd61 Lw30 Pw6 Hw3	7	15-21
49	FDLWXP	1692	13.2	60	Fd63 Lw29 Pw7 Pl1	7	<15
50	CWHWXG	7	22.2	68	Cw69 Hw31	9,10,11	>22
51	CWHWXM	1671	19.3	59	Cw65 Hw26 Se7 Bl2	9,10,11	17-22
52	CWHWXP	6823	15.5	57	Cw64 Hw27 Fd5 Se4	9,10,11	<17
53	HWBLXG	9	20.7	65	Hw75 Fd13 Se12	12,15,16,17	>20
54	HWBLXM	2283	15.6	55	Hw73 Bl13 Se11 Cw3	12,15,16,17	15-20
55	HWBLXP	2141	11.8	57	Hw78 Bl12 Se6 Cw4	12,15,16,17	<15
56	HWFDXG	16	19.9	47	Hw50 Fd30 Cw20	13	>19
57	HWFDXM	288	17.6	62	Hw60 Fd23 Cw9 Lw8	13	16-19
58	HWFDXP	3005	13.4	62	Hw60 Fd25 Pw9 Cw6	13	<16
59	HWCWXG	579	20.0	46	Hw57 Cw36 Se6 Bl1	14	>19
60	HWCWXM	685	17.4	63	Hw62 Cw31 Se5 Fd2	14	16-19
61	HWCWXP	10210	13.6	61	Hw61 Cw36 Se2 Pd1	14	<16
62	BLSEXG	310	19.0	58	Bl56 Se35 Hw9	18,19,20	>17
63	BLSEXM	2695	14.1	50	Bl61 Se37 Cw1 Hw1	18,19,20	12-17
64	BLSEXP	4872	10.9	44	Bl60 Se38 Pl2	18,19,20	<12
65	SECWXG	982	23.8	46	Se77 Cw14 Hw8 Bl1	21,22,23,25,26	>21
66	SECWXM	744	15.2	50	Se73 Cw12 Hw11 Fd4	21,22,23,25,26	15-21
67	SECWXP	1581	11.8	51	Se71 Cw13 Hw12 Bl4	21,22,23,25,26	<15
68	SEBLXG	1671	24.2	42	Se59 Bl38 Cw2 Hw1	24	>20
69	SEBLXM	7013	13.8	42	Se60 Bl39 Hw1	24	17-20
70	SEBLXP	7231	9.1	47	Se60 Bl39 Hw1	24	<17
71	PLLWXG	10	24.1	70	Pl80 Se10 Bl10	28,30,31,32	>20
72	PLLWXM	8	17.8	80	Pl50 Bl40 Hw10	28,30,31,32	17-20
73	PLLWXP	304	13.9	62	Pl82 Se9 Py6 Bl3	28,30,31,32	<17
74	PLFDXG	55	21.4	75	Pl34 Pl29 Lw20 Hw17	27,29	>20
75	PLFDXM	9	17.2	70	Pl70 Lw20 Fd10	27,29	17-20
76	PLFDXP	189	14.0	64	Pl37 Pw30 Fd23 Lw10	27,29	<17
77	LWFDXG	172	24.9	60	Lw57 Fd22 Hw13 Cw8	33,34	>21
78	LWFDXM	527	19.0	50	Lw71 Fd19 Cw5 Pw5	33,34	17-21
79	LWFDXP	704	13.9	59	Lw71 Fd19 Hw6 Cw4	33,34	<17
Total		68391					

7.3.2 Analysis Units 101 – 121, 201-269, 301-321 (TIPSY Managed Stands)

These analysis units define managed stands that will be modeled using BATCHTIPSY managed stand yield tables (MSYTs). These stands have been managed since establishment and include all artificially regenerated sites. MSYTs

for existing managed stands are listed in Table 7.4. Analysis units 101-121 represent MSYTs for the current species mix, determined from the existing forest cover descriptions. Analysis units 301-321 represent MSYTs for these areas following harvest and stand reestablishment. In this case the species mix represents current silviculture objectives for the TFL. A list of the areas associated with each of the MSYTs, subdivided into existing and future areas is provided in Tables 7.4 and 7.5.

Note: Where the leading species in the MSYT differs from the existing leading species, the following site index conversion relationships were employed:

$$SI_{Fdi} = -.690 + 0.983 * SI_{Lw}$$

$$SI_{Fdi} = 4.56 + 0.887 * SI_{Hw}$$

$$SI_{Sw} = -1.95 + 1.160 * SI_{B}$$

Table 7.4(a) - TIPSY (existing) Analysis Unit Descriptions

Existing Analysis Unit		Net Area	Avg. SI50	Existing Modeled Species Composition	Future Analysis Unit		SI50	Future Modeled Species Composition
101	DFIR-G	151	24.4	Fd57 Cw16 Hw14 S13	301	Fd/oth –G	24.4	Fd80 Pl20
102	DFIR-M	4664	17.9	Fd67 Pw11 Cw11 Pl11	302	Fd/oth-M	17.9	Fd80 Pl20
103	DFIR-P	601	12.0	Fd73 Cw11 Pw8 Hw8	303	Fd/oth-P	12.0	Fd60 Pl40
104	CEDR-G	22	23.7	Cw58 Hw29 Fd13	304	SeCw-G	23.7	Fd70 S20 Cw10
105	CEDR-M	2377	19.6	Cw53 Hw28 Fd11 S8	305	SeCw-M	19.6	Fd70 S20 Cw10
106	CEDR-P	577	13.1	Cw51Hw28 Fd12 Pw9	306	SeCw-P	13.1	Fd70 S20 Cw10
107	HEML-G	1101	21.1	Hw69 Cw21 Fd10	307	FdHw-G	23.3	Fd80 Pl10 S10
108	HEML-M	5329	17.9	Hw56 Cw26 Pw10 Fd8	308	FdHw-M	20.4	Fd80 Pl10 S10
109	HEML-P	1185	12.0	Hw58 Cw28 Fd7 Pw7	309	FdHw-P	15.2	Fd70 Pl30
110	BALS-G	301	18.8	Hw64 S29 Cw7	310	SeHw-G	19.9	S70 Pl20 Hw10
111	BALS-M	2815	15.1	Hw70 S26 Pl4	311	SeHw-M	15.6	S60 Pl30 Hw10
112	BALS-P	526	11.0	Hw65 S30 Cw5	312	SeHw-P	10.8	S50 Pl40 Hw10
113	SPRU-G	51	22.8	S62Pl20 Hw9 Cw9	313	SeHw-G	22.8	S70 Pl20 Hw10
114	SPRU-M	10113	16.1	S77 Hw14 Pl5 Cw4	314	SeHw-M	16.1	S60 Pl30 Hw10
115	SPRU-P	1282	10.1	S78 Hw10 Pl8 Cw4	315	SeHw-P	10.1	S50 Pl40 Hw10
116	PINE-G	845	23.5	Fd63(1) Pl20 Hw17	316	PlLw-G	23.5	Fd60 Pl40
117	PINE-M	642	19.4	Pl60 Fd40(1)	317	PlLw-M	19.4	Fd50 Pl50
118	PINE-P	3746	14.6	Pl73 Fd27(1)	318	PlLw-P	14.6	Pl60 Fd40
119	LARC-G	259	24.5	Fd74(1) Pl26	319	Fd/oth –G	23.4	Fd80 Pl20
120	LARC-M	225	19.5	Fd77(1) Pl23	320	Fd/oth-M	18.5	Fd80 Pl20
121	LARC-P	756	13.7	Fd73(1) Hw14 Pl13	321	Fd/oth-P	12.8	Fd60 Pl40
Total		37568						

(1) Includes white pine and larch which in TIPSY are modeled as Douglas-fir

Table 7.5 lists attributes for existing natural stands, following harvest.

Table 7.5(a) - TIPSY (future) Analysis Unit Descriptions

Existing Natural (Thrifty)				Future Managed			
Analysis Unit		Net Area	Avg. SI50	Analysis Unit		SI50	Modeled Species Composition
1	FDCW-G	3155	23.4	201	Fd/other –G	23.4	Fd80 Pl20
2	FDCW-M	10719	18.5	202	Fd/other-M	18.5	Fd80 Pl20
3	FDCW-P	1583	13.6	203	Fd/other-P	13.6	Fd60 Pl40
4	FDHW-G	2473	22.9	204	Fd/other –G	22.9	Fd80 Pl20
5	FDHW-M	7041	18.1	205	Fd/other-M	18.1	Fd80 Pl20
6	FDHW-P	568	13.8	206	Fd/other-P	13.8	Fd60 Pl40
7	FDLW-G	2726	23.2	207	Fd/other –G	23.2	Fd80 Pl20
8	FDLW-M	11336	18.2	208	Fd/other-M	18.2	Fd80 Pl20
9	FDLW-P	561	13.9	209	Fd/other-P	13.9	Fd60 Pl40
10	CWHW-G	320	24.1	210	SeCw-G	24.1	Fd70 S20 Cw10
11	CWHW-M	3212	19.1	211	SeCw-M	19.1	Fd70 S20 Cw10
12	CWHW-P	1222	14.5	212	SeCw-P	14.5	Fd70 S20 Cw10
13	HWBL-G	369	22.5	213	FdHw-G	24.5	Fd80 Pl10 S10
14	HWBL-M	1172	16.9	214	FdHw-M	19.6	Fd80 Pl10 S10
15	HWBL-P	190	12.9	215	FdHw-P	16.1	Fd70 Pl30
16	HWFD-G	1966	21.1	216	FdHw-G	23.3	Fd80 Pl10 S10
17	HWFD-M	4576	17.5	217	FdHw-M	20.1	Fd80 Pl10 S10
18	HWFD-P	2554	13.8	218	FdHw-P	16.8	Fd70 Pl30
19	HWCW-G	1833	21.3	219	FdHw-G	23.4	Fd80 Pl10 S10
20	HWCW-M	7015	17.8	220	FdHw-M	20.4	Fd80 Pl10 S10
21	HWCW-P	2749	13.0	221	FdHw-P	16.1	Fd70 Pl30
22	BLSE-G	2090	19.7	222	SeHw-G	20.9	S70 Pl20 Hw10
23	BLSE-M	5755	15.0	223	SeHw-M	15.4	S60 Pl30 Hw10
24	BLSE-P	1268	10.4	224	SeHw-P	10.1	S50 Pl40 Hw10
25	SECW-G	206	25.2	225	SeHw-G	25.2	S70 Pl20 Hw10
26	SECW-M	931	17.1	226	SeHw-M	17.1	S60 Pl30 Hw10
27	SECW-P	226	12.2	227	SeHw-P	12.2	S50 Pl40 Hw10
28	SEBL-G	474	22.8	228	SeHw-G	22.8	S70 Pl20 Hw10
29	SEBL-M	1815	16.5	229	SeHw-M	16.5	S60 Pl30 Hw10
30	SEBL-P	298	11.6	230	SeHw-P	11.6	S50 Pl40 Hw10
31	PLLW-G	1138	21.5	231	PlLw-G	21.5	Fd60 Pl40
32	PLLW-M	3728	18.4	232	PlLw-M	18.4	Fd50 Pl50
33	PLLW-P	1955	15.2	233	PlLw-P	15.2	Pl60 Fd40
34	PLFD-G	4050	22.6	234	PlLw-G	22.6	Fd60 Pl40
35	PLFD-M	5774	18.6	235	PlLw-M	18.6	Fd50 Pl50
36	PLFD-P	3141	15.2	236	PlLw-P	15.2	Pl60 Fd40
37	LWFD-G	3672	23.0	237	Fd/other –G	22.0	Fd80 Pl20
38	LWFD-M	6306	18.9	238	Fd/other-M	17.9	Fd80 Pl20
39	LWFD-P	2411	15.0	239	Fd/other-P	14.1	Fd60 Pl40
Total		112578					

8.0 GROWTH AND YIELD

This section outlines the methodologies used to develop yield tables that will be included in the timber supply analysis and the volume information that is reported in this Information Package. Growth and yield modeling will be modified compared with techniques employed in support of MWP #8. Key changes are as follows:

- Revised forest cover inventory data
- Use of new SI50 values from the MoF OGSI adjustment equations for managed stands that will apply to existing old growth (sensitivity analysis)
- Allowance for genetic gain

8.1 Site Index

The most recent MoF site index curves embedded in VDYP Version 6.4 have been used to assign existing site index (SI50) to existing natural stands based on inventory age and height. This site value has been used to assign stands to the appropriate analysis unit (VDYP AUs 1–39, 101–139 and 201–239) for modeling. Table 8.1 lists the site index curve reference for each species present in VDYP Version 6.4

Table 8.1 - Source of Site Index Equations

Species	Site Index Reference
Trembling aspen	Goudie (1982)
Subalpine fir	Kurucz (1982)
Western redcedar	Kurucz (1985)
Paper birch	Goudie (1982)
Interior Douglas-fir	Thrower & Goudie (1992)
Western hemlock	Wiley (1978)
Western larch	Milner (1992)
Lodgepole pine	Goudie (1984)
Ponderosa pine	Han & Scrivini (1986)
Western white pine	Curtis, Diaz & Clendenen (1990)
Interior spruce	Goudie (1984), natural stands

Analysis unit site index is derived as the area-weighted average of the polygon site indices in that analysis unit (pooled species group and site class). Analysis units are assigned to site classes good (G), medium (M) and poor (P) based on the site index ranges specified in Table 7.3. These classes are a general description of the relative productivity of the stands but are not related to the old MoF G, M, and P classification.

In the base case, no OGSI adjustments are applied to the Managed stand assignment for sites currently occupied by old growth (age class 8 & 9). However, a sensitivity analysis will be performed using adjustments based on

MoF OGSI adjustment equations from the report *Interim Old Growth Site Index Adjustment Equations and Application Guidelines*, MoF Research Branch 97.1.25. The SI50 values assigned to the old growth stands (based on inventory age and height) that will be used to develop the VDYP yield tables will be adjusted for developing managed stand yield tables. The site index adjustment equations for the species found on TFL 23 are listed in Table 8.2. Existing managed (1–25 years) and natural thrifty (26–140 years) stands will use the inventory SI50 for developing all yield tables.

Table 8.2 - Old Growth Site Index Adjustment Equations

Old Growth Species	Adjustment Equation	SI_{OG} Range	ITG
Subalpine fir (Bl)	$SI_{SG} = 8.824+0.5682 * SI_{OG}$	4.5 – 22.0	18-20[1]
Western redcedar (Cw)	$SI_{SG} = 20.69$	11.6 – 22.0	
Douglas-fir (Fd)	$SI_{SG} = 8.215+0.6211 * SI_{OG}$	6.4 – 25.2	1-8[1]
Western hemlock (Hw)	$SI_{SG} = 11.42+0.5430 * SI_{OG}$	4.7 – 17.5	12-17[1]
Western larch (Lw)	$SI_{SG} = 22.08$	11.0 – 28.3	
Lodgepole pine (Pl)	$SI_{SG} = 15.554+0.2929 * SI_{OG}$	7.3 – 23.7	28-31[1]
Ponderosa pine (Py)	$SI_{SG} = 8.311+0.6081 * SI_{OG}$	4.3 – 19.2	
White spruce (Sw)	$SI_{SG} = 18.208+0.1593 * SI_{OG}$	5.8 – 25.4	21-26[1]

[1] Adjustments will be applied to these inventory type groups (prjage >= 140).

The equations listed above will only apply to the SI50 for managed stands using the guidelines provided in the MoF report. A summary of the unadjusted and adjusted values is provided in Table 8.3.

Table 8.3 - TIPSY (future) Analysis Unit Descriptions

A. unit		Base case SI50	OGSI Adjustment		Species Conversion	
base	ogsi		species	SI50	species	SI50
241	341	22.3	Fd	22.1		n.a
242	342	18.2	Fd	19.5		n.a
243	343	12.7	Fd	16.1		n.a
244	344	21.8	Fd	21.8		n.a
245	345	17.4	Fd	19.0		n.a
246	346	13.0	Fd	16.3		n.a
247	347	21.5	Fd	21.6		n.a
248	348	18.4	Fd	19.6		n.a
249	349	13.2	Fd	16.4		n.a
250	350	22.2	Cw	n.a		n.a
251	351	19.3	Cw	n.a		n.a
252	352	15.4	Cw	n.a		n.a
253	353	20.7	Hw	22.7	Fd	24.7
254	354	15.5	Hw	19.8	Fd	22.1
255	355	11.8	Hw	17.8	Fd	20.3
256	356	19.9	Hw	22.2	Fd	24.3
257	357	17.6	Hw	21.0	Fd	23.2
258	358	13.4	Hw	18.7	Fd	21.1
259	359	20.0	Hw	22.3	Fd	24.3
260	360	17.4	Hw	20.9	Fd	23.1
261	361	13.6	Hw	18.8	Fd	21.2

based on P&T silviculture planning. Table 8.5 describes the regeneration strategies currently in place on TFL 23.

Table 8.5 - Regeneration Strategies & Analysis Units

Managed Stand AU	Existing Natural Stands	Operational Species Composition	Modeled Species Composition [1]	Density[2]
Fd/Other-G	1,4,7,37	Fd30 Pw30 Lw20 Pl20	Fd80 Pl20	1600
Fd/Other-M	2,5,8,38	Fd30 Pw30 Lw20 Pl20	Fd80 Pl20	1600
Fd/Other-P	3,6,9,39	Pl40 Fd30 Pw20 Lw10	Fd60 Pl40	1600
SeCW-G	10	Pw40 Fd30 Se20 Cw10	Fd70 S20 Cw10	1600
SeCW-M	11	Pw40 Fd30 Se20 Cw10	Fd70 S20 Cw10	1600
SeCW-P	12	Pw30 Fd20 Se20 Cw20 Pl10	Fd70 S20 Cw10	1600
FdHw-G	13,16,19	Fd30 Pw30 Lw20 Pl10 Se10	Fd80 Pl10 S10	1600
FdHw-G	14,17,20	Fd30 Pw30 Lw20 Pl10 Se10	Fd80 Pl10 S10	1600
FdHw-G	15,18,21	Fd30 Pw30 Pl30 Lw10	Fd70 Pl30	1600
SeHw-G	22,25,28	Se70 Pl20 Bl10	S70 Pl20 Hw10	1600
SeHw-M	23,26,29	Se60 Pl30 Bl10	S60 Pl30 Hw10	1600
SeHw-P	24,27,30	Se50 Pl40 Bl10	S50 Pl40 Hw10	1600
PlLw-G	31,34	Lw60 Pl40	Fd60 Pl40	1600
PlLw-M	32,35	Lw50 Pl50	Fd50 Pl50	1600
PlLw-P	33,36	Pl60 Lw40	Pl60 Fd40	1600

[1] Lw and Pw are modeled as Fd in BatchTIPSY
Bl is modeled as Hw in BatchTIPSY
[2] Includes ingress

All managed stands will regenerate to the same MSYT after harvest in the timber supply analysis simulations.

8.7.2 Aggregated Yield Tables for Managed Stands

All managed stands will be assigned to the set of MSYTs described in the previous section. All stands regenerated since 1972 (both natural and planted) will be assigned to managed stand yields for the analysis. This reflects the silviculture history on the license. P&T has maintained recommended stocking standards on these areas.

Managed stand yields were developed using MoF BatchTIPSY. BatchTIPSY incorporates the following inputs to derive a yield curve for each analysis unit:

- Leading species;
- Initial density - based on current stocking objectives, including ingress;
- Treatments;
- Site index;
- Operational adjustment factors (OAF1 15%, OAF2 5%); and
- Regeneration delay - 0 (delays are incorporated in forest level analysis).

The guidelines for assigning existing natural stands to future MSYTs are provided in Table 8.4. Appendix II provides a full list of the BatchTIPSY yield tables for

managed stands. Table 10.5 summarizes the minimum harvest age attributes for the MSYTs.

8.7.3 Regeneration Delay

Silviculture prescriptions and past performance indicate a regeneration delay of two years. Some harvested areas have regeneration in place within the same year on TFL 23. For the timber supply analysis all harvested areas will be assigned a 2-year regeneration delay.

8.7.4 Genetic Gain Allowances

Based on the existing tree improvement program, it is reasonable to expect yield gains for stands originating from genetically improved planting stock. In the absence of specific information, a factor of 3% was used to increase the yields of all future managed stands. This allowance is well within provincial expectations for yield increases associated within genetic improvement.

8.8 Silviculture History

8.8.1 Existing Managed Immature Stands

A summary of the existing managed immature inventory and analysis unit assignment for those stands is provided in Table 7.4. This component of the inventory includes all stands established since 1967 (25 years old and younger).

Table 8.6 - Age Distribution – Existing Managed Stands

1-5	6-10	11-15	16-20	21-25	Total
4845	10235	4953	5713	11821	37567

8.8.2 Non-Satisfactorily Restocked

The recent forest re-inventory identified 6,165 net ha of potentially non-satisfactorily restocked (NSR) lands on TFL 23. In the analysis, these areas will be regenerated according to the strategies outlined in Table 8.5. Table 8.7 summarizes the regeneration plans for the NSR that will be modeled.

Table 8.7 - NSR Regeneration Strategy

Current Thrifty Distribution			NSR Assignment	
Species Group	Existing Thrifty (ha)	percent	Area	Analysis Unit
FDCW	15616			
FDHW	10124	47%	2898	207
FDLW	14819			
LWFD	12412			
CWHW	4770	4%	246	211
HWBL	1732			
HWFD	9107	20%	1233	217
HWCW	11614			
BLSE	9187			
SECW	1403	12%	740	229
SEBL	2623			
PLLW	6882	17%	1048	235
PLFD	13025			
Total	113314	100	6165	

10.1.2 Recreation and Landscape

Recreation and Landscape inventories were updated in 1994. Both inventories were completed to MoF standards for the entire TFL area. Visual sensitivity classes defined in the Landscape inventory will be used to identify management zones in which visual management will be emphasized.

10.1.3 Landscape Units

Landscape units for TFL 23 were recommended in the most recent MOU for the KBLUP. MoF/MoELP provided a digital file of the LU boundaries. These areas are intended to be broad contiguous areas over which objectives related to natural resources are to be met. For the purposes of this analysis, landscape level biodiversity targets will be assigned at the LU-BEC/NDT level.

10.1.4 Streams, Lakes and Wetlands Classification

The creek classification is being updated for the entire TFL to FPC standards. Approximately 25% of the re-classification is complete for use in the MP #9 timber supply analysis.

Classification to FPC standards allows identification of riparian reserve and management zones (RRZs and RMZs) for the timber supply analysis. Local knowledge has been used in FPC updates of the TRIM creeks. Operationally, streams are classified based on field data.

Wetlands and lakes were classified using GIS queries on lakes and wetland size as per the FPC Riparian Management Area Guidebook.

10.1.5 Wildlife

Ungulate winter range is based on KBLUP linework (KBLUP Implementation Strategy 97.06.01). Caribou habitat mapping was completed for the TFL in 1997 using telemetry survey results.

10.1.6 Cultural Heritage

MoF completed an archaeological overview assessment in 1995 for the Arrow Forest District, including TFL 23. This assessment included an inventory of all archaeological sites reported for the West Kootenays.

10.2 Forest Cover Requirements

The analysis will apply forest cover objectives to model wildlife habitat guidelines, biodiversity, hydrologic green-up, silvicultural green-up and visual quality objectives. Forest cover objectives place maximum and minimum limits on the amount of young second growth and/or old growth found in landbase aggregates (LU-BEC/NDTs and REAs).

Timberline's proprietary simulation model CASH6 has the option of using a pseudo-geographic or full spatial approach to modelling timber availability, giving considerable flexibility depending on data structure and analysis objectives. This

allows the analysis to mirror, as closely as possible, the intent of forest cover objectives on harvesting in operations.

Maximum depletion and minimum old growth objectives on forest cover are explicitly implemented. Productive forest stands such as inoperable and uneconomic forest types which have been excluded from the timber harvesting landbase may be included to better model forest structure and disturbance levels. These non-harvesting areas are referred to as non-contributing forest.

Any number of forest cover groups may be used to aggregate forest stands for the purpose of modelling forest cover objectives. For example, a forest cover group will be created to model caribou habitat within a specific region of the TFL and this will be overlapped with landscape level biodiversity requirements for Landscape Unit-BEC/NDT.

There are three forest cover constraint classes available for modeling within each forest cover group:

- Disturbance - the maximum area that can be younger than a specified age or shorter than a specified height. This is intended to model cutblock adjacency and green-up requirements.
- Mature Retention - the minimum proportion of area that must be retained over a lower retention age. This is intended to model thermal cover for wildlife or mature biodiversity requirements. Mature and old growth retention forest cover objectives overlap and area that qualifies for both is counted in both.
- Old growth Retention - the minimum area that must be older than, or as old as, a specified age. This is intended to model both retention of cover and retention of old growth.

The use of forest cover objectives as described above improves forest management modeling by ensuring that the non-timber resources are given appropriate consideration.

Forest cover objectives to be applied to the forest cover groups representing REAs are presented in Table 10.2. REA requirements are based on those used in the KBLUP and from MoELP.

Table 8.3 (continued)

A. unit		Base case SI50	OGSI Adjustment		Species Conversion	
base	ogsi		species	SI50	species	SI50
262	362	19.0	Bl	19.6	Sw	20.8
263	363	14.1	Bl	16.8	Sw	17.5
264	364	10.9	Bl	15.0	Sw	15.4
265	365	23.8	Sw	22.0		n.a
266	366	15.2	Sw	20.6		n.a
267	367	11.8	Sw	20.1		n.a
268	368	24.2	Sw	22.1		n.a
269	369	13.8	Sw	20.4		n.a
270	370	9.1	Sw	19.7		n.a
271	371	24.1	Pl	22.6		n.a
272	372	17.8	Pl	20.8		n.a
273	373	13.9	Pl	19.6		n.a
274	374	21.4	Pl	21.8		n.a
275	375	17.2	Pl	20.6		n.a
276	376	14.0	Pl	19.7		n.a
277	377	24.9	Lw	n.a	Fd	23.8
278	378	19.0	Lw	n.a	Fd	18.0
279	379	13.9	Lw	n.a	Fd	13.0

8.2 Utilization Levels

Standard close utilization levels will be used in the development of the yield tables as documented in Table 8.4.

Table 8.4 - Utilization Levels

Stand Types	Utilization		
	Minimum DBH (cm)	Stump Height (cm)	Top DIB (cm)
Managed stands (TIPSY)	12.5	30.0	10.0
Natural stands (VDYP)-PL	12.5	30.0	10.0
Natural stands (VDYP)-other	17.5	30.0	10.0

8.3 Decay, Waste and Breakage

VDYP generated volumes (for both current polygon volumes and VDYP yield tables) are net DWB using forest inventory zone (FIZ) G and loss factors for special cruise 128 (Nakusp PSYU/TFL 23).

8.4 Operational Adjustment Factors

Deductions for DWB are inherent in VDYP forecasts based on the DWB factors for the assigned FIZ and PSYU. BATCHTIPSY incorporates operational adjustment factors (OAFs) to adjust gross volumes:

- OAF1 – for unmapped stand openings, 15% for all TIPSY yield tables; and
- OAF2 – for age-related losses in volume, 5% for all TIPSY yield tables.

OAFs are based on standard MoF values for developing MSYTs. However, silviculture surveys and operational mapping indicate that OAF1 of 15% may be

too high. A sensitivity analysis of managed stand yields will evaluate the impacts of different OAF1 values by increasing and decreasing MSYT volumes.

8.5 Volume Deductions

Volume deductions are made by reducing stand volume if a component of a stand is unmerchantable but the remainder of the stand is large enough, and of acceptable quality, to be merchantable. All stand volumes are reduced by the DWB factors included in VDYP and OAF1 and OAF2 noted above. In addition, all analysis unit and polygon volumes reported are conifer only. No deciduous volumes are included.

