APPENDIX III

Timber Supply Analysis

- Timber Supply Analysis (September, 2000)
- Addendum to the Timber Supply Analysis (March, 2001)

Weyerhaeuser Company Limited

Tree Farm Licence 39

Timber supply analysis in support of

Management Plan #8

September 2000

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Executive Summary

This report describes a timber supply analysis that is part of Management Plan #8 for Tree Farm Licence 39, held by Weyerhaeuser Company Limited. The analysis is part of the Timber Supply Review. The analysis was undertaken using the company inventory and growth and yield information, and the British Columbia Forest Service simulation model FSSIM.

The analysis models current forest management practices, including all required aspects of the Forest Practices Code, local issues raised by the Forest Districts, and the company stewardship zones and variable retention harvesting practices.

The analysis finds that the planned gradual rate of decline in harvest levels described in previous management plans remains sustainable. The base case results indicate a first-period harvest level of 3.66 million m^3/yr, which is 2.1% lower than the 1996–2000 harvest level. Further declines in harvesting of 9.1% occur over the next 40 years, by which time harvesting reaches a long-term sustainable level of 3.33 million m^3/yr.

The analysis tested options for alternative land base, growth and yield, and forest management assumptions. The options show that short-term harvest levels are not sensitive to changed assumptions. Mid- and long-term harvest levels are sensitive to estimates of existing timber volumes and future rates of growth, land base withdrawals, and the amount of timber left unharvested in variable retention units. The options also show that harvest levels are not significantly sensitive to biodiversity or visual quality requirements, older minimum harvest ages, or the utilization of currently uneconomic timber.

The analysis separately modelled each of the six harvest units that constitute TFL 39. This report presents summarized results. A data CD is included that presents base case and all option results for each individual harvest unit.

Acknowledgements

This analysis builds on the work of others. Shawn Ellsworth assembled the GIS inventory data. Nick Smith developed the site index assignment and stand regeneration models. Kurt Raynor assigned the cruised second-growth stands to yield tables. Bill Wilson developed the model yield tables using the company growth model Y-XENO.

Peter Kofoed authored the Information Package. The Information Package explains all the management assumptions used in the analysis, including the work done by Nick and Kurt, the Weyerhaeuser philosophy of stewardship zones and variable retention, and methods used to model the Forest Practices Code and other current forest management requirements.

Peter was also closely involved in the derivation of the timber harvesting land base and development of the FSSIM models. Peter was exacting, meticulous, and fair in all aspects of the project. His familiarity with the TFL 39 land base and forest inventory was invaluable in conducting an accurate analysis.
I gratefully thank Peter for his support, enthusiasm, and professionalism.

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Timber supply analysis in support of Management Plan #8

1.0 INTRODUCTION

As part of the Tree Farm Licence obligations, the licensee must submit a management plan for the licence area once every 5 years. Management Plan #8 (MP#8) is a continuation of the 40-year history of forest management in TFL 39. Forest practices have evolved even since Management Plan #7, with the adoption of variable retention harvesting, stewardship zones, and the implementation of the Forest Practices Code. Silvicultural practices continue to evolve, with increased expectations of gain from genetically selected seed sources. Management for recreation and visual resources is developing into a science.

MP#8 describes the licensee’s intent and methods for managing timber and non-timber resources in the license area. An important component of the Management Plan is a proposed rate of harvest. The proposal is supported by a timber supply analysis that demonstrates the consequences of that harvest level.

The timber supply analysis is the process of assessing the factors that influence timber availability — economic, physical, biological, and social — for the TFL 39 land base. This analysis looks ahead 250 years, and projects changes in the forest that will occur during that time under different management scenarios. The timber supply analysis tests sustainable harvest levels on the TFL 39 land base, modelling all current forest management guidelines and practices.

1.1 Description of TFL 39

Tree Farm Licence 39 (TFL 39) consists of seven supply blocks on the coast of British Columbia, from north of Vancouver to west of Bella Coola, with units on Vancouver Island, the Queen Charlotte Islands, and smaller islands along the coast. TFL 39 is held by Weyerhaeuser Company Limited, and is managed by four timberlands operations; Queen Charlotte (Queen Charlotte Islands), Port McNeill, North Island (north of Campbell River), and Stillwater (Powell River). The TFL is divided into six working circles. Figure 1 is a key map to the location of the six working divisions. This analysis separately models current management within each working circle and reports aggregated results.

TFL 39 Map - Coastal British Columbia

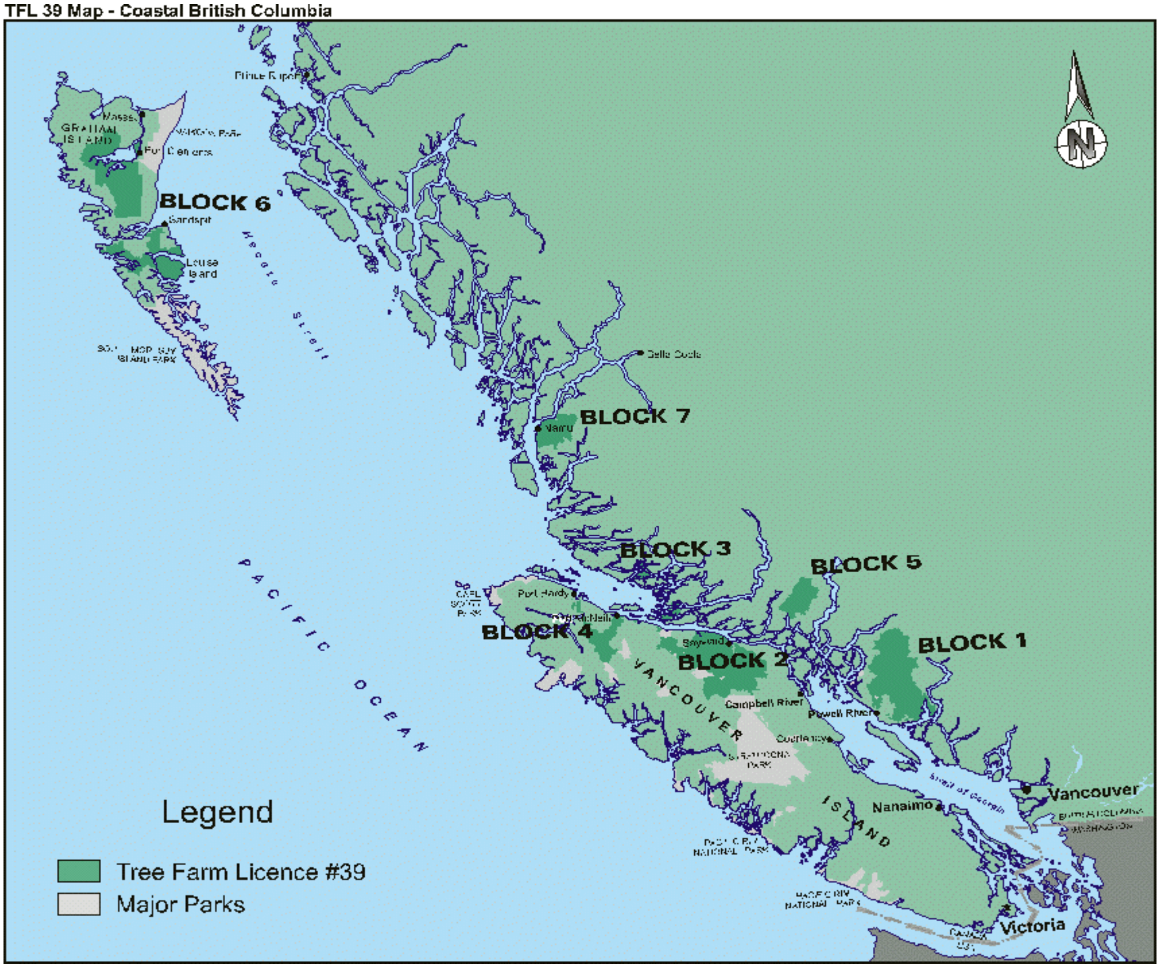

Figure 1. Key map to the location of supply blocks in TFL 39.

TFL 39 covers a total 801,393 ha, of which 68% are stocked with productive forest. The majority of this area is in the Coastal Western Hemlock biogeoclimatic zone, with some areas in the Mountain Hemlock zone at higher elevations. The dominant tree species is hemlock, although stands of Douglas-fir are common in southern areas. The total area considered available and suitable for timber production is 369,970 ha, which is 67% of the productive forest and 46% of the total TFL 39 area. Approximately 43% of the area suitable and available for timber production is presently stocked with old-growth stands, and the remaining 57% is stocked with regenerating forest up to 130 years of age.

The annual allowable cut (AAC) for TFL 39 is 3.74 million m^3/yr. This harvest rate is apportioned among the six divisions as listed in Table 1.

TABLE 1. Administration and allowable annual cut apportionment for TFL 39.

Supply Block	Block Name	MoF Forest District	Weyerhaeuser Operations	AAC contribution (m^3/yr)
Block 1	Powell River	Sunshine Coast	Stillwater	445,000
Block 2	Adam River	Campbell River	North Island	1,335,000
Block 3|4	Coast Islands|Port Hardy	Port McNeill	Port McNeill	415,000
Block 5	Phillips River	Campbell River	Stillwater	100,000
Block 6	Queen Charlotte Islands	Queen Charlotte	Queen Charlotte	1,210,000
Block 7	Namu	Mid-Coast	Port McNeill	195,000
Sub-total	TFL 39			3,700,000
Deciduous	(Not block specific)			40,000
Total AAC	TFL 39			3,740,000

The harvest from TFL 39 creates approximately 5,000 direct jobs on the BC Coast. Most of the woodlands jobs are located in communities on Northern Vancouver Island, Queen Charlotte Islands and Powell River / Sunshine Coast. The processing jobs occur mainly in Powell River, Nanaimo, Chemainus, Port Alberni and the Lower Mainland. Of the total direct jobs, approximately 35% are on Vancouver Island, 25% in the Powell River / Sunshine Coast area, the Queen Charlotte Islands and the Mid Coast and 40% in Vancouver / Lower Mainland.
An additional workforce is employed or contracted to undertake silviculture activities and specialist consultants (biologists, foresters, engineers, and technicians) work with Weyerhaeuser on contract.

The TFL 39 land base is actively managed for recreation and visual landscape amenity values and for fish and wildlife production. Weyerhaeuser does not draw direct revenue from the recreation or the fish and wildlife values that it produces, and does not include employment that those values provide in the 4,000-persons employment estimate.

2.0 INFORMATION PREPARATION FOR THE TIMBER SUPPLY ANALYSIS

A timber supply analysis applies current forest management and growth and yield information to the current inventory. The analysis builds a computer model of each forest that is used to test harvest levels and their consequences. The computer model can also be used to test alternative management practices and growth and yield assumptions. The following sections describe the input components to the six models developed for this project.

2.1 Land base inventory

Weyerhaeuser maintains the land base and forest inventory in a geographic information system (GIS). The 120 layers of attributes required for the timber supply analysis were compiled from the GIS information and provided by Weyerhaeuser in the fall of 1999. The inventory information describes in great detail the geographic location, area and nature of forest cover, and administrative boundaries within TFL 39. The inventory is current to 1995.

The provided files are the results of overlay of the required inventory information, rather than the raw map information. The TFL 39 database describes 2.3 million unique pieces of land. The database includes netdown factors developed using definitions in the Information Package (TFL 39, MP#8 Timber Supply Analysis Information Package, October 1999). Those file netdown factors are used in the analysis. Some netdowns were changed in March 2000; those changes are reported in Appendix 1.

The inventory file represents the land base for the entire TFL 39. It includes information on land that does not contain forest (water bodies, rock, roads), and information on forested areas where timber harvesting is not expected to occur (wildlife habitat preserves, unstable soils, recreation sites). These areas do not contribute to forest harvesting opportunities in TFL 39. Before assessing timber supplies, these areas are identified and removed from the timber harvesting land base (THLB). These areas are not removed from TFL 39, they are simply placed into no-harvest status in the model.

Table 2 summarizes the areas removed from the inventory to define the THLB. The list is developed sequentially, and the area removed for items lower in the table may also contain area that has already been removed for reasons higher in the table. Overlapped areas are removed only once. Descriptions of the reasons for area removals are outlined here, and are further discussed in Appendix 1.

Areas removed from the inventory include:

- Areas not managed as part of TFL 39 — slivers contained at mapsheet edges, and other forest tenured areas within TFL 39.
- Parks and Protected Areas (as identified in the Protected Areas Strategy (PAS) in Blocks 2 and 4). These areas are not part of TFL 39 but are included in the comprehensive files.
- Non-forested areas (areas occupied by rock, swamp, alpine areas, water bodies).
- Non-commercial forest (scrub forest and brush areas).
- Roads (areas occupied by the permanent road access system).
- Physically inoperable areas (productive timber that is inaccessible).
- Environmentally sensitive areas (ESA) (sensitive for reasons of soil stability, anticipated regeneration problems, wildlife habitat needs, rare ecosystems, heritage values, and part of the Tsitika watershed).
- Riparian reserves (forest on the edges of lakes and fish-bearing streams—these areas are mapped, and an additional allowance was made for unmapped riparian areas).
- Economically inoperable areas (low timber volumes, low site productivity).
- Deciduous forest not expected to be harvested.
- Wildlife tree patches retained during harvest operations.
- Variable retention reserves of within-block patches.
- Culturally modified trees in Block 6.

TABLE 2. Derivation of the timber harvesting land base

Netdown category	Block 1 (ha)	Block 2 (ha)	Block 3|4 (ha)	Block 5 (ha)	Block 6 (ha)	Block 7 (ha)	TFL 39 (ha)
TFL 39 total area	**186,979**	**203,065**	**67,288**	**47,411**	**240,311**	**56,339**	**801,393**
Non-forest	34,983	4,756	3,518	12,731	12,112	6,169	74,269
Non-productive	55,562	28,031	8,364	19,588	35,163	20,283	166,991
Permanent roads	1,893	4,414	1,663	298	3,460	164	11,892
Productive forest	**94,542**	**165,864**	**53,743**	**14,793**	**189,576**	**29,723**	**548,241**
Inoperable	4,349	6,985	501	1,739	1,135	1,388	16,096
Environmentally sensitive	7,331	19,514	3,333	2,836	28,863	5,680	67,556
Mapped riparian	2,972	5,567	2,060	348	9,284	1,032	21,264
Uneconomic	1,382	2,003	1,077	315	7,909	2,950	15,636
Deciduous	1,189	744	139	17	833	2	2,924
Unmapped riparian	773	1,310	466	95	1,416	187	4,247
Wildlife tree patches	2,295	3,113	1,496	189	2,803	185	10,081
Variable retention patches	4,187	9,376	2,328	1,169	15,251	5,105	37,415
Culturally modified trees	0	0	0	0	3,052	0	3,052
Net current THLB area	**70,064**	**117,251**	**42,343**	**8,086**	**119,030**	**13,196**	**369,970**
Less future roads	2,003	3,063	810	89	4,061	420	10,446
Long-term THLB area	**68,061**	**114,188**	**41,533**	**7,997**	**114,969**	**12,776**	**359,524**

Figure 2 illustrates the fractions of the THLB contributed by each timber supply block. Blocks 1, 2 and 6 dominate TFL 39.

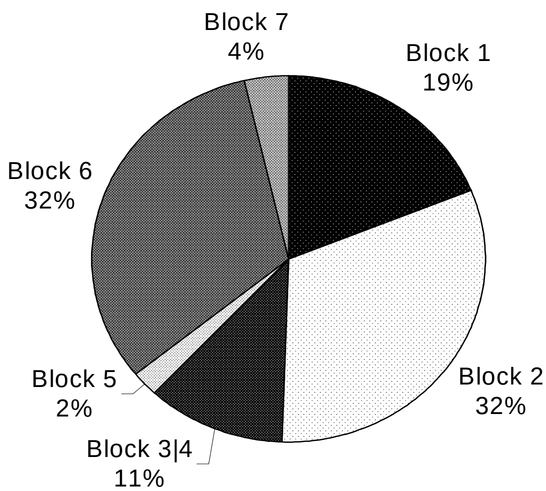

Figure 2. Proportion of THLB contributed by timber supply block.

Figure 3 shows the present composition of forests within the THLB by leading species and site class, and whether old- or second-growth timber. The two species groups are modelled. The Douglas-fir (F) group includes lodgepole pine and yellow cedar stands, and the hemlock (H) group includes spruce, balsam fir and red-cedar. Four site classes are defined in the models — high, good, medium, and poor. Refer to Appendix 1, "Definition of analysis units," for a discussion of species and site index considerations. The THLB is stocked 82% with hemlock and 18% with Douglas-fir. The THLB is 22% high site, 41% good site, 24% medium site, and only 12% poor site. Younger stands generally occur on the better growing sites within the THLB.

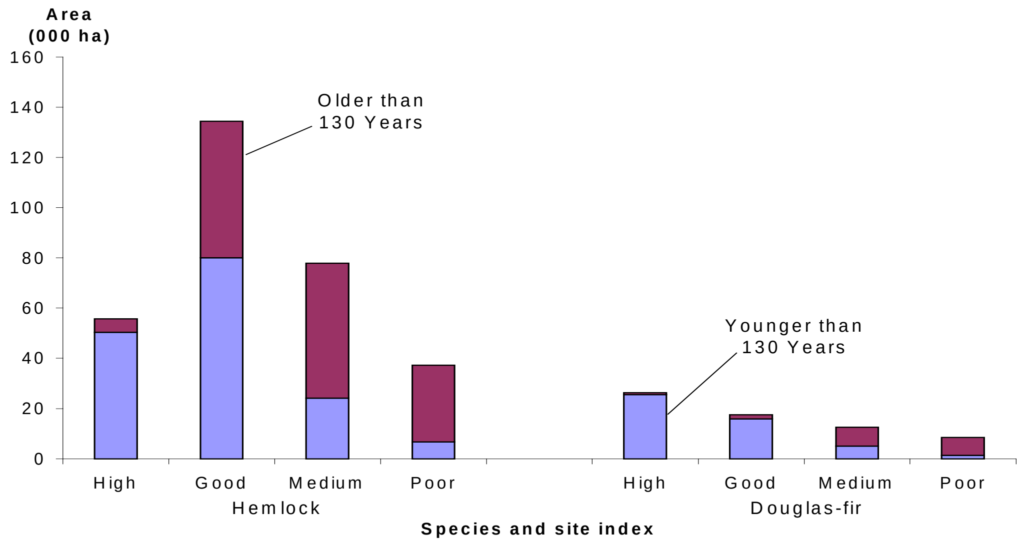

Figure 3. THLB area distribution by species and site index.

Figure 4 illustrates the distribution of area within the THLB by age class. The older forest (>130 years) occupies 43% of the THLB area and is 90% hemlock. Older second-growth (ages 33–130 years) occupies 25% of the THLB and are 68% hemlock. The youngest class of forest (less than 33 years old) occupies 31% of the THLB and is 84% hemlock. The Douglas-fir inventory mainly occurs (46%) in the 33–130 yr age class.

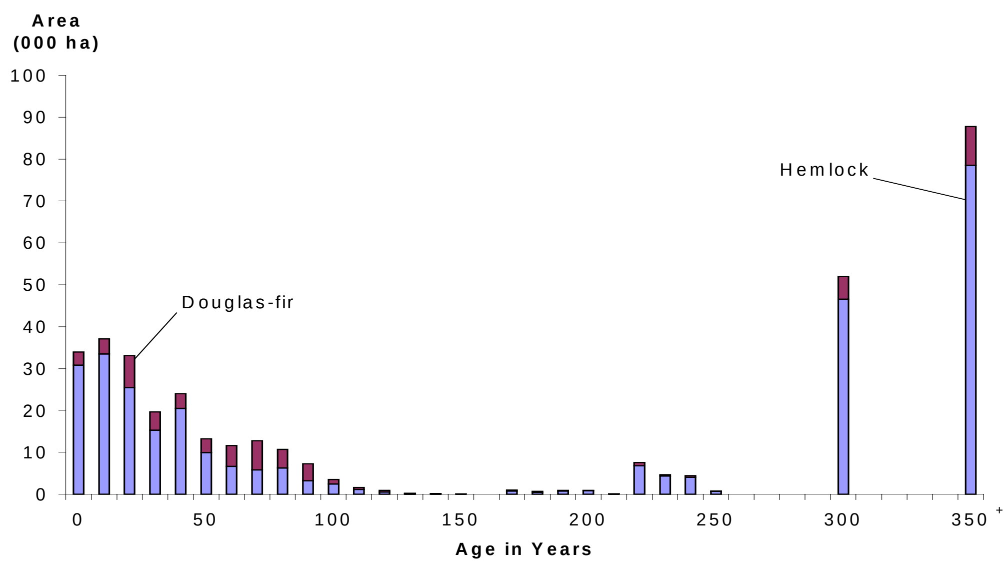

Figure 4. THLB age class distribution.