8.6 Yields for Unmanaged Stands

8.6.1 Current Inventory Volumes

Volumes reported in this information package were developed with VDYP Version 6.4 (BATCHPROCESS). Appropriate DWB factors and utilization levels were included in the development of these polygon volumes.

8.6.2 Yield Tables for Unmanaged Stands

Inventory type group and site index were used to define analysis units for the older immature and mature component (age >25 years) of the inventory that will be modeled on VDYP NSYTs. Table 7.3, Section 7.3.1 summarizes the analysis unit definitions for this subset of the inventory.

The VDYP natural stand yields at the analysis unit level were developed with the following methods:

- Each polygon in the net landbase was assigned to an analysis unit on the basis of inventory type group and site index.
- Area-weighted average species composition, crown closure and site index were extracted for each analysis unit.
- These attributes, in addition to DWB factors associated with forest inventory zone G and special cruise 128 were used to drive VDYP.
- Yields are compiled to 17.5 cm dbh (12.5 cm for Lodgepole pine), 10.0 cm top and 30.0 cm stump.

Inputs to VDYP are presented in Table 7.3. Yield tables developed with VDYP that will be used in modeling the existing natural forest are presented in Appendix I. A summary of minimum harvest age attributes for the VDYP yield tables is presented in Table 10.4

8.7 Yields for Managed Stands

8.7.1 Silviculture Management Regimes

The following section describes regeneration plans for the TFL and the link between existing and regeneration analysis units. In the TFL 23 analysis all cut-over sites will be planted after harvest. Regeneration delays are not inherent in the yield curves, but are assigned in forest estate modeling. All regeneration is

Table 7.5(b) - TIPSY (future) Analysis Unit Descriptions

Existing Natural (Mature)				Future Managed			
Analysis Unit		Net Area	Avg. SI50	Analysis Unit		SI50	Modeled Species Composition
41	FDCWXG	46	22.3	241	Fd/other –G	22.3	Fd80 Pl20
42	FDCWXM	1776	18.2	242	Fd/other-M	18.2	Fd80 Pl20
43	FDCWXP	3457	12.7	243	Fd/other-P	12.7	Fd60 Pl40
44	FDHWXG	127	21.8	244	Fd/other –G	21.8	Fd80 Pl20
45	FDHWXM	886	17.4	245	Fd/other-M	17.4	Fd80 Pl20
46	FDHWXP	1509	13.0	246	Fd/other-P	13.0	Fd60 Pl40
47	FDLWXG	42	21.5	247	Fd/other –G	21.5	Fd80 Pl20
48	FDLWXM	2062	18.4	248	Fd/other-M	18.4	Fd80 Pl20
49	FDLWXP	1692	13.2	249	Fd/other-P	13.2	Fd60 Pl40
50	CWHWXG	7	22.2	250	SeCw-G	22.2	Fd70 S20 Cw10
51	CWHWXM	1671	19.3	251	SeCw-M	19.3	Fd70 S20 Cw10
52	CWHWXP	6823	15.4	252	SeCw-P	15.4	Fd70 S20 Cw10
53	HWBLXG	9	20.7	253	FdHw-G	22.9	Fd80 Pl10 S10
54	HWBLXM	2283	15.5	254	FdHw-M	18.4	Fd80 Pl10 S10
55	HWBLXP	2141	11.8	255	FdHw-P	15.0	Fd70 Pl30
56	HWFDXG	16	19.9	256	FdHw-G	22.2	Fd80 Pl10 S10
57	HWFDXM	288	17.6	257	FdHw-M	20.3	Fd80 Pl10 S10
58	HWFDXP	3005	13.4	258	FdHw-P	16.4	Fd70 Pl30
59	HWCWXG	579	20.0	259	FdHw-G	22.3	Fd80 Pl10 S10
60	HWCWXM	685	17.4	260	FdHw-M	20.0	Fd80 Pl10 S10
61	HWCWXP	10210	13.6	261	FdHw-P	16.6	Fd70 Pl30
62	BLSEXG	310	19.0	262	SeHw-G	20.0	S70 Pl20 Hw10
63	BLSEXM	2695	14.1	263	SeHw-M	14.4	S60 Pl30 Hw10
64	BLSEXP	4872	10.9	264	SeHw-P	10.6	S50 Pl40 Hw10
65	SECWXG	982	23.8	265	SeHw-G	23.8	S70 Pl20 Hw10
66	SECWXM	744	15.2	266	SeHw-M	15.2	S60 Pl30 Hw10
67	SECWXP	1581	11.8	267	SeHw-P	11.8	S50 Pl40 Hw10
68	SEBLXG	1671	24.2	268	SeHw-G	24.2	S70 Pl20 Hw10
69	SEBLXM	7013	13.8	269	SeHw-M	13.8	S60 Pl30 Hw10
70	SEBLXP	7231	9.1	270	SeHw-P	9.1	S50 Pl40 Hw10
71	PLLWXG	10	24.1	271	PlLw-G	24.1	Fd60 Pl40
72	PLLWXM	8	17.8	272	PlLw-M	17.8	Fd50 Pl50
73	PLLWXP	304	13.9	273	PlLw-P	13.9	Pl60 Fd40
74	PLFDXG	55	21.4	274	PlLw-G	21.4	Fd60 Pl40
75	PLFDXM	9	17.2	275	PlLw-M	17.2	Fd50 Pl50
76	PLFDXP	189	14.0	276	PlLw-P	14.0	Pl60 Fd40
77	LWFDXG	172	24.9	277	Fd/other –G	23.8	Fd80 Pl20
78	LWFDXM	527	19.0	278	Fd/other-M	18.0	Fd80 Pl20
79	LWFDXP	704	13.9	279	Fd/other-P	13.0	Fd60 Pl40
Total		68391					

7.4 Age Class Distribution

Tables 7.6 and 7.7 summarize the distribution of area and volume (net decay, waste and breakage (DWB)) by age class (age in 20s) for the productive, operable and net operable (timber harvesting) components of the TFL 23 forest inventory. All ages are projected to December 31, 1997.

Table 7.6 - Area by Age Class

Age Class	Area by Age Classification (ha)		
	Productive	Operable	Net[1]
NSR	11313	7631	0
0 (NCBr)	197	0	0
1 –20	34373	33652	25747
21-40	41848	36619	29958
41-60	16187	11648	10205
61-80	30552	22823	20487
81-100	33107	25790	22640
101-120	37954	31543	28586
121-140	16723	13998	12521
141-250	132864	74540	60238
251+	16716	10591	8155
Total	371834	268835	218537

[1] Based on Current Management Option netdowns

Table 7.7 - Volume by Age Class

Age Class	Volume by Age Classification (1000 m^3)[1]		
	Productive	Operable	Net[2]
21-40	167	159	153
41-60	1370	985	1086
61-80	3856	2946	3307
81-100	5741	4602	5171
101-120	8329	7043	7777
121-140	4095	3497	3811
141-250	41684	25740	21931
251+	6593	4505	3514
Total	71835	49477	46750

[1] Volumes are based on VDYP
[2] Based on Current Management Option netdowns

Volumes are based on VDYPbatch Version 6.4. This provides a reasonable estimate of volume for the TFL 23 inventory. Only volumes for stands > age 25 are included. The contribution to standing inventory of stands < age 25 would be negligible.

9.0 NON-RECOVERABLE LOSSES

Fire, insects, disease and other natural factors can cause catastrophic losses of whole stands of trees. Over the long-term the probability of losses to natural causes can be predicted. Where losses occur in merchantable stands some of the dead or dying timber may be salvageable. When modeling the timber supply, the non-recoverable losses (NRLs) are added to the desired harvest target and then subtracted from the forecast upon completion of the modeling to determine the net timber harvest. Table 9.1 summarizes the estimated NRLs for TFL 23.

Table 9.1 - Annual Non-Recoverable Losses

Category	Losses to Hazards (m^3/year)		
	Gross	Salvage	Net Loss
Fire	18,700	11,600	7,100
Insects	18,000	5,000	13,000
Disease			
Year 1 – 99	5,780	2,890	2,890
Year 100+	5,780	5,780	0
Wind	7,500	4,500	3,000
Total	49,980		
Year 1 – 99		23,990	25,990
Year 100+		26,880	23.100

- *Fire losses* are based on fire records from 1986-1992.

- *Insect losses* include losses to mountain pine and spruce bark beetles in the operable land base.

- *Blowdown losses* account for edge losses, normal stand blowdown, and for blowdown associated with 10-year storm events.

- *Disease losses* are those associated with white pine blister rust. The losses are at a maximum at present and are expected to fall to zero over the next 100 years. The rationale for this expected decline in impact is two-fold. First, the age at which stands with a white pine component are being attacked is, and will continue to be, lower than the original stands which were attacked when the white pine blister rust was originally introduced into the region. Therefore, future stands will have a longer period to replace lost volumes prior to harvest. Second, only rust resistant seed will be used wherever possible.

The present inventory suggests that no more than 2.5% of the net operable mature volume is white pine. The Arrow TSA white pine survey completed in the fall of 1992 suggests that the standing volume in attacked mature white pine stands is 66% of that for similar undisturbed stands.

Based on the above, unsalvaged disease losses were calculated as follows:

- The contribution of white pine to the AAC was calculated as:
  680,000 (AAC) * 0.025 (Pw component) = 17,000 cubic metres
- The annual loss was calculated as:
  17,000*.34 (% remaining) = 5,780 cubic metres.
- This loss was assumed to be 50% salvageable.

10.0 INTEGRATED RESOURCE MANAGEMENT

This Section provides details on how modeling methodology will address non-timber resource requirements.

10.1 Forest Resource Inventories

This section documents the status of all non-timber resource inventories. Approximate dates of completion and approvals are presented in Table 10.1.

Table 10.1 - Non-Timber Resource Inventory Status

Inventory Category	Data Source	Mapping Scale	Date of Completion	Date of Acceptance	Authority
Terrain Hazard	Terratech	1:20,000	Completed 95.09.30	97.03.30	MoF District
Biogeoclimatic Zones	MoF - Arrow	1:250,000	Received 98.02.23	98.02.23	MoF Region
Caribou habitat – P&T	Nanuq	1:250,000	Completed 97.10.31	Draft	
Caribou habitat – KBLUP	MoELP - Nelson	1:250,000	97.06	97.06	IAMC
Ungulate winter range	MoF - Columbia	1:250,000	Received 97.06.31	97.06.30	MELP
Ungulate winter range	KBLUP - Arrow	1:50,000	Received 97.06.30	1991	MELP
Community watersheds	MoELP - Nelson	1:20,000	Received 98.01.01	98.01.01	MELP
Domestic watersheds	MoELP - Nelson	1:20,000	Received 98.01.01	98.01.01	MELP
Riparian Classification	Pope & Talbot	1:20,000	97.12.30	97.12.30	MELP
Operability	Pope & Talbot	1:20,000	97.07.30	97.07.30	MoF District
Landscape Units – Draft	MoF - Columbia	1:250,000	1996/1997	Draft	Ministers Advisory Committee
Landscape Units	MoF - Arrow	1:250,000	Received 98.02.01	98.04.08	MoF District Manager
Recreation & Landscape	Pope & Talbot	1:20,000	Completed 94.02.01	94.05.27	MoF Region

10.1.1 Terrain Mapping

A terrain classification project to level D was completed in 1995. This classification will replace the Es_1 classification used in previous timber supply analyses.

Table 10.2 - REA Forest Cover Objectives

Resource Emphasis Area	Forest Cover Objective		
	Maximum Disturbance	Minimum Mature Retention	Minimum Old Growth Retention
Caribou habitat – ESSF	25% < 2m	30% > 140 years	10% > 250 years(1)
Caribou habitat – ICH	25% < 2m	40% > 140 years	10% > 250 years(1)
Caribou – operable			70% > 140 years(2)
Visual Class II-PR (west side)	25% < 5m		
Visual Class II-PR (east side)	15%<5 m		
Community watershed	20% < 9m		
Domestic watershed	25% < 6m		
Ungulate WR – ESSF	25% < 2m	40% > 120 years	
Ungulate WR – ICH	25% < 2m	40% > 120 years	
Ungulate WR – IDF (NDT 4)	25% < 2m	25% > 120 years	
Timber emphasis	25% < 2m		
Contributing components	all harvestable	all operable	(1) all operable (2) all productive

Areas with insufficient mature or old growth forest to meet the prescribed forest cover objectives may still be able to contribute to the periodic harvest. A component of the forest is put into a reserve with the expectation that these stands will eventually overcome the mature or old growth deficiency. If there is still forest area older than minimum harvest age beyond this reserve component harvesting will continue in the REA.

10.2.1 Forest Cover Objectives – Rationale

Forest cover requirements for REAs listed in Table 10.2 are based on a number of sources that are discussed in the following sections.

10.2.1.1 Visual Quality Objectives

Visual quality is based on an intersection of P&T's recent landscape inventory and the KBLUP scenic area inventory. P&T's information identified visually sensitive areas using VQO attributes (PR, M, *etc.*). The KBLUP inventory designated visual sensitivity classes for the Nelson Region.

The visual REAs defined for the analysis include:

- Visual PR (east side) – visually sensitive areas visible from the main highway on the east side of Arrow Lake from Galena Bay to Fauquier;
- Visual PR (west side) –visually sensitive areas on the west side of Arrow Lake contained within Landscape Unit 26; and
- Visual Class II & III -Design - KBLUP Class II & III visually sensitive.

Within the Visual PR areas on the east side of Arrow Lake P&T's VQO designation will dictate the forest cover constraints imposed in the analysis. Visual PR areas on the west side of Arrow Lake (Vipond Landscape Unit) will be permitted to exceed standard VQO disturbance limits by 10% over the next 20 years to allow for visual rehabilitation of existing cutblocks. Visual Class II & III Design REAs will use visual cutblock design operationally and do not require any additional forest cover constraints to address visual quality.

10.2.1.2 Adjacent Cutblock Green-up

Silvicultural green-up is required on all areas of the TFL prior to harvesting adjacent areas. This is not modeled explicitly in the timber supply analysis. Instead, the disturbance thresholds outlined in Table 10.2 for each REA are assumed to account for this adjacency requirement

10.2.1.3 Management for Identified Wildlife

Recently, inventories and research have been carried out on TFL 23 for Mountain Caribou. The areas identified as important caribou habitat and associated forest conditions that are necessary to ensure the maintenance of this habitat will be included in the analysis.

Caribou and ungulate winter range REAs will allow all operable, including non-harvestable forest areas to affect mature and old growth forest cover requirements. However, only the net harvestable landbase will be used in the determination of maximum disturbance levels. The caribou operable forest cover constraint incorporates productive forest areas which lie outside the 1994 operability line. In these areas, at least 70% of the productive forest must be maintained in age classes 8 and 9. Therefore, all productive forest components within this zone affect the forest cover constraint.

10.2.1.4 Landscape Level Biodiversity

The Arrow District Manager has recommended Landscape Units for the portion of TFL 23 within the Arrow District. Landscape Unit recommendations for the Columbia District are still in draft form. These units, along with the appropriate BEC/NDT designation, will be the base areas over which landscape level biodiversity will be monitored in the Current Management Option.

MoF/MoELP correspondence *Achieving Acceptable Biodiversity Timber Impacts* (97.08.25) and *Incorporating Biodiversity and Landscape Units in the Timber Supply Review* (97.12.01) were used to develop landscape level mature+old and old growth seral stage requirements for TFL 23. Tables 10.3 and 10.4 summarize the forest cover objectives that will be modeled for each LU-BEC/NDT in order to achieve the desired mature+old and old growth seral stage objectives in the forest. Minimum percentages are dependant upon the biodiversity emphasis assigned to a specific landscape unit.

Early seral requirements are not required for the NDTs in TFL 23. Mature+old and Old growth percentages listed in Table 10.3 are based on the Biodiversity Guidebook values for low intermediate and high biodiversity emphasis. Within the Arrow District (LUs10-31), these assignments are based on the KBLUP. Within the Columbia District (LUs 1-4), biodiversity emphasis assignments are currently in draft form only. Therefore, only weighted average seral stage percentages are employed in the Current Management Option for these LUs. Handbook values are weighted 45% low, 45% intermediate and 10% high to arrive at the weighted average figures in Table 10.3.

Table 10.3 - BEC/NDT Seral Stage Requirements (minimum percent)

Emphasis	NDT	Mature + Old			Old		
		ESSF	ICH	IDF	ESSF	ICH	IDF
Low	1,5	19	17		6	4	
	2	14	15		3	3	
	3	14	14		5	5	
	4		17	17		4	4
Intermediate	1,5	36	34		19	13	
	2	28	31		9	9	
	3	23	23		14	14	
	4		34	34		13	13
High	1,5	54	51		28	19	
	2	42	46		13	13	
	3	34	34		21	21	
	4		51	51		19	19
Weighted	1,5	30	28		14	10	
Average	2	23	25		7	7	
	3	20	20		11	11	
	4		28	28		10	10

Table 10.4 - BEC/NDT Seral Stage Requirements (minimum age)

NDT	Mature + Old			Old		
	ESSF	ICH	IDF	ESSF	ICH	IDF
1,5	120	100		250	250	
2	120	100		250	250	
3	120	100		140	140	
4		100	100		250	250

10.2.1.5 Reductions to Reflect Volume Retention in Cutblocks

Volume is retained in cutblocks by means of a number of landbase removals outlined in Section 6 of this report. In addition, P&T engineers and biologists have identified specific areas within the net landbase that should be reserved as wildlife trees patches. P&T currently has a project that will identify old growth management areas (OGMAs).

Productive forest landbase reductions occur all across the landbase as shown in the summary tables for LU-BEC/NDTs. Each productive forest area excluded from timber harvesting measuring at least 0.25 ha in size was buffered with a 250-metre radius. A review of unbuffered areas within the timber harvesting landbase was made and additional reserves were identified to ensure that all productive forest reserves were not more than 250 metres apart. The Biodiversity Guidebook indicates that this is a maximum acceptable distance between productive forest or wildlife tree reserves. Reserve areas for each REA are summarized in Table 7.3.

Riparian reserve zones (RRZs) and riparian management zones (RMZs) have been addressed by imposing landbase netdowns. Section 6.7, Table 6.7 outlines the details of these reductions. P&T will manage these areas by reserving a component of the RMZ adjacent to the existing RRZ. The remainder of the RMZ will be included in harvesting as per the prescription for the overall cutblock.

10.2.1.6 Land Use Plans

The Kootenay Boundary Land Use Plan has been developed for the Nelson Forest Region which includes TFL 23. New parks have been established as part of the Plan. Recommended LUs and recommended biodiversity emphases are under continuing review. Assumptions associated with these aspects of the Plan will be included in the timber supply analysis.

10.3 Timber Harvesting

10.3.1 Minimum Merchantability Standards

Minimum merchantability is assessed for each yield table based on volume, diameter and/or age at which culmination of mean annual increment is reached (MAI). From this assessment the minimum age required for harvesting has been determined for each analysis unit yield table. Culmination age for VDYP natural stand yield tables and TIPSY managed stand yield tables was assigned to the age when volume less DWB is maximized to one decimal place (*ie.* further increases in MAI would be less than 0.05 m^3/ha/year). This is a reasonable approach to avoid excessively high culmination ages resulting from small increases in MAI. Culmination of MAI was used to determine minimum harvest age for managed stand yield tables. Summaries of the minimum harvest age attributes for the natural and managed stand yield tables are presented in Tables 10.4 – 10.6.

Table 10.5(a) - Minimum Harvest Age Attributes for VDYP NSYTs - Thrifty

VDYP Natural Stand AU	Net Area (ha)	Minimum Harvest Age Attributes				
		Age	Dbh	Height	Volume	MAI
FDCW-G	3155	100	34.2	33.7	415.1	4.2
FDCW-M	10719	120	33.9	29.4	333.3	2.8
FDCW-P	1583	140	31.2	23.3	204.8	1.5
FDHW-G	2473	90	31.3	31	348.5	3.9
FDHW-M	7041	110	32.3	27.5	296.9	2.7
FDHW-P	568	120	29	21.9	201.8	1.7
FDLW-G	2726	90	32.3	31.4	303.4	3.4
FDLW-M	11336	110	32.3	27.6	241.2	2.2
FDLW-P	561	130	31.1	23	177.4	1.4
CWHW-G	320	80	31.9	30	300.5	3.8
CWHW-M	3212	80	31.2	23.7	248.9	3.1
CWHW-P	1222	90	27.6	19.3	185	2.1
HWBL-G	369	80	29	29.3	310.4	3.9
HWBL-M	1172	90	30.1	24	315.2	3.5
HWBL-P	190	110	29	21.2	237.9	2.2
HWFD-G	1966	80	30.5	27.5	312	3.9
HWFD-M	4576	90	30.6	24.8	286.1	3.2
HWFD-P	2554	90	26.8	19.7	194	2.2
HWCW-G	1833	80	29.6	27.7	306.7	3.8
HWCW-M	7015	90	31.8	25.2	274.6	3.1
HWCW-P	2749	130	32	23.2	254.6	2.0
BLSE-G	2090	80	29.4	24.7	237.6	3.0
BLSE-M	5755	90	28.1	20.3	168.4	1.9
BLSE-P	1268	150	28.1	20.2	172.5	1.2
SECW-G	206	80	30.4	30.3	386	4.8
SECW-M	931	100	30.6	25.2	290.2	2.9
SECW-P	226	150	32.6	25.7	293.8	2.0
SEBL-G	474	80	29.3	27.6	267.6	3.3
SEBL-M	1815	100	30	24.5	217.1	2.2
SEBL-P	298	150	30.9	24.9	233.2	1.6
PLLW-G	1138	70	21.6	24	263	3.8
PLLW-M	3728	80	21.4	22.2	237.5	3.0
PLLW-P	1955	90	20.7	19.8	203.1	2.3
PLFD-G	4050	70	22.7	25.1	249.5	3.6
PLFD-M	5774	70	20.7	20.9	179.6	2.6
PLFD-P	3141	110	23.3	21.7	214.8	2.0
LWFD-G	3672	100	31.4	32.9	300.7	3.0
LWFD-M	6306	120	31.6	30.5	270.8	2.3
LWFD-P	2411	120	28.8	25.5	190.2	1.6

Table 10.5(b) - Minimum Harvest Age Attributes for VDYP NSYTs - Mature

VDYP Natural Stand AU	Net Area (ha)	Minimum Harvest Age Attributes				
		Age	Dbh	Height	Volume	MAI
FDCWXG	46	100	32.6	32.1	362.5	3.6
FDCWXM	1776	130	37.6	30.1	319.2	2.5
FDCWXP	3457	120	29.2	20.1	127.5	1.1
FDHWXG	127	100	32.7	31.4	359.4	3.6
FDHWXM	886	110	30.8	26.4	286.9	2.6
FDHWXP	1509	120	28.4	20.6	174.6	1.5
FDLWXG	42	100	33.4	31	305.8	3.1
FDLWXM	2062	130	36.1	30.4	292.6	2.3
FDLWXP	1692	130	30	21.8	152.6	1.2
CWHWXG	7	80	31.8	27.6	302.8	3.8
CWHWXM	1671	80	31.2	23.9	277.8	3.5
CWHWXP	6823	90	28.8	20.5	213.3	2.4
HWBLXG	9	70	26.9	24.5	276.9	4.0
HWBLXM	2283	90	27.9	22	292.9	3.3
HWBLXP	2141	130	30.7	21.3	254.6	2.0
HWFDXG	16	80	31.8	26	300.1	3.8
HWFDXM	288	80	28.5	23	252.5	3.2
HWFDXP	3005	100	28.9	20.5	219.3	2.2
HWCWXG	579	80	30.7	26.1	305.9	3.8
HWCWXM	685	90	29.7	24.7	286	3.2
HWCWXP	10210	100	28	20.8	217.1	2.2
BLSEXG	310	80	28.8	23.7	238.4	3.0
BLSEXM	2695	100	28.3	20.6	177.4	1.8
BLSEXP	4872	130	28.8	19.2	151.1	1.2
SECWXG	982	80	31.1	28.8	342.3	4.3
SECWXM	744	110	30.7	24.5	296.8	2.7
SECWXP	1581	130	30.5	22.8	269.6	2.1
SEBLXG	1671	80	30.4	29.2	271.1	3.4
SEBLXM	7013	110	29.3	22.7	193.5	1.8
SEBLXP	7231	150	28.9	21.1	172.9	1.2
PLLWXG	10	60	21.2	24.7	270.9	4.5
PLLWXM	8	80	21.2	21.5	261.2	3.3
PLLWXP	304	90	20.3	18.3	176.3	2.0
PLFDXG	55	80	27.1	28.1	300.2	3.8
PLFDXM	9	80	20.6	20.9	196.5	2.5
PLFDXP	189	80	20	17.3	149.4	1.9
LWFDXG	172	100	33.1	35.3	326	3.3
LWFDXM	527	120	32.4	30.6	248.2	2.1
LWFDXP	704	140	30.3	26	203.6	1.5

Table 10.6 - Minimum Harvest Age Attributes for TYPSY MSYTs (existing)

Managed Stand AU	Minimum Harvest Age Attributes				
	Age	Dbh	Height	Volume	MAI
101	80	27.4	31.2	504.4	6.3
102	100	22.2	25.9	320.8	3.2
103	120	17.3	18.8	152.4	1.3
104	100	32.2	34.4	766.3	7.7
105	100	27.3	28.8	536.4	5.4
106	110	20.8	20.6	259.2	2.4
107	80	26.5	27.9	485	6.1
108	90	24.6	26	410.3	4.6
109	120	21.5	21.5	273.9	2.3
110	80	24.2	24.9	389.5	4.9
111	100	23.4	23.7	346.9	3.5
112	130	22	21.6	283	2.2
113	70	25.6	26.6	428.9	6.1
114	100	24.2	24.9	377.8	3.8
115	150	22.6	22.7	307.8	2.1
116	80	25.8	29.4	427.3	5.3
117	70	21	22	260.7	3.7
118	90	19.8	19.4	207	2.3
119	70	24.7	28.7	390.4	5.6
120	80	21.4	24.7	285.6	3.6
121	110	18.6	20.3	185.4	1.7
301	80	26.5	31	446.1	5.6
302	100	22	25.8	305.9	3.1
303	100	17.2	17.3	135.1	1.4
304	80	26.4	30.7	456.8	5.7
305	90	23.4	27.1	360.6	4.0
306	130	19.8	22	230.2	1.8
307	80	25.4	29.9	413.2	5.2
308	90	23.8	28.1	364.5	4.1
309	90	19	20.6	199.2	2.2
310	80	24.7	25.5	394	4.9
311	100	23.4	23.7	342.8	3.4
312	140	22.2	21.8	287.3	2.1
313	60	23.6	23.9	357	6.0
314	90	22.8	22.9	321.1	3.6
315	150	22.1	21.7	282.2	1.9
316	70	24.1	27.4	368.9	5.3
317	70	21	22.6	265.6	3.8
318	90	19.4	19.4	197.2	2.2
319	80	25.4	29.7	411.9	5.1
320	100	22.7	26.6	326.7	3.3
321	110	18.5	19.2	175	1.6

Table 10.7(a) - Minimum Harvest Age Attributes for TIPSY MSYTs (future)