2.2 Timber growth and yield

Weyerhaeuser in-house models were used to develop estimates of the existing volumes and estimates of future timber volumes that will grow from present young stands and future regenerated stands. The inventory is divided into three age groups that are assigned volumes in different ways.

The oldest age group consists of stands older than 130 years. These stands have volume estimates assigned in the inventory files. The file volumes were reduced, making allowance for cull and decay, waste and breakage. These older stands were then aggregated into analysis units, as explained in Appendix 1. Older-stand analysis units are groupings of stands that are similar in leading species, growing site quality, and merchantability. The area-weighted average net volume per hectare is assigned to each stand grouping in the model. In the model, this volume is assumed to neither increase nor decrease over time.

The Weyerhaeuser growth and yield model Y-XENO was used to estimate volume development for younger stands. Y-XENO is calibrated to approximately 2,200 company growth and yield plots in coastal BC, 900 of which are located within TFL 39. Most of the plots are located in Douglas-fir and hemlock stands. Y-XENO accepts inputs for species, growing site quality, establishment density, establishment site occupancy, planted and natural stand establishment, and thinning and spacing treatments if required. Y-XENO simulates growth of an individual stand according to the input parameters, and reports total and merchantable volumes, average stand diameters, height, basal area, and stocking over time.

The older second-growth stands (ages 33–130 years) have mostly been timber cruised, and the company has good estimates of volumes in these stands. Y-XENO shows that higher density stands have greater volumes per hectare. Weyerhaeuser assessed the cruised stand information and used volume and basal area to match the cruise information for individual timber stands to Y-XENO yield projections across a range of establishment densities. Each individual stand in this age range was assigned to the establishment density that most closely matched — on volume or basal area — the cruise information.

Younger second-growth stands (less than 33 years old) and future regenerated stands are assigned to development types according to the biogeoclimatic variant, supply block, stewardship zone, and leading species of the stand. Weyerhaeuser has developed a set of assignment matrices that contain the probabilities of a regenerating stand developing along particular pathways. For each stand type (species and geographic location) there may be up to 10 post-harvest development pathways. Using local knowledge and professional judgement, Weyerhaeuser has developed a grid of assignment probabilities for the proportion of each stand that would follow each pathway. Some pathways involve planting with varying degrees of natural in-seeding. Some pathways consist of varying degrees of low-, medium-, or high-density natural regeneration. The detailed tables of percentage assignment to each establishment pathway are provided in the Information Package.

Data preparation for this analysis used the tabular assignment of establishment type probabilities described in the Information Package. For each existing stand type and location, a set of up to 10 future conditions may be expected. Tables in the Information Package list the percentage of the existing type that would regenerate to each future type. Tabular assignments vary according to whether the stand is managed for Old Growth, Habitat, or Timber stewardship zone, because of the different levels of tree retention among the stewardship zones and therefore different quantities of natural seed source.

The implementation of the regeneration model uses the sequential record number as a marker to the assignment. The probabilities are converted to an integer value ranging from 0 to 99, and the last two digits of the stand record number in the database file is used to determine the type that the stand would regenerate to. This method is unbiased, given the large number (2.3 million) of stand records. The method was tested by adding a constant value to the line number before establishment type assignment, and resulted in less than 0.5% change in cumulative assignment.

The tables of establishment type assignment are based on professional observation, and potential uncertainty in the tabular numbers provided in the Information Package may exceed the variability/bias of the implementation. In summary, for a given stand the species, block, biogeoclimatic variant, and stewardship zone are input to the regeneration model. The regeneration model then predicts the probability distribution of post-harvest stand establishment types among 10 planted/natural and density classes.

For this timber supply analysis, the number of establishment classes were aggregated to three — one planted and two natural regeneration density classes. The aggregation was based on the assignments of the Weyerhaeuser regeneration model. For example, if the company model predicts an establishment density of 12,000 or 6,000 stems per hectare (sph), the analysis assigns the stands to an 8,000 sph class. If the model predicts 3,000, 1,500, or 600 sph, the analysis assigns the stands to a 1,500 sph class. Stocking levels for the high and low density classes were developed by inspecting the amount of area assigned to each among the 10 detailed density classes. The distribution between planted and naturally regenerated stands was maintained as per the detailed model.

The regeneration model was used to assign all stands younger than 33 years (non-cruised) to existing development types. The model was also used to determine the regeneration expectations for all existing stands to future regenerated types. The model does not address nuances due to growing site quality — all growing sites are assumed to regenerate in the same percentage distribution among establishment types. The implementation assigns all regenerating stands to the same biophysical site index class as is assigned in the inventory.

Yield adjustments (reductions) applied to the Y-XENO yield tables include losses for decay, waste and breakage (Douglas-fir 5%, hemlock 6.5%), losses to insects (2%), and deductions for incomplete stocking (6% in Blocks 1 and 5, 4% elsewhere). Existing stands older than 33 years (cruised) are not reduced for incomplete stocking, since the cruise information embodies this potential effect. The yield tables assigned to future regenerated stands are additionally reduced by 30% in the Old Growth zone, 11% in the Habitat zone, and 3% in the Timber zone to account for competition effects from in-block variable retention patches. Yields for future planted stands assume genetic gains of 13% for Douglas-fir and 6.5% for hemlock.

Timber stands must reach 350 m^3/ha before being harvested in the timber supply model. This volume is achieved by 40 years of age on some high-site hemlock stands, and not until 200 years of age for lower-density poor-site Douglas-fir stands. Appendix 1 provides more information about minimum harvest age criteria.

2.3 Management practices

Timber supply depends on the amount of volume standing in the inventory and its expected rate of growth. Timber supply also depends on the management practices that are applied on the land base. The timber supply analysis inspects consequences through three or more forest rotations. To ensure sustainability of the resource, harvest of the current inventory is constrained so that supplies will last until young stands have developed and are ready for harvest. Practices that ensure early post-harvest establishment and rapid subsequent growth therefore facilitate increased timber supply both now and in the future. The following discussion highlights some current practices, and Appendix 1 provides quantitative detail about how the practices are modelled.

All harvested stands are assumed to be regenerated within one year of harvest. Stands are tended so that they promptly achieve a free-growing state. All planted stands are assumed to use genetically improved trees, that grow faster than natural stock. Damaging agents are kept to endemic levels, and catastrophic losses are assumed to create unsalvageable losses equal to 1% of the harvest level. The analysis does not incorporate gains from fertilization or the yield effects of thinning and spacing treatments. These silviculture treatments are the subject of a separate, parallel analysis that is underway and due to be completed by December 2000.

Not all trees from a harvested stand are removed to the mill. Some trees are too small to have merchantable value, and some living trees are maintained on all sites to maintain streamside protection, to provide bird, bear and ungulate habitat, and to provide future snag and coarse woody debris for future biodiversity values. The analysis makes allowances for in-block tree retention and level of utilization.

The Forest Practices Code limits the size of harvest units on the coast to 40 ha, and a harvest unit must be greened-up (stocked with trees at least 3-m tall) before adjacent units may be harvested. This suggests a four-pass harvest system, with approximately one-quarter of an area harvested at each entry. The analysis includes a four-pass harvesting constraint within the THLB.

Landscape-level biodiversity values are included in the analysis. Each biogeoclimatic variant within each landscape unit has requirements for retention of mature productive forest. The levels of retention depend on the variant. Landscape unit biodiversity emphasis ratings are draft at this time, so a weighted average of the three levels of biodiversity emphasis classes is used for all landscape units. Constraints that address landscape-level biodiversity incorporate all productive forest except tree patches retained in Habitat and Timber variable retention harvest units. Figure 5 shows the present distribution of age classes in the productive forest, and the size of the THLB compared with the size and age of the reserved productive forest.

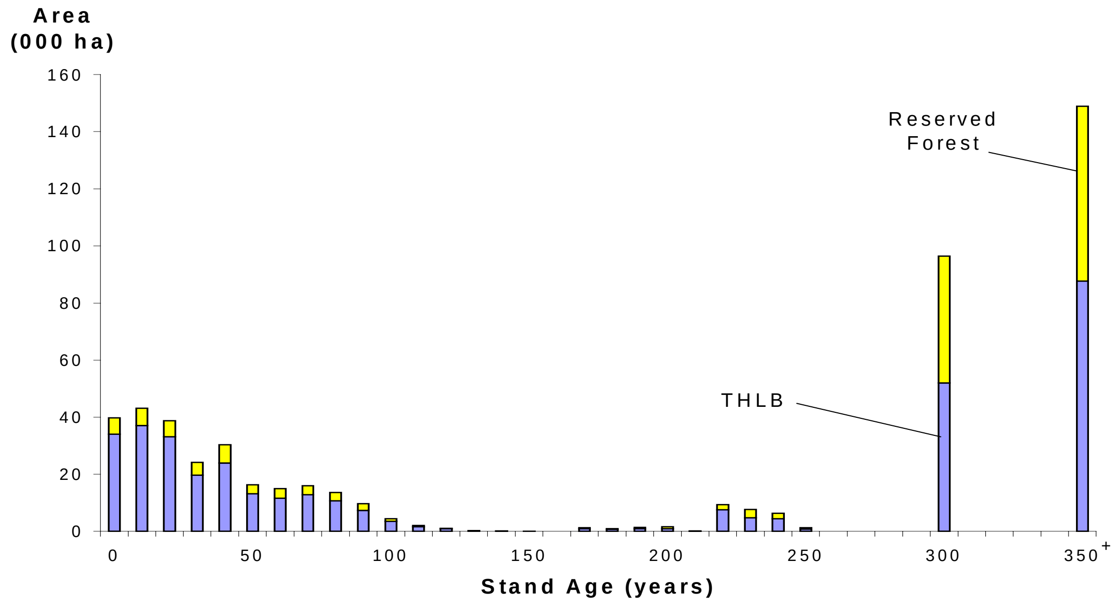

Figure 5. Productive forest age class distribution.

Visual quality of the landscape is a concern in many areas of TFL 39. Cruise ships and pleasure craft ply the coastal waters, and outdoor recreation trails and canoe routes pass through some blocks. The areas of visual landscape concern have been mapped and are included in the forest inventory. Approximately 15% of the THLB is rated Retention or Partial Retention, and a further 10% is rated Modification. The analysis constrains harvesting in these visually sensitive areas.

The Coastal Watershed Assessment Procedure has identified specific watersheds in Blocks 1, 2, and 3|4 where future harvesting will occur at a slow steady pace. Appendix 1 lists the areas and the limits to the pace of harvesting in the model. A small area of community watersheds is also identified for special treatment in the analysis.

Avalanche run-out zones are identified in Blocks 2 and 7. These areas are constrained to a slow, steady rate of harvesting similar to the sensitive watersheds. Figure 6 illustrates the scope of areas with special management concerns.

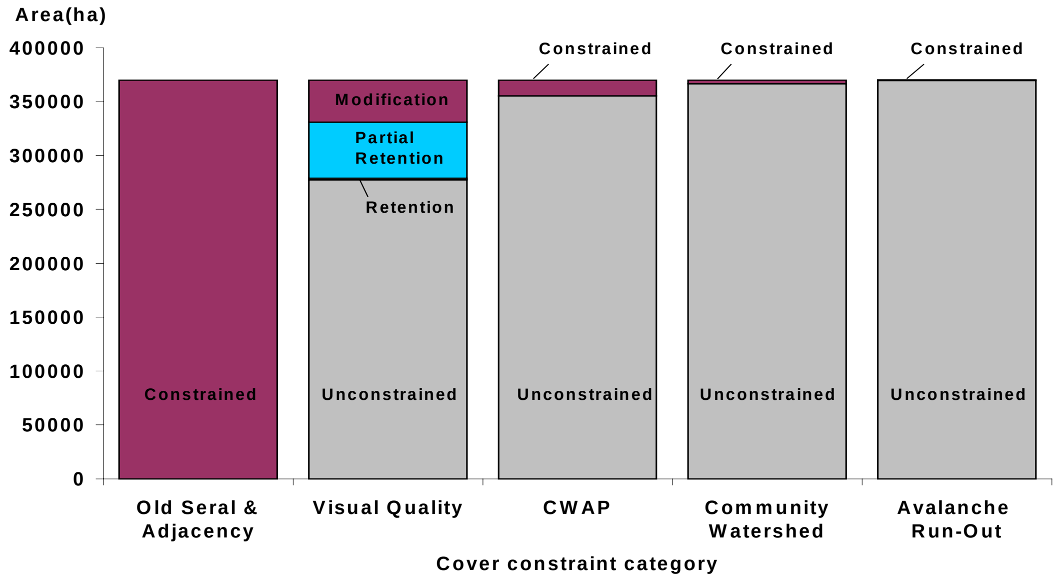

Figure 6. TFL 39 THLB areas with special management concerns.

3.0 TIMBER SUPPLY ANALYSIS METHOD

The purpose of this analysis is to investigate short- and long-term timber harvesting potential from TFL 39. The analysis is a computer simulation of the current forest management practices and current assumptions about growth and yield applied to the TFL 39 inventory. The B.C. Forest Service Simulator (FSSIM) computer modelling system is used for the analysis.

FSSIM serves as an accounting tool that tracks the growth, harvest, and regeneration of forest stands. It monitors forest conditions and age class structures during the simulation, and halts harvesting when specified limits are reached. Working with FSSIM is an iterative process — a chosen harvest level is input, results of the simulation are reviewed, the harvest level is raised or lowered, and another simulation is run. A solution is achieved when a particular harvest level produces the desired mix of future forest conditions.

FSSIM allows the use of forest cover constraints that limit the area covered by stands younger than a specified age and/or that require that at least a specified area be older than a required age. This facility enables modelling of old-growth requirements for biodiversity, and modelling of limits on harvest activity due to watershed or visual landscape concerns.

TFL 39 contains seven timber supply blocks. Blocks 3 and 4 are combined into one model, and all other blocks are modelled independently. The reason for building the analysis with six models is that the blocks are geographically separated, have different forest age class structures, and are managed as separate entities. The separated modelling will provide indication of the portions of the overall TFL 39 harvest level that could be allocated to each block.

The analysis develops a "base case" that represents a best estimate of timber supplies that may be expected using current management. The analysis then inspects options that are reasonable variations of the base case input assumptions. The option testing provides an indication of which input assumptions are critical to the analysis, and which inputs have little effect. Certain land base options that inspect protected area proposals are specific to particular blocks, but most of the options are inspected for all blocks. The results of the option testing are reported for the aggregate TFL 39 in Section 5.0. Section 6.0 discusses results for each block, and the data CD graphically presents the base case and all option results for all modelling.

This analysis models growth and harvesting from 2001 onward. One 5-year period of harvesting and growth occurs before the start of the reported planning horizon. Harvest levels for this pre-process period in the models are set to the actual levels experienced in TFL 39 during the period 1996–2000.

4.0 RESULTS

This section presents the results of the timber supply analysis of TFL 39. The results use the best and most recent assumptions about forest management in TFL 39, and are referred to as the base case. Section 5 of this report tests the base case for issues of uncertainty.

The results presented here are for the aggregate TFL 39, although modelling was conducted independently for six separate blocks within TFL 39. Section 6 of this report discusses results independently for each block.

4.1 Base case harvest forecast

The TFL 39 harvest flow was modelled in five-year periods for the first 20 years and in decades for subsequent planning periods. Figure 7 shows the base case harvest forecast for TFL 39. An initial harvest level of 3.66 million m^3/yr is maintained for the first 5-year period. This is followed by an orderly decline in the harvest level, to a long-term sustainable level of 3.33 million m^3/yr, 9.1% lower than the starting level. The harvest level declines at an average rate of 1.3% per 5-year period. Unsalvaged losses to natural forces such as insects, fire, windthrow, and disease are estimated to be 36,600 m^3/yr (1% of the harvest level) and have been subtracted from all harvest forecasts shown in this report.

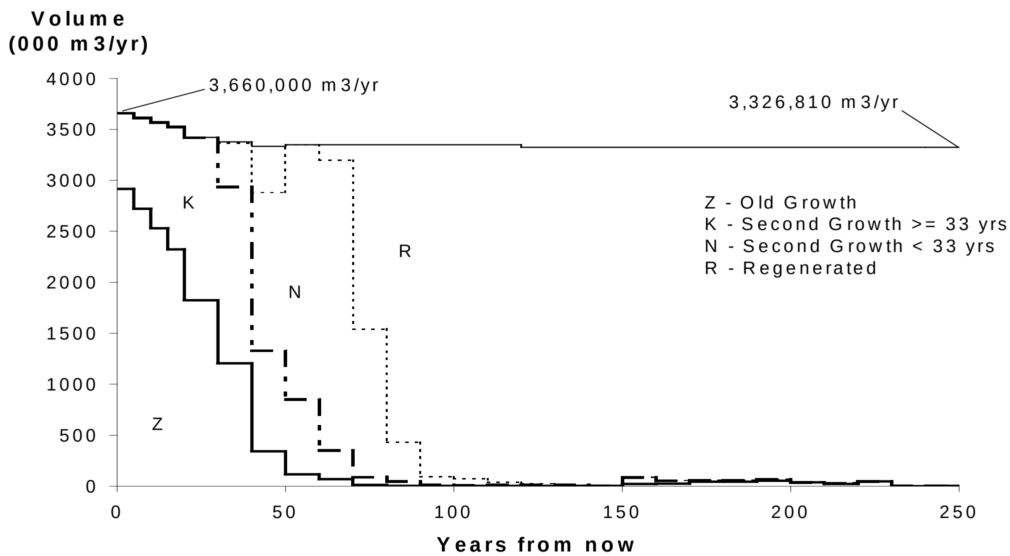

FIGURE 7. Base case harvest forecast for TFL 39.

Figure 7 also illustrates the transition from the harvest of old-growth timber stands to the harvest of managed second-growth stands. In the first period the harvest consists of 2.92 million m³/yr of old-growth timber and 0.74 million m³/yr of older second-growth timber. The ratio of old-growth harvesting to second-growth harvesting is 80:20. By 20 years from now the ratio becomes 53:47, and thereafter second-growth harvesting contributes the majority of the cut.

The harvest flow criteria used to define the base case harvest forecast are:

1. Establish starting harvest levels consistent with the Management Plan #7 strategy. Adjust harvest levels between blocks as necessary.
2. In Blocks 1, 2, 3|4 and 6 restrict harvest level declines to 5% per 5-year period, 10% per 10-year period. Attempt to achieve declines at half that rate. In Blocks 5 and 7 the transition to long-term sustainable yields may require harvest reductions in excess of 10% per decade.
3. Do not let harvest levels drop below the long-term sustainable harvest level.
4. Determine a long-term harvest level that achieves a stable growing stock beyond 100 years in the planning horizon.

Figure 8 illustrates the standing inventory (growing stock) and the changing composition of the future forest under the base case harvest flow. The categories in Figure 8 identify the forest according to stand ages now. For example, at year 50 in the planning horizon, the area identified as “N”, which then constitutes 50% of the TFL 39 growing stock, would be 50 to 83 years old. The volume of standing growing stock stabilizes at 117 million m³, down 23% from the current standing volume of 151 million m³. The long-term growing stock divided by the long-term harvest level (117/3.33 = 35) indicates a conservative ratio of forest conditions in TFL 39 — there is on average 35 year’s worth of harvest volume standing in the forest at any time in the long term.

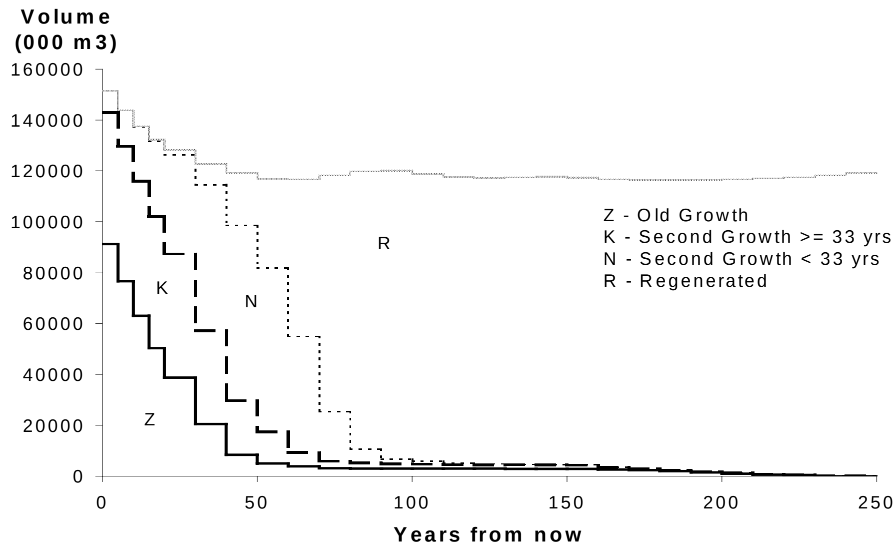

FIGURE 8. Growing stock levels over time for the base case.