Managed Stand AU	Minimum Harvest Age Attributes				
	Age	Dbh	Height	Volume	MAI
201	80	25.4	29.7	411.9	5.1
202	90	21.5	25	288.2	3.2
203	110	19.3	20.5	204.3	1.9
204	90	26.6	31	446.6	5.0
205	90	21.2	24.6	277.9	3.1
206	100	18.9	19.8	189.8	1.9
207	80	25.1	29.5	404.9	5.1
208	100	22.3	26.2	316.3	3.2
209	90	18.2	18.8	167.6	1.9
210	80	26.8	31.2	470.6	5.9
211	90	22.8	26.4	342.7	3.8
212	110	20	22.3	238.6	2.2
213	70	24.5	29	389.9	5.6
214	90	22.8	26.9	334.5	3.7
215	90	19.7	21.8	224.3	2.5
216	80	25.4	29.9	413.2	5.2
217	90	23.4	27.5	351	3.9
218	80	19.4	21.2	213.8	2.7
219	80	25.5	30	416.7	5.2
220	80	22.2	26.1	317.2	4.0
221	90	19.7	21.8	224.3	2.5
222	70	24	24.5	371.4	5.3
223	100	23.3	23.5	339.8	3.4
224	150	22.1	21.7	282.2	1.9
225	60	25.5	26.5	421.6	7.0
226	90	23.8	24.2	357.3	4.0
227	110	21.4	20.8	259.8	2.4
228	60	23.6	23.9	357	6.0
229	90	23.1	23.2	331.7	3.7
230	130	22.3	22	292.7	2.3
231	70	22.4	25.1	314.2	4.5
232	80	21.4	23.2	276.7	3.5
233	90	19.9	20.1	215.5	2.4
234	80	25.2	28.5	396.7	5.0
235	70	20.4	21.7	244.1	3.5
236	90	19.9	20.1	215.5	2.4
237	90	25.5	29.8	414.2	4.6
238	100	22.0	25.8	337.2	3.1
239	100	19.1	20.2	199.3	2.0

Table 10.7(b) - Minimum Harvest Age Attributes for TIPSY MSYTs (future)

Managed Stand AU	Minimum Harvest Age Attributes				
	Age	Dbh	Height	Volume	MAI
241	80	24.1	28.3	373.4	4.7
242	100	22.3	26.2	316.3	3.2
243	110	18.4	19.1	171.7	1.6
244	80	23.5	27.7	356.2	4.5
245	100	21.5	25	288.2	2.9
246	110	18.8	19.7	185.1	1.7
247	90	24.9	29.2	396	4.4
248	90	21.5	25	288.2	3.2
249	100	18.3	19	170.2	1.7
250	90	26.5	30.7	457.5	5.1
251	90	23.1	26.6	349.9	3.9
252	110	21	23.7	272.7	2.5
253	80	24.9	29.4	399.3	5.0
254	90	21.6	25.2	293.9	3.3
255	90	18.8	20.3	193.7	2.2
256	80	24.1	28.4	375	4.7
257	90	23.6	27.8	357.6	4.0
258	90	20	22.2	233.2	2.6
259	90	26	30.6	430.2	4.8
260	90	23.2	27.4	347.7	3.9
261	90	20.1	22.5	239.1	2.7
262	80	24.8	25.7	399.8	5.0
263	110	23.4	23.7	340.8	3.1
264	140	22	21.6	279	2.0
265	60	24.3	25	385.4	6.4
266	100	23.1	23.3	333.1	3.3
267	120	21.8	21.3	271.8	2.3
268	60	24.6	25.4	396.3	6.6
269	110	22.9	22.9	320.4	2.9
270	150	21.1	20.3	239.5	1.6
271	70	24.9	28.2	389.6	5.6
272	70	19.8	20.7	223.1	3.2
273	90	18.9	18.7	178.7	2.0
274	80	23.8	27	358.5	4.5
275	70	19.4	20	207.4	3.0
276	90	18.8	18.5	175.6	2.0
277	80	25.8	30.2	425.6	5.3
278	90	21.1	24.4	274.5	3.1
279	110	18.8	19.7	185.1	1.7

Table 10.7(c) - Minimum Harvest Age Attributes for TIPSY MSYTs (future)

Managed Stand AU	Minimum Harvest Age Attributes				
	Age	Dbh	Height	Volume	MAI
341	80	23.9	28	366.3	4.6
342	90	22.6	26.5	325.1	3.6
343	90	20.1	21.8	232.6	2.6
344	90	25.1	29.4	403.4	4.5
345	90	22.1	25.8	308.5	3.4
346	90	20.2	22	238.5	2.7
347	80	23.3	27.4	349.8	4.4
348	90	22.7	26.6	328.5	3.7
349	90	20.3	22.2	241.5	2.7
350	90	26.5	30.7	457.5	5.1
351	90	23.1	26.6	349.9	3.9
352	90	19.2	21	211.5	2.4
353	70	24.7	29.2	396.4	5.7
354	80	24.1	28.4	375	4.7
355	80	22.5	25.8	320.1	4.0
356	80	26.5	31.2	447.1	5.6
357	80	25.2	29.7	409.7	5.1
358	80	23.2	26.7	341.8	4.3
359	80	26.5	31.2	447.1	5.6
360	80	25.1	29.6	406.3	5.1
361	80	23.3	26.8	344.9	4.3
362	70	23.8	24.3	365.6	5.2
363	90	24.1	24.6	369.3	4.1
364	90	22.2	21.9	293.2	3.3
365	70	24.9	25.7	402.3	5.7
366	70	23.7	24.1	360.6	5.2
367	70	23.3	23.5	343	4.9
368	70	24.9	25.8	405.1	5.8
369	70	23.6	23.9	354.7	5.1
370	80	24.5	25.1	383	4.8
371	80	25.2	28.5	396.7	5.0
372	80	23.6	26.2	348.4	4.4
373	70	20.9	21.8	255.7	3.7
374	80	24	27.2	364.6	4.6
375	70	22	24.1	298.6	4.3
376	80	20	20.4	221.9	2.8
377	80	25.8	30.2	425.6	5.3
378	90	21.1	24.4	274.5	3.1
379	110	18.8	19.7	185.1	1.7

It should be recognized that the application of forest cover objectives in some LU-BEC/NDTs and REAs might delay stand entry well beyond the minimum ages provided in Tables 10.4 and 10.5. This delay will result in long-term harvest levels below the theoretical Long Run Sustained Yield (LRSY) which is based on harvesting all stands at culmination age.

10.3.2 Initial Harvest Rate

The initial harvest rate for the Current Management and other options will be the current AAC for TFL 23 plus non-recoverable losses. The harvest rate is broken down as follows:

- P&T – 599,300m^3/year
- SBFEP – 80,700m^3/year
- Total harvest – 680,000m^3/year
- Non-recoverable losses – 26,000m^3/year

Therefore, the total annual volume requirement for TFL 23 is 706,000m^3/year. This will form the initial harvest rate for the Current Management Option. At year 100 of the simulation the NRL component will be reduced to 23,000m^3/year.

In the TFL 23 MP#9, no partitioned cut is being proposed. Over the past 5 years, harvesting within aerial operability zones and in problem forest types has been documented in the annual reports submitted by the licensee.

10.3.3 Harvest Rules

Harvest rules are included in the simulation model to rank stands for harvest. The general rule is oldest first. With this rule in place older stands are queued for harvest ahead of younger stands. Harvest rules interact with forest cover requirements to determine the actual order of harvesting within the model. If a higher ranked stand is constrained within a forest cover group then the model will select the next highest-ranking stand that is eligible for harvest. Thus, while the oldest first rule is employed, the imposition of forest cover constraints results in a distribution of harvest ages between absolute oldest and minimum harvest age.

10.3.4 Harvest Profile

At present the harvest profile within TFL 23 is based mainly on the existing mature species profile, modified by forest cover and seral stage objectives which, to varying degrees, control harvesting within specific landscape units. No specific harvest species profile parameters will be employed in the analysis. However, the distribution of harvest by leading species group will be presented in the analysis report.

10.3.5 Harvest Flow Objectives

In all phases of the analysis the harvest flow objectives will be to:

- Sustain the current harvest level for as long as possible;
- Decrease the periodic harvest rate in acceptable steps during the periods when declines are required to meet all objectives associated with the various resources on TFL 23;
- Do not permit the mid-term harvest to fall below a level reflecting basic maintenance of the productive capacity of the TFL.
- Achieve an essentially even-flow long-term sustainable supply with consideration for forest cover requirements; and
- Take advantage of opportunities to increase the harvest rate by implementing management programs while maintaining the requirements of non-timber resources.

A number of alternative harvest flows will be evaluated for the Current Management Option in order to gain a complete understanding of the factors that influence timber supply on TFL 23.

11.0 SENSITIVITY ANALYSIS

This section provides detailed descriptions of the sensitivity analyses that will be performed on the Current Management Option. The sensitivities attempt to reflect alternative management or potential changes to mandated forest practices.

11.1 Landbase Revisions

Three landbase revisions will be made to the netdowns described in Section 6.1. All forest areas removed from the timber harvesting landbase in the following sensitivities will still contribute to forest cover objectives and landscape level biodiversity requirements where appropriate.

11.1.1 Exclude Shelter Bay Block

This scenario will evaluate the assumptions outlined in the Current Management Option without the landbase associated with the Shelter Bay Block. Shelter Bay is part of the Columbia Forest District. In this sensitivity analysis 24,476 ha of net operable area will be excluded from the landbase. This area represents 4,700,000m^3 of coniferous timber. The revised current net operable landbase is 200,226 ha and the long-term net operable landbase is 198,666 ha.

11.1.2 Addition of Marginally Economic Stands

Marginally economic stands are typically hemlock and balsam pulpwood stands that are only available under optimal market conditions. In this sensitivity analysis 3,660 ha of marginally economic mature stands will be added to the timber harvesting landbase. This area represents 1,300,000m^3 of coniferous timber. The revised current net operable landbase is 228,362 ha and the long-term net operable landbase is 226,802 ha.

11.1.3 Remove Aerial Areas

In this scenario 19,504 ha of forest requiring aerial harvesting methods will be excluded from the timber harvesting landbase. This assumes that these areas will not be available for timber supply at any time. This area represents 3,500,000m^3 of coniferous timber. The revised current net operable landbase is 205,198 ha and the long-term net operable landbase is 203,638 ha.

11.1.4 Adjust Timber Harvesting Landbase

In this scenario, the timber harvesting landbase will be adjusted by +/- 10%. The non-harvestable landbase will be adjusted accordingly, to maintain the total forested area.

11.1.5 Remove Stands with SI50 < 9.0 metre

MoF has expressed concern regarding the operational feasibility of accessing these stands. Therefore, an analysis will be performed in which these stands will be removed from the timber harvesting landbase.

11.2 Growth and Yield

A number of alternative growth and yield inputs will be used in individual sensitivity analyses to evaluate their impact on timber supply.

11.2.1 OGSI Adjustment to Managed Stand SI50

P&T recently completed an OGSI to determine site index potential under managed stand conditions for sites currently occupied by old growth. The results were comparable to recent MoF draft OGSI adjustments. MoF OGSI adjustments will be employed in a sensitivity analysis. Section 8.1 provides the MoF site index adjustment equations.

In this sensitivity analysis any adjustment in stand volume associated with the OGSI equations will be excluded. The managed stand yields in this scenario will be based on the unadjusted site index associated with old growth natural stands, which may be up to one third less than the adjusted value.

11.2.2 Adjust Natural and Managed Stand Yields

To test the overall sensitivity of the results to variation in yield expectations, separate analyses will be performed in which the NSYT and MSYT values are varied by +/- 10%.

11.2.3 Altered Minimum Harvest Age

Minimum harvest ages for managed stands will be altered by 10 years.

11.2.4 Regeneration Delay

Regeneration delay will be increased to 5 years and reduced to 0 years in this series of analyses.

11.3 Forest Cover Objectives

11.3.1 Resource Emphasis Area Maximum Disturbance

In a series of sensitivity analyses, the following forest cover objectives will be altered systematically, in order to test the effect upon timber supply:

- alter maximum disturbance constraint in IRM, caribou and ungulate winter range zones;
- alter caribou thermal and old-growth cover constraints;
- alter ungulate winter range thermal constraint;
- alter VQO disturbance constraints; and
- employ full biodiversity constraints in low emphasis landscape units.

APPENDIX V

V.2 Timber Supply Analysis Report

POPE & TALBOT LTD.
ARROW LAKES TREE FARM LICENCE 23
MANAGEMENT PLAN #9

TIMBER SUPPLY ANALYSIS REPORT
(AMENDED VERSION)

Prepared by:

Pope & Talbot Ltd.
&
Timberline Forest Inventory Consultants Ltd.

September, 1998

Reference: 9740014

Timberline
Forest Inventory Consultants

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Executive Summary

A timber supply analysis has been completed as a component of Management Plan #9 for Pope and Talbot (P&T) Tree Farm License (TFL) 23. A timber supply model was employed to forecast long-term timber availability under a variety of scenarios. The information generated through this analysis will ultimately be used by the provincial Chief Forester in determining the Allowable Annual Cut (AAC) for TFL 23 for the next five years (1999-2003). The current AAC for the TFL is set at 680,000 cubic metres.

While the AAC represents the harvest level in the short term, there is an associated harvest flow which represents the expected timber availability over the next 250 years. Four concurrent timber flow objectives were established for TFL 23: 1) maintain the current AAC for as long as possible, 2) limit the rate of decadal decline to a maximum of 10%, 3) maintain a mid-term harvest level tied to the basic productivity of the landbase, and 4) achieve a long-term steady harvest level that reflects continuation of the current level of management on the TFL.

The inventory information used to define the resource characteristics for TFL 23 incorporates a number of recent updates to account for past disturbances, new operability definitions, environmentally sensitive areas, and updated definitions of non-timber resources such as recreation, wildlife and visual quality values.

While approximately 371,800 hectares were determined to be productive forest, only approximately 224,700 hectares (60%) of this area was considered as part of the net timber harvesting landbase, the balance having been classified as inoperable, or reserved for other purposes.

The productive forest was subdivided into 13 landscape units for the purpose of establishing mature and old growth biodiversity seral stage objectives. In addition, a number of overlapping management zones were established. Specific forest cover objectives were set for each zone, based on its management objectives. Both seral stage and management zone forest cover objectives were incorporated into the timber supply analysis procedure.

A base case scenario was analyzed. Using the same base case inputs, three alternative timber flow patterns were explored. A base case timber flow pattern was selected from these alternatives, taking into consideration the timber flow policy stated above. This timber flow scenario results in the maintenance of the existing AAC of 680,000 cubic metres for a period of 40 years.

Based on this outcome, a series of sensitivity analyses was completed to test the impact of changing specific input assumptions. Over the next 80 years, the timber supply is constrained by two major factors. Disturbance levels (*i.e.* the maximum amount of area below green-up height) are at critical levels over the next 20 years. Therefore, if the maximum levels permitted are lowered there will be a significant negative impact on timber supply. Specifically, the time horizon over which the current AAC can be maintained will be shortened.

In addition, the supply of timber above minimum harvest age reaches a critical level at decade 8. Therefore, unforeseen delays in the availability of timber from second growth stands will have a negative impact on timber supply, as the supply from existing mature volumes must be stretched over a longer time horizon.

Equally important however, it should be noted that timber supply in the short and medium terms can also be significantly enhanced, if in fact disturbance requirements can be relaxed, and/or the availability of second growth timber can be accelerated.

Short and mid-term levels are also sensitive to wildlife thermal forest cover objectives, specifically caribou and ungulate winter range requirements. Refined caribou habitat mapping has already indicated a lessening of this impact. Further assessment of these and other management zone definitions will further improve the reliability of future timber supply forecasts.

With the exception of several sensitivity scenarios which entailed the removal of a significant component of the harvestable landbase, the first decade AAC level of 680,000 cubic metres can be maintained within the sensitivity ranges tested.

In the base case, the long-term harvest level was determined to be 634,000 cubic metres/year (net of non-recoverable losses (NRLs). However, this was based on managed stand yield curves developed using existing site index estimates from old growth stands. These site indices are known to underestimate the true productivity of the managed stands which are regenerated following harvest. After adjusting for this negative bias, the long-term harvest level was forecasted to be 709,000 cubic metres/year, an increase of approximately 12% over the base case. Forecasted long-term levels are approximately 8% below the theoretical long run sustainable yield (LRSY). The latter is calculated based on harvesting all stands at culmination of mean annual increment (MAI). Given the imposition of conflicting forest cover and harvest scheduling objectives, the realized long-term level will always be less than the calculated LRSY.

A second option has also been analyzed. This option employs all of the base case inputs, with the exception of the definition of caribou management zones. In the base case, caribou management zones were those defined in the Kootenay-Boundary Land Use Plan (KBLUP) Implementation Strategy. However, Pope and Talbot has been redefining caribou habitat mapping and definition of habitat range using five years of telemetry data and field inventory studies. These refined zones were employed in Option 2. Analysis of this second option indicates that the Pope and Talbot caribou habitat definition is less constraining in the mid-term, providing an opportunity either to extend the current AAC for an additional decade, or reduce the mid-term stepdown in harvest. Alternative harvest flows were analyzed to determine the immediate impact of managing caribou to the KBLUP line work, vs Pope and Talbot's refined line work. This impact was determined to be 19,000 cubic metres/year, which equates to 27 direct jobs and 47 indirect jobs.

In addition to these long-term analyses, a spatial feasibility assessment has also been completed. As laid out in the MoF guidelines for the preparation of the 20 year plan, the spatial plan sets out a hypothetical sequence of harvesting over a period of at least 20 years. The 20 year plan utilizes a spatial harvest block layout strategy, developed with little or no field information, to test achievement of a harvest level that conforms to current standards and practices as defined for the

base case in the Timber Supply Analysis Information Package. The TFL 23 20 year spatial feasibility analysis was prepared with these objectives in mind. It is not designed to be an operational plan, but a test of timber availability given the current structural characteristics and spatial distribution of components of the resource, and the structural and spatial management objectives associated with KBLUP and the Forest Practices Code. The outcome of the analysis for TFL 23 demonstrated that the base case AAC of 680,000 cubic metres could be achieved given the spatial objectives imposed in the analysis. The results of this spatial analysis are being reported under separate cover.

Based on the outcome of these analyses, it is proposed that the AAC for TFL 23 be set at 680,000 cubic metres for the period January 1, 1999 to December 31, 2003. This harvest is maintainable for a period of 40 years. It is then reduced by 10% in the fifth decade, and then by 6.5% in the sixth decade to a minimum mid-term level of 572,000 cubic metres. Based on application of MoF-approved site index adjustments, the long-term level rises to 709,000 cubic metres by decade 10.

The proposed AAC is supported by five critical factors: 1) The base case analysis demonstrates that this level is sustainable for four decades, 2) Mid-term reductions are reasonable given the productivity of the landbase, 3) Long-term productivity is maintained within 8% of the productivity of the landbase, 4) sensitivity analyses demonstrate that the first decade harvest is attainable, even under significant downward pressures, and 5) a 20-year spatial analysis has demonstrated that the AAC is spatially attainable over the 20 year analysis period.

1. Introduction

A timber supply analysis has been completed as a component of Management Plan #9 (MP #9) for Pope & Talbot's (P&T) Tree Farm License (TFL) 23. The analytical methodology employs a forest level simulation model, which is used to forecast the long-term development of the forest given:

- a description of the initial forest conditions,
- expected patterns of stand growth,
- a specified set of rules for harvesting and regenerating the forest,
- a specified set of forest structural characteristics, and
- consideration of non-timber values.

The process enables forest managers to evaluate timber availability under a range of alternative scenarios. This information is ultimately used by the provincial Chief Forester in determining the allowable annual cut (AAC) for the TFL.

Because of the changing nature of resource management objectives, as well as the dynamic nature of forest inventories, the timber supply predictions generated by these analyses are not viewed as static. For this reason, TFL licensees are required to re-evaluate timber supply for each successive management plan, incorporating new sources of information and any changes to management objectives. This adaptive management process ensures that harvest strategies remain sustainable in the long term, even in the face of changing circumstances.

Two options have been identified for analysis. Specifically these are:

- Base case incorporating the Kootenay-Boundary Land Use Plan (KBLUP) caribou habitat definition, and
- Base case inputs with the substitution of the Pope and Talbot caribou habitat definition.

These options have been reviewed and evaluated, and an AAC has been selected and submitted for acceptance by the Chief Forester.

2. General Description of the Landbase

The Arrow Tree Farm License (TFL 23) is located in the south-eastern corner of the province, extending from Valhalla National Park in the east to Monashee National Park in the west. It is situated along the Arrow Lakes south of Glacier National Park.

During the period of Management and Working Plan #7, TFL 23 was divided into two new TFLs. The larger, southern portion was retained by Pope & Talbot Limited. Pope & Talbot purchased this license agreement from Westar Timber Limited.

The total area is approximately 556,897 hectares, 67% of which is capable of supporting productive forest stands. Included in this are approximately 6,800 hectares of Schedule A land. Approximately 32% of the operable forest area is mature forest (> age 140) dominated by western hemlock, balsam and Douglas fir.

Continuous harvesting and forest management activities have occurred on the TFL since the mid 1950's. Since that time, approximately 50,000 hectares of second growth forest have been established. The area harvested since 1970 has been intensively managed. The current AAC is set at 680,000 cubic metres per year. The Small Business Forest Enterprise Program (SBFEP) cut is 80,700 cubic metres attributed to Schedule B lands.

3. Timber Flow Objectives

Forest cover objectives and the biological capacity of the net harvestable landbase will dictate the harvest level. In this analysis, the harvest flow reflects a balance of the following objectives:

1) maintain the current AAC for as long as possible,
2) limit the rate of decadal decline to a maximum of 10%,
3) maintain a mid-term harvest level that represents the basic productivity of the landbase, and
4) achieve a long-term harvest level that reflects continuation of the current level of management on the TFL.

4. Forest Information

A complete description of the information used in the TFL 23 timber supply analysis is contained in the document "Timber Supply Analysis Information Package for Tree Farm License #23 Final Version", dated September, 1998. This document has been reviewed and accepted by the Ministry of Forests (MoF) Timber Supply Branch (TSB) staff. The following is a brief summary of the contents of that report.

4.1 Growth and Yield

4.1.1 Natural stands (age > 25)

Natural stand yield tables (NSYT) for the timber supply analysis were developed using the batch version of the Ministry of Forests (MoF) program VDYP (Variable Density Yield Prediction Version 6.4a). Separate yield curves were developed for thrifty (age 26-140) and mature (age 141+) stands, to facilitate the application of old growth site index (OGSI) adjustments for sensitivity analysis purposes.

4.1.2 Managed stands (age < 26)

Managed stand yield tables (MSYT) were modeled using BATCHTIPSY (Version 2, Beta 5). These stands have been managed since establishment and include both natural and artificially regenerated sites. Separate tables were developed for existing managed stands (< age 26) and all

future managed stands established following the harvest of existing natural stands.

Figure 1 provides an example of VDYP and TIPSY curves for medium site Douglas fir types in the 41-140 (thrifty) age class. The VDYP curve is applied to existing stands, while the TIPSY curve is used to model the post-harvest managed yield. Figure 2 provides an example of yield expectations for medium site Douglas fir stands in the mature (141+) age class. In Figure 2, managed curves are presented both with and without the OGSI adjustment.

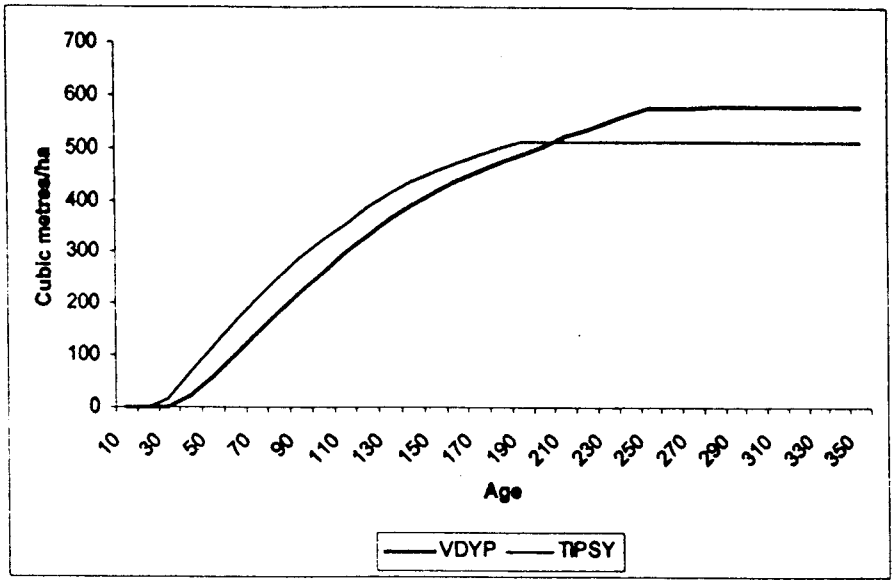

Figure 1. Douglas fir yield curves – medium site class – thrifty

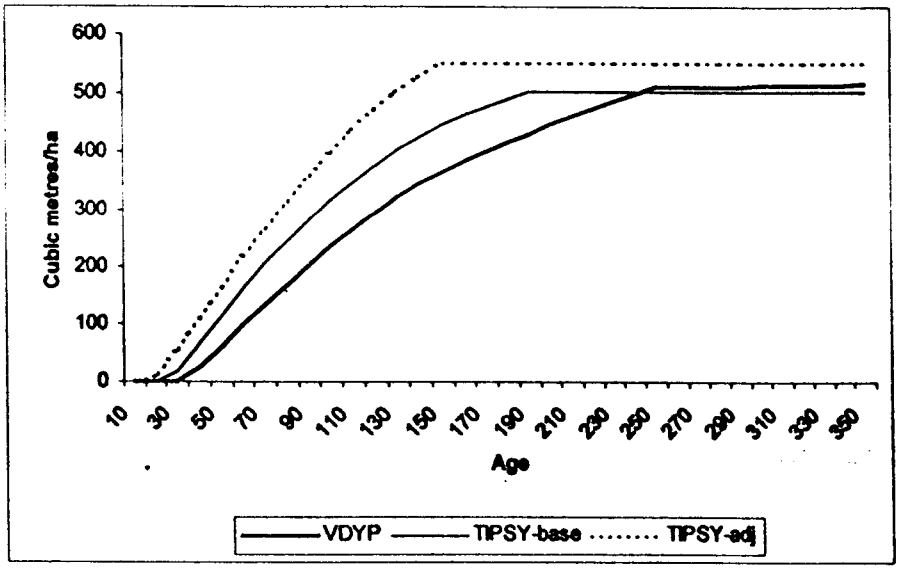

Figure 2. Douglas fir yield curves – medium site class – mature

4.2 Net Timber Harvesting Landbase

Land is removed from the total TFL 23 area for three principle reasons:

- it is unproductive for forest management purposes,
- it is or will become inoperable under the assumptions of the analysis, or
- it is scheduled to be withdrawn for other purposes.

The area netdown is presented in Figures 3 and 4. The total harvestable landbase of 224,702 hectares includes 6,165 hectares of NSR lands, scheduled to be restocked. It represents harvestable area in both conventional and aerial operability classes.
Note: In Figure 4, the unharvestable component includes unmerchantable types, low site removals, deciduous leading types, soils (Terrain IV and V or slopes > 75%), and ESAs.

4.3 Inventory Aggregation

In order to reduce the complexity of the forest description for the purposes of timber supply simulation, considerable aggregation of individual stands is necessary. However, it is critical that this aggregation not obscure either biological differences in forest stand productivity, or differences in management objectives and prescriptions. Management differences are recognized by grouping stands into landscape units and management zones on the basis of similarity of management objectives. Biological similarity is captured by grouping stands into analysis units on the basis of similar species and site productivity.

4.3.1 Landscape Units

For planning purposes, TFL 23 has been subdivided into 13 landscape units. In the timber supply analysis, all forest cover and biodiversity seral stage requirements must be met within the boundaries of these landscape units. Figures 5 and 6 summarize the distribution of productive area by landscape unit and BEC/NDT zone.

4.3.2 Management Zones

The landbase has also been segregated into resource emphasis areas (REAs) to facilitate the application of management criteria. These include:

- Caribou management,
- Partial retention visual quality objectives (VQO),
- Community watersheds (ComH20),
- Domestic watersheds (DomH2O),
- Ungulate winter range (UWR), and
- Integrated resource management (IRM).

Figure 7 provides a summary of the area within each Resource Emphasis Area. It should be noted that, as these zones in many cases overlap, the areas are not additive.

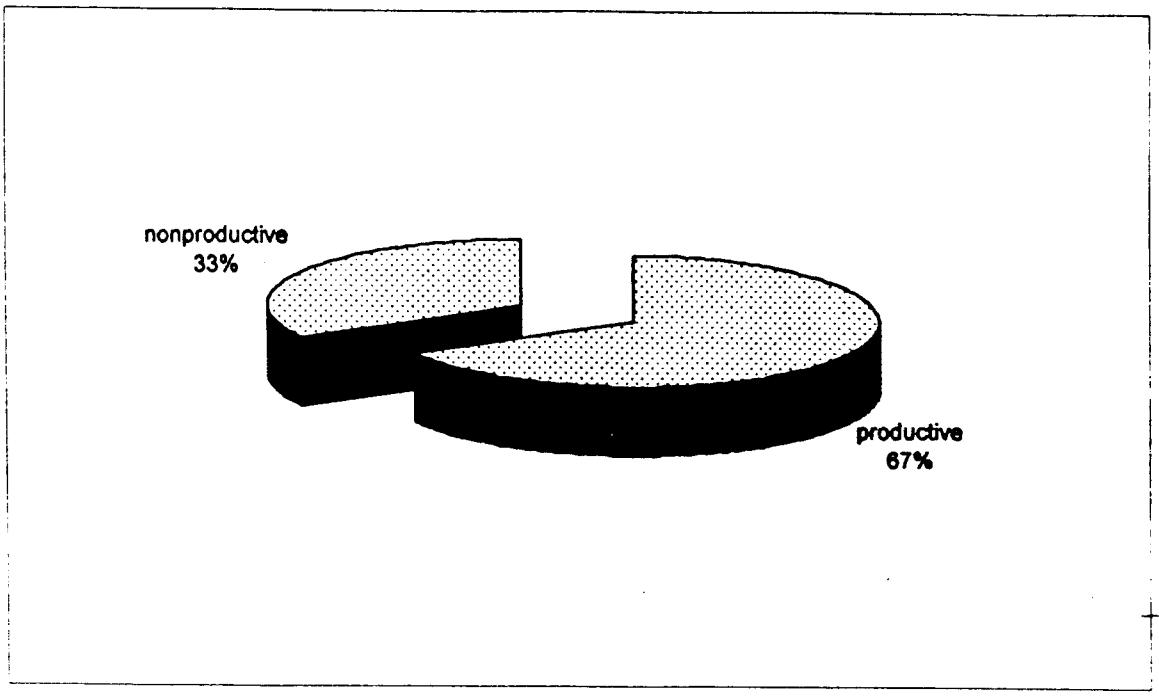

Figure 3. Distribution of total area (556,897 ha)

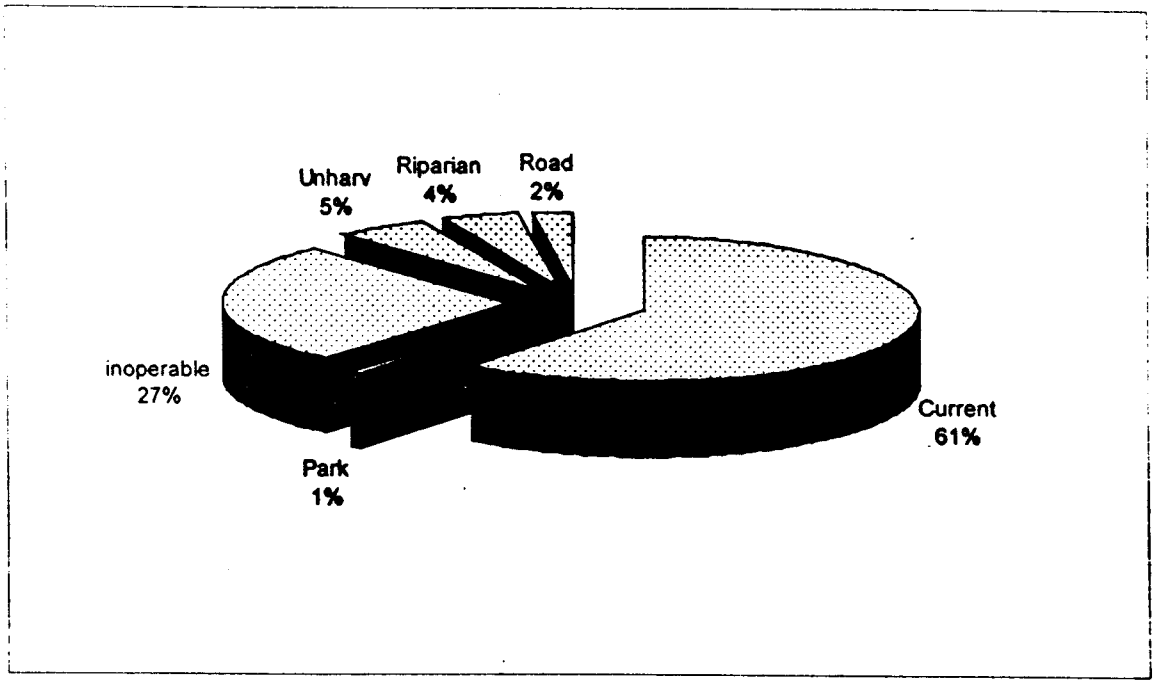

Figure 4. Distribution of productive area (371,834 ha)

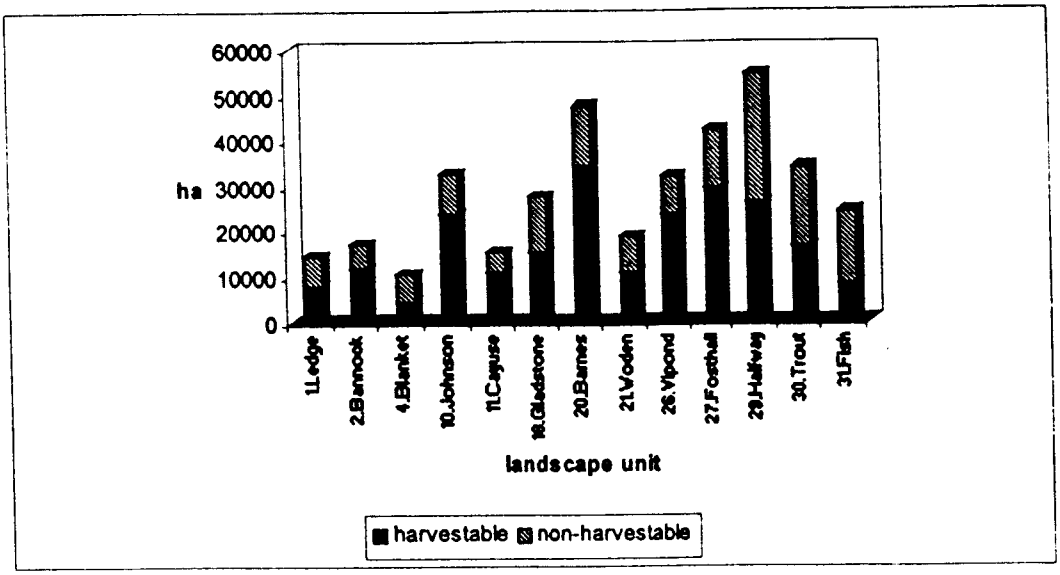

Figure 5. Distribution of productive area by landscape unit

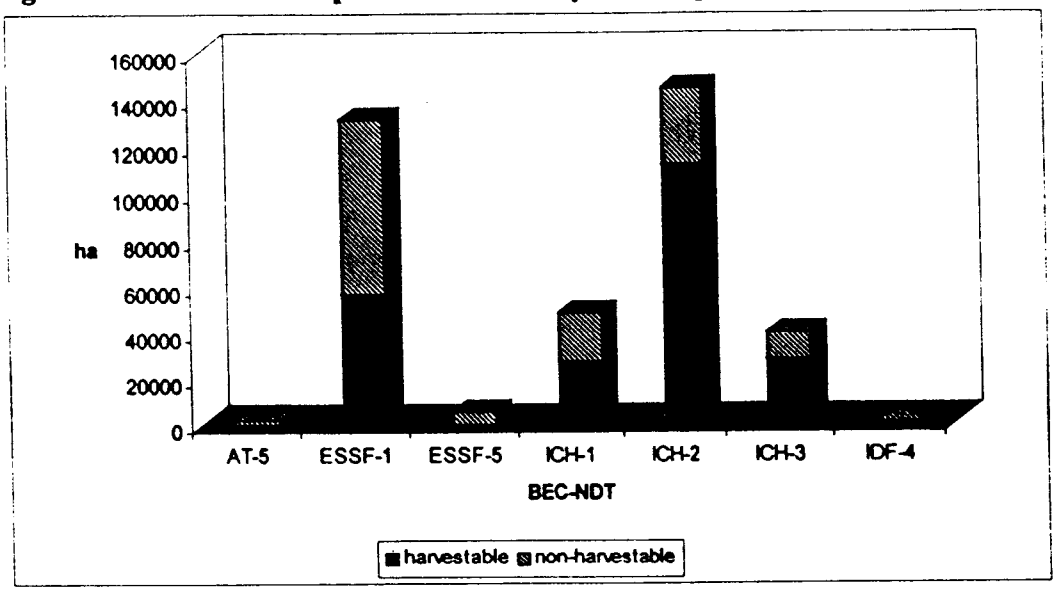

Figure 6. Distribution of productive area by BEC/NDT

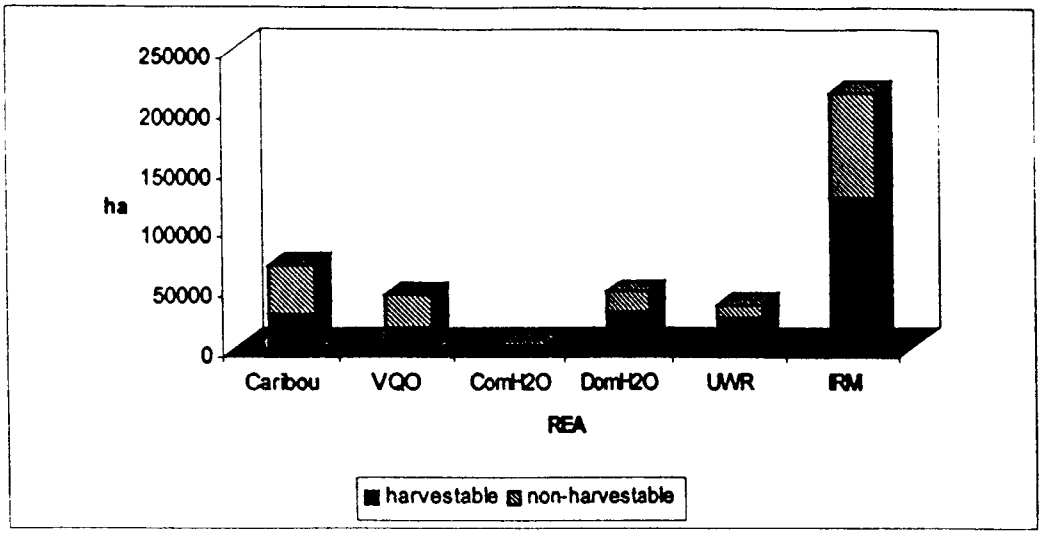

Figure 7. Distribution of productive area by Resource Emphasis Area

4.3.3 Analysis units

To capture biological similarity, the inventory has been assembled and aggregated into analysis units on the basis of:

- inventory type groups,
- maturity, and
- site index range.

The distribution of area by inventory type groupings is shown in Figure 8.

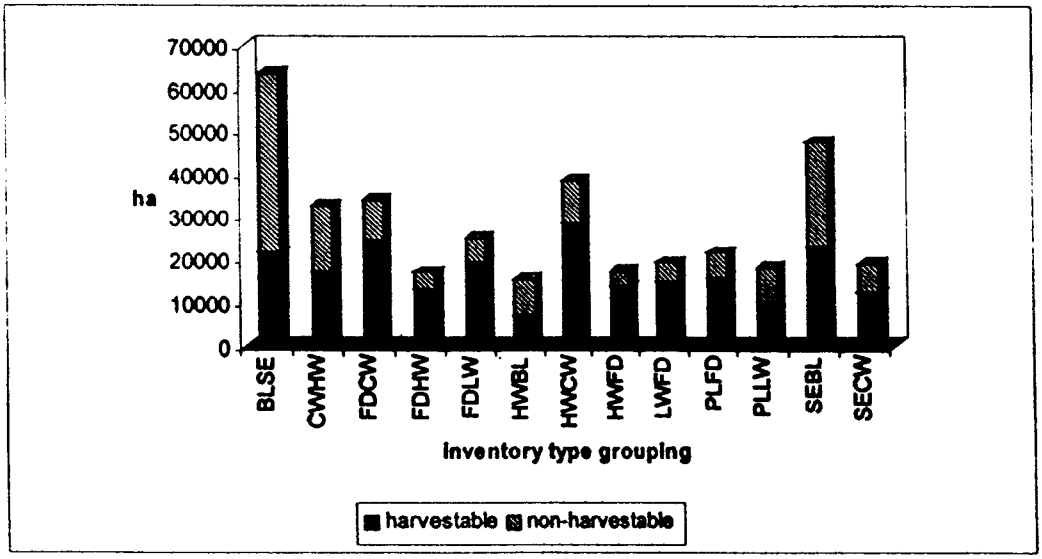

Figure 8. Distribution of productive area by species (inventory type grouping)

Site index stratification is independent of any subsequent site index modifications. Figures 9 (a-b) show the distribution of productive area by broad site productivity classification, both before and after the application of old growth site index adjustments.

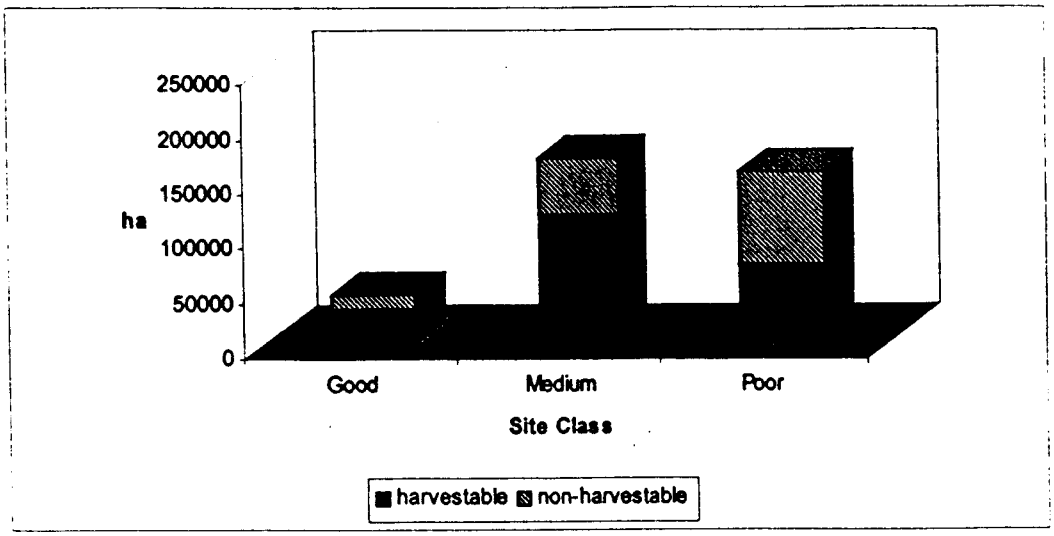

Figure 9a. Distribution of productive area by site class (without OGSI adjustment)

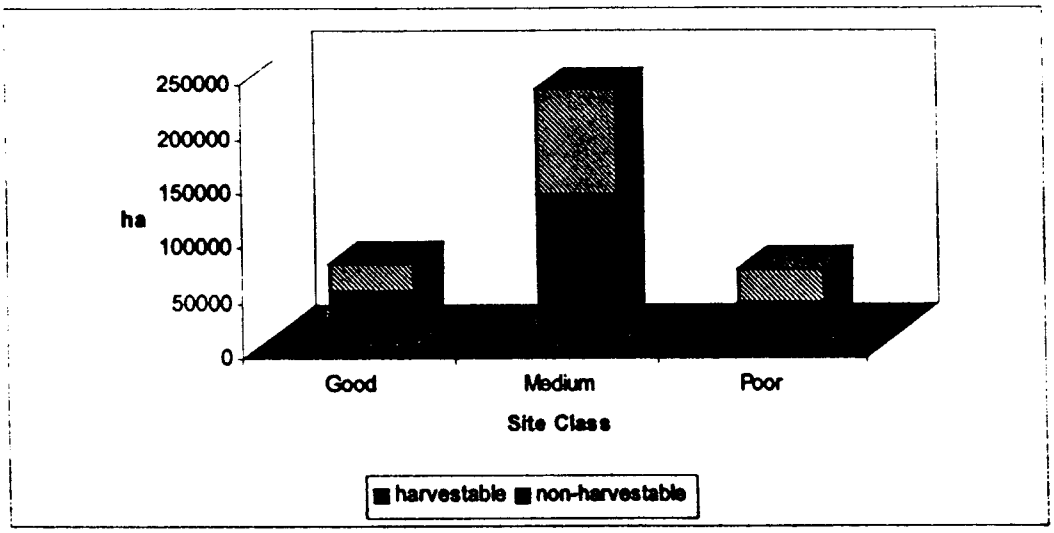

Figure 9b. Distribution of productive area by site class (with OGSI adjustment)

5. Timber Supply Analysis Methods

Timberline's proprietary simulation model CASH6 (Critical Analysis by Simulation of Harvesting) Version 6 was used to develop harvest schedules for all options and sensitivity analyses included in the MP #9 timber supply analysis. The model uses a geographic approach to landbase and inventory definition in order to adhere as closely as possible to the intent of forest cover requirements on harvesting.

CASH6 can simulate the imposition of overlapping forest cover objectives on timber harvesting and resultant forest development. These objectives are addressed by placing restrictions on the distribution of age classes, defining maximum or minimum limits on the amount of area in young and old age classes respectively found in specified components of the forest. Objectives are of two types:

1. Disturbance (below green-up)
The disturbance category is defined as the total area below a specified green-up age. This disturbed area is to be maintained below a specified maximum percent. The effect is to ensure that at no time will harvesting cause the disturbed area to exceed this maximum percent. This category is typically used to model adjacency, visual, wildlife or hydrological green-up requirements in resource emphasis areas, and early seral stage requirements at the landscape unit level.

2. Retention (old growth)
The retention category is defined as the total area above a specified old growth age. This retention area is to be maintained above a specified minimum percent. The effect is to ensure that at no time will harvesting cause the retention area to drop below this minimum percent. This category is typically used to model thermal cover and/or old growth requirements in wildlife management resource emphasis areas, and mature and old growth seral stage requirements at the landscape unit level.

The model projects the development of a forest, allowing the analyst to impose different harvesting/silviculture strategies on its development, in order to determine the impact of each strategy on long-term resource management objectives.

CASH6 was used to determine harvest schedules that incorporate all integrated resource management considerations. CASH6 was also employed to model the 20-Year Spatial Feasibility Analysis. This component of MP #9 was completed as a separate process from the remainder of the timber supply analysis, and is reported under separate cover.

In these analyses, timber availability is forecasted in decadal time steps (periods). The main output from each analysis is a projection of the amount of future growing stock, given a set of growth and yield assumptions, and planned levels of harvest and silviculture activities. Growing stock is characterized in terms of total and merchantable volume, as well as volume above minimum harvest age.

A 250 year time horizon was employed in these analyses, to ensure that long-term growing stock stability is not compromised. Also, harvest levels included allowances for non-recoverable losses. Harvest figures reported here exclude this amount.

Over the next rotation (90 years) it will be necessary to reduce harvest levels prior to achieving the long-term level. Unless otherwise stated, in the timber supply forecasts which follow, the decadal rate of decline was limited to 10%, and the mid-term harvest level was not permitted to drop below a minimum target level. The long-term steady harvest level will always be slightly below the theoretical long-term level, attainable only if all stands are harvested at the age when mean annual increment (MAI) maximizes. This is due to the imposition of minimum harvest ages and forest cover requirements, which alter time of harvest.

6. Option 1: Base Case – KBLUP Caribou Habitat Option

6.1 Introduction

This option incorporates:

- Management activity as defined by current operations with emphasis on the last 5 years;
- Implementation of the Forest Practices Code (FPC) as it was interpreted at the date of Statement of Management Objectives, Options and Procedures (SMOOP) approval, August 28, 1997;
- Recommended Landscape Units (LUs) defined for TFL 23 with biodiversity emphasis assignments to address landscape level biodiversity;
- A recently updated (December 31, 1997) forest cover inventory;
- VDYP natural stand yields for natural unmanaged stands (> 25 years old);
- TIPSY managed stand yields for all existing (1 – 25 years old) and future managed stands;
- Current close utilization standards;
- Basic silviculture on all sites;
- Genetic gains from tree improvement;
- New Park Areas from KBLUP;
- Special management for important wildlife including KBLUP caribou habitat definitions ;
- Visual quality requirements;
- Consideration of sensitive areas based on recent inventories including terrain (soils) and regeneration problems;
- Revised operability which defines areas requiring aerial harvesting systems;
- inclusion of provincial and federal park lands to height of land for contribution to seral stage requirements; and
- Consideration of uneconomic forest stands and forest health.

As directed by MoF Timber Supply Branch (TSB) staff, this base case utilizes regenerating stand yield curves which employ the existing site index estimates. However, it is recognized that these existing estimates are low when based on height/age estimates in old growth stands.

Three alternative flow scenarios associated with the base case assumptions were initially tested:

1. Increase initial harvest level by 5%, subject to a mid-term minimum harvest objective,
2. Maximize the mid-term level, subject to meeting the current AAC in the first decade, and
3. Maintain the existing AAC as long as possible, subject to the mid-term minimum level.

The results are presented in Table 1 and Figure 10.

Table 1. Net harvest levels – base case

Decade	Scenario 1	Scenario 2	Scenario 3
1	714000	680000	680000
2	714000	621000	680000
3	670000	621000	680000
4	612000	621000	680000
5	612000	621000	612000
6	572000	621000	572000
7	572000	621000	572000
8	572000	621000	572000
9	572000	621000	572000
10	634000	634000	634000
11	634000	634000	634000
12+	634000	634000	634000

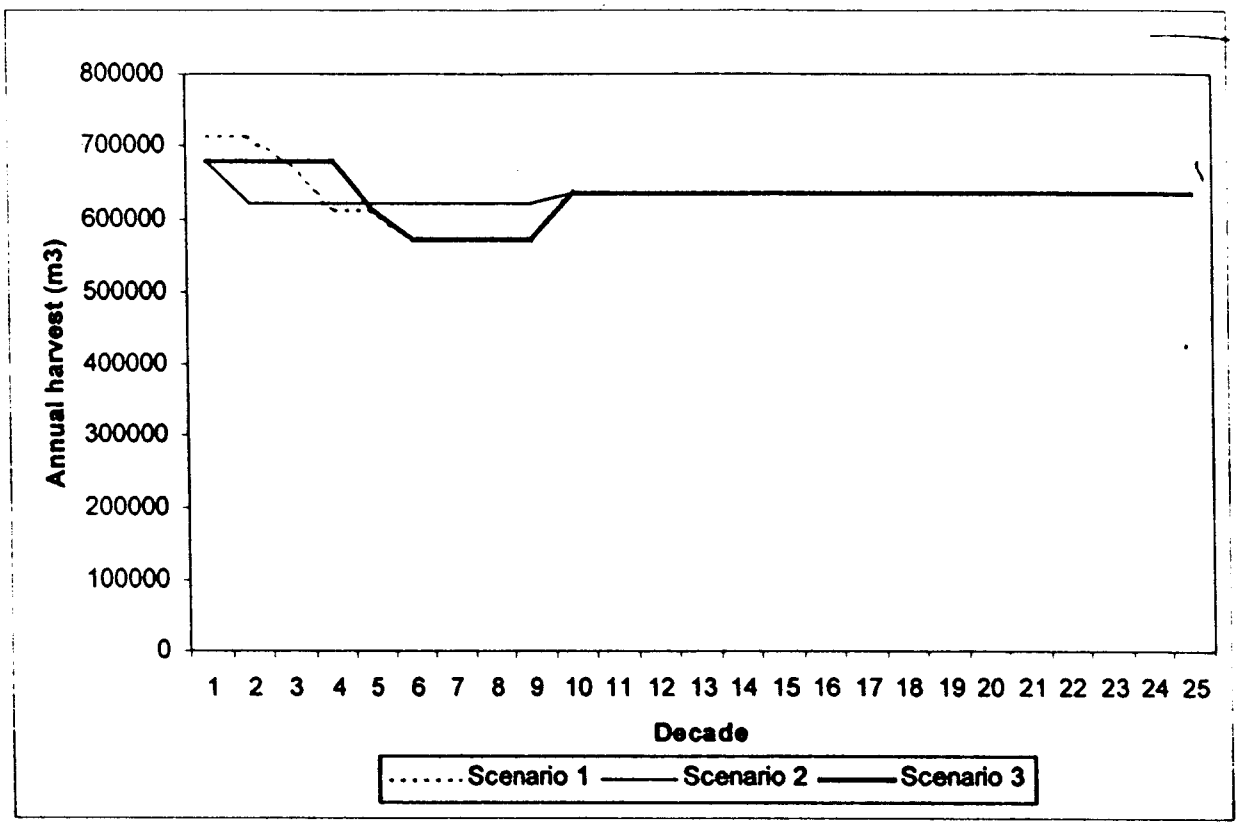

Figure 10. Net harvest levels – base case

Scenarios 1 and 2 represent departures from the harvest flow policy. They are included to demonstrate opportunities to alter the short and medium term harvest, without compromising long-term objectives. Scenario 3 was selected as the basis for sensitivity analysis, as it adheres to the harvest flow policy adopted by Pope & Talbot (Section 3). In scenario 3, the initial harvest level is set at 680,000 cubic metres/year, (the current AAC), and maintained for 4 decades. A drop of 10% in the fifth decade and a further drop of 6.5% in the sixth decade are necessary to avoid unacceptably low mid-term levels. The long term steady level is 634,000 cubic metres, which is approximately 8% below the theoretical long term level (690,900 cubic metres) based on maximizing MAI. This difference results from the downward pressures associated with conflicting forest cover and harvest scheduling objectives.

Figure 11 displays the 250 year growing stock profile associated with this scenario. Growing stock within the harvestable landbase declines steadily for 8 decades at which point harvesting emphasis shifts from existing mature types to second growth. Beyond this point, growth and harvest rates equalize, and growing stock remains stable to the end of the simulation period. Available growing stock (volume above minimum harvest age) minimizes at decade 8. The harvest flow over decades 1-9 is largely controlled by this minimum. Further increases prior to decade 9 would result in the harvest at decade 9 falling below the mid-term minimum, which is contrary to the harvest flow policy adopted in these analyses.