Figure 9 illustrates the area harvested by block over time for the TFL 39 base case. This is the area from which trees are actually removed, and does not include within-block area of retained riparian forest, wildlife trees, or variable retention patches. In the first period 5,600 ha/yr are harvested. The area harvested declines to a low point of 4,150 ha/yr 50 years from now. The decline in area harvested is due to harvest-level reductions, and also because the model is harvesting older second-growth stands that have greater per-hectare volumes than the current old-growth stands. In the long term the annual area cut stabilizes at approximately 4,700 ha/yr.

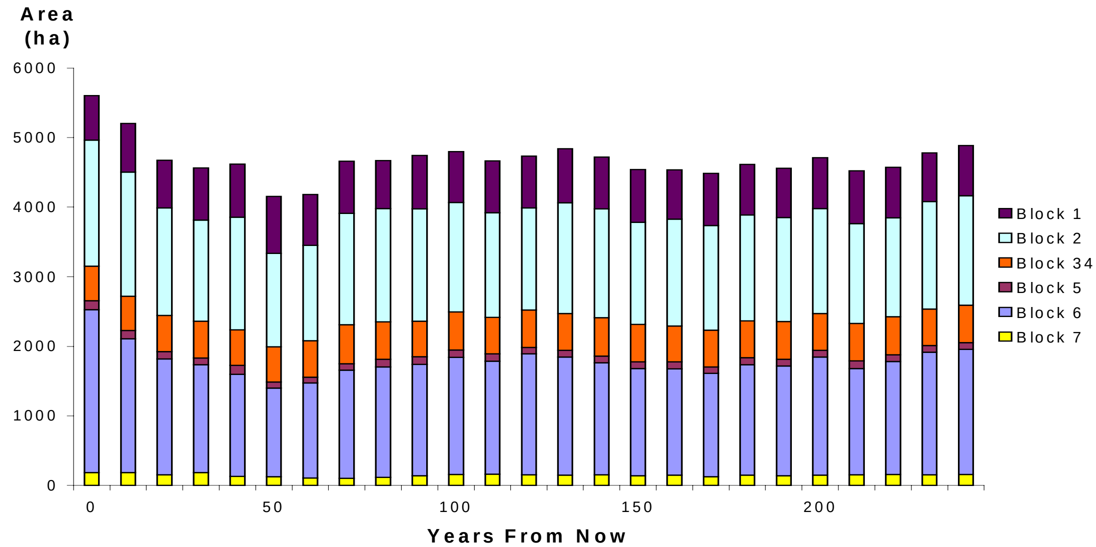

FIGURE 9. Area harvested over time for the base case.

Figure 10 illustrates the average volume per hectare harvested over the planning horizon for each block, and for TFL 39 as a whole. Block 1, with excellent forest growing sites and the greatest area of Douglas-fir, has significantly higher volumes than average. Blocks 6 and 7 have generally lower growing site quality, and therefore lower average volumes per hectare in the long term. The TFL 39 average confirms the previous observation. As the model harvests second-growth more intensively, the realized volume per hectare rises, from an average 660 m³/ha in the first period to 815 m³/ha by 50 years from now. In the long-term, volumes harvested average approximately 710 m³/ha.

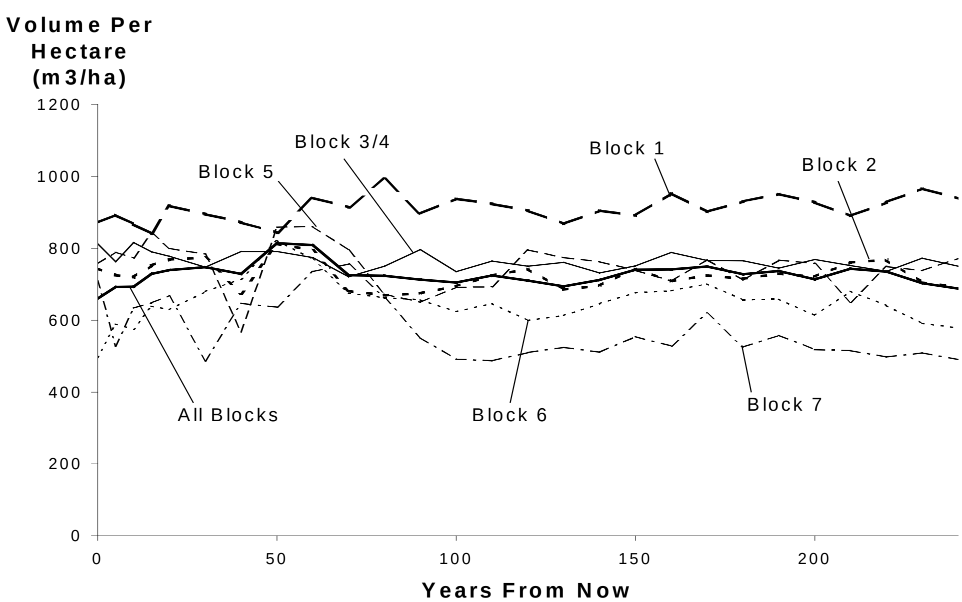

FIGURE 10. Average volume per hectare harvested over time for the base case.

Figure 11 shows the volume-weighted average age of forest stands cut in each block over the planning horizon. Blocks 1 and 3|4 have a significant portion of harvesting in second-growth stands from the first period, whereas harvesting in Block 7 is completely in old-growth stands until 60 years from now. The average for TFL 39 shows a steady reduction over the next 40 years, as increasing volumes of second-growth form part of the harvest level. In the long term the average ages harvested range from 65 to 85 years.

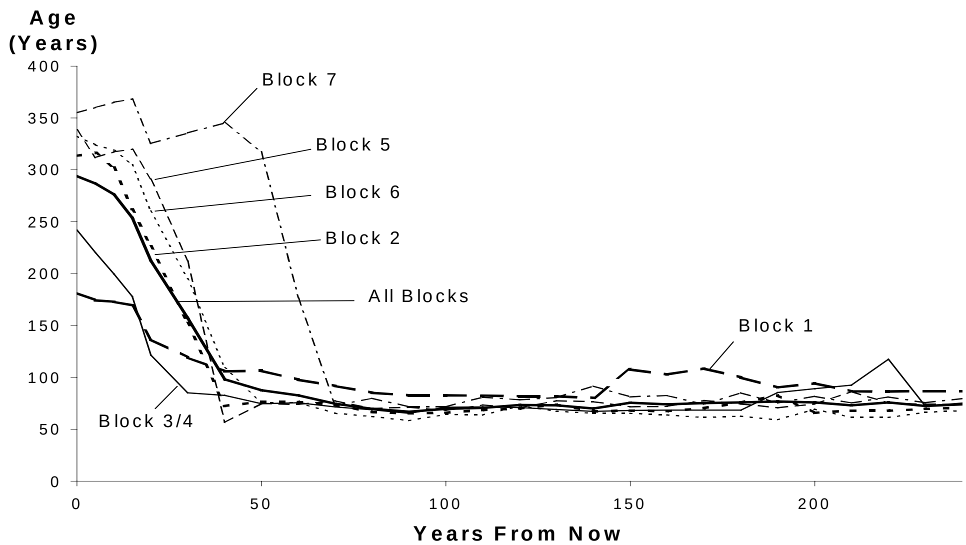

FIGURE 11. Average stand ages harvested over time for the base case.

The charts in Figures 12a – 12c show how the age class composition in the productive forest changes over time; snapshots at times 0, 100, and 200 years in the planning horizon. The present age class distribution illustrates the second-growth forest on previously harvested areas. Some of this young area may also be due to past fire, windthrow and other stand-renewing events. The reserved forest is approximately 15% of the productive forest area across all age classes, in addition to the larger areas of reserved old growth. By 100 years from now a completely regulated forest covers the THLB, while the reserved forest continues to grow older. A somewhat younger regulated forest covers the landscape in the base case by 200 years from now.

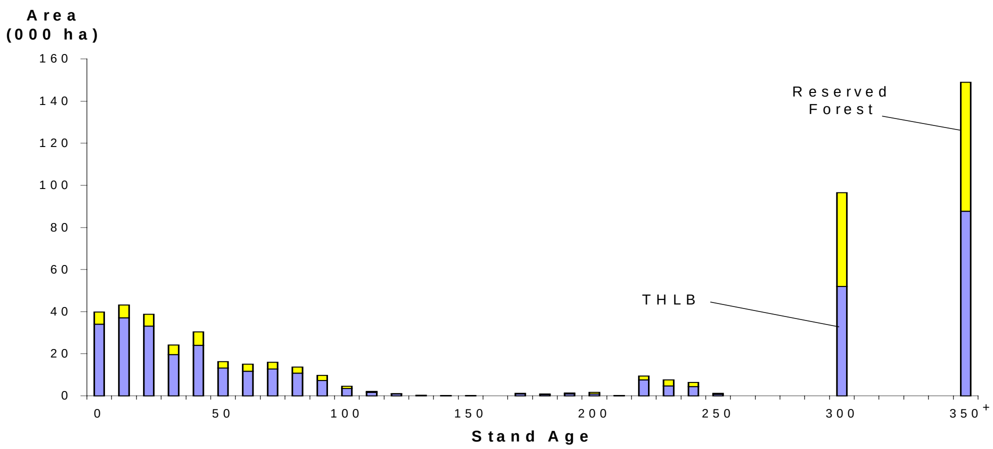

FIGURE 12a. Age class distribution in the productive forest now.

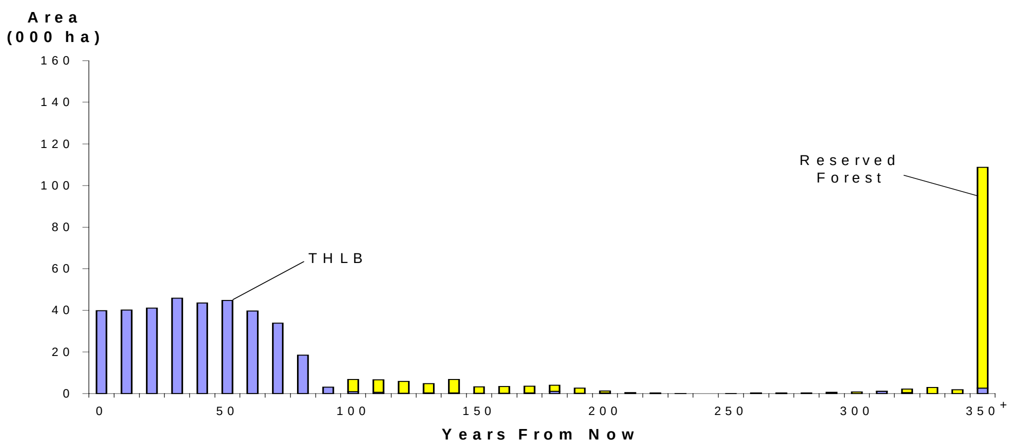

FIGURE 12b. Age class distribution 100 years from now for the base case

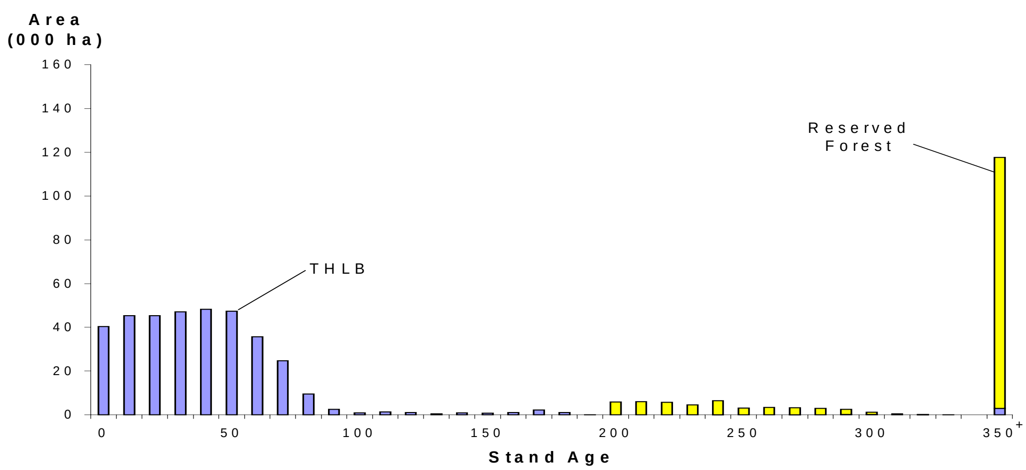

FIGURE 12c. Age class distribution 200 years from now for the base case.

Appendix 2 includes a page that illustrates the age class distribution for each Block at the end of one forest rotation, 70 years from now. By that time all blocks have achieved a regulated forest, although Block 1 still has some older second-growth that is harvested in the following 30-year period in the model. The charts in the Appendix are all to the same scale, and therefore illustrate the relative importance of each block in supporting the TFL 39 harvest level.

5.0 OPTION TESTING

The base case harvest forecast embodies all current assumptions about forest land management and growth and yield. However, there may be uncertainties in the data and assumptions used in the timber supply model. This section of the report tests issues that may have an impact on the results. The option results provide decision makers with information about important variables that may affect the base case. The options compare harvest flows under alternative assumptions with the base case harvest flow. The options are numbered sequentially, according to the descriptions in the Information Package submitted to the B.C. Forest Service in the autumn of 1999.

5.1 Option 1 – Base case

Option 1 is the base case, already discussed. Option 1 describes a feasible harvest level of 3.66 million m^3/yr for TFL 39. Options 2 and 3 address the new Forest Project assumptions regarding stewardship zones and variable retention. Options 4 through 6 address non-timber management issues. Options 7 through 9 address the definition of the timber harvesting land base. Options 10 through 13 address potential moratorium and deferred areas. Options 14 through 17 address timber volume estimates, and Options 18 and 19 address site index assignment and minimum harvest ages.

As described in the Information Package, this analysis does not test silviculture options. Instead, options that test the impact of using genetically improved stock, forest fertilization, spacing, thinning, and other stand-tending treatments will be tested in a separate “Type 2” analysis. The “Type 2” analysis will use the same base case model, and is expected to be complete by December 2000, in time to support decision making regarding Management Plan #8.

5.2 Option 2 - Excludes stewardship zones and variable retention

Weyerhaeuser has adopted variable retention harvesting practices in all of its coastal operations, including all of TFL 39. The transition from clearcutting to variable retention will be completed by the end of 2003. This is an important change since Management Plan #7. The TFL 39 land base is divided into three stewardship zones, with approximately 65% in the Timber zone, 25% in the Habitat zone and 10% in the Old Growth zone. The company goal is to reserve two-thirds of the Old Growth zone from harvest. Minimum retention levels of 10%, 15%, and 20% are targeted for Timber, Habitat, and the one-third harvested in the Old Growth zones respectively. Modelling assumes that other reserves for wildlife tree patches and riparian areas will meet half the targets in the Timber and Habitat zones. The base option includes incremental area netdowns of 5%, 7.5% and 70% for Timber, Habitat and Old Growth zones to account for variable retention and the additional habitat protection in old growth zones. Yield tables for regenerated stands are also reduced 3% in the Timber zone, 11% in the Habitat zone, and 30% in the Old Growth zone to account for competition and shade effects of the retained trees.

The potential benefits of within-block reserves include improved visual conditions, improved ability to meet landscape biodiversity goals, and increased access to high-value timber stands that are presently reserved. However, these expected offsetting timber supply benefits due to stewardship management are not portrayed in this analysis.

Option 2 tests the impact of the variable retention harvest practice by removing the netdowns of 5%, 7.5%, and 70%, and by removing the yield curve reductions of 3%, 11%, and 30% from the base case model. With more harvestable area, and higher future yields, Figure 13 shows that the starting harvest level may be maintained for 30 years. The long-term harvest level is 15.8% higher than the base case long-term harvest level.

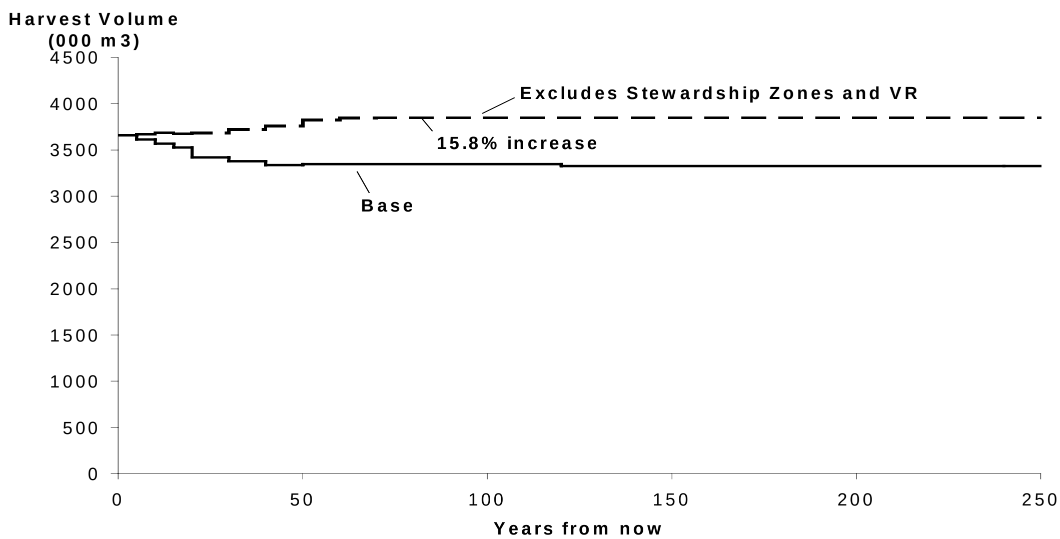

FIGURE 13. Harvest levels with stewardship zones and variable retention excluded

The increase in long-term harvest levels varies by block, ranging from 10.3% in Block 3|4 (which is 90% Timber zone), to 52% in Block 7 (which is 35% Old Growth zone and 27% Habitat zone). Table 3 summarizes the THLB area by block for Option 2 and shows the aggregate percentage area increase relative to the base case.

TABLE 3. Increased area with variable retention netdowns removed.

Supply block	Base case THLB area (ha)	Option 2 THLB area (ha)	Increase in area (%)
Block 1	70,064	74,254	6.0
Block 2	117,251	126,628	8.0
Block 3|4	42,343	44,671	5.5
Block 5	8,086	9,255	14.5
Block 6	119,030	133,900	12.5
Block 7	13,196	18,300	38.7
Total TFL 39	369,970	407,008	10.0

5.3 **Option 3 -** Increase variable retention netdown by 10%

Weyerhaeuser has been experimenting with the variable retention harvesting method. A company survey of 38 units harvested in 1999 and the first half of 2000 found that in these units 23% of the original forest basal area was maintained on site. The survey included in its measure wildlife tree patches, riparian reserves, and deciduous and unmerchantable timber that has been accounted for in the base case. Weyerhaeuser intends to fine-tune its retention practices closer to the base case targets and is also refining its survey procedures to differentiate retained forest according to the definitions in MP#8. However, an Option was undertaken to investigate the consequences of retaining more THLB timber than was assumed in the base case.

Option 3 increases the incremental area netdown for variable retention by 10 percentage points, to 15% in the Timber zone and to 17.5% in the Habitat zone. Figure 14 illustrates the effect on harvest flow. The first period harvest level declines by 42,000 m^3/yr, due to a shortfall in Block 3|4. There is a steeper rate of decline in harvest levels (averaging 8% per decade) than for the base case (which averaged 2.6% per decade). Assuming that these higher retention levels would be maintained in perpetuity, the long-term harvest level is 10% lower than the base case long-term harvest level. The long-term impact is similar among the individual blocks, ranging from 8.8% in Block 1 to 12.0% in Block 7.

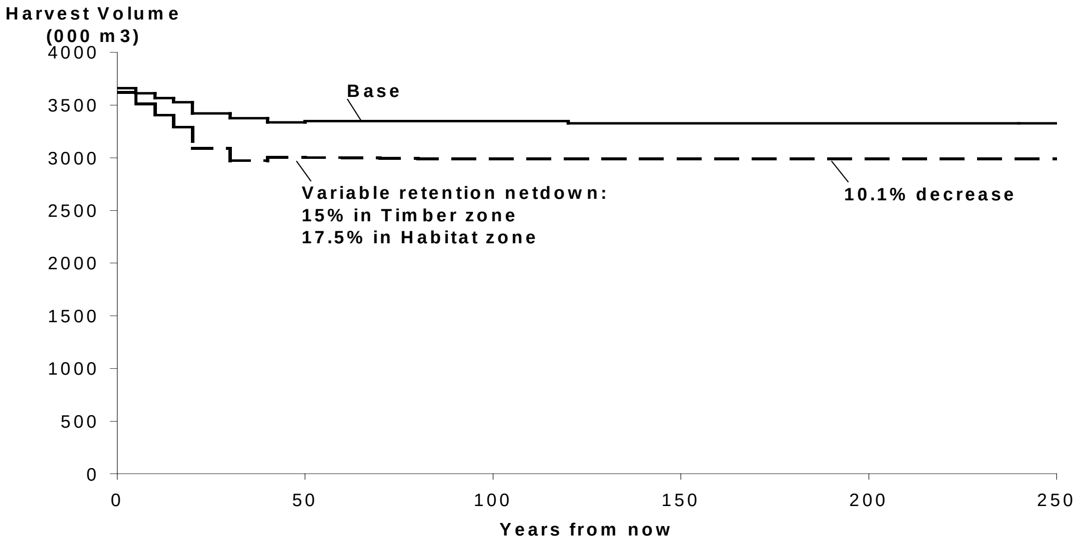

FIGURE 14. Harvest levels with variable retention netdown increased 10%.