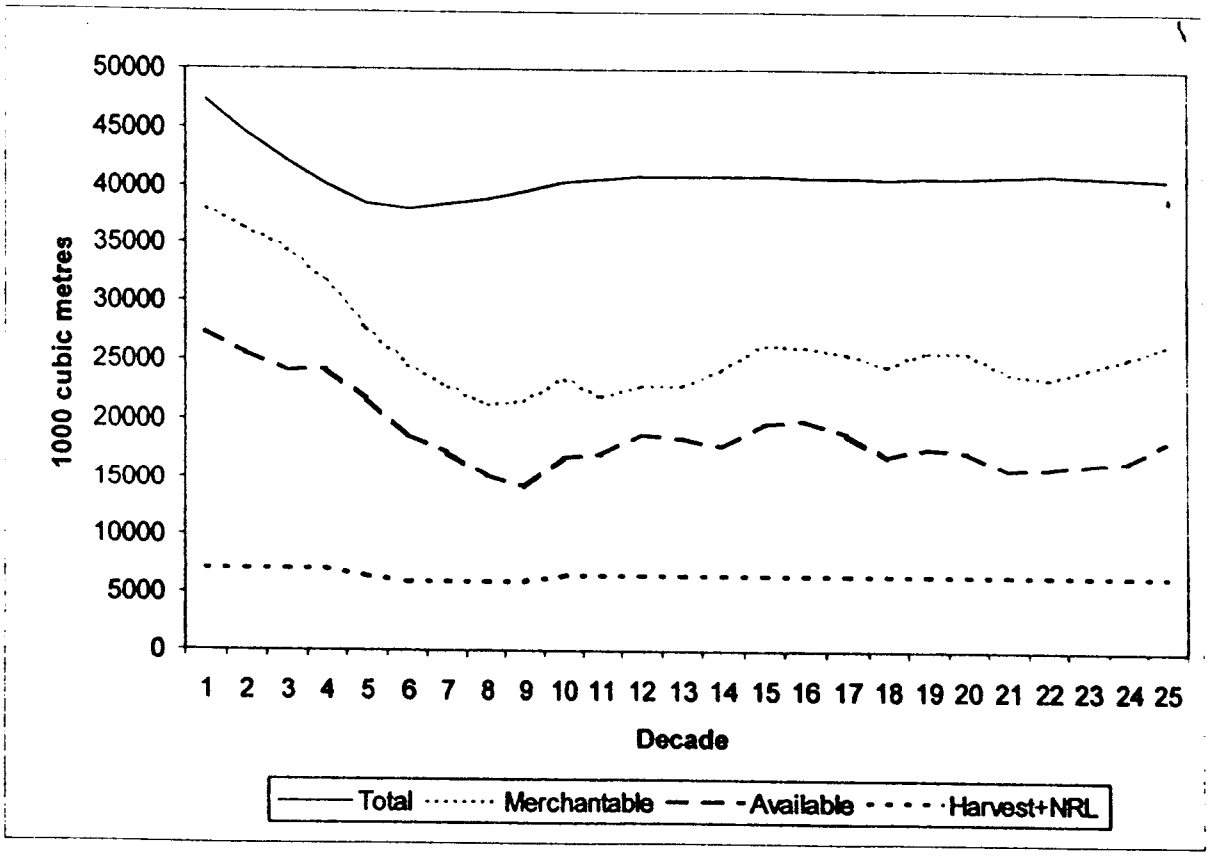

Figure 11. Growing stock profile – base case

Figures 12 and 13 show harvested volume/hectare and area harvested/year for the base case.

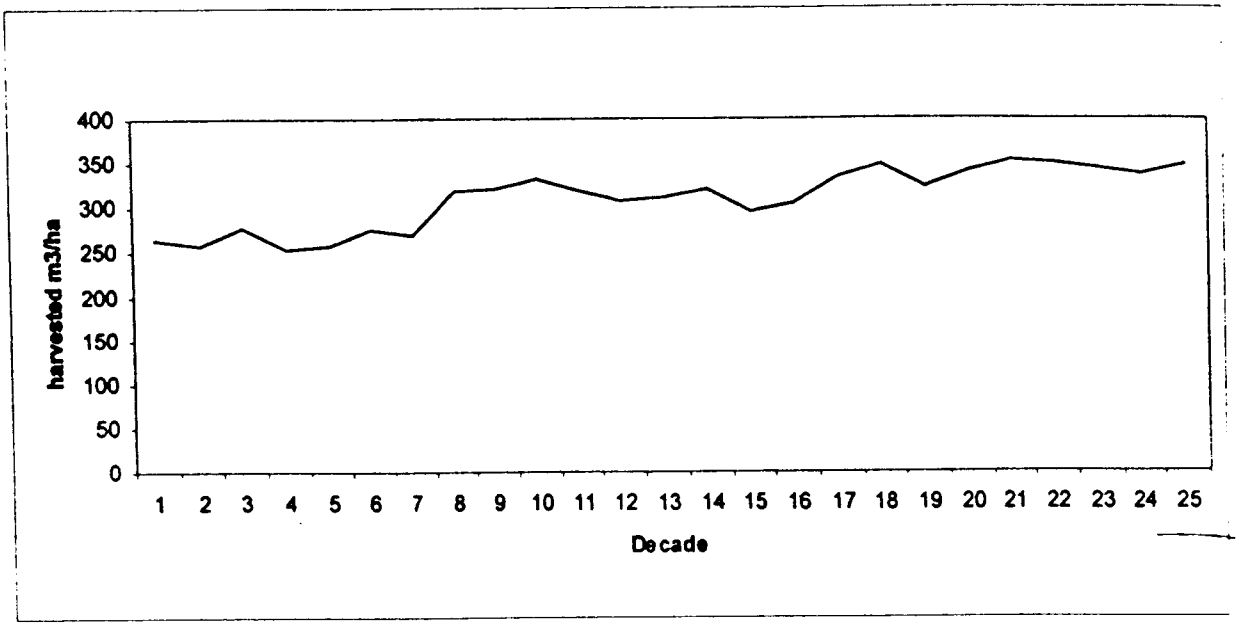

Figure 12. Harvested volume/ha – base case

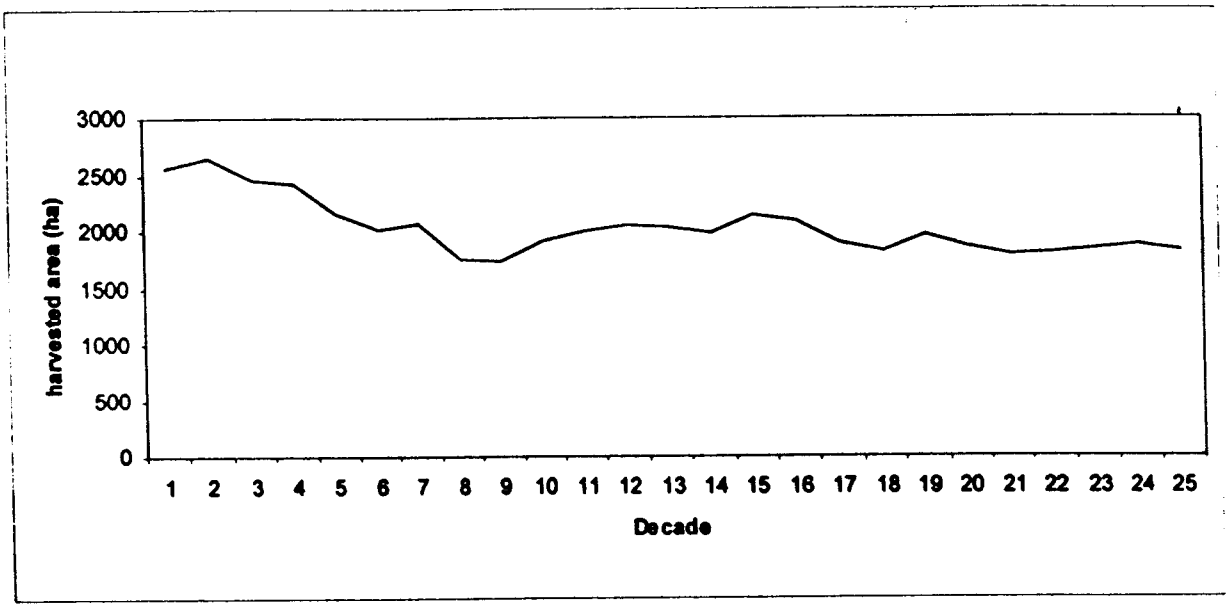

Figure 13. Harvested area – base case

Figures 14-18 show the changes in forest structure over time. Each figure indicates the residual structure of the total productive forest, including the unharvestable components.

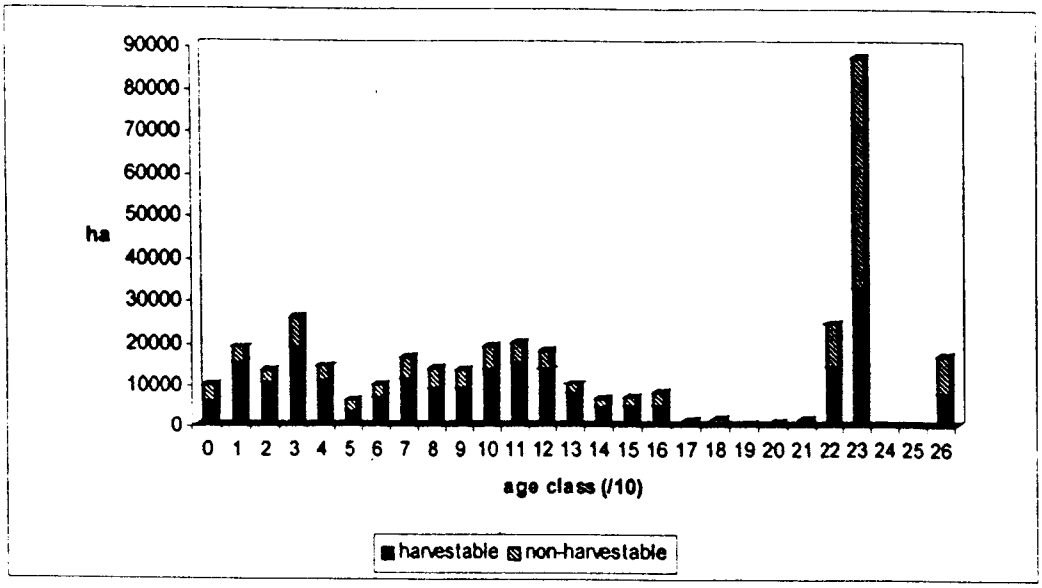

Figure 14. Age structure – end of period 1

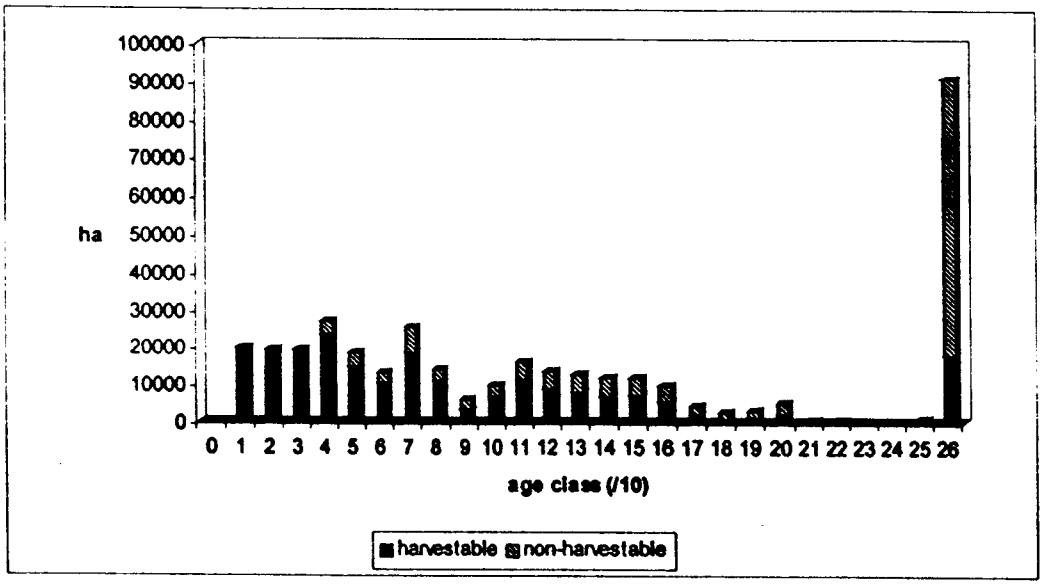

Figure 15. Age structure – end of period 5

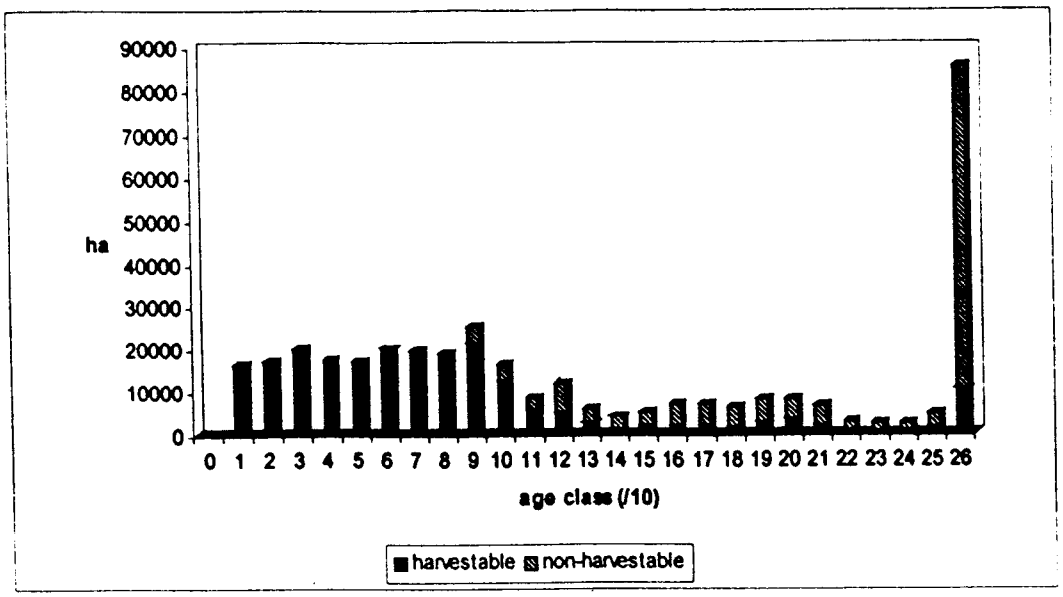

Figure 16 Age structure – end of period 10

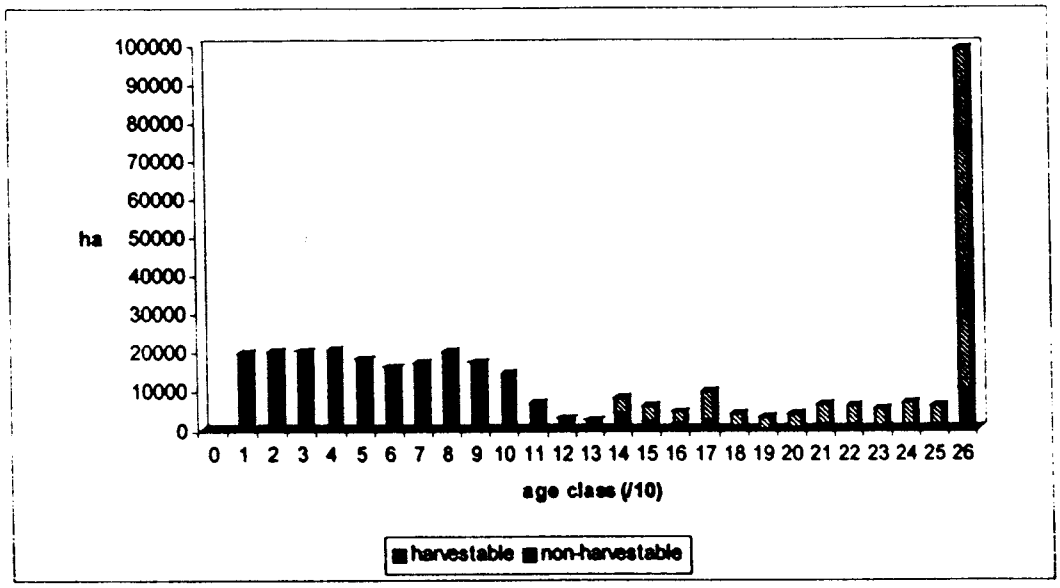

Figure 17 Age structure – end of period 15

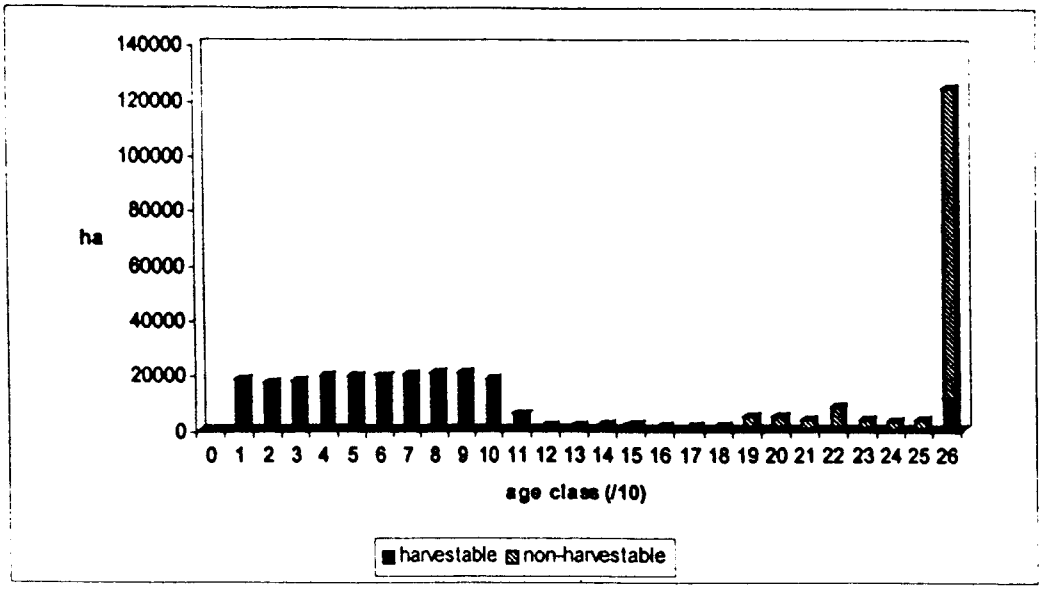

Figure 18 Age structure – end of period 20

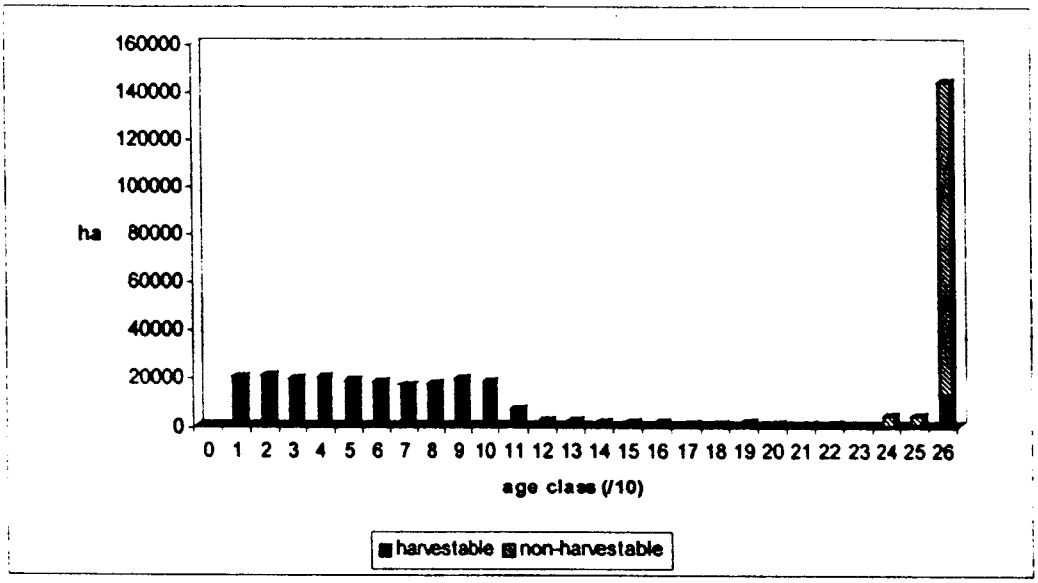

Figure 19 Age structure – end of period 25

While the harvestable old growth inevitably declines in the future, the total productive area greater than age 250 increases steadily over time, reaching approximately 86,900 hectares by the end of decade 10, and 153,500 hectares by the end of decade 25. In other words, fully 23% of the productive forest is above age 250 by the end of the first rotation, and 41% by the end of the second rotation. This has very positive implications with respect to old growth biodiversity objectives for the TFL.

Seral stage objectives are modeled at the Landscape Unit/BEC Variant level, and forest cover objectives are modeled at the Landscape Unit/REA level. Periodic results for the base case are presented in Appendix 1 of this report.

6.2 Summary – Base Case

The base case scenario provides for an initial harvest level of 680,000 cubic metres. However, the timber flow policy adopted for Management Plan #9 necessitates a reduction of 10% in decade 5, and 6.5% in decade 6. A long-term level of 634,000 cubic metres is achieved in decade 10.

Short and medium term harvest levels are largely dictated by the availability of harvestable regenerating stands. Timber availability is particularly constrained in decade 9. Therefore, any changes to inventory information, growth and yield expectations or silviculture treatment scenarios that affect the harvestable age of second growth stands can have a significant impact on short and medium term timber supplies.

The long-term harvest level is driven by the productive capacity of the harvestable landbase. The theoretical capacity is measured by the average mean annual increment (MAI) for second growth managed stands. The calculations (rounded) for the base case are shown below:

Net current landbase (including NSR)	224 700
- future roads	- 2 500
= net long-term landbase	= 223 100
X average MAI	x 3.2
= **theoretical** gross long-term (rounded)	= 713 900
- non-recoverable losses (NRLs)	-23 000
= **theoretical** net long-term (rounded)	= 690 900

In the base case, the theoretical long-term harvest level of 690,900 cubic metres could be attained if all stands were harvested at MAI culmination age. The realized long term net level of 634,000 cubic metres is approximately 8% lower, as stands cannot always be harvested at this age due to harvest scheduling requirements conflicting with forest cover objectives.

Sensitivity issues that can affect the base case harvest flow are explored in the next section.

7. Option 1. Base Case – Sensitivity Analysis

Sensitivity analysis provides a measure of the upper and lower bounds of the base case harvest forecast, reflecting the uncertainty of assumptions made in the base case. The magnitude of the change in the sensitivity variable(s) reflects the degree of uncertainty surrounding the assumption associated with that variable. By developing and testing a number of sensitivity issues, it is possible to determine which variables most affect results. This in turn facilitates the management decisions which must be made in the face of uncertainty.

To allow meaningful comparison of sensitivity analyses, they are usually performed using the base case option and varying only the assumption being evaluated. All other assumptions remain unchanged. Sensitivity issues are summarized in Table 2. The timber supply impacts are illustrated in Sections 7.1 - 7.15.

Table 2. Sensitivity analysis levels – Current Management Option

Issue	Sensitivity Levels to be Tested	Section
Landbase revisions	Remove Shelter Bay block to assess the contribution of the Columbia District to the AAC of TFL 23	7.1
	Add marginally economic stands	7.2
	Remove aerial operable areas	7.3
	Adjust timber harvesting landbase by +/- 10%	7.4
	Remove stands with SI50 < 9 m	7.5
Growth and yield inputs	Apply OGSI adjustments to managed stands	7.6
	Adjust existing stand yields by +/- 10%	7.7
	Adjust future managed stand yields by +/- 10%	7.8
	Adjust managed stand minimum harvest ages by +/- 10 years	7.9
	Increase and decrease regeneration delay	7.10
Management considerations & forest cover objectives	Alter maximum disturbance levels in caribou, ungulate winter range and IRM zones	7.11
	Alter caribou thermal and old growth objectives	7.12
	Alter thermal cover objectives in ungulate winter range	7.13
	Alter VQO maximum disturbance levels	7.14
	Employ full biodiversity objectives in low emphasis LUs	7.15

7.1 Remove Shelter Bay Block

The Shelter Bay block represents a total of 40,692 hectares of productive area, 24,476 hectares of which are within the net harvestable landbase. This represents 11 % of the net harvestable area incorporated into the base case analysis. As shown in Table 3 and Figure 20, removal of this area results in a 10% reduction in harvest levels in the first 100 years, and 11% in the long term.

Table 3. Net harvest levels – Remove Shelter Bay block

Decade	Base case	Remove block
1	680000	612000
2	680000	612000
3	680000	612000
4	680000	612000
5	612000	551000
6-9	572000	517000
10+	634000	563000

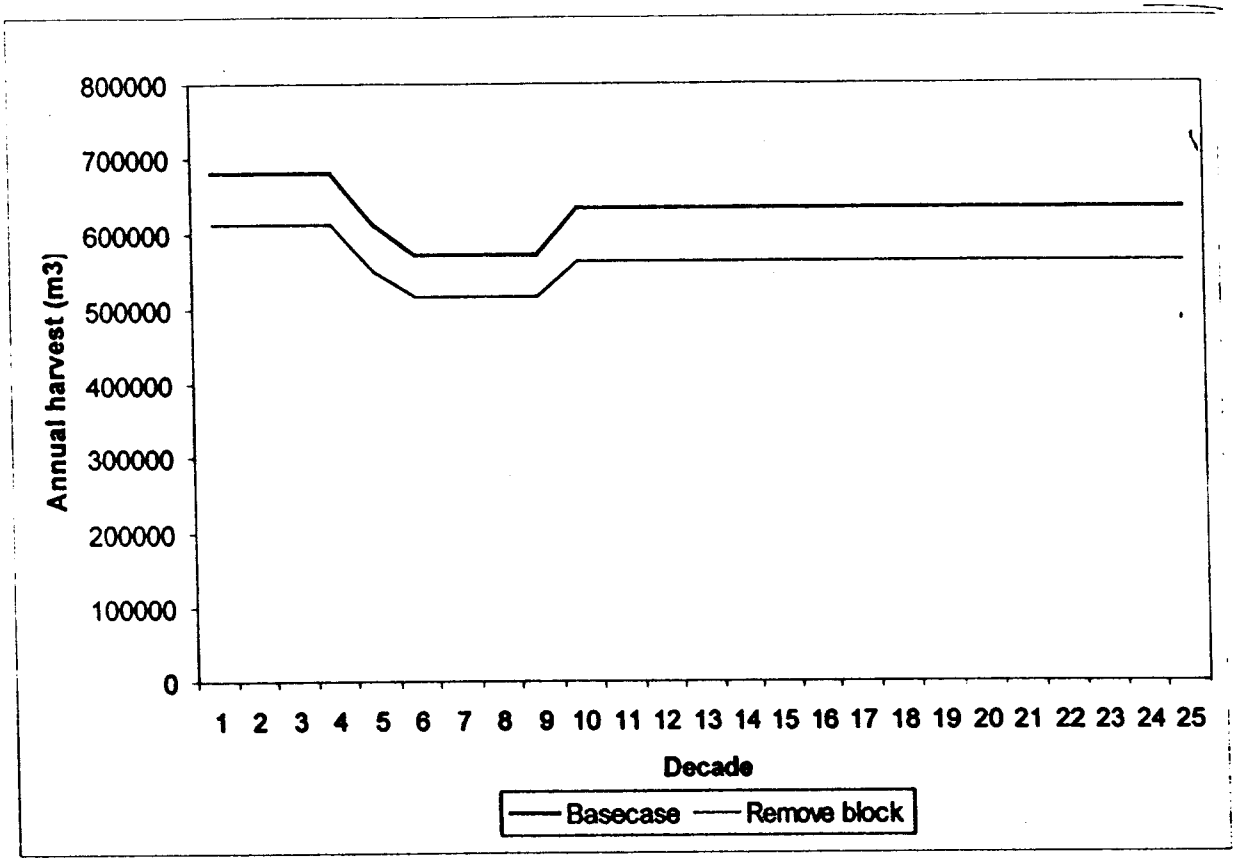

Figure 20. Net harvest levels – Remove Shelter Bay block

7.2 Add Marginally Economic Stands

Approximately 4,071 hectares of overmature hemlock and balsam leading types were excluded from the net harvestable landbase. While some of this area would also be removed for other reasons, primarily riparian zones, a total of 3,660 hectares could be added back to the net harvestable landbase, if they could be economically accessed. This represents an increase of 1.6% in the size of the harvestable landbase. The impact of incorporating these stands into the annual timber supply amounts to 1% over the time horizon of the analysis. This is summarized in Table 4 and Figure 21.

Table 4. Net harvest levels – Add marginally economic stands

Decade	Base case	Add stands
1	680000	680000
2	680000	680000
3	680000	680000
4	680000	680000
5	612000	620000
6-9	572000	582000
10+	634000	640000

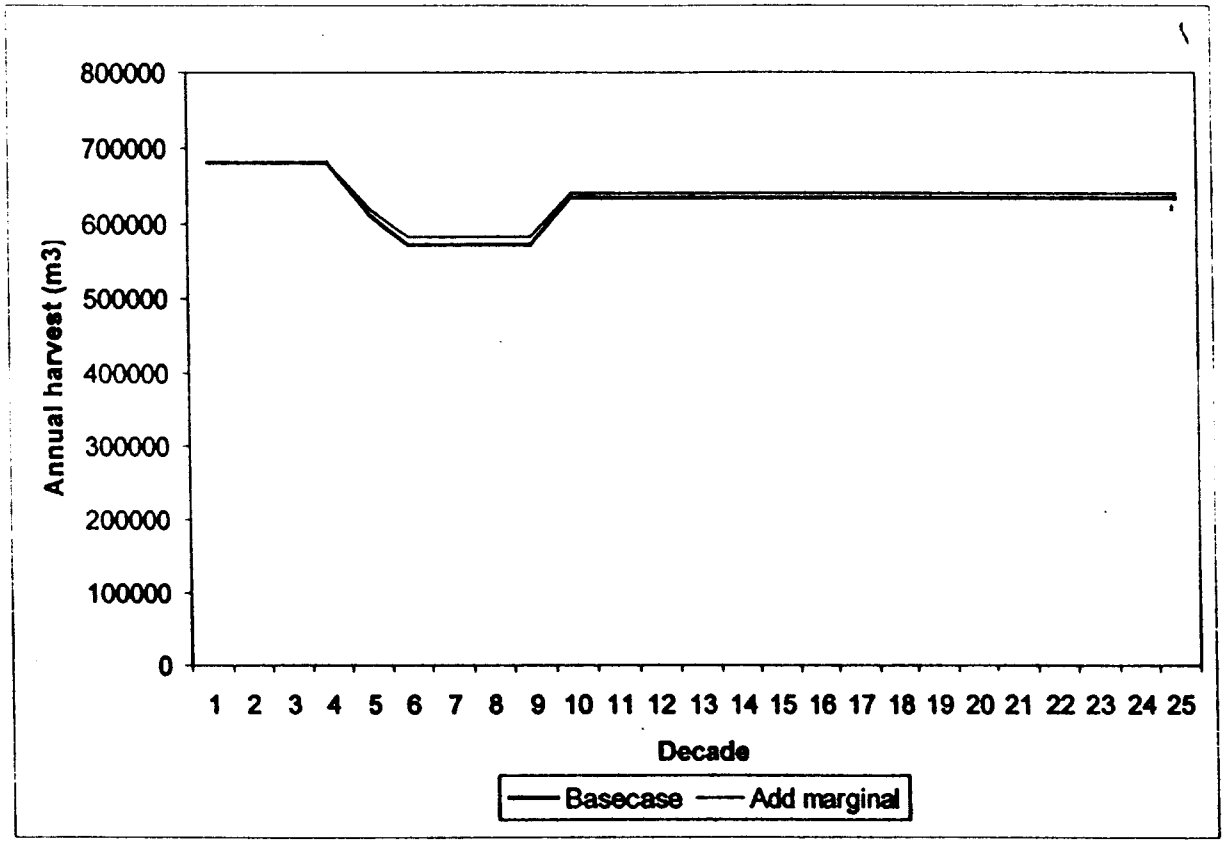

Figure 21. Net harvest levels – Add marginally economic stands

7.3 Remove Aerial Operable Area

The new Pope and Talbot operability classification identified a total of 24,194 hectares of productive area which is accessible using aerial harvesting methods, including long line and helicopter forwarding. 19,504 hectares of this area are within the net harvestable landbase. This represents approximately 9% of the net harvestable area. To estimate the contribution of these areas to the timber supply of TFL 23, these areas were removed from the harvestable landbase. They were however, assumed to contribute to forest cover and seral stage objectives. The results are presented in Table 5 and Figure 22. A 56,000 cubic metre/year reduction in harvest is required over the total time horizon of the analysis. This reflects the current AAC aerial partition of 50,000 cubic metres of aerial volume, plus 6,000 cubic metres attributed to the small business program.

Table 5. Net harvest levels – Remove aerial operable stands

Decade	Base case	Remove aerial
1-4	680000	624000
5	612000	556000
6-9	572000	516000
10+	634000	578000

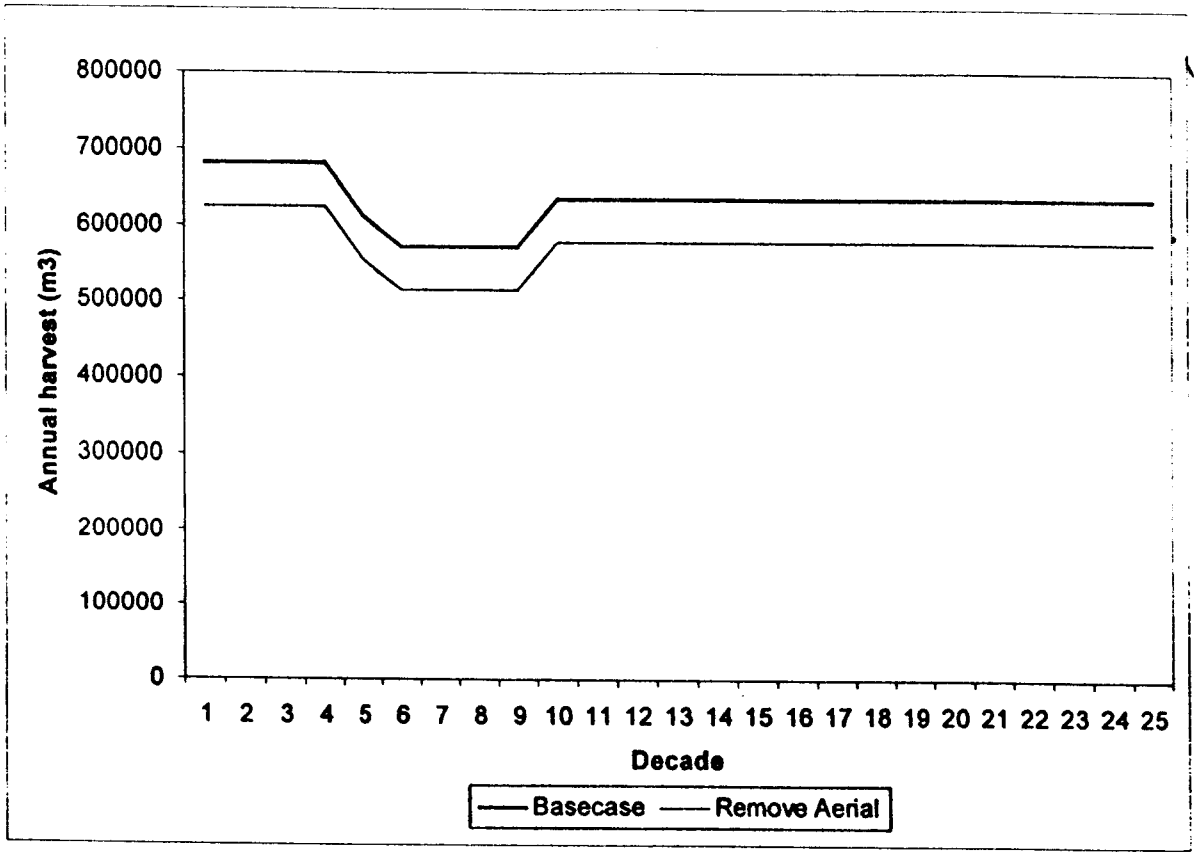

Figure 22. Net harvest levels – Remove aerial operable areas

7.4 Adjust Timber Harvesting Landbase

In order to further assess the sensitivity of the timber supply to changes in the harvestable landbase, the net landbase was arbitrarily adjusted by +/-10% (22,470 ha). In order to maintain the same total productive forest area, the non-harvestable landbase was adjusted accordingly. Predictably, these changes had a proportional impact on short and long-term timber supply, as shown in Table 6 and Figure 23.

Table 6. Net harvest levels – Adjust timber harvesting landbase

Decade	Area - 10 %	Base case	Area + 10 %
1	612000	680000	748000
2	612000	680000	748000
3	612000	680000	748000
4	612000	680000	748000
5	551000	612000	673000
6-9	515000	572000	629000
10+	571000	634000	697000

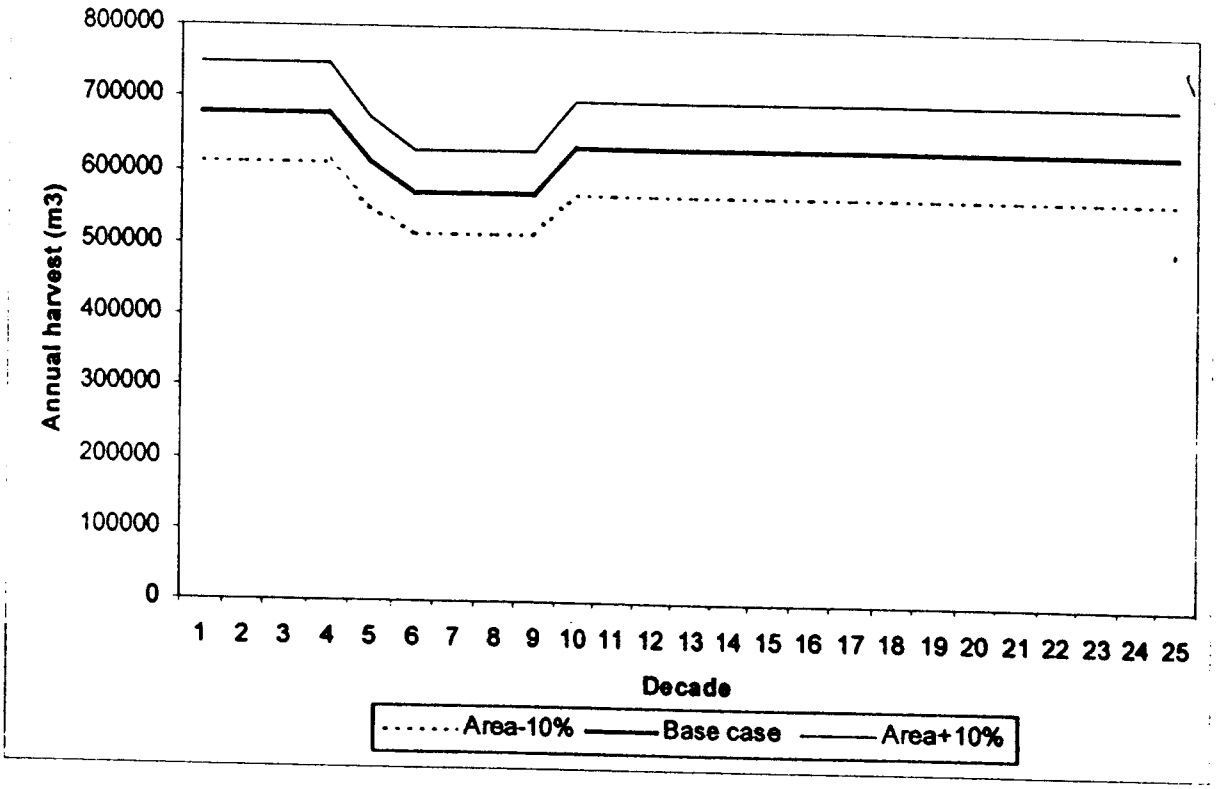

Figure 23. Net harvest levels – Adjust timber harvesting landbase

7.5 Remove Stands with Site Index < 9.0 metres

4,461 hectares of harvestable forest area are currently assigned site index values between 8.0 and 8.9, although most of these stands are spruce and balsam types greater than age 140, and therefore affected by old growth site index biases. In this analysis, these areas were removed from the harvestable landbase, although retained in the productive landbase for biodiversity contribution. This resulted in a reduction of 4,361 hectares (2%) in the net harvestable landbase. Yield curves for the affected analysis units were reconstructed to reflect this removal. As shown in Table 7 and Figure 24, the impact was to reduce harvest levels in the short and medium term by approximately 2%, while long-term levels were reduced by 1 %. The impact on timber supply was less than proportional to the landbase removal, as these stands are at the low end of the productivity spectrum.

Table 7. Net harvest levels – Remove stands with SI50 < 9.0 metres

Decade	Base case	Remove stands
1-3	680000	680000
4	680000	662000
5	612000	596000
6-9	572000	556000
10+	634000	629000

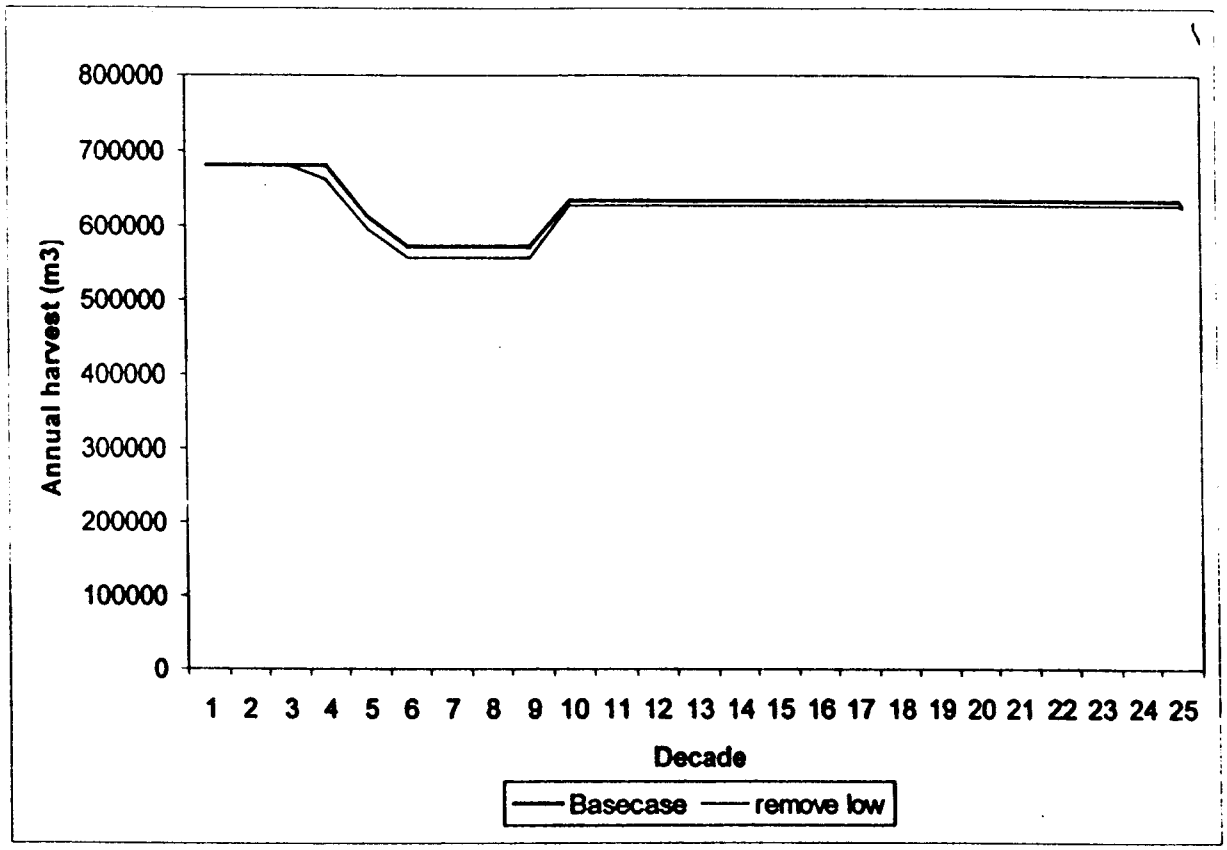

Figure 24. Net harvest levels – Remove stands with SI50 < 9.0 metres

7.6 Apply OGSI Adjustments

As outlined in the data package, the base case analysis incorporates managed stand yield curves which are derived from existing site index data for thrifty (age < 141) and old growth (age > 140) types. The latter are know to incorporate a negative bias. In this analysis, adjusted managed yield forecasts and green-up ages were substituted, using the MoF approved interim OGSI adjustment factors described in the data package. The results are presented in Table 8 and Figure 25. The impact is realised primarily in the long term, when these second growth stands become available for harvest. This impact (12%) is proportional to the increase in MAI of the forest, which is 3.2 cubic metres/hectare/year in the base case, and 3.6 cubic metres/hectare/year in the OGSI scenario.

Table 8. Net harvest levels – Apply OGSI adjustments

Decade	Base case	OGSI
1	680000	680000
2	680000	680000
3	680000	680000
4	680000	680000
5	612000	612000
6-8	572000	608000
9	572000	709000
10+	634000	709000

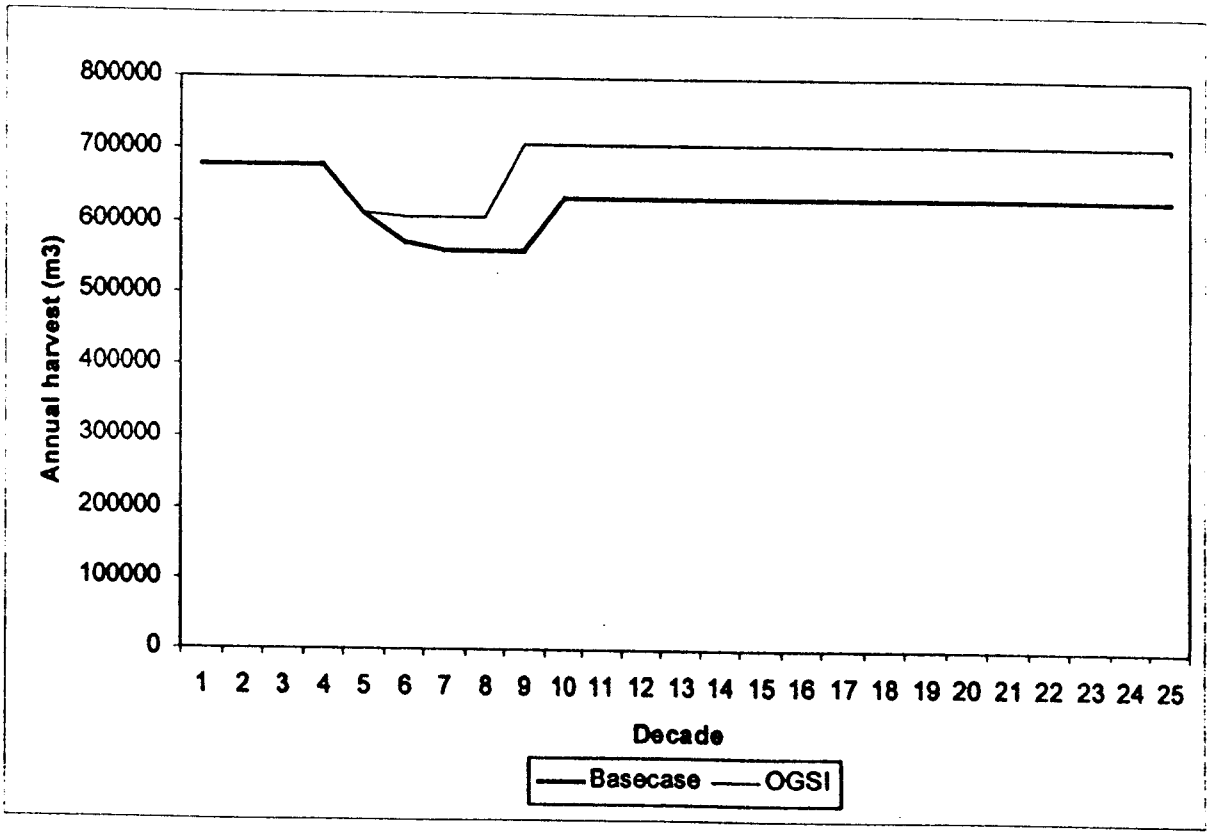

Figure 25. Net harvest levels – Apply OGSI adjustments

7.7 Adjust Existing Stand Yields

A test of the sensitivity of the timber supply to changes in natural stand yield table (NSYT) forecasts was completed. In this case, no changes were made to yield forecasts for existing or future managed stands. Overall, changing NSYT expectations by +/- 10% has a proportional impact on timber supply over the next 80 years, as shown in Table 9 and Figure 26. Beyond this point the impact diminishes, as the managed stand yield forecasts were not adjusted.

Table 9. Net harvest levels – Adjust existing stand yields

Decade	Yield – 10 %	Base case	Yield + 10 %
1	680000	680000	680000
2	680000	680000	680000
3	612000	680000	680000
4	550000	680000	680000
5	502000	612000	680000
6-9	502000	572000	680000
10	502000	634000	680000
11+	634000	634000	634000

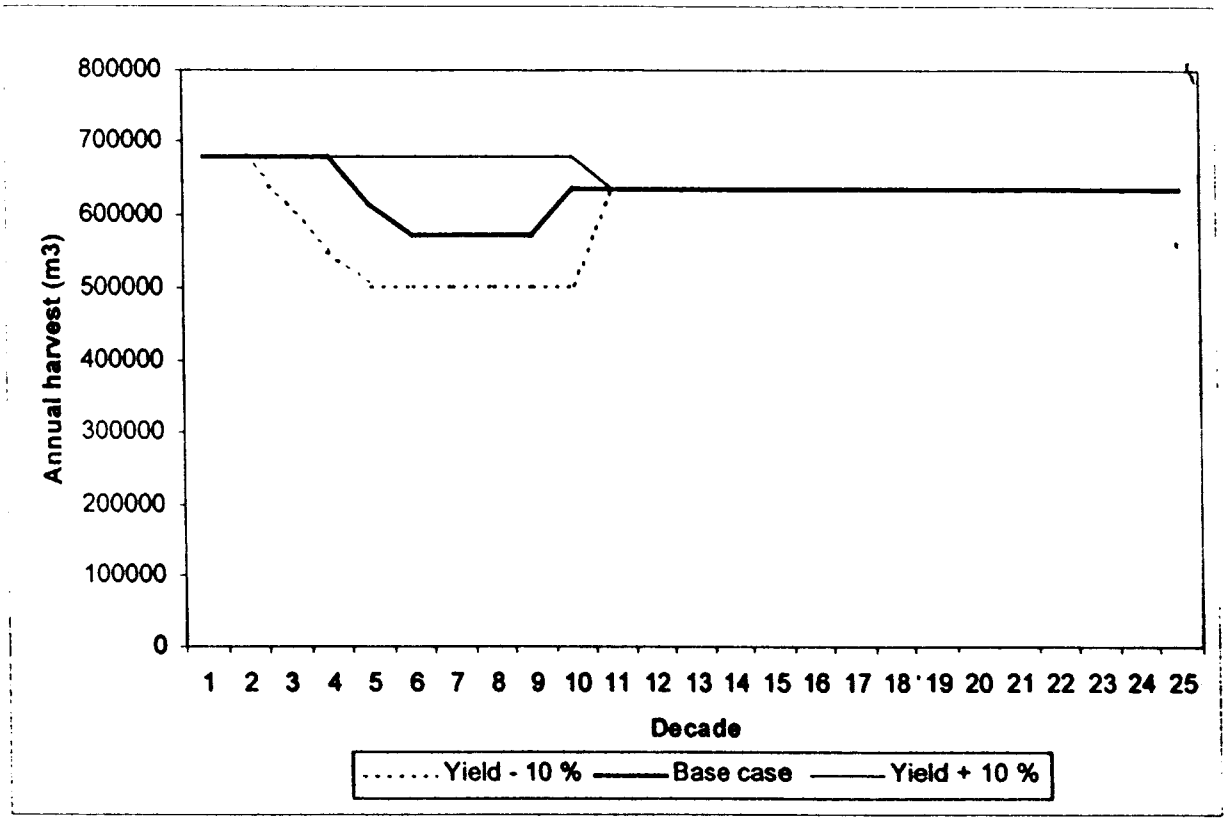

Figure 26. Net harvest levels – Adjust existing stand yields

7.8 Adjust Managed Stand Yields

A test of the sensitivity of the timber supply to changes in managed stand yield table (MSYT) forecasts was also completed. In this case, no changes were made to yield forecasts for existing natural stands. Overall, changing MSYT expectations by +/- 10% has a proportional impact on timber supply after 100 years, as shown in Table 10, Figure 27. Predictably, the impact prior to this point is insignificant.

Table 10. Net harvest levels – Adjust managed stand yields

Decade	Yield – 10 %	Base case	Yield + 10 %
1	680000	680000	680000
2	680000	680000	680000
3	680000	680000	680000
4	680000	680000	680000
5	612000	612000	612000
6-9	564000	572000	579000
10+	575000	634000	697000

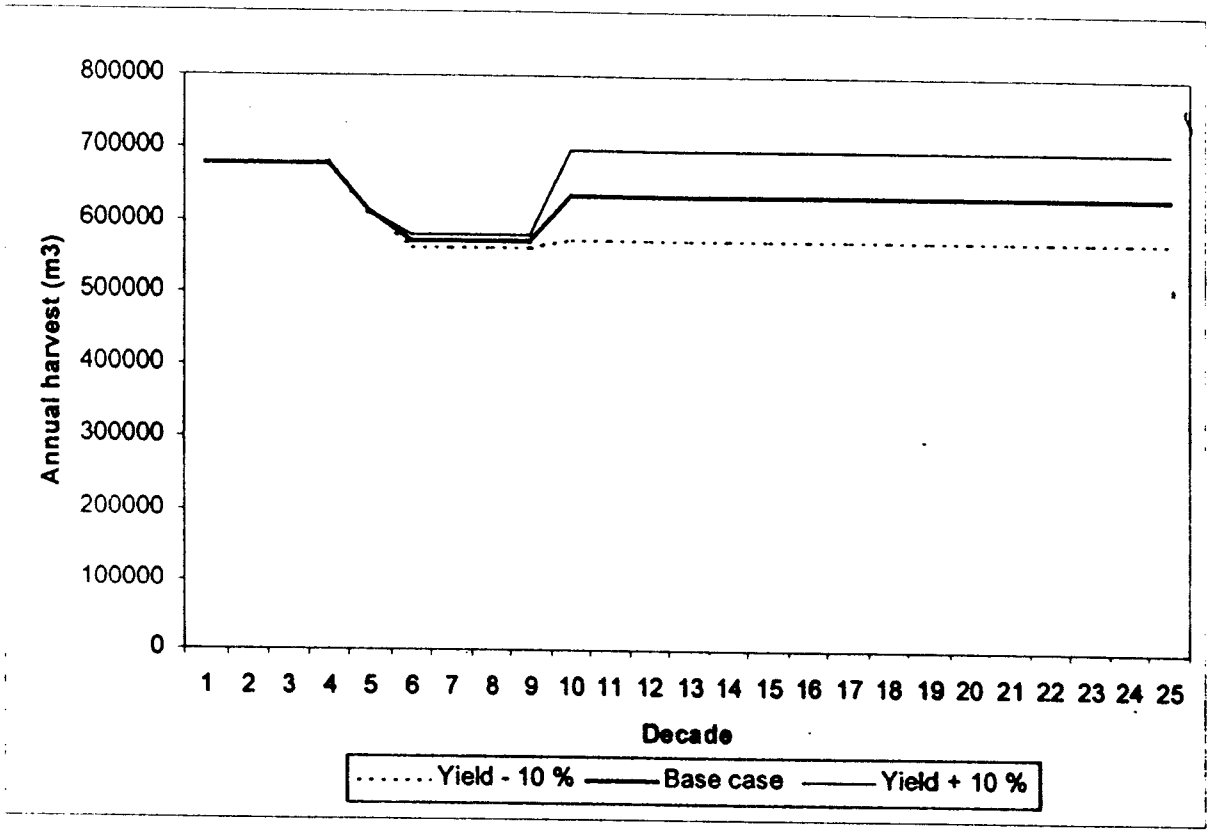

Figure 27. Net harvest levels – Adjust managed stand yields

7.9 Adjust Minimum Harvest Ages (managed stands)

Minimum harvest ages in the base case were established to coincide with the age at which mean annual increment (MAI) in volume culminates. This is an arbitrary approach, representing a conservative estimate of this age; *i.e.* in some cases it is reasonable to expect to harvest stands at an earlier age. The sensitivity to this assumption was tested by arbitrarily adjusting these ages by +/- 10 years. The results are presented in Table 11 and Figure 28. As the base case timber supply is primarily constrained by the availability of second growth timber in decade 8, the timber supply is sensitive to changes in this availability.