5.4 Option 4 - Landscape biodiversity - include early and mature seral stage constraints

The base case includes requirements for retention of intact areas of forest older than 250 years, and requirements for recruitment of older second-growth forests to old seral ages where there are presently inadequate inventories of existing old seral forest to meet targets. The old seral requirements are modelled independently for each landscape unit by biogeoclimatic variant.

Option 4 adds early seral requirements for landscape units with draft intermediate and high biodiversity emphasis, and adds mature seral requirements for all landscape units. Old seral requirements are maintained as per the base case. Early seral requirements limit the amount of area that may be younger than 40 years. Mature seral constraints require maintaining forest older than 80 years (CWH) or 120 years (MH). Current government policy (B.C. Ministry of Forests 1997) is that these constraints are applied only if they do not impact timber supply.

Figure 15 illustrates that Option 4 has a significant negative effect on the short-term harvest schedule. First-period harvests decline 21%, from 3.66 million m^3/yr to 2.89 million m^3/yr. By 20 years from now, the harvest level is 26% below the base case harvest level. Harvesting then recovers until in the long term, past 100 years from now, the harvest levels are essentially identical.

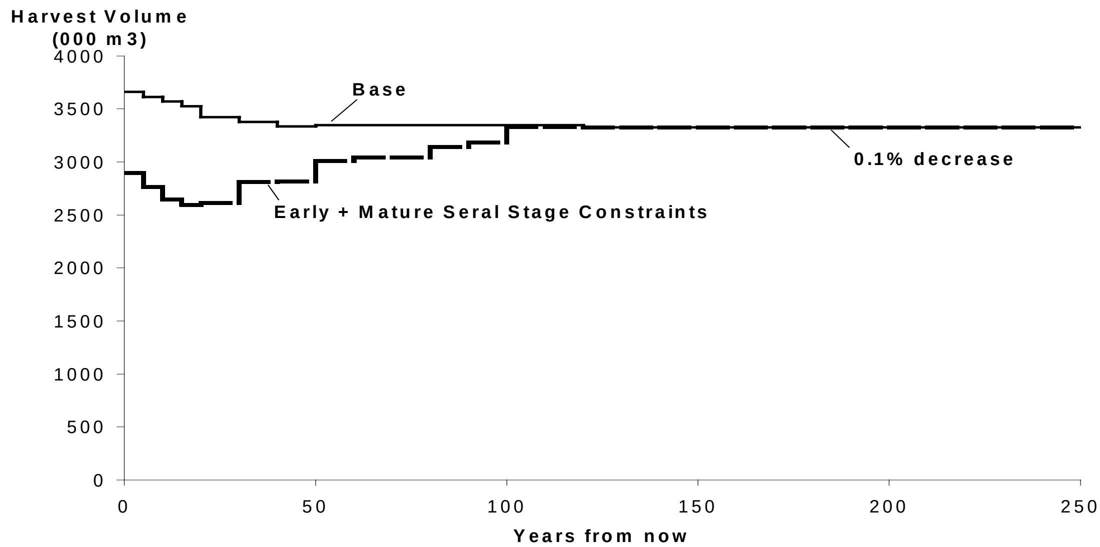

FIGURE 15. Harvest levels with early and mature seral stage constraints.

The short-term impact is due to recent harvesting history. There are presently extensive areas aged less than 40 years, which constrain further harvesting in the intermediate and high biodiversity emphasis areas. The effect is more pronounced in certain blocks. For example, Block 5 consists of the high biodiversity emphasis Phillips landscape unit, and has 41% of the THLB now less than 40 years old. The proposed early seral constraint for the Phillips landscape units is a maximum of from 17% to 27%, depending on variant, of the productive forest (including areas netted down) younger than 40 years old. In Block 5 the impact for Option 4 is a 95% reduction from the first-period base case harvest level. In the long term, harvests remain 11% below the base case. Block 7, in contrast, with very little harvesting history and intermediate biodiversity emphasis, shows no short- or long-term effects for Option 4.

5.5 Option 5 - Landscape biodiversity — draft biodiversity emphases

The base case uses a draw-down for old seral forest cover requirements. The model is permitted two 70-year forest rotations before completely meeting old seral requirements. This permits some older second-growth stands to be harvested in the short term. These stands might otherwise be reserved for recruitment to meet old seral status (250+ years).

Option 5 tests the impact of the draw-down, by requiring landscape units with intermediate or high biodiversity emphasis to meet the long-term old seral constraints from the beginning of the planning horizon. Any landscape unit/biogeoclimatic variant combination that presently has insufficient productive old seral stands to meet objectives will be required to reserve enough older second growth from harvest to meet the objectives as soon as possible.

The draft landscape biodiversity emphases and Weyerhaeuser stewardship zones are consistent with areas classified as Special Management Zones (SMZs) in the draft Vancouver Island Land Use Plan. The Johnstone Strait, Tsitika and Strathcona-Schoen SMZs in Block 2 are nearly all in the more constraining old growth or habitat stewardship zones. In addition, most of these SMZ areas are in the Tsitika and White high biodiversity emphasis landscape units.

Option 5 has is no noticeable effect on the TFL 39 harvest schedule. Block 5 experiences a reduction in harvest of 2,000 m³/yr for one decade, 40 to 50 years from now. All other Blocks achieve the base case harvest flow. Growing stock levels in TFL 39 are identical to the base case under Option 5.

5.6 Option 6 - Visual landscape constraints

Visual landscape constraints limit the amount of area in a management unit that may be younger than the age of visually effective green-up (VEG). In the base case VEG is achieved at 5-m height in Blocks 1–5, and 6-m height in Blocks 6 and 7. Visual landscape requirements are prescribed according to the number of expected viewers and viewing duration, and are grouped into classes for management purposes. The classes that permit timber harvesting are named Retention (1–5% visible alteration), Partial Retention (6–15% visible alteration), and Modification (16–25% visible alteration). Reserved merchantable timber and all other green forested land within mapped visually sensitive areas contribute to the land base on which the percentage alteration is calculated.

The base case assumed management to the upper end of the range for each class, in recognition of the contribution made by variable retention harvesting, and cutblock design. Option 6 tests the harvest-level effect of limiting the rate of alteration to the middle or lower end of each visual quality class. Figure 16 illustrates that management to the middle of the range would have no noticeable effect on harvest levels throughout the planning horizon. Table 2 (Derivation of THLB) illustrated that there is an abundance of un-merchantable and reserved forest area, and these types are well represented in visually sensitive areas.

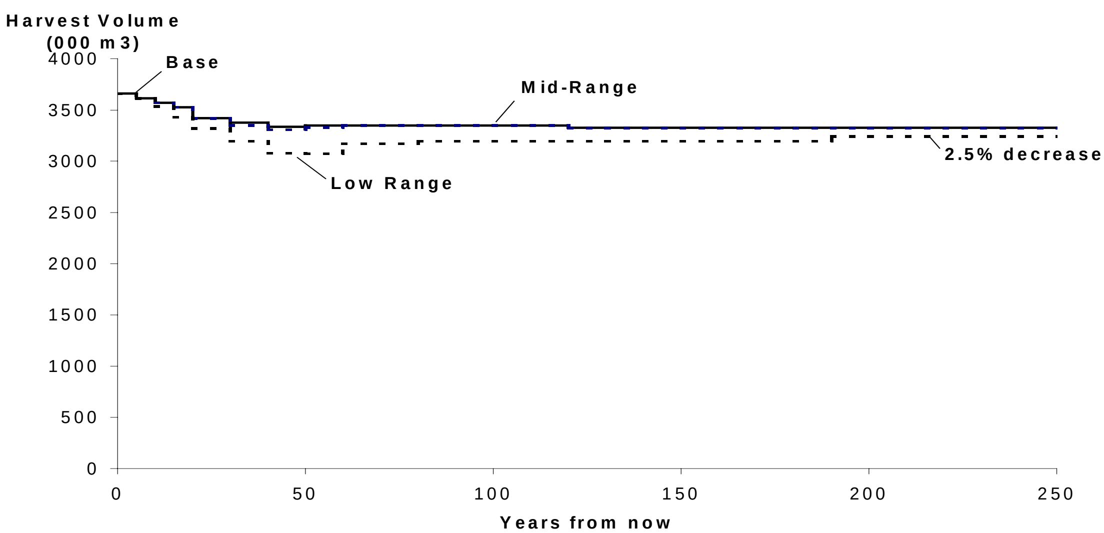

FIGURE 16. Harvest levels with alternative visual landscape constraints.

Managing to the most restrictive end of the percentage alteration for each visual quality class, the base case harvest level may be maintained for 10 years. Thereafter harvesting is gradually reduced below base case levels, to 8% below the base case 40 years from now. In the long term, TFL 39 harvest levels would be 2.5% lower to meet the most restrictive visual quality guidelines. The impacts from visual quality are most significant in Block 1 (6.9% long-term decrease) which is influenced by canoe routes and water-oriented recreation, and Block 3|4 (4.9% long-term decrease) which is influenced by coastal visibility from cruise ships. Block 6 is also sensitive to visual quality. All other blocks are able to maintain the long-term base case harvest levels with even the most restrictive visual quality constraint.

5.7 Option 7 - Harvest mature timber classified as "currently uneconomic" over 100 years
The base case excludes some forest stands as presently uneconomic to harvest. However, taking advantage of market cycles, it may be possible to profitably harvest these excluded stands. Option 7 adds the excluded areas back into the timber harvesting land base. Harvesting in the added areas is spread over 100 years in the model. Figure 17 illustrates the resulting harvest flow.

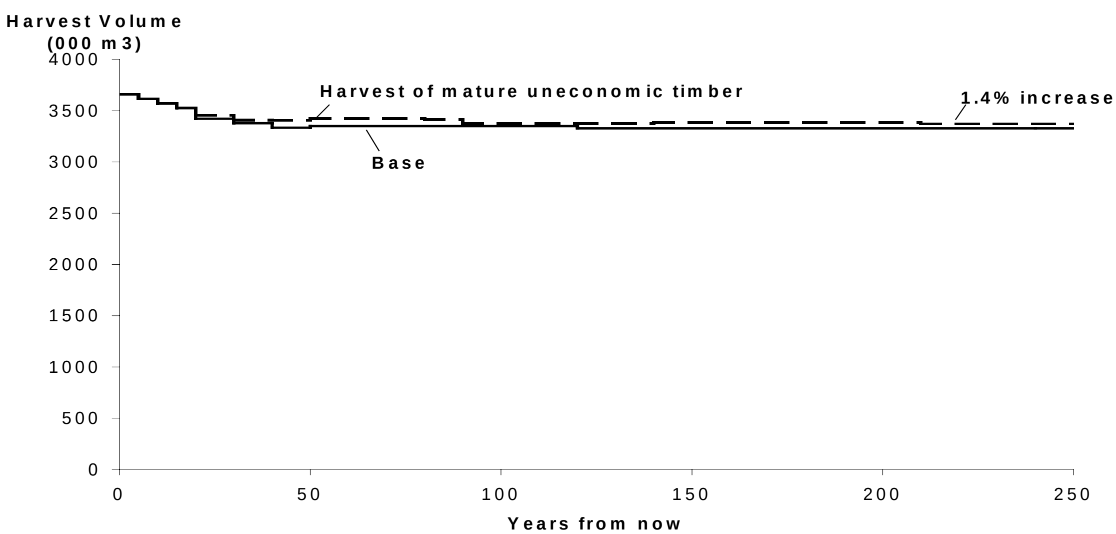

FIGURE 17. Harvest levels with uneconomic timber added to the THLB.

The assumption that presently uneconomic timber will become economically feasible to harvest in the future adds very little to the base case harvest forecast. For the next 20 years the assumption makes no difference to the projected harvest level, and in the long term there is a 1.4% increase in overall TFL 39 harvest levels. There is no difference in long-term harvest levels for Blocks 1 and 2 in this option. The other blocks are located further north on the coast, and each shows a gain of approximately 2.5%, with Block 7 showing a gain in the long term of 9% relative to base case harvest levels. An alternative computation is if the 5.3 million m³ added to the THLB by this option were harvested over 100 years, the base case harvest level would rise by 53,000 m³/yr.

5.8 Option 8-9 - Increase and decrease the THLB by 5%

Options 8 and 9 vary the assumed size of the THLB by moving 5% of the THLB into the non-harvest category, or moving an area equivalent to 5% of the THLB from harvest-excluded area back into the THLB. This has an impact on the assumed area available for harvest, of course, and also has an impact on the area outside the THLB that contributes to meeting forest cover requirements. The impacts are combined in Figure 18 to provide a net resulting impact for TFL 39. A 5% land base increase provides a 4.6% increase in long-term harvest levels, and a 5% land base decrease provides a 5.4% decrease in long-term harvest levels. Both options are modelled with a starting harvest level matching the base case, with gradual divergence to the stable long-term level.

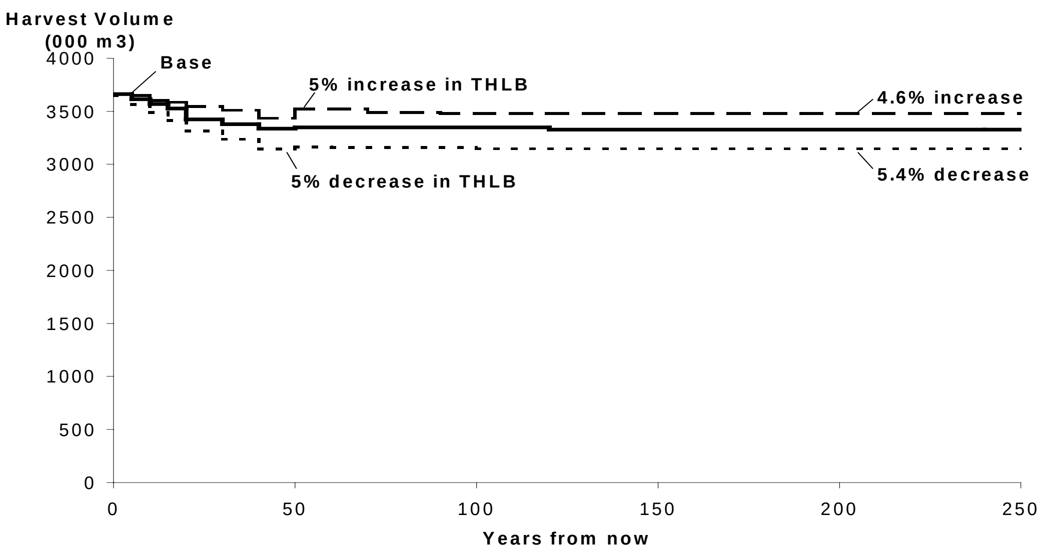

FIGURE 18. Harvest level with the THLB changed by +/- 5%.

Some issues discussed during review of the Information Package may be related to this sensitivity analysis:

- Retention in riparian management zones is modelled in the base case at 60% of the guidebook maximum levels. Moving to guidebook maximum levels would decrease the THLB by 0.6%, well within the 5% modelled in Option 9.
- Current practice in the Sunshine Coast District is to apply a 30 m reserve around large lakes (those greater than 1000 ha in size) rather than 10 m management zone assumed in this analysis. In Block 1 Powell Lake and Lois Lake are larger than 1000 ha. The total area (gross area ignoring other netdowns) of a 30 m buffer around these two lakes is 737 ha. The impact on the Block 1 THLB would be less than 1%.

- In other comments related to Block 1 it was suggested that the additional 1% allowance for streams unmapped at a scale of 1:20,000 is excessive. The 1% allowance is small compared to the 5% sensitivity applied in Option 8. This increase offsets the concern about reserves around larger lakes discussed in the previous paragraph

The modelling for Options 8 and 9 attempted to maintain growing stock levels within the THLB proportionate to the land base increase or decrease. Figure 19 illustrates the growing stock levels produced by the harvest flows illustrated in Figure 18. With the land base increase or decrease spread across all sites, the change in harvest levels is not significantly different than the change in the land base.

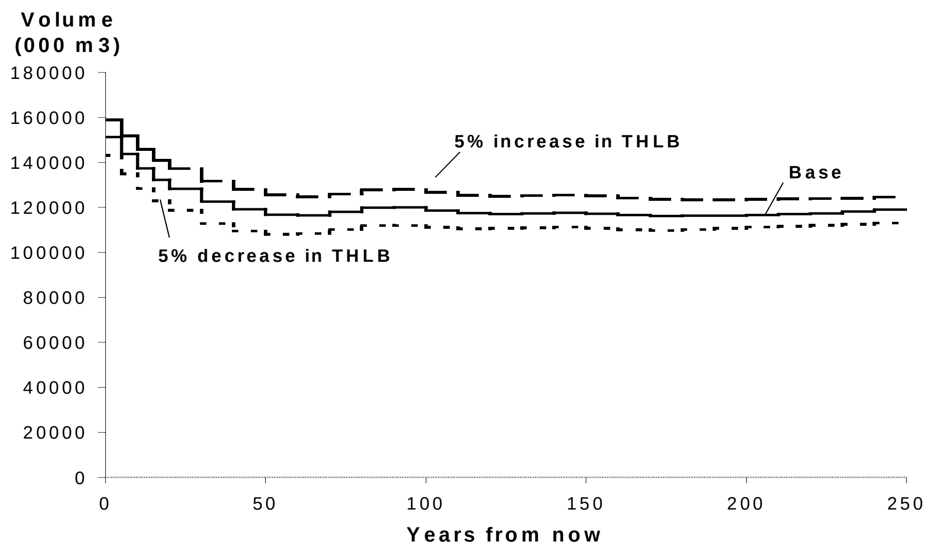

FIGURE 19. Growing stock levels with the THLB changed by +/-5%.

Options 8 and 9 represents the potential impact of unexpected land base withdrawals or additions that might occur within the terms of the license agreement. Such land base changes would need explicit geographic description to assess actual expected impacts on harvest levels. Options 10 to 13 test specific current land base issues.

5.9 **Option 10 -** Exclude the Confederation Lake Park and the Duck Lake Protected Area in Block 1

Option 10 excludes potential protected areas in Block 1. The proposed Confederation Lake Park and the Duck Lake Protected Area cover 1,424 ha, or 2% of the Block 1 THLB in the base case. There is some harvesting flexibility in Block 1, with considerable volumes of second growth presently maturing. Excluding these areas from Block 1 makes no difference to the harvest level for the next 50 years, and causes a 1.2% decrease in the long-term harvest level.

5.10 Option 11 - Exclude the Phillips Lake area in Block 5

Option 11 excludes the Phillips Estuary/Lake area in Block 5. Most of this area lies in the Old Growth stewardship zone and was excluded in the base case. The additional exclusion amounts to 96 ha. There is no impact for the first 40 years, and a 1.2% reduction in long-term harvest levels for Block 5.

5.11 Option 12 - Exclude the Haida Declared Protected Areas in Block 6

Block 6 consists of TFL 39 areas on the Queen Charlotte Islands (QCI), which are the home of the Haida First Nations. The Haida have declared specific areas within the QCI as culturally important and wish to have these areas protected from timber harvesting. Excluding these areas reduces the THLB by 12.9%. The effect of removing these areas is reduced because the Haida Declared Protected Areas are significantly coincident with the Old Growth stewardship zone.

Option 12 models exclusion of the declared protected areas in two ways. Figure 20 illustrates that if the areas are excluded from the THLB, it is possible to maintain the base case harvest level for the next 5 years. This is followed by a steeper decline in harvest levels, a dip in harvesting 40–50 years from now, and a long-term level that is 11.3% lower than the base case.