Table 11. Net harvest levels – Adjust minimum harvest ages (managed stands)

Decade	Age + 10 years	Base case	Age – 10 years
1	680000	680000	680000
2	680000	680000	680000
3	612000	680000	680000
4	559000	680000	680000
5	559000	612000	680000
6	559000	572000	680000
7-8	559000	572000	612000
9	559000	572000	612000
10+	634000	634000	634000

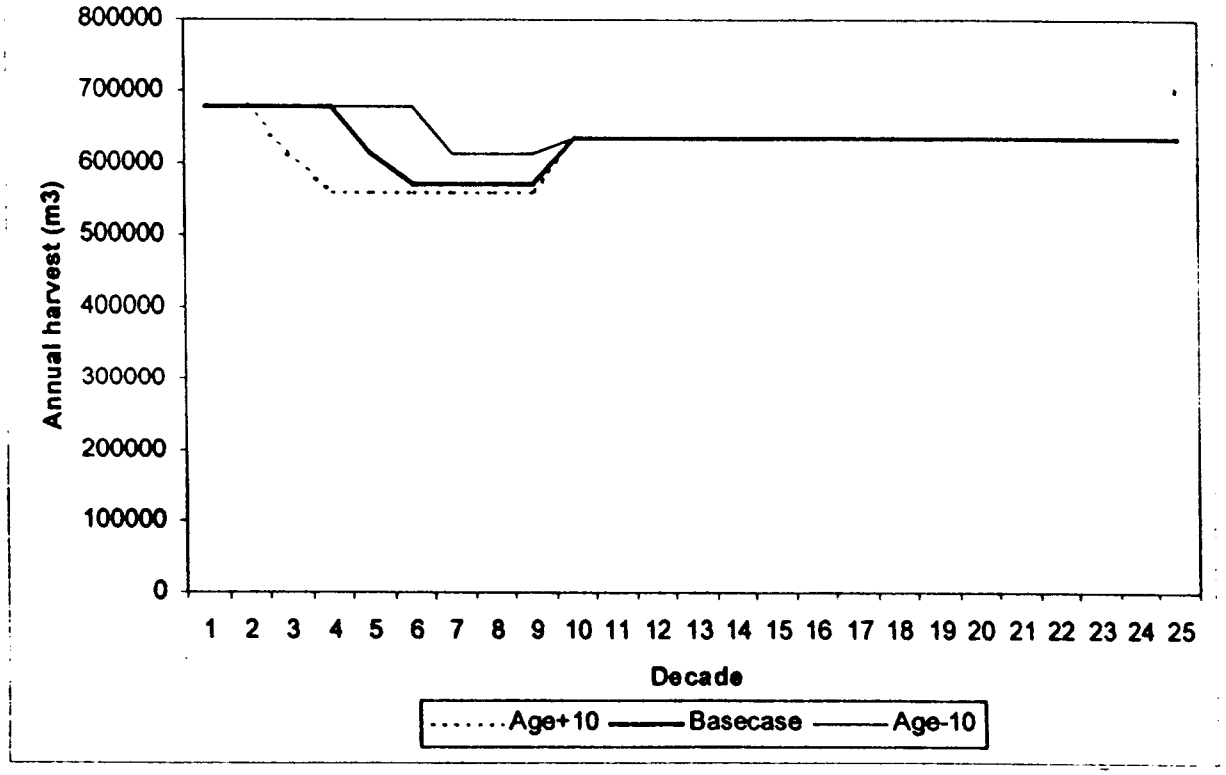

Figure 28. Net harvest levels – Adjust minimum harvest ages

7.10 Alter Regeneration Delay

The base case employs an average regeneration delay of two years, representing the average time between harvest and stand establishment. While this is deemed to be a reasonable expectation for TFL 23, a test was done to determine the sensitivity of the results to a change of +/- one year. As shown in Table 12 and Figure 29, a reduction in the delay increases timber availability by 1-2% in the short and medium terms.

Table 12. Net harvest levels – Alter regeneration delay

Decade	3 year delay	Base case	1 year delay
1		680000	680000
2		680000	680000
3		680000	680000
4		680000	680000
5	no impact	612000	634000
6		572000	612000
7-9		572000	579000
10+		634000	637000

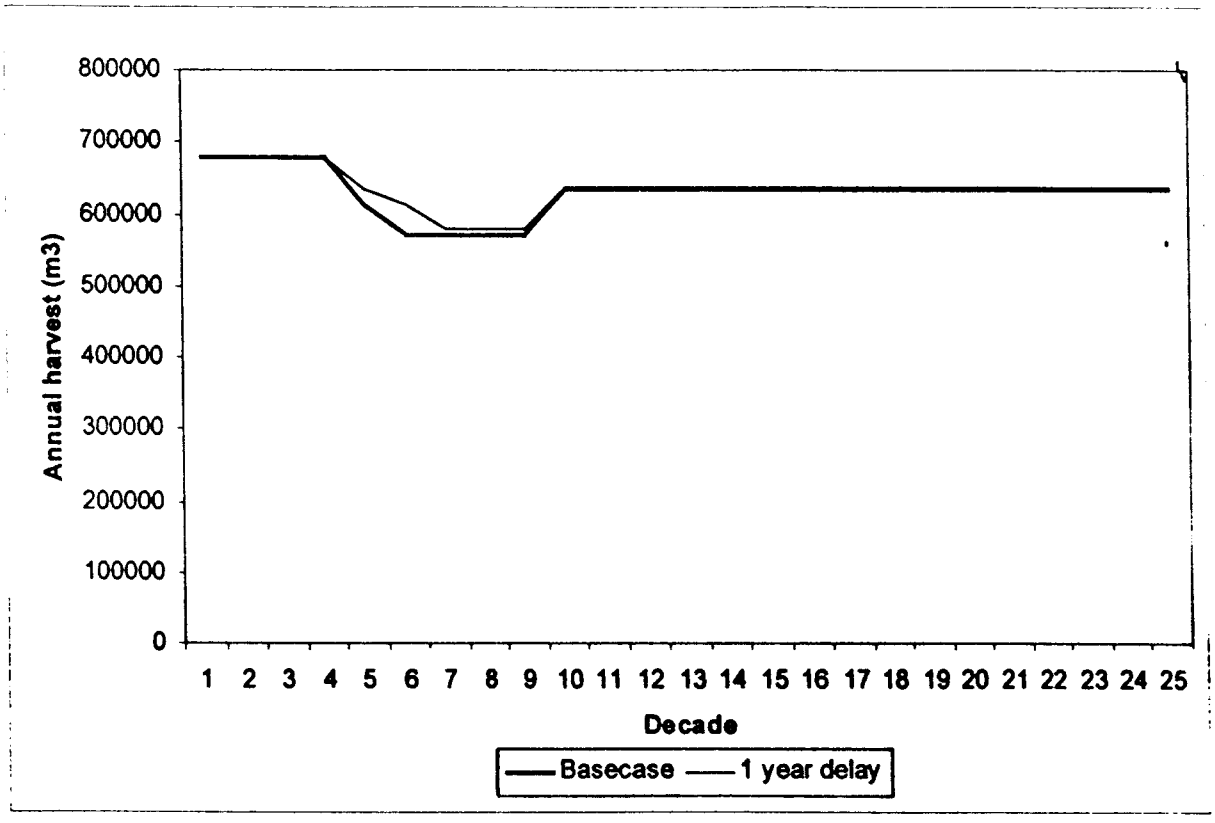

Figure 29. Net harvest levels – Alter regeneration delay

7.11 Alter Maximum Disturbance Levels – IRM, Caribou and Ungulate Winter Range

In the base case, maximum disturbance levels for these zones are set at 25%; *i.e.* the amount of area in the net harvestable landbase below green-up cannot exceed 25%. As shown in Table 13 and Figure 30, the timber supply is sensitive to changes in this objective, as timber supply is particularly limited in the second decade.

Table 13. Net harvest levels – Alter maximum disturbance levels – IRM, Caribou, UWR

Decade	-5%	Base case	+ 5 %
1	680000	680000	680000
2	574000	680000	680000
3	680000	680000	680000
4	654000	680000	680000
5	612000	612000	640000
6	572000	572000	612000
7-9	572000	572000	572000
10+	634000	634000	634000

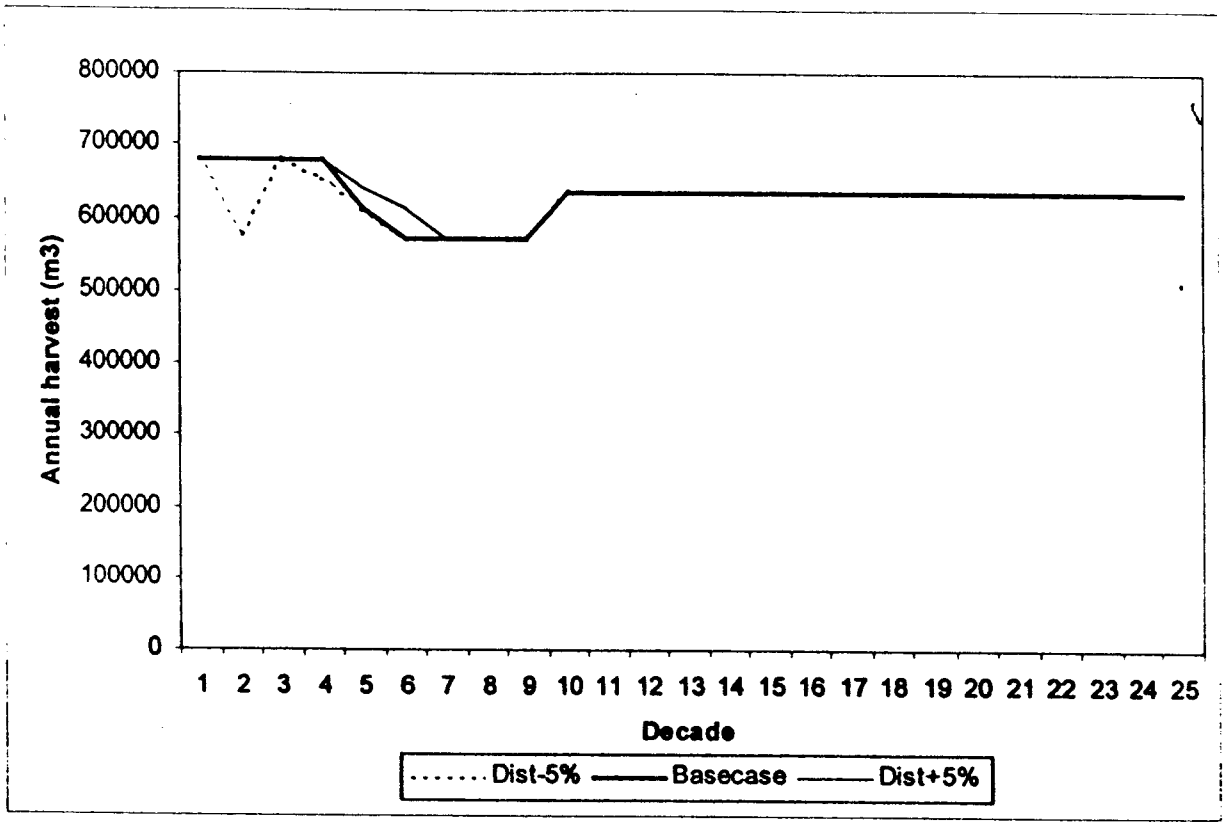

Figure 30. Net harvest levels – Alter maximum disturbance levels

7.12 Alter Caribou Thermal and Old Growth Objectives

Sensitivity tests were performed on the impacts of changing both the thermal and old growth objectives which control minimum levels of forest cover above specified ages. While the timber supply is insensitive to changes in the old growth objective established for caribou management zones, the mid-term supply is significantly impacted if the thermal objectives are altered by +/- 5%. This is shown in Table 14, and Figure 31.

Table 14. Net harvest levels – Alter caribou thermal cover objectives

Decade	+5%	Base case	-5 %
1	680000	680000	680000
2	680000	680000	680000
3	680000	680000	680000
4	612000	680000	680000
5	585000	612000	616000
6	585000	572000	612000
7-9	585000	572000	572000
10+	632000	634000	637000

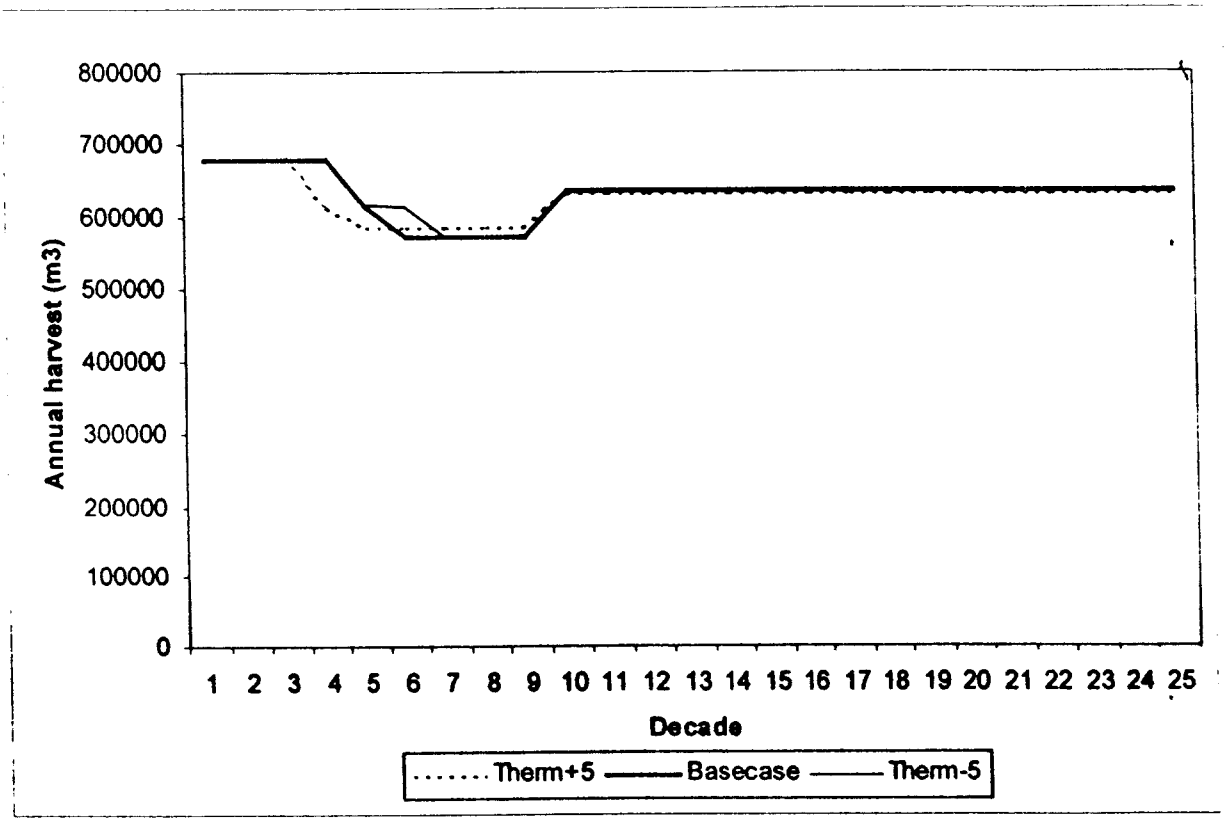

Figure 31. Net harvest levels – Alter caribou thermal cover objectives

7.13 Alter Ungulate Winter Range Thermal Objectives

A sensitivity test was also performed to test the impact of changing the thermal objective in the ungulate winter range zones. As was the case with the caribou zone analysis, the supply is significantly impacted if the thermal objectives are altered by +/- 5%. This is shown in Table 15 and Figure 32.

Table 15. Net harvest levels – Alter ungulate winter range thermal cover objectives

Decade	+5%	Base case	-5 %
1	680000	680000	680000
2	680000	680000	680000
3	680000	680000	680000
4	663000	680000	680000
5	602000	612000	636000
6	572000	572000	584000
7-9	572000	572000	572000
10+	631000	634000	637000

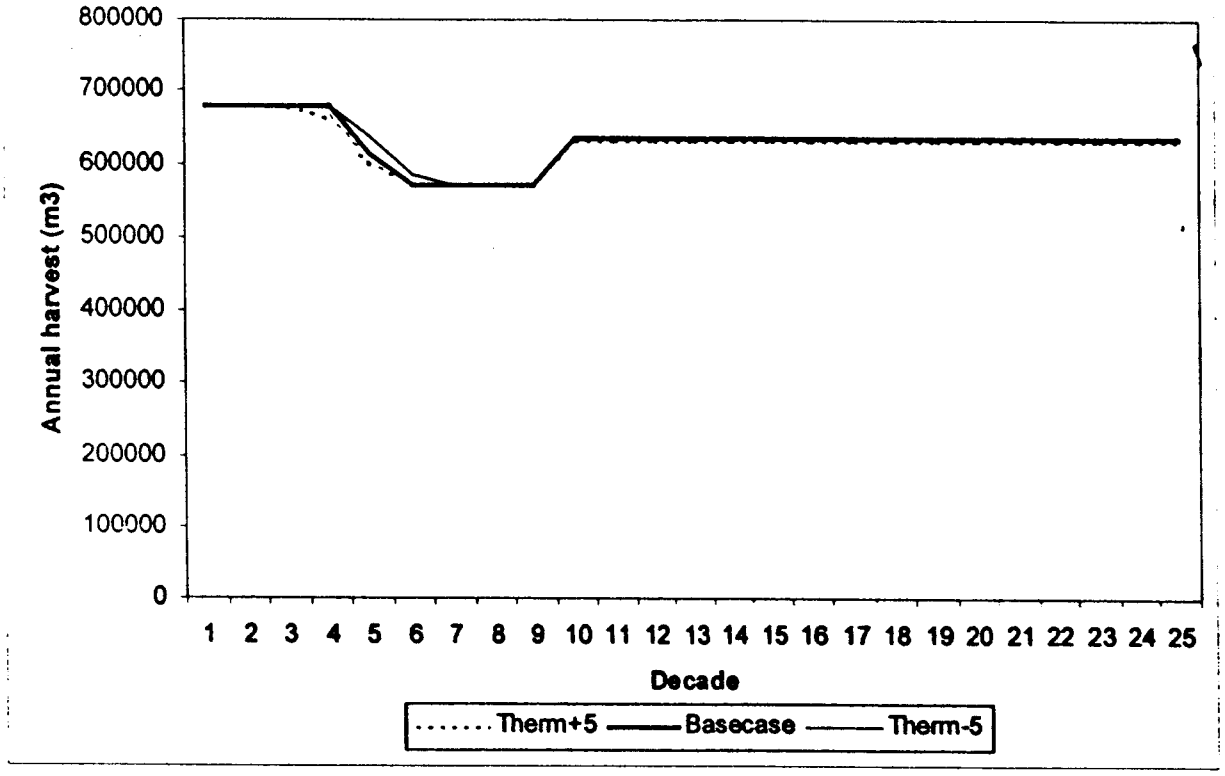

Figure 32. Net harvest levels – Alter ungulate winter range thermal cover objectives

7.14 Alter Maximum Disturbance Levels – VQO

When the VQO objectives established in the base case were altered by +/- 5%, the timber supply was significantly impacted, as shown in Table 16, and Figure 33. Again, as was the case in Section 7.10, this can be explained by the fact that the base case timber supply is constrained by the level of disturbance predicted for decade 2.

Table 16. Net harvest levels – Alter disturbance objectives – VQO

Decade	-5%	Base case	+5 %
1	680000	680000	680000
2	680000	680000	680000
3	646000	680000	680000
4	612000	680000	680000
5	572000	612000	666000
6	572000	572000	596000
7-9	559000	572000	572000
10+	632000	634000	637000

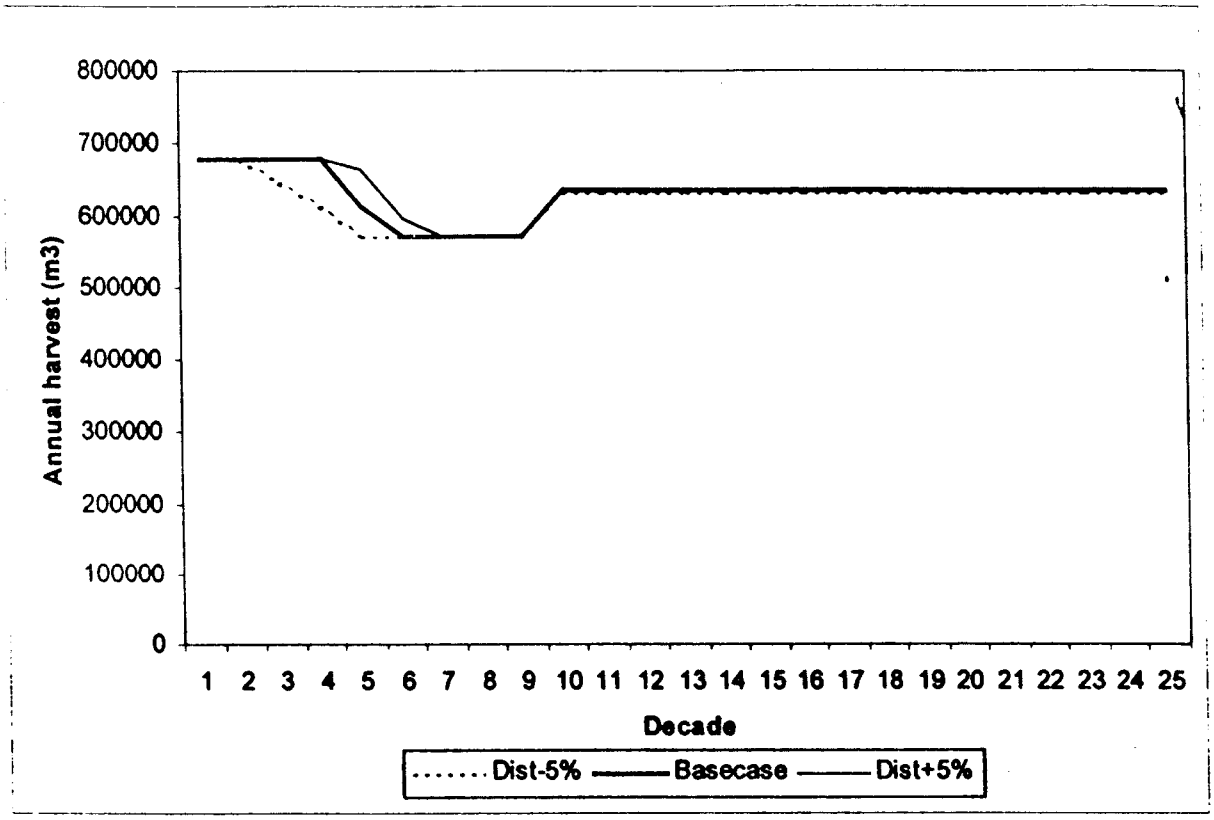

Figure 33. Net harvest levels – Alter disturbance objectives – VQO

7.15 Full Biodiversity Objectives in Low Emphasis Landscape Units

In the base case, only one-third of the old growth seral stage requirements were used initially for low emphasis biodiversity deployment landscape units. The objective sought was to meet the full biodiversity requirements over three rotations (240 years). The results were monitored to ensure that this in fact occurred in the analysis (Appendix 1). In this sensitivity analysis the full requirement was implemented immediately to determine if this would be constraining on timber supply. The results, as shown in Table 17 and Figure 34, indicate that this is clearly the case.

Table 17. Net harvest levels – Full biodiversity objectives in low emphasis

Decade	Base case	Full low emphasis
1	680000	680000
2	680000	680000
3	680000	612000
4	680000	612000
5	612000	572000
6-9	572000	572000
10+	634000	634000

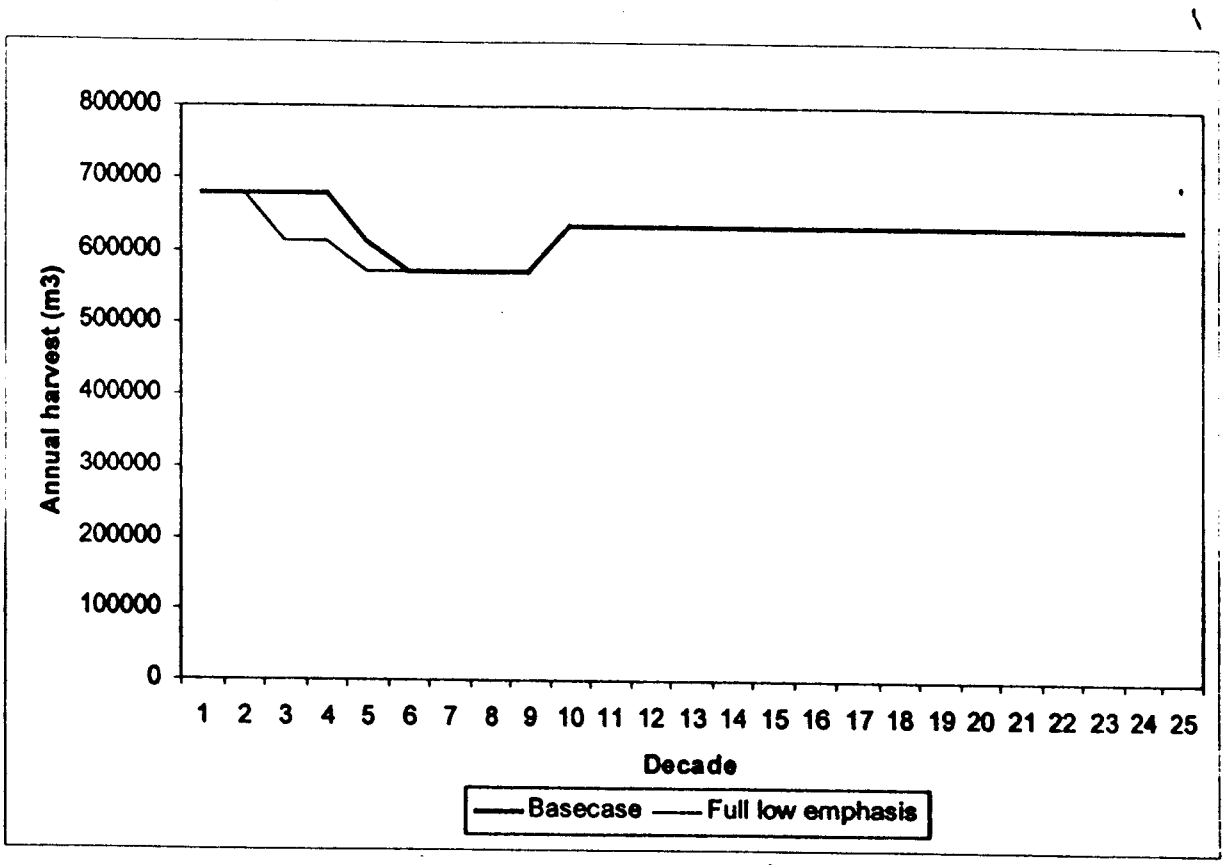

Figure 34. Full biodiversity objectives in low emphasis

7.16 Summary of Sensitivity Issues

Table 18 provides a summary of the impacts of the sensitivity issues explored in this section. Impacts (%) are only listed where the results differed from the base case by more that .5%. Impacts shown represent aggregate differences over the periods indicated, and are rounded to the nearest percentage value.