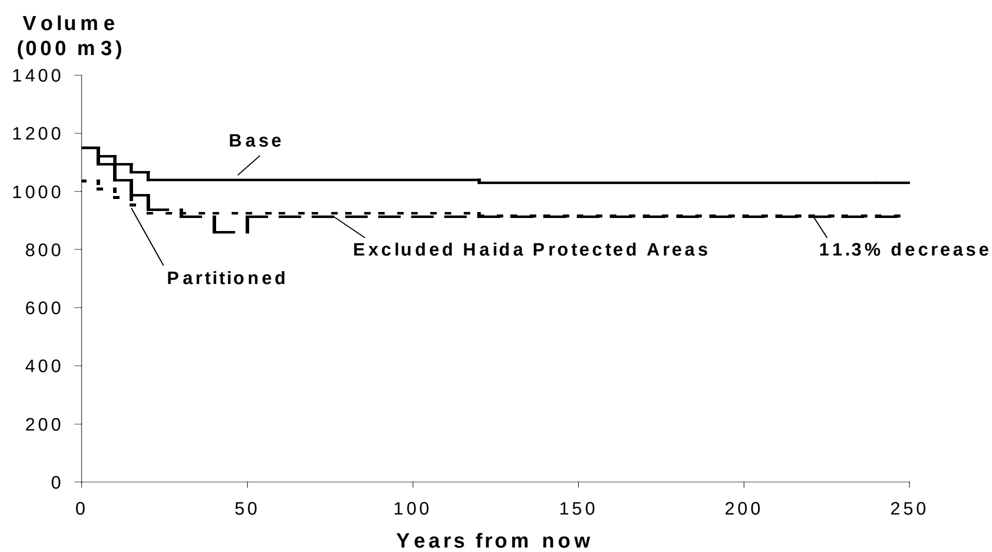

FIGURE 20. Block 6 harvest levels with the Haida Declared Protected Areas excluded.

The alternative flow assumes a partitioned harvest from the beginning of the planning horizon. The Haida protected areas contribute 11% of the base case harvest flow for Block 6, and the partitioned harvest would allocate that percentage to be cut from the protected areas, with 89% of the Block 6 base case harvest coming from other areas in the QCI. Additional areas outside the protected areas may become inaccessible if the declared protected areas cannot be crossed by

Weyerhaeuser harvesting equipment — this additional constraint on timber availability was not modelled in Option 12.

5.12 Option 13a - Exclude the Koeye Watershed and Fougnar Bay in Block 7
Option 13 tests land base and harvest flow assumptions for Block 7 (Namu), located in the Mid-Coast Forest District. The Central Coast Land and Resource Management Plan process is considering protection of the Koeye Watershed and Fougnar Bay areas within Block 7. Option 13a excludes these areas, which reduces the THLB by 1,863 ha (14.1%). The Koeye Watershed is largely in the Old Growth stewardship zone, and was already significantly reduced in the base case. For this option, the model attempted to maintain an orderly subsequent decline in harvest levels at 10% per decade. Figure 21 illustrates that it is necessary to reduce the first-period harvest by 6,500 m^3/yr to 123,500 m^3/yr. The long-term impact of the land base removal is a 14.5% reduction in harvest level, to a long-term harvest rate of 66,000 m^3/yr.

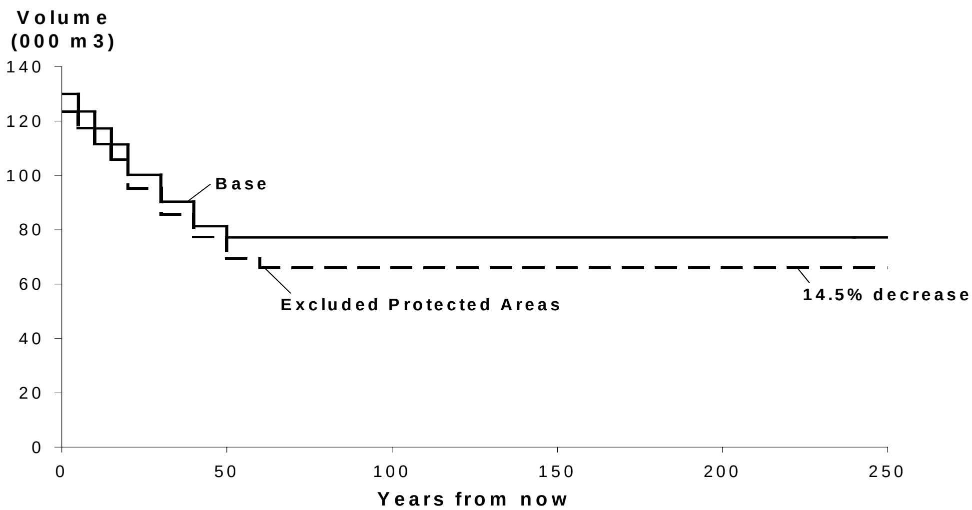

FIGURE 21. Block 7 harvest level with the Koeye Watershed excluded.

5.13 Option 13b - Exclude marginal timber stands from the THLB in Block 7
The Mid-Coast Forest District requested a sensitivity test assuming that marginal, lower-volume timber stands would not be harvested over the planning horizon. Option 13b illustrates the effect of this assumption. Other timber stands can maintain the base case harvest levels for 50 years. If the marginal stands are still considered uneconomic at that time, the harvest rate would continue to decline, to a stable long-term level of 64,350 m^3/yr, 17% below the base case long-term harvest level.

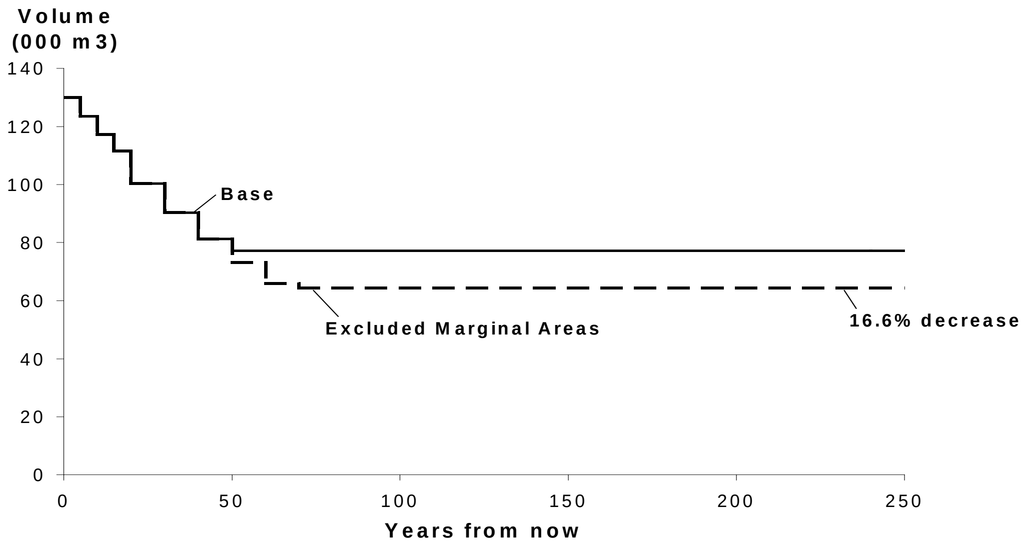

FIGURE 22. Block 7 harvest level with marginal areas excluded.

5.14 Option 13c – Set the first-period harvest to a level intermediate between the current allocation and the base case in Block 7

The harvest level attributed to Block 7 in the current management plan (MP#7) is 195,000 m³/yr. To model a harvest flow that does not decline more than 10% per decade it was necessary to reduce the first-period harvest to 130,000 m³/yr in the base case. Option 13c (Figure 23) illustrates the feasibility of starting at a higher harvest level. The four 5-year periods at the start of the planning horizon support harvests of 150,000, 125,000, 110,000, and 105,000 m³/yr, respectively. With this altered short-term harvest pattern, the base case harvest levels are achievable after 20 years from now.

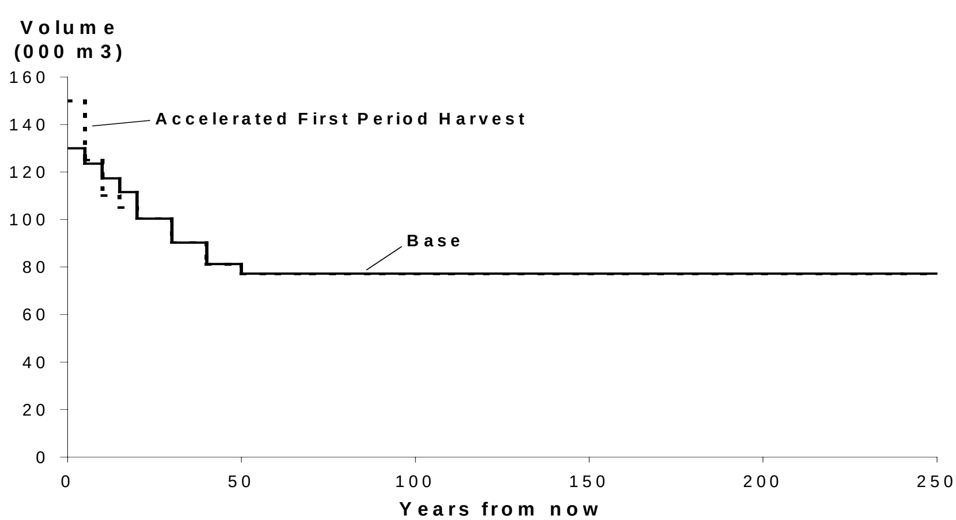

FIGURE 23. Block 7 accelerated first-period harvest level.

5.15 Option 14-15 - Increase and decrease mature volumes by 10%

In the base case, 64% of the volume harvested over the next 40 years comes from older stands, defined as stands presently over 130 years of age. The short-term harvest level is therefore sensitive to estimates of merchantable volume in old-growth stands.

Audits on most of the 1964 (original cruise) portion of the mature inventory have been completed. Volumes have been adjusted according to the audit results where inventory estimates were not based on direct plot estimates or where significant differences occurred between the audit sample and the inventory. Refer to section 5.3.1 in the Information Package.

The following table summarizes volume differences between the inventory and the audit results where the audit results were not significantly different and hence not applied in the analysis. Note that these differences occur for only a part of the mature inventory; labeled as MCI (classified as accessible timber in the 1964 inventory and not replaced with more recent operational cruising). The right hand column in the table summarizes the impact on total gross mature volumes by block.

TABLE 4. Summary of inventory audit results for mature stands

Block	**Audit to Inventory Comparison**		**% difference (relative to base option) for total mature volume**
	% difference in volume (audit relative to inventory)	**% of gross base option mature inventory in comparison**	
Block 1	Minus 1%	23%	Minus (< 1%)
Block 2	Plus 9%	50%	Plus 4.5%
Block 3|4	Minus 5%	28%	Minus 1.4%
Block 5	Plus 13%	25%	Plus 3.25%
Block 7	Minus 5%	47%	Minus 2.35%
Total TFL 39			Plus 1.4%

Mature stands are assigned volumes according to the inventory, and are assumed to neither increase nor decrease in volume until harvested in the timber supply model. Options 14 and 15 test the effect on harvest levels if the volume estimates are 10% too high or too low. The 10% margin covers the variation in audit results. Effects are modelled to occur in the early part of the planning horizon. Figure 24 illustrates that if there is actually 10% more volume in mature stands than estimated, the starting harvest level can be maintained for 20 years, followed by a more gradual decline in harvest levels to the base case long-term harvest level.

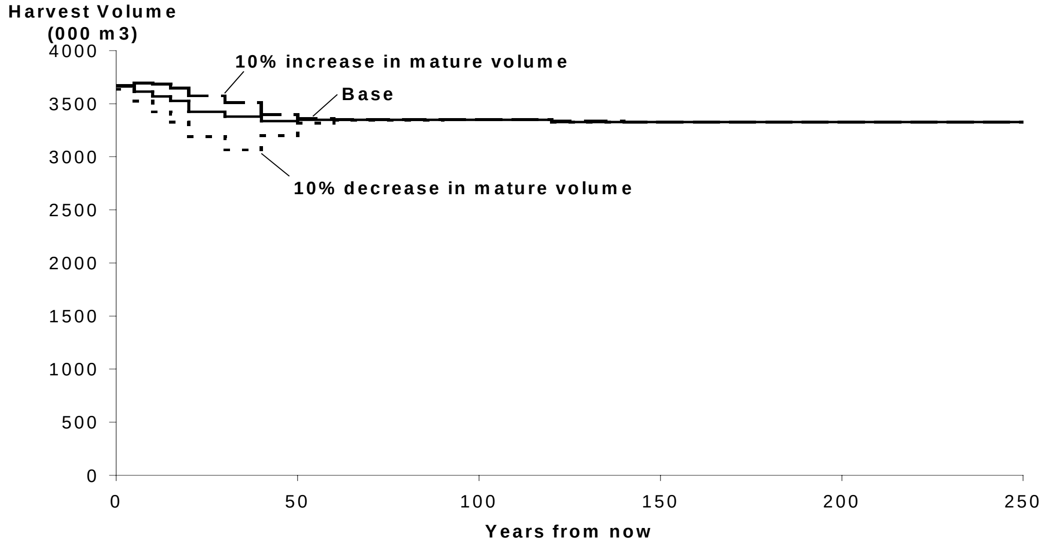

FIGURE 24. Harvest levels with mature volumes changed by +/- 10%.

If there were 10% less volume in mature stands than has been estimated, two blocks in TFL 39 would require first-period harvest-level reductions from the base case. Block 3|4 would require a first-period reduction of 14,000 m³/yr, and Block 7 would require a first-period reduction of 11,200 m³/yr if required to meet 10% per decade harvest level reductions.. Combined, this would be a 0.7% first-period reduction in the TFL 39 harvest level. Subsequently, harvest levels decline to 3,063,000 m³/yr by 30 years from now, 9% below the base case, before recovering to match the base case long-term harvest level.

5.16 Option 16-17 - Increase and decrease second-growth volumes by 10%

In the base case 742,600 m³/yr of second-growth timber (stands presently younger than 130 years) is harvested in the first planning period. The second-growth volume harvested rises steadily as a proportion of total harvest volume, until by 50 years from now essentially all harvesting is in second-growth stands.

Volume estimates for second-growth stands were developed using the computer model Y-XENO, as described previously (Section 2.2). Options 16 and 17 test the mid- and long-term effect on harvest levels if second-growth volumes are under or over-estimated by 10%. Figure 25 illustrates that if stands grow 10% faster than modelled in the base case, harvest levels will stabilize at 3.4 million m³/yr by 30 years from now, and will eventually rise to a long-term level of 3.6 million m³/yr, 8.2% above the base case. Harvest levels were modelled to not permit a mid-term dip. The long-term harvest level is accompanied by a rising level of growing stock in the long term, suggesting that the long-term harvest level could rise to 10% above the base case once the transition from mature to second-growth harvesting is complete.

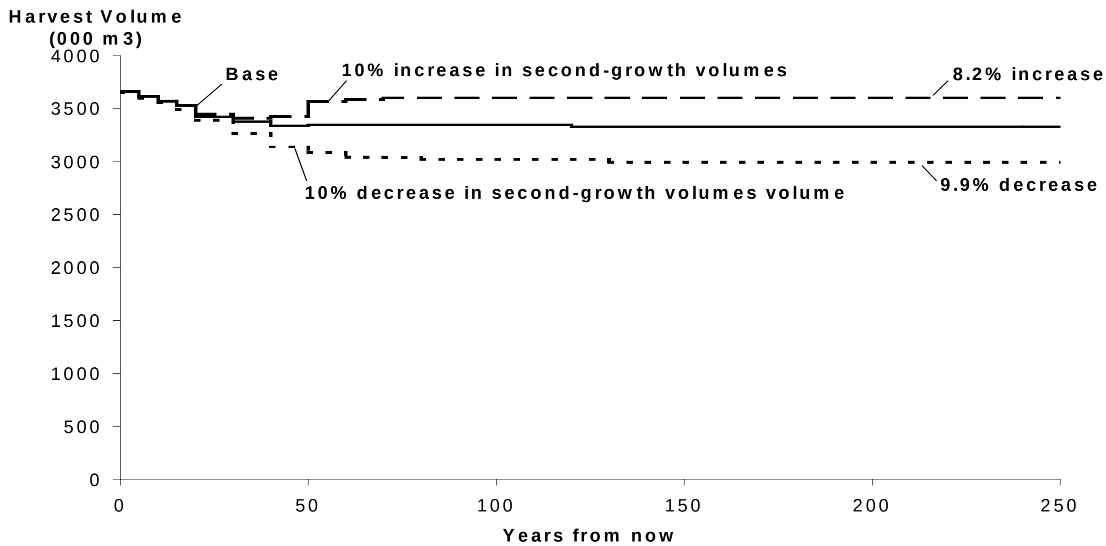

FIGURE 25. Harvest levels with second-growth volumes changed +/- 10%.

If there were 10% less volume in second-growth stands, harvest levels begin to diverge lower than the base case by 15 years from now, and reach a stable long-term harvest level approximately 10% below the base case.

5.17 Option 18 - Apply inventory site indexes

Previous management plan timber supply analyses used inventory site index for their base case. Inventory site index is estimated according to the height and age of forest stands. However, it is generally recognized now that estimates of site productivity based on measurements of old-growth forest often under-rate the growing site potential for regenerated stands. Weyerhaeuser has developed a biophysical method of estimating growing site potential, using topographic position and climate. The biophysical site index was introduced in Management Plan #7 as a sensitivity option, and was found to raise long-term harvest levels 19.3% in that timber supply analysis.

This analysis uses the biophysical site index for the base case. Option 18 tests the harvest flow that would be indicated if the old inventory site index estimates were used instead. The land base was re-aggregated into the four site classes modelled, new weighted average yield tables were developed for each class using Y-XENO, and all other model factors (land base netdowns, forest cover requirements, variable retention management) were maintained as per the base case. Figure 26 illustrates the extent to which areas shifted down among the site classes. In hemlock stands, approximately 44,000 ha of high sites and 40,000 ha of good sites dropped to become 4,000 ha of medium sites and 79,000 ha poor sites. In Douglas-fir stands, approximately 10,000 ha of high sites dropped to become 2,000 ha of good sites, 1,000 ha of medium sites, and 7,000 ha of poor sites. The poor site class was extended to include inventory site index 11 for this Option, but 1,216 ha dropped from the THLB. Figure 27 shows the effect of this option on TFL 39 harvest flow.

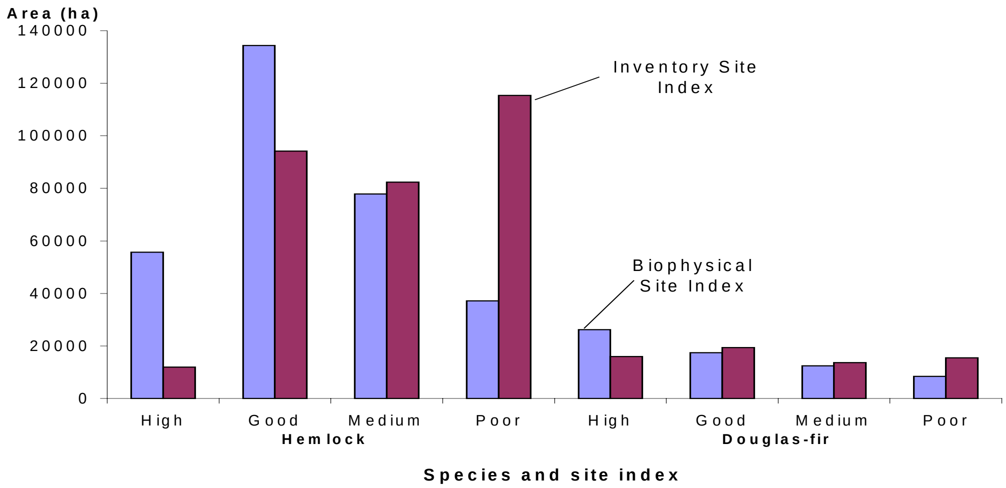

FIGURE 26. Option 18 shift in area among site classes.

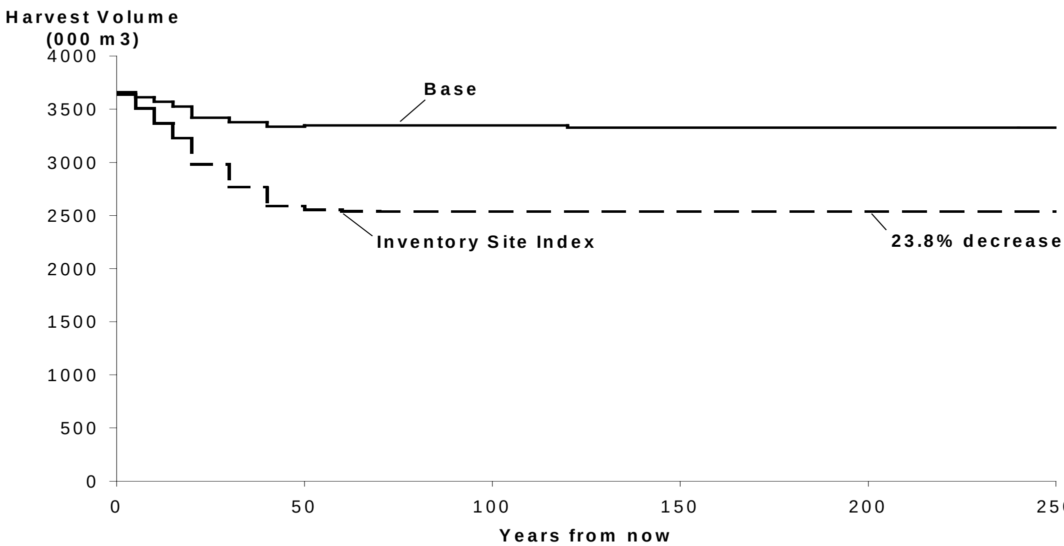

FIGURE 27. Harvest levels using inventory site index.

In Figure 27 the first-period harvest level declines 21,000 m³/yr, due to a shortfall in Block 7 if harvest levels are constrained to not decline more than 10% per decade. The rate of decline in harvest levels for TFL 39 increases to 4% per 5-year period and 8% per decade, from the 2.6% per decade rate of decline in the base case. Harvest levels decline for an additional 20 years relative to the base case, and stabilize 23.8% lower than the base case long-term harvest level. The decrease in long-term harvest level varies by block, from 13% in Block 1 to over 30% in Blocks 5 and 7. The Option 18 growing stock level stabilizes 22% lower than the base case.

5.18 Option 19 – Increase minimum harvest ages by 10 years

In the base case the minimum harvest age is set to the age when a stand achieves 350 m^3/ha. Minimum harvest ages range from approximately 45 years on high growing sites, to 80-120 years on poor growing sites. Option 19 tests for the effect of raising all minimum harvest ages by 10 years. Figure 28 illustrates that the rate of harvest level reduction must be increased, to reserve timber supply until second-growth stands are more mature. A low point, 3% below the base case level, is reached 40 years from now. The long-term harvest level is 0.1% below the base case level.

FIGURE 28. Harvest levels with minimum harvest ages increased 10 years.

The increased minimum harvest ages affect growing stock levels. After 50 years from now, the 10-year increase in minimum harvest ages causes the standing inventory to be approximately 4% higher than in the base case.

6.0 BLOCKS THAT COMPRISE TFL 39

TFL 39 consists of seven separate supply blocks on northern Vancouver Island, the mainland coast, and the Queen Charlotte Islands. Supply Blocks 3 and 4, managed by the Port McNeill division, are treated as a single harvest unit in the analysis. This section of the report discusses each block in turn. A brief description highlights the character of its timber supply situation, and a summary comment describes the results of the option analysis of the block. Appendix 2 provides graphs that describe the land base and inventory for all blocks. Appendix 3, the data CD, includes an organized presentation of graphs of all option results for all blocks.

Table 2 (Derivation of THLB) presented a detailed derivation of the timber harvesting land base for all supply blocks. In the timber supply model, excluded productive forest contributes to old seral cover requirements (excluding variable retention netdowns) and both excluded productive and excluded non-productive forest contributes to watershed, avalanche, and visual quality constraints. The four-pass harvesting constraint applies within the THLB area.

6.1 Block 1, the Powell River Block, is located on the British Columbia mainland area known as the Sunshine Coast. Block 1 includes 24% of the total TFL 39 land area, and 19% of the THLB. Harvesting in Block 1 dates from 1890, and there is presently an extensive inventory of maturing second-growth timber.

Block 1 has the highest proportion (47%) of Douglas-fir leading stands of all blocks in TFL 39. Over half of this Douglas-fir inventory is presently aged 70 to 120 years, growing on sites rated good and high site productivity. The old growth remaining in Block 1, covering 18% of the THLB area, is primarily hemlock on medium to good growing sites.

Figure 29 illustrates the base case harvest flow for Block 1. The maturing second-growth forests provide a rising timber supply, from the present 550,000 m^3/yr to a harvest level of 670,000 m^3/yr by 50 years from now. This rising harvest level offsets a declining harvest forecast for some other blocks, which are in earlier stages of conversion from old growth to managed second growth.

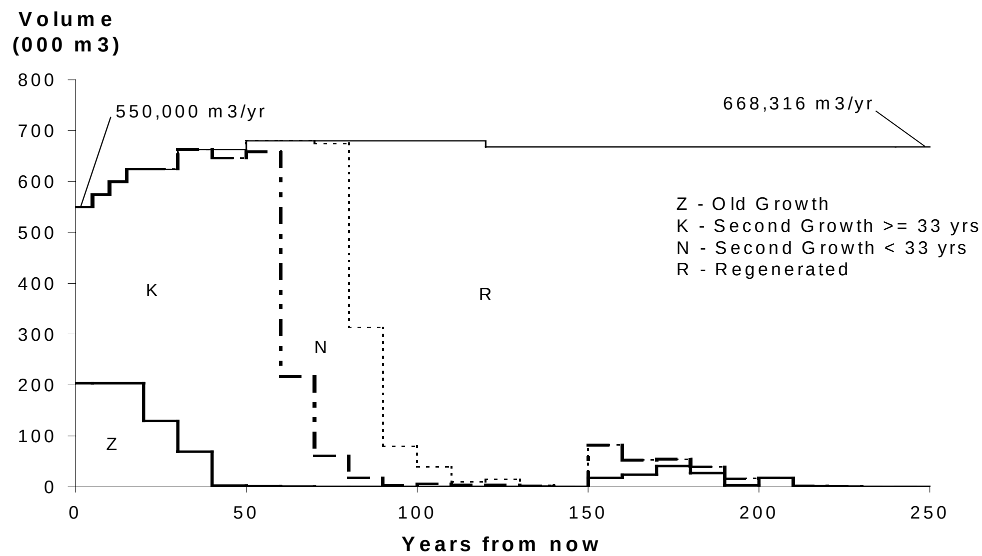

FIGURE 29. Block 1 base case harvest flow.

The options analysis of Block 1 illustrates the robustness of the starting harvest level. Only Option 4, adoption of early seral forest cover constraints, affects the first-period harvest. All other options permit the modelled first-period harvest to be achieved — including increased in-block variable retention levels, 5% land base withdrawal, 10% reductions in assumed old-growth or second-growth volumes, and visual quality constraints managed at the most constraining end of the range. With harvesting at the base case rate, the present Block 1 growing stock of 33 million m³ is expected to decline to approximately 29 million m³ over the next 100 years, and will stabilize at that new level.

6.2 Block 2, the Adam River Block, is located northwest of Campbell River on Vancouver Island. Block 2 includes 26% of the total TFL 39 land area, and 32% of the THLB. Block 2 is the second-largest block in TFL 39 by land area and contributes the largest timber supply of all the blocks, due to its better growing sites compared with more northerly blocks. In 1999 Block 2 became the first management unit in British Columbia to receive Canadian Standards Association Sustainable Forest Management System (Z809) certification of forest management practices.

Block 2 is stocked 15% with leading Douglas-fir stands, the remainder being hemlock, balsam, and cedar stands, which are all modelled as hemlock in the analysis. Forty-six percent of the THLB is stocked with old-growth stands. Second-growth stands range up to 50 years of age, with small areas of 60– and 70–year-old forest. Growing sites are mainly good to high site class.

Figure 30 illustrates the projected harvest flow from Block 2. Harvests decline in orderly steps of 2.5% per 5-year period, and 5% per decade until reaching a sustainable level 40 years from now. The long-term harvest level is stable at 1.08 million m³/yr, 19% lower than the starting harvest level. Most of the remaining old-growth is converted to managed stands over the 40-year period, and the growing stock declines from the present 48 million m³ to a low of 35 million m³, recovering to a stable long-term level of approximately 37 million m³, 77% of present levels.

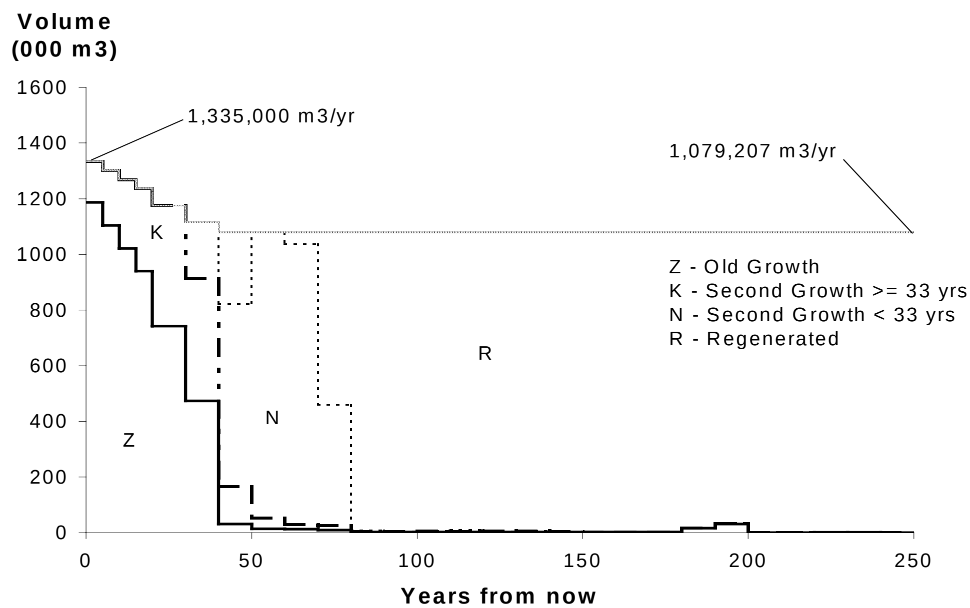

FIGURE 30. Block 2 base case harvest flow.

The options analysis of Block 2 shows that the first-period harvest level is stable under all options except the test of adopting early seral forest cover constraints. All other options that might have a negative timber supply consequence are able to achieve the first-period harvest level by increasing the slope of the subsequent transition to the long-term level. The increased pace of transition does not exceed 10% per decade for any option. However, increasing the assumed level of variable retention or reducing mature volume estimates both cause a dip below the long-term harvest level 30 to 40 years from now.

6.3 Block 3 (Coast Islands) and **Block 4** (Port Hardy) are modelled as a single unit in the analysis. Block 3 consists of several separate areas on islands between Vancouver Island and the mainland. Block 4 is on Vancouver Island, reaching south between Port Hardy and Port McNeill.

Block 3 is sensitive to visual quality concerns, being visible to recreational boaters and the frequent cruise ships plying British Columbia's coastal waterways. Thirty-nine percent of the Block 3 THLB is in the Retention or Partial Retention recommended visual quality classes. In Block 4 visual quality is not a concern.

The Block 3|4 THLB inventory is 26% old-growth. The THLB is 17% stocked with second growth over 50 years of age, but the majority of the second-growth inventory is not yet 50 years old. This restricts mid-term timber supply and reduces flexibility to meet supply targets for some options tested.

Figure 31 illustrates the base case harvest flow for Block 3|4. Harvesting is modelled as a flat line set at 400,000 m³/yr. There is a 2.5% dip in supply, to 390,000 m³/yr in the period 30 to 40 years from now. Harvesting in old growth and older second growth is largely completed by then, and the timber supply must come from stands presently younger than 33 years old. Growing stock levels stabilize after that point at 15 million m³, down from 16 million m³ today.

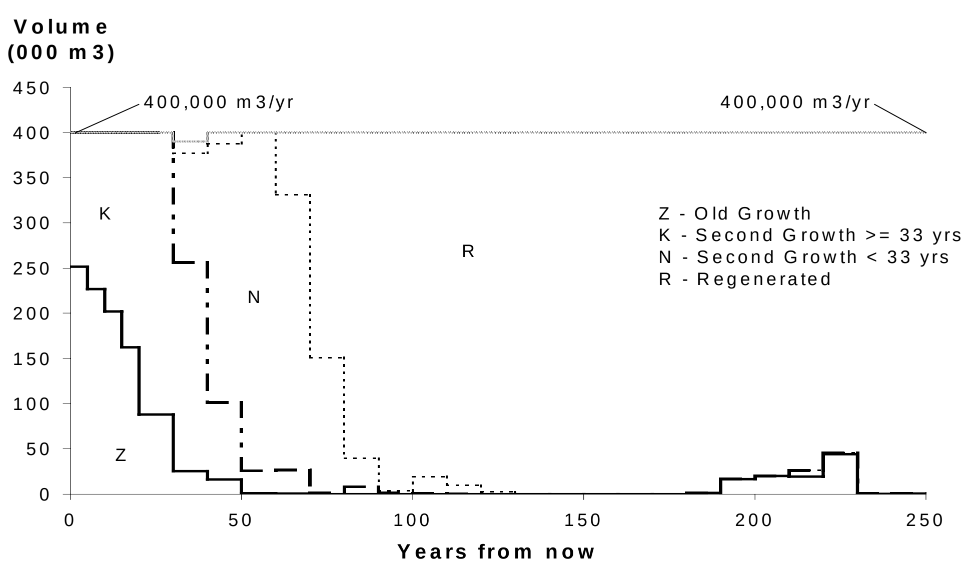

FIGURE 31. Block 3|4 base case harvest flow.

The options testing illustrates that timber supply at the 400,000 m^3/yr level is sensitive to changed assumptions. For example, increasing the land base by 5% does not raise the harvest level until 50 years from now, whereas reducing the land base by 5% causes an immediate harvest level decline of 3.5%. Similarly, increasing second-growth volumes by 10% provides a gain starting in 40 years, whereas reducing second-growth volumes the same amount forces the starting harvest level down by 3.5%. Also, raising minimum harvest ages 10 years reduces the harvest level by 1% from the first period. The Option 3 test of increased levels of in-block variable retention reduces the first-period harvest level by 9.7%. An alternative harvest flow for these Options would be to maintain the first period at 400,000 m^3/yr and extend and/or deepen the dip in supply anticipated 30 years from now. Short-term supply in Block 3|4 generally cannot be raised without increasing the dip expected 30 to 40 years from now.

6.4 Block 5, the Phillips River Block, is located on the mainland, between Knight and Bute Inlets. Harvest operations are camp-based, as there are no major communities in the vicinity. Block 5 is managed as habitat and old growth stewardship zones, with no timber emphasis zone. The THLB is 39% non-conventional (helicopter) harvesting.

The inventory in Block 5 is dominated by hemlock. The small areas in the analysis modelled as Douglas-fir are approximately half yellow cedar stands. Although there are some high growing sites, notably in second growth, the remaining old growth occurs on medium to good growing site quality.

The THLB is presently 57% stocked with old-growth timber. Second-growth forests are generally younger than 30 years of age, due to the recent harvesting history in this block. Figure 32 illustrates the base case harvest flow. For the next 20 years all harvesting will come from old-growth stands. During the period 20 to 40 years from now, the limited area of older second growth will supplement old-growth harvesting, followed by a transition to reliance on second-growth forests. The long-term harvest level is 24% lower than the first-period harvest level, and the long-term growing stock stabilizes at 2.8 million m^3, 18% lower than the present 3.6 million m^3.

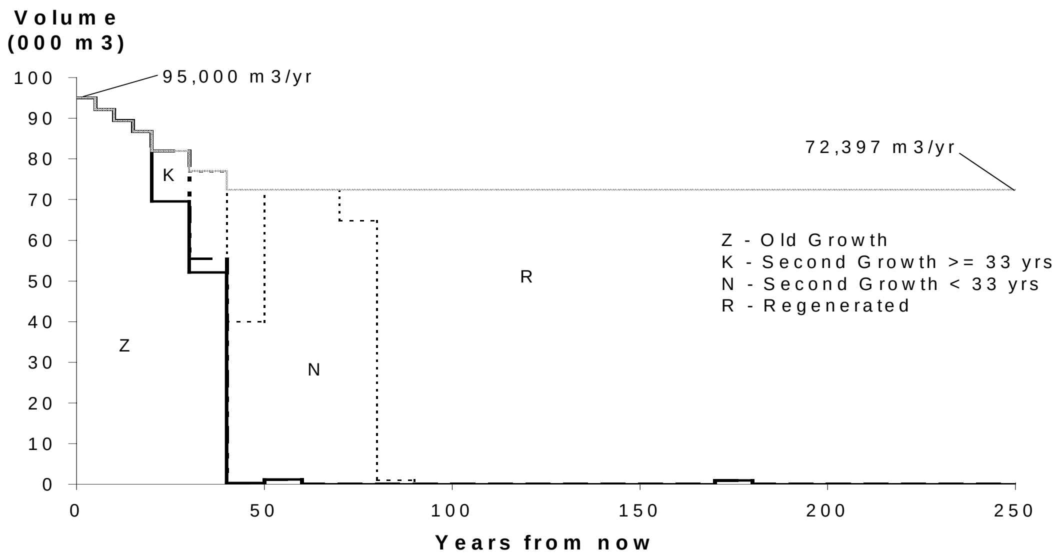

FIGURE 32. Block 5 base case harvest flow.

The options analysis shows that the timber supply from Block 5 is robust. Visual quality constraints do not affect harvest flow, even at the most constrained level. A 5% reduction in the THLB does not affect first-period harvest levels. Option 11 tested excluding the Phillips Lake area, with no impact on timber supply for 50 years. Decreases of 10% in assumed old-growth or second-growth yields do not affect first-period harvest levels. Option 18 tested using the old inventory site index, which would decrease the long-term harvest level 33.6%, but would permit the first-period harvest level to be maintained.

Option 4, adopting early seral forest cover requirements, provides interesting results in Block 5. The starting harvest level is reduced by 95%, to 5,000 m³/yr for this option. Harvesting does not rise to 50% of base case levels until 60 years from now, and the long-term harvest level is 11% lower than the base case. Early seral constraints limit the amount of area that may be younger than 40 years old. The Phillips Landscape Unit is rated High biodiversity emphasis, and adopting the early seral constraints as modelled would effectively halt harvesting for at least one decade in Block 5.

6.5 Block 6, the largest Block in TFL 39, is located on the Queen Charlotte Islands (QCI). There are many communities associated with Block 6, including Sandspit, Queen Charlotte City, Skidegate, Port Clements, Tlell, and Masset. Harvesting activities in Block 6 are a major employment contributor in the QCI.

The forest in the QCI consists of hemlock, red-cedar, spruce, and yellow cedar. In the timber supply model yellow cedar and lodgepole pine follow the Douglas-fir stand development path, and the other species are all modelled as hemlock. Productive forests cover 75% of the total Block 6 area; however, netdowns remove one-third of the productive forest from the THLB. Within the THLB, 56% of the area is presently stocked with old growth. Second-growth stands are evenly distributed across a range of from zero to 60 years of age, with lesser areas up to 110 years old. Second-growth stands mainly occur on high and good growing site quality, while the old-growth is evenly distributed among good, medium, and poor growing sites.

Figure 33 illustrates the base case harvest flow for Block 6. The starting harvest level of 1.15 million m³/yr declines at a rate of 2.5% per 5-year period, to a stable long-term level of 1.03 million m³/yr by 20 years from now. A small but increasing portion of the harvest is from second-growth stands, although old-growth accounts for the majority of harvested volume until 40 years from now. Growing stock in Block 6 declines from the present 45 million m³ to a stable level of 32 million m³ by 50 years from now.

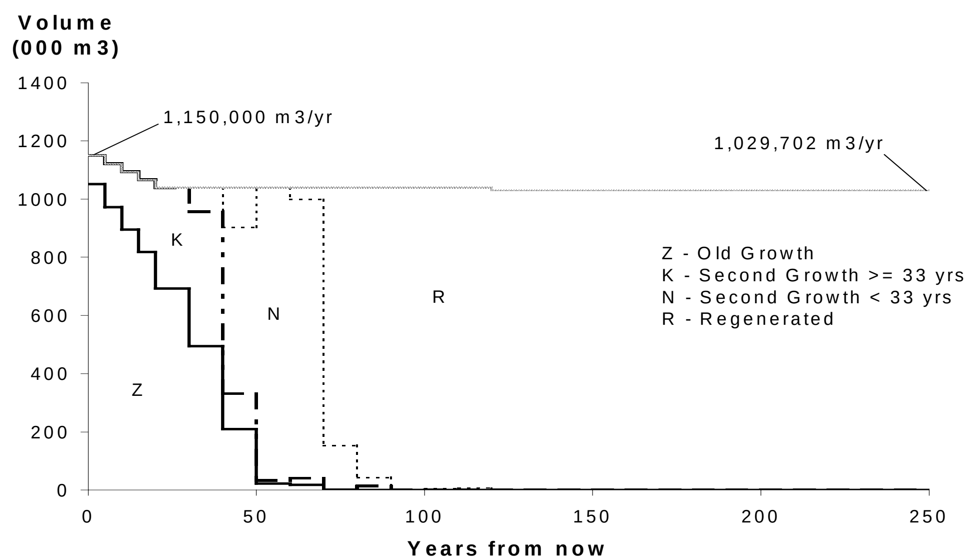

FIGURE 33. Block 6 base case harvest flow.

The option analysis shows that mid-term (30 to 60 years from now) timber supply would be sensitive to visual quality concerns, if visually sensitive areas are managed at the most stringent end of current guidelines. A 5% reduction in THLB area lowers the long-term harvest level by 6%, falling below the base case by 30 years from now. If mature volumes were 10% lower than estimated, the first-period harvest level could be achieved; however, the harvest level would fall below the long-term level beginning 15 years from now, recovering to the base case level by year 60. If timber presently classed as uneconomic to harvest were to become economic, the long-term harvest level would rise 2.6%. Increasing minimum harvest ages by 10 years creates a small dip in the harvest forecast during the transition to second-growth harvesting, 30 to 60 years from now, but does not affect the long-term harvest level.