Table 18. Sensitivity analyses – summary

		Harvest level		
		Decades 1-4 (40 year total)	Decades 5-9 (50 year total)	Long-term (decadal)
Base Case Harvest (cubic metres) =		**27200000**	**29000000**	**6340000**
Issue tested	Change from base case			
Shelter Bay block	remove 24 500 ha		-10%	-11%
Marginal type contribution	shift 3 ,660 ha to harvestable status		+2%	1%
Aerial operability cont.	Shift 19 504 ha to non-harvestable status	-9%	-9%	-9%
Harvestable landbase	remove 10%	-10%	-10%	-10%
	add 10%	+10%	+10%	+10%
Low SI50 removal	Shift 4,360 ha (SI<9) to non-harvestable status	-1	-3	-1%
OGSI adjustments	increase regenerating yields		+8%	+12%
Natural stand yield tables	yield – 10%	-7%	-13%	
	yield + 10%	+3%	+17%	
Managed stand yield tables	yield – 10%		-1%	-10%
	yield + 10%		+1%	+10%
Minimum harvest ages (managed stands)	+10 years	-7%	-4%	
	-10 years		+10%	
Regeneration delay	3 years			
	1 year		+3%	
Disturbance levels (IRM, caribou, ungulates)	-5%	-5%		
	+5%		+2%	
Thermal cover objectives (caribou)	+5%	-3%		
	-5%		+2%	
Thermal cover objectives (ungulates)	+5%	-1%		-1%
	-5%		+1%	+1%
VQO disturbance objectives	-5%	-4%	-3%	
	+5%		+3%	
Low emphasis biodiversity	Full guidebook values	-5%	-2%	

Predictably, changes to the net harvestable landbase result in corresponding proportional changes to timber supply. While of interest, these changes are not anticipated to occur on TFL 23. Similarly, arbitrary changes in natural and managed stand yield forecasts have corresponding impacts on respectively short and long-term timber supplies. In terms of yield expectations, the OGSI adjustment impacts represent realistic expectations for increases in long-term yield, although they have not been incorporated into the base case, following the direction given by the Ministry of Forests.

Timber supply is very sensitive to changes in minimum harvest ages. Given the conservative nature of the minimum harvest ages employed in the base case, this represents a significant opportunity to enhance mid-term timber supplies, if earlier harvest age estimates can be substantiated.

The sensitivity of timber supply to changes in maximum disturbance levels is of concern, given the current state of flux with respect to these policies. Policy changes which result in more restrictive disturbance levels will result in significant downward pressure on the short-term timber supply on TFL 23. On the other hand, intensive landscape level planning efforts could result in significant improvement in short-term timber supplies. For example, although the current VQO maximum disturbance levels significantly impact on timber availability in the first 40 years, relaxation of these requirements in specific landscape units could enable harvesting activities specifically designed to lessen existing visual impacts.

The existing wildlife objectives also exert significant downward pressure on timber availability over the next 40 years. Pope and Talbot has undertaken an extensive re-valuation of caribou habitat requirements on TFL 23. The result has been a redefinition of the boundaries of identified caribou management areas. The impact of this change is explored in the next section.

8. Option 2. Pope and Talbot Caribou Habitat Option

A second option has also been analyzed. This option employs all of the base case inputs, with the exception of the definition of caribou management zones. In the base case, caribou management zones were those defined in the Kootenay-Boundary Land Use Plan (KBLUP) Implementation Strategy. However, Pope and Talbot has been redefining caribou habitat mapping and definition of habitat range using five years of telemetry data and field inventory studies. The resultant habitat zones encompass less area than was mapped for the KBLUP strategy, and have not at this time been fully accepted by the Ministry of Environment, Lands and Parks (MoELP). These refined zones were employed in Option 2.

The timber supply scenario associated with this option is presented in Table 19 and Figure 35. This analysis should be viewed as preliminary, as the full integration of the refined linework into the timber supply analysis database was not complete at the time of analysis. To evaluate this option, an earlier stage of the database was employed. This database included all of the themes incorporated into the final dataset, with the exception of existing and future road allowances. A relative impact was derived from this database by comparing the impacts of employing KBLUP *vs.* Pope and Talbot caribou linework. This relative impact (+19,000 cubic metres/year) was then applied to the base case results.

Table 19. Net harvest levels – Pope and Talbot Caribou option

Decade	Base case	Caribou option
1	680000	699000
2	680000	699000
3	680000	699000
4	680000	699000
5	612000	631000
6-9	572000	591000
10+	634000	634000

The results of this analysis indicate that the Pope and Talbot caribou habitat definition is significantly less restrictive, making it possible to increase the annual harvest by approximately 19,000 cubic metres/year for the first 9 decades. While this analysis is preliminary in nature, owing to limitations on data readiness at time of analysis, it serves to demonstrate significant potential to mitigate impacts on timber supply associated with the protection of caribou habitat.

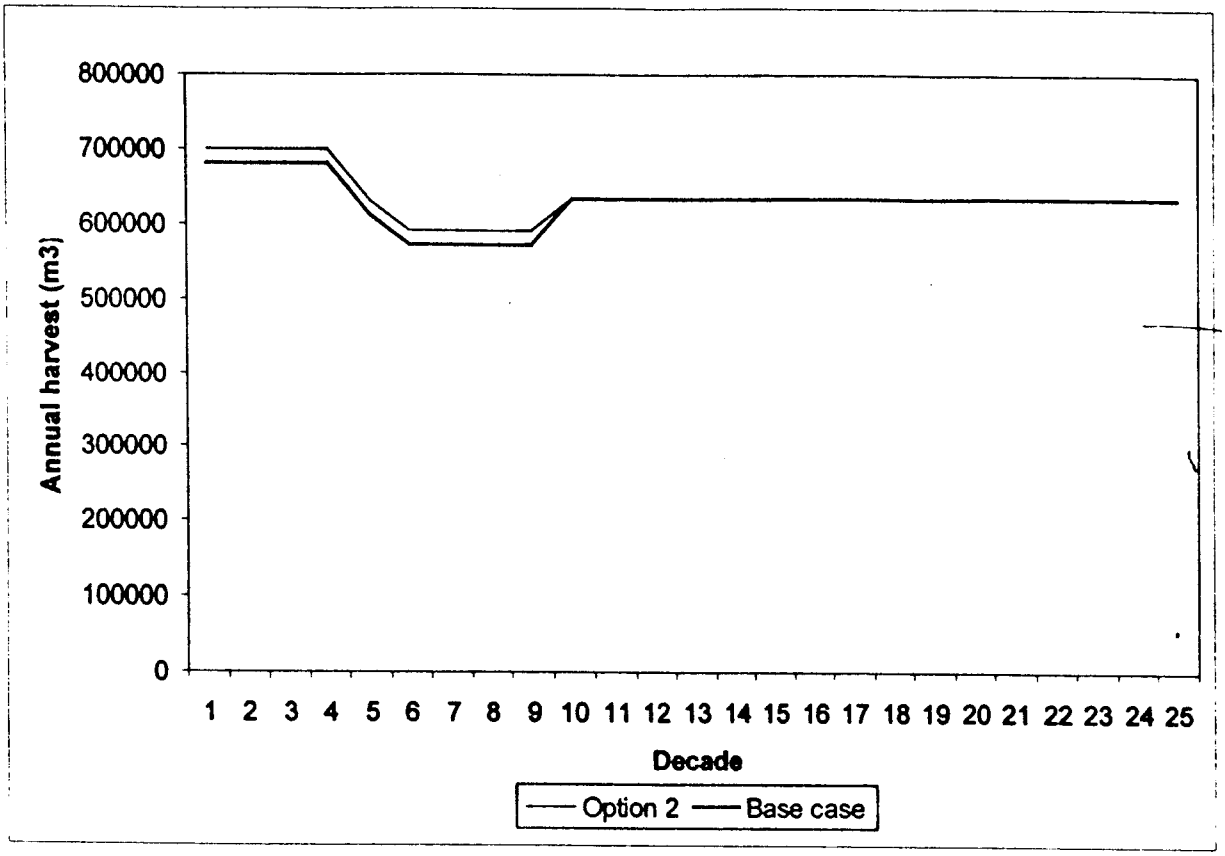

Figure 35. Pope and Talbot caribou option

9. Recommendations

Based on the results presented in this report, the following recommendations are put forward.

9.1 Allowable Annual Cut

It is proposed that the AAC for TFL 23 be set at 680,000 cubic metres for the period January 1, 1999 to December 31, 2003. This harvest is maintainable for a period of 40 years. It is then reduced by 10% in the fifth decade, and by 6.5% in the sixth decade to a minimum level of 572,000 cubic metres. The long-term level of 634,000 cubic metres is attained in decade 10.

This proposal is supported by the following analysis results:

1. The sustainability of the proposed AAC over a forty year period is clearly demonstrated.
2. Mid-term reductions are modest, and reasonable given the productive capacity of the landbase.
3. Long-term productivity is maintained within 8% of the theoretical maximum productivity of the landbase.
4. Sensitivity analyses demonstrate that the first decade harvest level is attainable, even under significant downward pressures.
5. The attendant 20-year spatial analysis demonstrates that, under a spatially explicit assessment of cut block adjacency requirements, the recommended AAC is in fact attainable over the 20 year spatial time frame.

9.2 Timber Supply Uncertainties

9.2.1 Availability of Second Growth Volumes

Harvest volumes for the first 7 decades originate largely from existing mature and thrifty stands. Beyond this point, the harvest relies mainly on volume availability from regenerating managed stands. Timber availability is most constrained in decade 9, and further increases in supply are limited by this availability. Significant opportunities exist to extend the current AAC beyond the fourth decade if earlier minimum harvest ages can be achieved in second growth types.

9.2.2 Impact of Maximum Disturbance Levels on Timber Supply

While the analysis demonstrates that the recommended AAC is attainable even with tightened disturbance requirements, forest cover disturbance levels are very close to the maximum levels during the first two decades. However, the disturbance levels defined in the analyses are surrogates for spatial objectives, which relate to the desirability of achieving specific forest structural patterns across the landscape. While the 20 year spatial feasibility analysis demonstrates feasibility under the terms of reference of the analysis, further opportunities to enhance timber supply are expected through additional landscape-level spatial analyses.

9.2.3 Impact of Wildlife Objectives on Timber Supply

Wildlife objectives, particularly caribou habitat requirements, exert significant downward pressure on timber supply, particularly in the mid-term. As demonstrated in Option 2, a more specific definition of habitat, resulting in smaller management zones, lessens this pressure significantly. Therefore, significant mid-term timber supply opportunities can be realized through application of these improved habitat definitions.

From the perspective of regional economic benefits, the incremental improvement in timber supply associated with the Pope and Talbot option 2 is significant. Based on an analysis prepared by the Interior Lumber Manufacturer's Association (ILMA) in 1996 for the Nelson Forest Region, it is estimated that each 1000 cubic metres of timber harvested equates to 1.43 direct jobs and 2.5 indirect and induced jobs, for a total of 3.93 jobs. Each job represents approximately 9 months of employment. Therefore, the additional 19,000 cubic metres of annual harvest available under Option 2 equates to 27 additional direct jobs and 47 additional indirect jobs.

Appendix 1. Base Case Seral Stage and Forest Cover Summaries

Tables A1-A5 provide summaries of the seral stage and resource emphasis status by landscape unit. The target levels are presented, along with the actual percentages for specific periods in the simulation.

If disturbance maximums are initially exceeded, harvesting cannot occur until sufficient area has reached green-up age to reduce the disturbance percentage below the maximum. Once the maximum disturbance level has been reached within a management zone, the model will not permit the disturbed area to again exceed the maximum.

If seral stage, thermal or old growth minimum percentages are not met within a seral stage zone or management zone, the model will reserve from harvest sufficient area in the oldest ages below the target age, to make up the deficit. If surplus harvestable area still is available after this reservation, it can be scheduled for harvest.

Note: Occasionally the values reported in Tables A1-A5 will drop below the minimums or increase above the maximums by 1 percentage point. These reflect rounding errors.

Table A1. Seral stage percentages – base case – mature+old

LU	Variant	NDT	BEO	Target	Achieved by period					
					Initial	5	10	15	20	25
1	AT p	5	average	30	94	98	98	100	100	100
1	ESSFwc 1	1	average	30	14	14	14	100	100	100
1	ESSFwc 4	1	average	30	79	70	72	78	77	78
1	ESSFwcp4	5	average	30	100	100	100	100	100	100
1	ICH mw 2	2	average	25	65	35	42	36	34	35
1	ICH mw 3	3	average	20	33	20	20	17	16	19
1	ICH wk 1	1	average	28	42	28	30	29	29	30
2	AT p	5	average	30	96	96	96	100	100	100
2	ESSFwc 4	1	average	30	72	44	46	49	46	48
2	ICH mw 2	2	average	25	56	65	53	39	42	40
2	ICH mw 3	3	average	20	29	29	41	32	33	32
2	ICH wk 1	1	average	28	40	28	37	38	41	37
4	AT p	5	average	30	97	98	98	100	100	100
4	ESSFwc 4	1	average	30	93	79	78	82	80	80
4	ICH mw 3	3	average	28	70	31	31	28	28	29
4	ICH wk 1	1	average	28	81	81	97	97	97	97
10	ESSFwc 1	1	intermed	36	32	36	34	36	33	36
10	ESSFwc 4	1	intermed	36	41	35	36	35	36	36
10	ICH dw	3	intermed	23	29	60	47	43	45	45
10	ICH mw 2	2	intermed	31	30	51	31	31	30	30
11	ESSFwc 1	1	intermed	36	24	36	35	35	36	35
11	ESSFwc 4	1	intermed	36	47	36	34	35	35	36
11	ESSFwcp4	5	intermed	36	94	94	94	100	100	100
11	ICH dw	3	intermed	23	38	67	44	47	43	45
11	ICH mw 2	2	intermed	31	26	47	37	31	31	31
11	IDF unn	4	intermed	34	25	63	41	41	39	39
18	ESSFwc 1	1	low	19	21	27	40	46	45	45
18	ESSFwc 4	1	low	19	46	44	64	70	68	69
18	ESSFwcp4	5	low	19	69	83	87	100	100	100
18	ICH dw	3	low	14	57	52	47	47	49	56
18	ICH mw 2	2	low	15	45	42	34	34	35	34
20	ESSFwc 1	1	intermed	36	32	36	36	36	36	34
20	ESSFwc 4	1	intermed	36	62	37	39	44	41	43
20	ESSFwcp4	5	intermed	36	91	91	91	100	100	100
20	ICH dw	3	low	14	37	39	41	50	34	26
20	ICH mw 2	2	low	15	44	24	21	20	20	21
20	ICH wk 1	1	low	17	66	23	25	28	26	25
21	ESSFwc 1	1	intermed	36	32	53	45	44	37	37
21	ESSFwc 4	1	intermed	36	42	55	60	64	62	62
21	ESSFwcp4	5	intermed	36	64	82	97	100	100	100
21	ICH mw 2	2	intermed	31	66	49	36	31	31	32
26	ESSFwc 1	1	low	19	43	30	37	51	56	41
26	ESSFwc 4	1	low	19	81	69	70	88	92	76
26	ESSFwcp4	5	low	19	100	100	100	100	100	100
26	ICH mw 2	2	low	15	47	32	38	34	34	36
27	ESSFwc 1	1	intermed	36	58	35	36	35	32	36
27	ESSFwc 4	1	intermed	36	75	47	47	56	53	53
27	ESSFwcp4	5	intermed	36	100	100	100	100	100	100
27	ICH mw 2	2	low	15	50	17	19	20	20	20
27	ICH wk 1	1	low	17	57	27	32	36	38	36
29	ESSFwc 1	1	high	54	79	60	64	69	67	67
29	ESSFwc 4	1	high	54	85	78	81	91	89	89
29	ESSFwcp4	5	high	54	83	83	88	100	100	100
29	ICH mw 2	2	intermed	31	57	43	38	36	38	37
29	ICH wk 1	1	intermed	34	74	54	61	61	59	58
30	ESSFwc 1	1	high	54	81	54	54	59	54	55
30	ESSFwc 4	1	high	54	82	72	72	85	87	85
30	ESSFwcp4	5	high	54	81	83	84	100	100	100
30	ICH mw 2	2	high	46	55	45	46	45	46	44
30	ICH vk 1	1	high	51	82	55	57	55	53	54
30	ICH wk 1	1	high	51	68	51	55	50	51	50
31	ESSFvc	1	low	19	97	97	99	99	99	99
31	ESSFvcp	5	low	19	95	95	95	100	100	100
31	ESSFwc 1	1	low	19	84	57	55	61	64	64
31	ESSFwc 4	1	low	19	85	77	79	88	88	87
31	ESSFwcp4	5	low	19	72	74	82	100	100	100
31	ICH mw 2	2	low	15	39	33	25	26	26	26
31	ICH vk 1	1	low	17	70	43	83	56	54	57
31	ICH wk 1	1	low	17	68	58	59	64	65	64

Table A2. Seral stage percentages – base case – old

LU	Variant	NDT	BEO	Target	Initial	Achieved by period 5	10	15	20	25
1	AT p	5	average	14	0	94	94	94	98	99
1	ESSFwc 1	1	average	14	0	14	14	14	14	92
1	ESSFwc 4	1	average	14	3	68	68	69	71	74
1	ESSFwcp4	5	average	14	0	100	100	100	100	100
1	ICH mw 2	2	average	3	1	7	7	25	32	34
1	ICH mw 3	3	average	5	33	20	10	15	11	11
1	ICH wk 1	1	average	4	6	26	21	17	19	25
2	AT p	5	average	14	0	96	96	96	96	100
2	ESSFwc 4	1	average	14	0	43	43	44	45	46
2	ICH mw 2	2	average	3	0	8	7	19	26	38
2	ICH mw 3	3	average	5	28	15	19	31	31	31
2	ICH wk 1	1	average	4	1	22	22	23	28	36
4	AT p	5	average	14	0	97	97	97	98	100
4	ESSFwc 4	1	average	14	2	76	74	76	77	80
4	ICH mw 3	3	average	5	34	25	25	27	27	27
4	ICH wk 1	1	average	4	14	73	73	75	80	97
10	ESSFwc 1	1	intermed	19	2	19	18	19	21	23
10	ESSFwc 4	1	intermed	19	0	20	18	18	25	24
10	ICH dw	3	intermed	14	17	17	42	41	41	41
10	ICH mw 2	2	intermed	9	2	9	8	9	17	19
11	ESSFwc 1	1	intermed	19	0	13	16	19	23	28
11	ESSFwc 4	1	intermed	19	0	23	17	19	20	25
11	ESSFwcp4	5	intermed	19	0	88	88	94	94	94
11	ICH dw	3	intermed	14	15	16	41	43	43	43
11	ICH mw 2	2	intermed	9	0	0	0	9	20	27
11	IDF unn	4	intermed	13	0	0	4	8	38	39
18	ESSFwc 1	1	low	6	0	7	6	12	31	42
18	ESSFwc 4	1	low	6	0	19	22	35	53	67
18	ESSFwcp4	5	low	6	0	40	55	77	83	96
18	ICH dw	3	low	5	28	26	41	47	47	48
18	ICH mw 2	2	low	3	0	3	3	7	20	26
20	ESSFwc 1	1	intermed	19	2	19	18	18	19	23
20	ESSFwc 4	1	intermed	19	1	32	29	31	33	38
20	ESSFwcp4	5	intermed	19	2	88	88	91	91	92
20	ICH dw	3	low	5	12	6	29	38	33	26
20	ICH mw 2	2	low	3	2	3	2	5	11	18
20	ICH wk 1	1	low	4	37	11	11	13	19	21
21	ESSFwc 1	1	intermed	19	2	18	18	18	31	36
21	ESSFwc 4	1	intermed	19	0	19	20	27	55	62
21	ESSFwcp4	5	intermed	19	0	63	64	64	90	100
21	ICH mw 2	2	intermed	9	2	5	6	13	21	27
26	ESSFwc 1	1	low	6	0	17	17	25	29	35
26	ESSFwc 4	1	low	6	0	58	58	64	68	72
26	ESSFwcp4	5	low	6	0	96	96	100	100	100
26	ICH mw 2	2	low	3	1	3	3	7	11	18
27	ESSFwc 1	1	intermed	19	6	29	28	21	19	23
27	ESSFwc 4	1	intermed	19	4	44	44	45	46	49
27	ESSFwcp4	5	intermed	19	0	100	100	100	100	100
27	ICH mw 2	2	low	3	3	4	4	8	9	15
27	ICH wk 1	1	low	4	7	12	12	20	26	30
29	ESSFwc 1	1	high	28	13	44	45	54	57	63
29	ESSFwc 4	1	high	28	7	68	69	75	77	81
29	ESSFwcp4	5	high	28	3	80	80	83	85	90
29	ICH mw 2	2	intermed	9	3	12	13	19	24	29
29	ICH wk 1	1	intermed	13	21	37	37	46	49	56
30	ESSFwc 1	1	high	28	6	46	45	45	41	46
30	ESSFwc 4	1	high	28	3	67	64	67	69	73
30	ESSFwcp4	5	high	28	1	80	80	83	83	87
30	ICH mw 2	2	high	13	3	22	18	27	36	40
30	ICH vk 1	1	high	19	10	37	36	52	51	52
30	ICH wk 1	1	high	19	16	40	37	36	39	47
31	ESSFvc	1	low	6	2	97	97	97	99	99
31	ESSFvcp	5	low	6	0	95	95	95	95	100
31	ESSFwc 1	1	low	6	17	54	51	51	52	59
31	ESSFwc 4	1	low	6	9	74	74	75	75	83
31	ESSFwcp4	5	low	6	6	72	72	72	75	94
31	ICH mw 2	2	low	3	3	5	5	11	20	25
31	ICH vk 1	1	low	4	23	35	35	38	41	52
31	ICH wk 1	1	low	4	12	28	27	33	49	59

Table A3. REA disturbance percentages – base case

LU	REA	Age	Target	Achieved by period					
				Initial	5	10	15	20	25
1	Uwr-ich	15	25	3	5	18	5	22	8
1	IRM	15	25	15	11	24	14	24	17
2	Dom-H20	27	25	28	3	24	15	24	17
2	Uwr-ich	15	25	4	0	24	1	22	3
2	IRM	15	25	27	16	24	10	24	13
4	Dom-H20	27	25	0	24	10	24	24	24
4	Uwr-ich	15	25	3	17	8	16	8	21
4	IRM	15	25	4	24	16	24	15	24
10	Dom-H20	27	25	14	13	25	24	24	25
10	Uwr-ich	15	25	1	17	10	17	14	14
10	IRM	15	25	4	19	11	17	13	18
11	Com-H20	36	20	0	5	9	11	10	10
11	Dom-H20	27	25	17	16	24	19	24	22
11	Uwr-ich	15	25	1	24	5	22	4	18
11	Uwr-idf	15	25	9	21	18	17	18	18
11	IRM	15	25	3	11	16	9	12	16
18	VQO-east	24	15	0	14	14	14	14	14
18	Com-H20	36	20	16	19	19	20	20	19
18	Dom-H20	27	25	1	25	23	24	24	25
18	Uwr-ich	15	25	1	18	10	22	8	24
18	IRM	15	25	6	18	11	21	15	23
20	VQO-east	24	15	10	14	14	14	14	14
20	Dom-H20	27	25	2	24	24	16	24	23
20	Uwr-ich	15	25	0	24	7	24	7	16
20	IRM	15	25	7	18	14	19	16	16
21	VQO-east	24	15	0	14	14	14	14	14
21	Dom-H20	27	25	21	24	24	24	24	24
21	Uwr-ich	15	25	0	0	7	20	0	20
21	IRM	15	25	8	25	8	24	9	24
26	VQO-west	24	15	14	14	15	15	15	15
26	Dom-H20	27	25	14	12	24	12	13	14
26	Uwr-ich	15	25	9	10	12	16	12	23
26	IRM	15	25	4	20	20	21	21	22
27	VQO-east	24	15	12	14	14	14	14	14
27	Uwr-ich	15	25	11	9	15	7	11	0
27	IRM	15	25	15	22	20	22	24	22
29	Car-essf	15	25	3	24	8	24	17	23
29	Car-ich	15	25	8	10	12	14	12	15
29	VQO-east	24	15	7	14	14	14	14	14
29	Com-H20	36	20	36	8	18	18	16	17
29	Dom-H20	27	25	13	25	21	25	24	24
29	Uwr-ich	15	25	4	19	8	14	7	17
29	IRM	15	25	7	24	13	24	13	24
30	Car-essf	15	25	7	24	9	24	17	15
30	Car-ich	15	25	5	3	19	6	19	7
30	Com-H20	36	20	31	19	19	13	18	19
30	Dom-H20	27	25	11	13	23	18	24	18
30	IRM	15	25	3	3	24	16	24	16
31	Car-essf	15	25	0	23	2	22	16	17
31	Car-ich	15	25	0	8	1	19	2	18
31	Dom-H20	27	25	2	24	12	19	24	20
31	Uwr-ich	15	25	0	18	0	18	0	13
31	IRM	15	25	16	24	23	24	24	24

Table A4. REA thermal percentages – base case

LU	REA	Age	Target	Achieved by period					
				Initial	5	10	15	20	25
1	Uwr-ich	120	40	44	40	40	40	40	40
2	Uwr-ich	120	40	20	37	40	40	40	40
4	Uwr-ich	120	40	31	40	40	40	40	40
10	Uwr-ich	120	40	25	40	40	40	40	40
11	Uwr-ich	120	40	18	45	39	39	39	39
11	Uwr-idf	120	25	6	30	27	27	24	24
18	Uwr-ich	120	40	44	39	39	39	39	39
20	Uwr-ich	120	40	21	46	40	42	40	40
21	Uwr-ich	120	40	0	40	40	79	71	71
26	Uwr-ich	120	40	22	39	39	39	39	39
27	Uwr-ich	120	40	15	76	45	53	67	64
29	Car-essf	140	30	82	31	29	34	29	29
29	Car-ich	140	40	48	40	40	40	40	40
29	Uwr-ich	120	40	52	40	40	40	40	40
30	Car-essf	140	30	82	33	29	29	29	29
30	Car-ich	140	40	59	40	40	39	39	39
31	Car-essf	140	30	97	36	30	30	30	30
31	Car-ich	140	40	96	51	47	47	47	47
31	Uwr-ich	120	40	4	56	81	81	81	81

Table A5. REA old growth percentages – base case

LU	REA	Age	Target	Achieved by period					
				Initial	5	10	15	20	25
29	Car-essf	250	10	8	15	16	24	18	19
29	Car-ich	250	10	14	28	29	34	36	39
29	Car-oper	140	70	77	74	80	89	88	88
30	Car-essf	250	10	6	28	23	21	16	16
30	Car-ich	250	10	13	30	28	30	34	38
30	Car-oper	140	70	79	71	72	86	84	85
31	Car-essf	250	10	2	36	29	27	17	14
31	Car-ich	250	10	14	50	46	47	47	47
31	Car-oper	140	70	89	82	86	87	86	86

APPENDIX V

V.3 Chief Forester's Rationale For AAC Determination