Option 12, discussed earlier, shows that an equitable partition of the base case harvest between proposed Haida protected areas and other Block 6 areas would allocate 11% of the base case harvest flow to come from the proposed Haida protected areas, and 89% from other areas.

6.6 Block 7, the Namu Block, is located on the mainland mid-coast, facing Fitz Hugh Sound and Burke Channel along the water access route to Bella Coola. Harvest operations are camp-based. The present inventory is predominantly old-growth hemlock on medium to poor growing sites. A brief harvesting history has created few second-growth stands, which are less than 15 years old.

The Block 7 forest is managed as a balanced mix of timber, habitat, and old-growth stewardship zones. Within the THLB, 29% of the area is classified for non-conventional (helicopter) harvesting, and another 18% of the area is of marginal merchantability. Block 7 forms part of the Central Coast LRMP, which is considering protection of the Koeye watershed.

Figure 34 illustrates the base case harvest flow for Block 7. The harvest flow was developed using a guideline permitting a maximum 5% decline per 5-year period and 10% decline per decade. However, Block 7 does not directly support a local community, and Option 13c tested steeper rates of decline. The harvest flow shown here seeks to maximize the short-term harvest level, subject to achieving a stable growing stock level and not declining below the stable long-term harvest level.

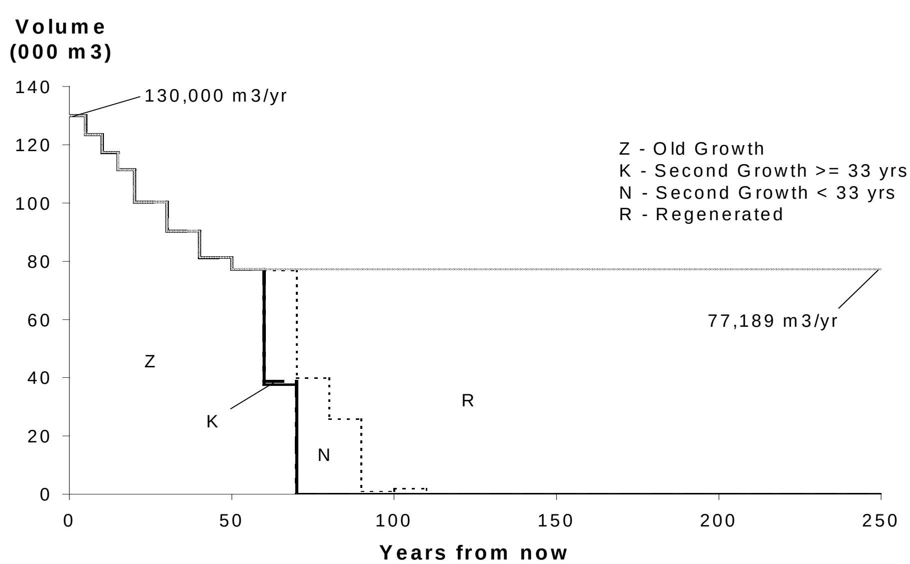

FIGURE 34. Block 7 base case harvest flow.

The indicated first-period harvest level with the guidelines modelled is 130,000 m³/yr. The harvest level then declines steadily to 77,189 m³/yr achieved 50 years from now, when old-growth harvesting is nearly complete and second-growth harvesting is about to commence. During the transition, growing stock levels decline from the present 6.3 million m³ to a stable level of approximately 2.9 million m³.

The options analysis illustrates that the Block 7 harvest flow is robust. The only options that affect the first 20 years of the base case flow are Option 14, which tested a 10% reduction in mature volume estimates, and Option 18, which tested using inventory rather than biophysical site index estimates. Increased minimum harvest ages, visual quality constraints at their most constraining level, and adoption of early seral forest cover requirements do not affect the base case harvest flow. Higher levels of variable retention, a 5% reduction in the THLB, and 10% lower regenerated stand volume estimates do not impact harvest levels until 60 years from now.

The three-part Option 13, reported earlier, tests several scenarios for Block 7. Excluding the Koeye watershed and Fougnar Bay causes a first-period decline of 6,500 m³/yr, and reduces the long-term harvest level by 11,200 m³/yr. Excluding assumed harvesting in marginally economic stands does not impact the harvest level for 50 years, but causes a 12,800 m³/yr reduction in long-term harvest levels.

A more gradual transition from the current harvest level (195,000 m³/yr) was tested by modelling a starting harvest level of 150,000 m³/yr, and allowing subsequent harvests to decline by more than 10% per decade. It was found that this intermediate harvest level is achievable with a 17% decline in harvest rates 5 years from now, followed by a 12% decline 5 years later.

Table 5 summarizes the base case harvest levels by timber supply block. Overall for TFL 39 the first-period harvest level is within 10% of the long-term harvest level, with local variance depending on the present age class composition of each block.

TABLE 5. Summary of short- and long-term base case harvest levels by block.

Supply block	**Management Plan #7 harvest level (m3/yr)**	**First-period harvest level (m3/yr)**	**Long-term harvest level (m3/yr)**	**Difference: first-period vs. long-term (%)**
Block 1	445,000	550,000	668,316	21.51
Block 2	1,335,000	1,335,000	1,079,207	-19.16
Block 3|4	415,000	400,000	400,000	0.00
Block 5	100,000	95,000	72,397	-23.79
Block 6	1,210,000	1,150,000	1,029,702	-10.46
Block 7	195,000	130,000	77,189	-40.62
Sub-total	3,700,000	3,660,000	3,326,811	-9.10
Deciduous	40,000	n/a	n/a	
Total TFL 39	3,740,000	3,660,000	3,326,811	-9.10

7.0 SUMMARY AND CONCLUSIONS

The results of this timber supply analysis indicate that the planned gradual reductions in harvest levels in TFL 39 may continue without creating severe future timber supply disruptions. A reduction in harvest levels totaling 11% over the next 40 years will bring harvesting to a level that may be sustained indefinitely.

This result reflects current knowledge about the forest inventory, future rates of growth and management practices. The analysis incorporated the best current scientific knowledge about the productivity of forests in TFL 39, and included all identified non-timber forest management considerations. The Weyerhaeuser variable retention and forest stewardship practices were included in the analysis, as were all mandatory requirements of the Forest Practices Code.

However, there always remains some uncertainty about assumptions made in an analysis. An options analysis was undertaken to develop an understanding of the potential impacts of uncertainty on the projected harvest levels. There may be uncertainty regarding the size of the productive land base, the existing and future timber volumes growing on the land base, and changing forest management practices and regulations.

The options analysis shows that the short-term TFL 39 harvest level is very stable. Only one option creates a significant first-period effect on the projected harvest level. This option would be the theoretical adoption of early and mature seral forest cover requirements. However, as noted, current provincial policy is that these requirements are not adopted.

Several factors were shown to have a significant effect on timber supply in either the medium- or long-term. These factors include estimates of existing stand volumes, regenerated stand volumes, the quantity of timber left in variable retention harvesting, and an increase or decrease in the TFL 39 timber harvesting land base. The sensitivity tests of these options, however, resulted in changes on the order of 10% in the long-term TFL 39 harvest forecast, and do not represent significant risk of future timber supply disruptions.

Options that tested the harvest of forest stands at older ages, the impacts of biodiversity and visual quality requirements, and the utilization of presently uneconomic timber, all have a small effect on projected timber supplies. Exclusion of specific proposed protected areas in Block 1 (Option 10) and Block 5 (Option 11) have a very small effect, not noticeable until 50 years from now.

Exclusion of the proposed Haida protected areas in Block 6 does have a significant local effect (11% reduction), as does the exclusion of the Koeye Watershed in Block 7 (14.5% long-term reduction). However, the order of magnitude of these reductions on the TFL 39 harvest level is 3.5% for the Haida protected areas, and 0.3% for the Koeye Watershed.

In conclusion, the analysis indicates that based on current inventory and growth and yield information, and current management practices, timber harvests in TFL 39 may safely be projected to continue the planned gradual adjustment to a sustainable long-term harvest level. Figure 35 illustrates the base case harvest levels projected in this analysis (solid line), compared with the harvest levels projected for the first 195 years in the previous Management Plan #7 timber supply analysis (dotted line). The dashed line in Figure 35 illustrates the projected harvest contribution from existing old-growth stands.

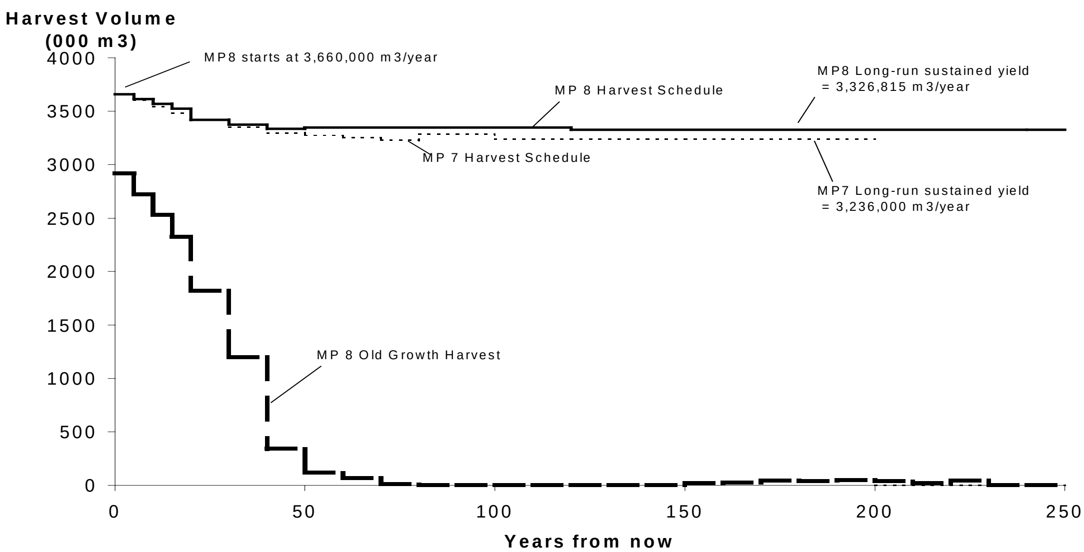

FIGURE 35. Comparison of MP#7 and MP#8 base case harvest flows.

The harvest levels are consistent between the two Management Plans. The main changes between the two analyses are the implementation of the Forest Practices Code, the adoption of stewardship zones and variable retention harvesting (Option 2) and the adoption of biophysical site index assignment for mature and young stands (Option 18). These changes had offsetting effects, and create a similar aggregate picture.

8.0 REFERENCES

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APPENDIX 1
Description of Data Inputs and Assumptions For the Timber Supply Analysis

Introduction

This section of the report outlines the methods and inputs used to derive the timber harvesting land base (THLB) and construct the timber supply model for TFL 39.

Inventory Information

The inventory consists of seven GIS map datasets, one for each of the seven blocks that comprise TFL 39. Each map dataset contains approximately 120 levels of information, including legal ownership, administrative boundaries, land cover (lakes, rock, forest, etc.), forest stand identifiers, forest cover information (species, site productivity, volume, age), economic and physical operability, and environmentally sensitive areas. The maps also identify the location of stewardship zones, protected areas (proposed and designated), visually sensitive areas, community watershed, and other location-specific issues that affect timber supply.

The forest cover inventory used for this project is current to 1995. The timber supply models built from the inventory were run for one 5-year period with harvesting set to the actual harvest rate, by block, for the 1996–2000 period. The first period shown and discussed in the report is actually the second period in the modelling.

Stewardship Zones

Weyerhaeuser BC Coastal Group is following the direction set by its predecessor company, MacMillan Bloedel Ltd., in phasing out clearcutting. Current and future harvesting use variable retention and increase conservation of old-growth forests and wildlife habitat. Forest lands are classified into three stewardship zones (old growth, habitat, and timber). This harvesting initiative is discussed in Section 8.5 of the Information Package for the TFL 39 MP#8 Timber Supply Analysis. The new management initiative has area and volume effects in the analysis.

In the Old Growth zone, the company intends to harvest in one-third of the zone, and retain 20% of the trees in harvested units. This is modelled as retention of 70% of the forest otherwise available for harvesting, which is removed from the THLB. The company intends to retain a minimum of 15% of the trees in the Habitat zone and a minimum of 10% of the trees in the Timber zone. Assuming that half of these targets are met from wildlife tree patches, environmentally sensitive areas, and riparian reserves, the THLB is reduced by 7.5% in the Habitat zone and by 5% in the Timber zone. These reductions are made after all other land base reductions have been made.

Additionally, it is recognized that the retained trees will compete with the regenerating forest for light, nutrients, and growing space. The rate of growth of the regenerating forest is therefore reduced in the model compared with an open-grown stand on the same site. The volume reductions are 30% in the Old Growth zone, 11% in the Habitat zone, and 3% in the Timber zone.

The models maintain differentiation among the stewardship zones, but do not apply zone-specific forest cover requirements to the areas remaining in the THLB. Table A1 summarizes the THLB area in each block by stewardship zone.

TABLE A1. THLB area by block and stewardship zone

Supply block	**Timber harvesting land base**		
	Old Growth (ha)	**Habitat (ha)**	**Timber (ha)**
Block 1	0	17,652	52,413
Block 2	1,020	30,895	85,335
Block 3|4	0	3,495	38,848
Block 5	228	7,858	0
Block 6	3,471	24,208	91,351
Block 7	1,879	4,380	6,937
Total TFL 39	6,598	88,488	274,884

Non-timber Resource Management Zones

Table 1 in the report summarizes area netdowns for environmentally sensitive areas, riparian reserves, parks and protected areas, wildlife tree patches, culturally modified trees, and variable retention reserves. These areas are all excluded from the THLB.

Additionally, there are non-timber resource concerns within the THLB. The timber supply models identify these areas as (potentially overlapping) zones, and apply forest cover requirements within the zones. The zones identified for the analysis include:

Avalanche run-out zone: Harvesting in these areas is constrained to protect the toe of the avalanche track. Avalanche run-out zones are mapped and include forested buffer areas. The models allow no more than 20% of the forested buffer to be less than 30 years old at any time.

Community watersheds: Within the THLB some forest areas provide community drinking water. The watersheds occur in Block 1 (1,445 ha), Block 2 (308 ha), and Block 6 (1,592 ha). The models allow no more than 10% of these areas to be less than 10 years old at any time.

Coastal watershed assessments: Certain watersheds within TFL 39 have recovery plans in place that include road and stream rehabilitation and short-term harvest restrictions. These areas have a rate-of-cut constraint applied in the models until 2010. Table A2 summarizes the area influenced and rate of cut modelled.

TABLE A2. Watershed rate-of-cut constraints.

Supply Block	**Watershed**	**THLB area (ha)**	**Maximum cut (ha/yr)**
Block 1	My	675	28
	Whittal	583	10
Block 2	Adam	3,294	59
	Elk	872	10
	Tsitika	4,036	260
Block 3|4	Benson	2,242	67
	Waukwass	2,802	99

Landscape biodiversity: Old seral forest cover constraints are applied for combinations of draft landscape units and biogeoclimatic variants within TFL 39. All productive forest, including productive forest outside the THLB, except forest reserved in variable retention patches, contributes to meeting the constraints. The constraints specify a percentage of the productive forest that must be older than 250 years. The constraints are phased in over three forest rotations, a procedure that is tested in Option 5. Table A3 summarizes the productive areas and the percentage required to be older than 250 years after two rotations for each landscape unit and variant combination. Landscape unit (LU) names are abbreviated to three characters in Table A3.

TABLE A3. Landscape units and BEC variant areas and constraints.

LU-variant	**Productive area (ha)**	**Constraint* (%>250 years)**	**LU-variant**	**Productive area (ha)**	**Constraint* (%>250 years)**
Block 1			**Block 3|4**		
BRICWHdm	2,992	9.4	BONCWHvm1	686	13.6
BRICWHvm2	1,313	13.6	BROCWHvm1	5,763	13.6
BUNCWHdm	4,374	9.4	CLKCWHvm1	8,782	13.6
BUNCWHvm2	2,631	13.6	CLKCWHvm2	2,042	13.6
BUNCWHxm1	450	9.4	CLKMHmm1	474	19.9
BUNMHmm1	1,379	19.9	GILCWHvm1	7,691	13.6
HASCWHdm	4,870	9.4	HOLCWHvm1	2,282	13.6
HASCWHvm2	1,414	13.6	MARCWHvm1	15,378	13.6
HASCWHxm1	1,440	9.4	MARCWHvm2	6,514	13.6
LOICWHdm	18,637	9.4	MARMHmm1	1,848	19.9
LOICWHvm2	9,174	13.6			
LOICWHxm1	777	9.4	**Block 5**		
LOIMHmm1	4,980	19.9	PHICWHdm	710	9.4

PODCWHdm	741	9.4
PODCWHvm1	5,419	13.6
PODCWHvm2	3,584	13.6
PODMHmm1	1,274	19.9
POLCWHdm	9,794	9.4
POLCWHvm1	2,405	13.6
POLCWHvm2	8,058	13.6
POLMHmm1	4,720	19.9
Block 2		
ADECWHvm1	27,754	13.6
ADECWHvm2	17,217	13.6
ADEMHmm1	8,394	19.9
SALCWHmm1	22,421	9.4
SALCWHmm2	7,990	9.4
SALCWHvm1	1,105	13.6
SALCWHvm2	446	13.6
SALCWHxm2	15,301	9.4
SALMHmm1	3,402	19.9
SAYCWHmm1	767	9.4
SAYCWHxm2	5,294	9.4
TSICWHvm1	11,287	13.6
TSICWHvm2	7,320	13.6
TSIMHmm1	3,650	19.9
WHICWHmm1	719	9.4
WHICWHmm2	470	9.4
WHICWHvm1	14,421	13.6
WHICWHvm2	8,153	13.6
WHICWHxm2	1,460	9.4
WHIMHmm1	4,594	19.9
PHICWHvm1	6,865	13.6
PHICWHvm2	5,079	13.6
PHIMHmm1	1,505	19.9
Block 6		
HIBCWHvh2	10,850	13.6
HIBCWHwh1	1,856	13.6
HIBCWHwh2	1,590	13.6
HONCWHwh1	1,253	13.6
HONCWHwh2	480	13.6
IANCWHwh1	18,732	13.6
IANCWHwh2	3,960	13.6
IANMHwh2	744	19.9
LOUCWHwh1	15,616	13.6
LOUCWHwh2	4,751	13.6
LOUMHwh2	1,484	19.9
LOYCWHwh1	19,798	13.6
LOYCWHwh2	1,442	13.6
MASCWHwh1	30,581	13.6
MASCWHwh2	10,768	13.6
MASMHwh2	2,122	19.9
NAICWHwh1	3,262	13.6
SEWCWHwh1	3,456	13.6
SEWCWHwh2	1,798	13.6
SKICWHwh1	14,822	13.6
SKICWHwh2	2,952	13.6
TLECWHwh1	8,136	13.6
TLECWHwh2	1,255	13.6
YAKCWHwh1	15,310	13.6
YAKCWHwh2	4,879	13.6
YAKMHwh2	740	19.9
Block 7		
NOKCWHvh2	25,973	13.6
NOKCWHvm2	1,488	13.6
NOKMHmm1	1,542	19.9

* Constraint applies by the end of two rotations from now.

Visual landscape: Forest cover constraints are applied in inventoried visually sensitive areas. Two variables are used to describe each constraint — the time required to reach visually effective green-up (VEG) and the percentage of the forest that may be younger than VEG at any time. All forested areas, including non-productive forest, scrub, and variable retention reserves, contribute toward meeting the constraints. Three recommended visual quality class (RVQC) groupings are modelled. Table A4 summarizes the visual landscape constraints used in the models.

TABLE A4. Recommended visual quality class areas and constraints.

Supply block	**RVQC**	**Forest area (ha)**	**THLB area (ha)**	**Years to VEG**	**Maximum % less than VEG**
Block 1	Retention	482	332	15	5
	Partial Retention	47,648	26,128	15	15
	Modification	20,996	9,063	15	25
Block 2	Retention	1,530	809	18	5
	Partial Retention	10,870	5,880	14	15
	Modification	15,471	9,829	15	25
Block 3|4	Retention	93	20	13	5
	Partial Retention	6,251	4,635	14	15
	Modification	707	587	15	25
Block 5	Retention	0	0	n/a	n/a
	Partial Retention	1,769	682	15	15
	Modification	132	57	17	25
Block 6	Retention	2,706	447	17	5
	Partial Retention	38,324	13,653	16	15
	Modification	29,631	19,044	16	25
Block 7	Retention	320	52	21	5
	Partial Retention	3,669	1,107	21	15
	Modification	859	252	23	25

Cutblock adjacency: Anywhere in the THLB, after an area is harvested, the adjacent areas cannot be harvested until green-up status is achieved. The average time to green-up in TFL 39 is 10 years, and it is assumed that four passes would be required to completely harvest an area. In the model a constraint is applied that no more than 25% of the THLB may be stocked with trees younger than 10 years old at any time.

Definition of Analysis Units

Each forest stand is to some degree different from all other stands in TFL 39. However, to simplify the process of generating and tracking volume development, individual forest stands are grouped into similar types. The factors used to define the groupings are species, growing site quality, stand density and whether the stand is planted or natural origin, present age, harvesting economics, stewardship zone, and forest cover contribution.

Species: Two species types are tracked in the models — Douglas-fir and western hemlock. Stands of lodgepole pine and yellow cedar are treated as Douglas-fir, and stands of spruce, balsam fir, and redcedar are treated as hemlock. The reason for the species simplification is that the growth and yield model (Y-XENO) used to develop the volume estimates is only calibrated for the two species modelled.

Growing site quality: The inventory is assigned to four site classes in the model. Older second growth stands (aged 33 – 130 years) have mostly been cruised, and the measured site index is used. Other stands are assigned site index using the biophysical site index model (BSIM). Site index (SI) expresses the height that dominant trees in the stand will achieve 50 years after reaching breast height. SI is recorded in the inventory dataset to the nearest 3-m class. High site includes stands with SI from 33 through 42, good site includes stands with SI 27 and 30, medium site includes stands with SI 21 and 24, and poor site includes stands with SI from 12 to 18. Stands with SI lower than 12 are excluded from the THLB. The average net-area-weighted site index was determined for each site class in each block, and unique yield tables were generated for each analysis unit in each block. Table A5 summarizes the average site indexes.

TABLE A5. Average site indexes.

Supply block	**D-fir High**	**D-fir Good**	**D-fir Medium**	**D-fir Poor**	**Hemlock High**	**Hemlock Good**	**Hemlock Medium**	**Hemlock Poor**
Block 1	35.5	29.0	22.5	16.0	33.5	28.5	23.0	17.0
Block 2	35.5	29.0	22.0	17.5	33.5	28.5	23.0	17.0
Block 3|4	35.0	28.5	22.5	17.0	33.5	29.0	23.0	17.0
Block 5	33.0	30.0	21.5	17.5	33.0	28.0	23.0	18.0
Block 6	n/a	27.0	21.5	17.5	33.5	28.5	22.5	16.0
Block 7	n/a	27.0	21.0	16.5	33.0	28.0	22.5	16.5

Stand density: Stands with high numbers of trees per hectare contain more merchantable volume than more open stands. Density information is maintained only for stands presently younger than 130 years, and for future regenerated stands. Stands presently younger than 33 years and future regenerated stands are grouped into three density classes using percentages predicted by the Weyerhaeuser regeneration model (explained in Section 2.2 of the report). The three classes are: planted with natural in-seeding, low-density natural regeneration, and high-density natural regeneration. In Blocks 3|4 through 7 only one density class (medium-density natural regeneration) is used for Douglas-fir. The stocking levels used to represent each class are different among blocks and were developed using local knowledge of regeneration characteristics.

Eighty-two percent of the stands presently aged 33 to 130 years have been cruised and therefore have reliable volume estimates. Douglas-fir stands in this age range are assigned among five density classes in Block 1, four classes in Block 2, and to the medium-density class in the other blocks. Hemlock stands in this age range are assigned among four density classes in Blocks 1, 2, 3|4, and 6, and to a single high-density class in Blocks 5 and 7. Cruised stands are assigned to the density class that produces the closest volume match for the stand age. The un-cruised stands in the age range were assigned among classes in proportions matching stand assignments using the cruise information.

Harvesting economics: Stands older than 130 years are divided into two classes based on merchantability criteria. The two classes are Conventional and Marginal. Marginal stands typically have lower volume per hectare. Stands with reasonable volume but requiring helicopter harvesting methods are included in the Conventional merchantability class.

Stewardship zone: Future regenerated stands are divided into Old Growth, Habitat, and Timber classes, based on their physical location. This permits the models to monitor the different growth pathways attributable to competition from different quantities of reserved trees in the three zones.

Forest cover contribution: Stands outside the THLB, whether productive and contributing to old seral requirements or nonproductive and contributing to watershed and visual quality constraints, are retained in the timber supply model but assigned to a zero volume curve.

Table A6 summarizes the classification of analysis units in the models. The data CD, attached to this report as Appendix 3, contains graphs for each block of the amount of area in each of the above classes that contribute to defining the analysis units. The number of unique analysis units ranges from 74 in Block 5 to 132 in Block 2. The yield curves attached to each analysis unit are different among blocks, due to different average site indexes and different definitions of the stocking levels in low and high density classes

TABLE A6. Old-growth analysis units.

Block	Species	Merchantability	Site class *
All Blocks	Fir	Economic	H, G, M, P
	Hemlock	Economic	H, G, M, P
	Fir	Marginal	H, G, M, P
	Hemlock	Marginal	H, G, M, P

* Site classes are H=high, G=good, M=medium, P=poor

TABLE A7. Older second-growth analysis units.

Block	Species	Density (sph)*	Site class
Blocks 1 & 2	Fir	600:1500:3000:6000	H, G, M, P
	Hemlock	600:1500:6000:12000	H, G, M, P
Blocks 3, 4 & 6	Fir	3000	H, G, M, P
	Hemlock	600:1500:6000:12000	H, G, M, P
Blocks 5 & 7	Fir	3000	H, G, M, P
	Hemlock	8000	H, G, M, P

* Block 1 has an additional low-volume class, with 80% of the 600 sph yield table

TABLE A8. Younger second growth and regenerated stand analysis units.

Block	Species	Plant/Natural : Density	Site class
Block 1	Fir	P1200, N500	H, G, M, P
		N3000	H, G, M, P
	Hemlock	P1000, N2000	H, G, M, P
		N1500	H, G, M, P
		N6000	H, G, M, P
Block 2	Fir	P1200, N500	H, G, M, P
		N3000	H, G, M, P
	Hemlock	P800, N5000	H, G, M, P
		N1500	H, G, M, P
		N8000	H, G, M, P
Blocks 3, 4, 5 & 7	Fir	N3000	H, G, M, P
	Hemlock	P800, N5000	H, G, M, P
		N1500	H, G, M, P
		N8000	H, G, M, P
Block 6	Fir	N3000	H, G, M, P
	Hemlock	P1000, N2000	H, G, M, P
		N1500	H, G, M, P
		N8000	H, G, M, P

Definition of the Timber Harvesting Land Base

Timber is harvested from only a portion of TFL 39. One of the first steps in the analysis is to identify the areas from which timber will be harvested. The THLB is derived by identifying areas where timber harvesting is not likely to occur under current forest management. The following discussion describes the characteristics of areas that are excluded from the THLB.

Land not managed as part of TFL 39

The inventory variables UNIT (39) and TENURE (4, 12, 20, 50) are used to identify the land base managed as part of TFL 39. The 30-year reserve in Block 1 is included in the THLB and identified as TENURE (8) and OWNER (5).

Non-forest land

Inventory variable CLASS > 22 identifies non-forested areas. These areas include sparse alpine forests, industrial areas, water bodies, and rock.

Scrub and non-productive forest

The inventory variable CLASS=2 identifies scrub forest, and CLASS=3 identifies non-productive forest with site index less than 12. These areas are removed from the THLB, but are maintained in the model to contribute to some forest cover constraints.

Environmentally sensitive areas

Netdowns for environmentally sensitive areas (avalanche, soils, bears, goats, deer, regeneration problems and cultural heritage) are identified in the inventory file, according to documentation in the Information Package. The netdown percentages in the file were used in defining the THLB, with some minor changes to the netdown percentages, received in March 2000. These were:
Block 1, goats: high sensitivity (84%), low sensitivity (46%)
Block 5, bears: low sensitivity (42%)
Block 5, goats: high sensitivity (82%)
Block 7, sensitive soils: high sensitivity (80%), low sensitivity (5%)

Riparian areas

The netdown for riparian management is identified for each stand in the inventory file. The netdown percentages in the file were used in defining the THLB, plus an additional riparian allowance of 1% of each stand's area was removed from the THLB.

Inoperable areas

Operability is defined in physical and economic terms in TFL 39. If a stand is uneconomic (ECON_TYPE=2) or inaccessible (OPER_TYPE=2) it is excluded from the THLB. If a stand is marginally economic (ECON_TYPE=1) or helicopter operable (OPER_TYPE=1) it is maintained in the THLB.

Deciduous stands

Deciduous stands (CLASS=17 to CLASS=22) are 50% removed from the THLB. The portion maintained in the THLB is included with the hemlock growth type.

Roads

Roads are identified in the inventory maps and assigned area in the inventory by attaching a 13-metre buffer to the centreline location. These road areas are removed from the THLB. Additionally, as harvesting proceeds, more area will be permanently removed from timber production. The timber supply model removes a percentage of the area harvested for all stands more than 55 years old in 1996. The percentages vary by block, depending on the amount of area that will be harvested with helicopters. Table A9 summarizes the road allowances used in the models.

TABLE A9. Road reductions to the THLB.

Supply block	Reduction for stands established prior to 1940 (%)	Reduction for stands greater than 130 years old (%)
Block 1	5.00	3.09
Block 2	5.00	4.95
Block 3|4	5.00	4.08
Block 5	5.00	1.79
Block 6	5.00	5.59
Block 7	5.00	3.59

Cultural heritage resources

An additional netdown of 2.5% for culturally modified trees is made in Block 6.

Protected Areas Strategy

The provincial Protected Areas Strategy has formally designated protected areas by order-in-council in Block 2 (Claud Elliott Creek, Claud Elliott Lake, Mount Elliott, Robson Bight, Schoen Lake, Tsitika River, White River Pocket Wilderness) and in Block 4 (Lower Nimpkish, Nimpkish Lake, Tahsish-Kwois). These areas are not yet legally removed from TFL 39, but were manually removed from the inventory during the compilation process.

Recreation and scenic areas

Visual landscape resources are managed directly in the timber supply models, using forest cover constraints, and are not removed from the THLB. The recreation inventory was updated in March 2000. Some stands that are identified in the inventory as requiring partial netdown were reclassified for inclusion in the THLB. The updated recreation inventory was used to identify areas to exclude from the THLB.

Stand-level biodiversity

Allowance is made for within-block reserves of wildlife tree patches by excluding a portion of every stand in the inventory. Table A10 lists the percentage exclusions for each Block.

TABLE A10. Exclusions for wildlife tree patches.

Supply Block	Percentage exclusion for wildlife tree patches (%)
Block 1	3.0
Block 2	2.4
Block 3|4	3.3
Block 5	2.0
Block 6	2.0
Block 7	1.0

Variable retention

Weyerhaeuser is in the middle of its five-year transition from clearcutting to variable retention. Allowances for variable retention and additional conservation in Old Growth zones are made in this analysis. All stands in the inventory, regardless of age, are reduced 70% if in the Old Growth zone, 7.5% if in the Habitat zone, and 5% if in the Timber zone. This reduction is in addition to the reductions for riparian reserves and wildlife tree patches and all other THLB netdowns.

Forest Management Assumptions

Utilization

The utilization specification defines the minimum size merchantable tree and the portion of a tree that contributes volume to the harvest level. In the analysis, the minimum merchantable tree for stands less than 130 years old is 12.5 cm dbh. Volume is calculated from a 30 cm stump height to a 10 cm top diameter.

For mature stands greater than 130 years old, inventory volumes are based on compilation to a minimum dbh of 22.5 cm, a 30 cm stump height and a 15 cm top diameter. These standards are not the same as standards (17.5 cm dbh) used in cutting permit cruises and for recovery.

Minimum harvest ages

The minimum harvest age is the lowest age at which a stand type (analysis unit) is available for harvest. The minimum harvest age in this analysis is achieved when a stand type reaches 350 m^3/ha. Minimum harvest ages apply only to second-growth stands. Each analysis unit has a unique minimum harvest age calculated using the volume criteria. Table A11 provides the range in ages for typical stands.

TABLE A11. Minimum harvest ages.

Species	Site class	Range of minimum harvest ages (years)
Douglas-fir	High	43 ~ 56
Douglas-fir	Good	54 ~ 75
Douglas-fir	Medium	89 ~ 136
Douglas-fir	Poor	150 ~ 201
Hemlock	High	40 ~ 56
Hemlock	Good	41 ~ 69
Hemlock	Medium	60 ~ 94
Hemlock	Poor	75 ~ 173

Unsalvaged losses

The yield tables used in the analysis include allowances for decay, waste and breakage, and insect damage. An additional allowance of 1% of the harvest level is made to account for unsalvaged losses to wind and fire. The harvest levels shown in the report have been reduced 1% from the actual level simulated in the models.

Silviculture

The base case model and all options use the following silviculture assumptions:

- Genetic improved stock will be used in all plantations. The assumed gain over Y-XENO output is 13% for Douglas-fir and 6.5% for hemlock.
- All harvested sites will be restocked with a 1-year regeneration delay
- All stands requiring brushing treatments to reach free-growing promptly will be treated as required.
- The model does not include effects of spacing or commercial thinning.
- Species succession follows the Weyerhaeuser regeneration model. The regeneration model and its implementation are described in the report text, Section 2.2. Site index is not adjusted at time of succession.

This analysis does not include options that inspect the effect of silviculture treatments. Instead a “Type 2” analysis of silviculture options is underway. The Type 2 analysis will report the cost of silviculture activities, employment creation, and volume and diameter effects of treatments. The Type 2 analysis is using FSSIM and the same base case model that was developed for this MP#8 analysis. The report from the Type 2 analysis is expected by December 2000.

Volume estimates for existing and regenerated stands

Existing stands older than 130 years use inventory file volumes (ADJ_VOL), reduced for cull and decay, waste and breakage. The volumes in this age class are assumed to neither increase nor decrease over the planning horizon.

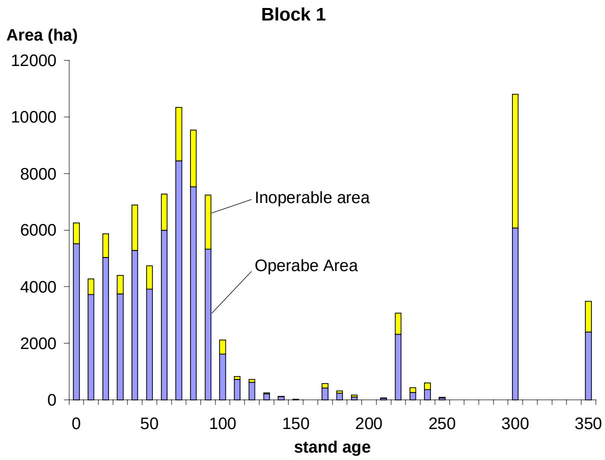
Stands younger than 130 years follow a yield table development pathway. The proprietary Weyerhaeuser growth and yield model Y-XENO was used to develop yield tables for this analysis. Y-XENO yield curves were then reduced in recognition of decay, waste and breakage, losses to insects, losses to incomplete site occupancy for lower density naturally regenerated stands, and competition effects in variable retention harvested blocks. The yield curves were increased for planted stands in recognition of genetic gains. Douglas-fir yield tables are capped at 1650 m^3/ha.

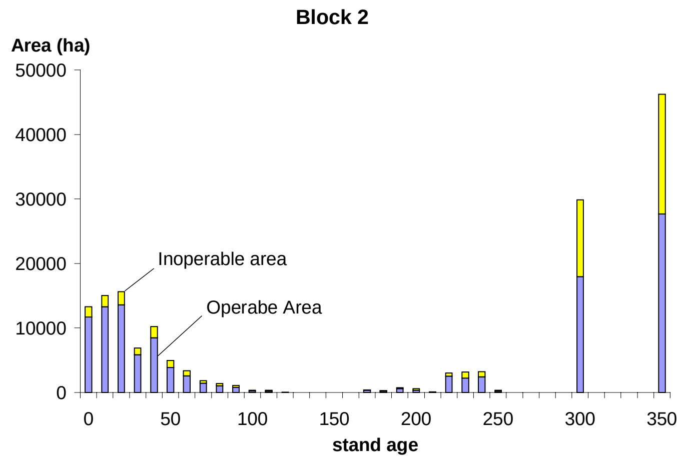
Preliminary yield tables were submitted to the B.C. Forest Service in the fall of 1999, and were approved for use in the analysis. The data CD, Appendix 3, contains all of the 750 yield tables developed for the base case, and all of the yield tables developed for the options that vary yield assumptions.

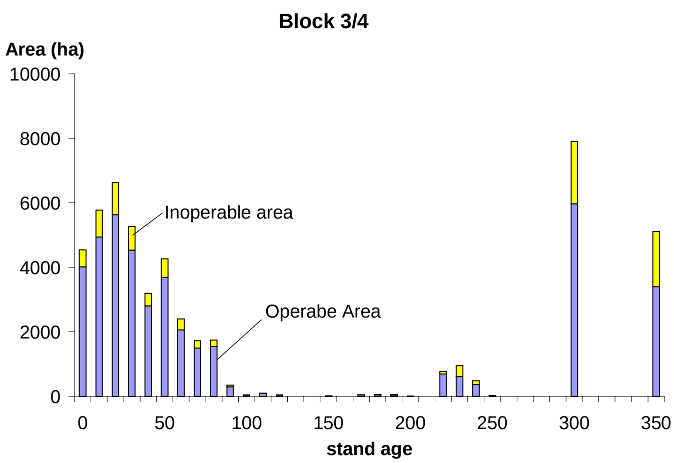
APPENDIX 2

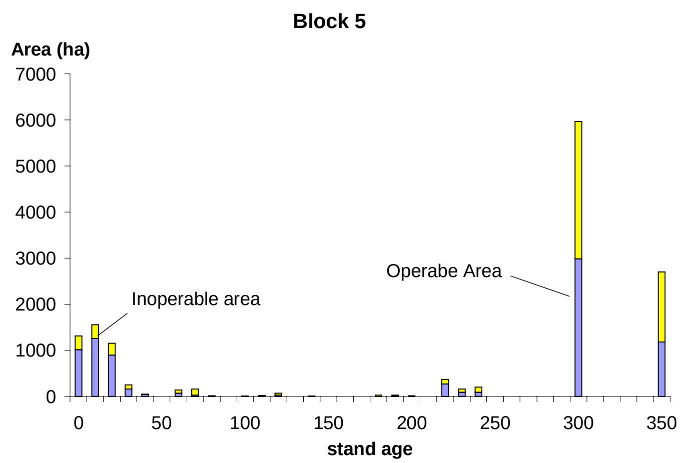
Graphs of block details in support of Section 6.0

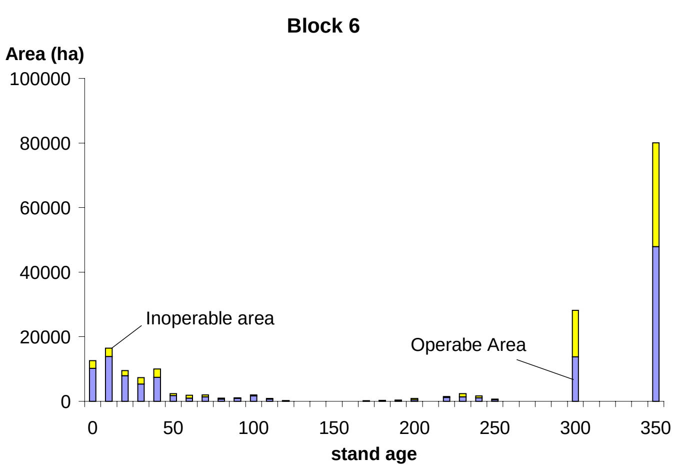
APPENDIX 2a. Present age-class distribution

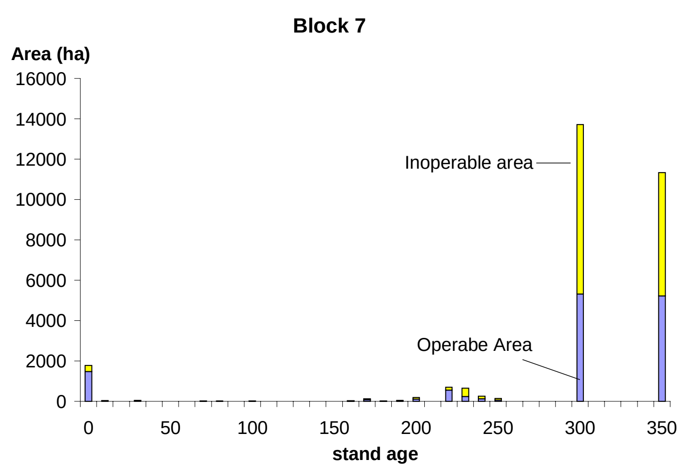




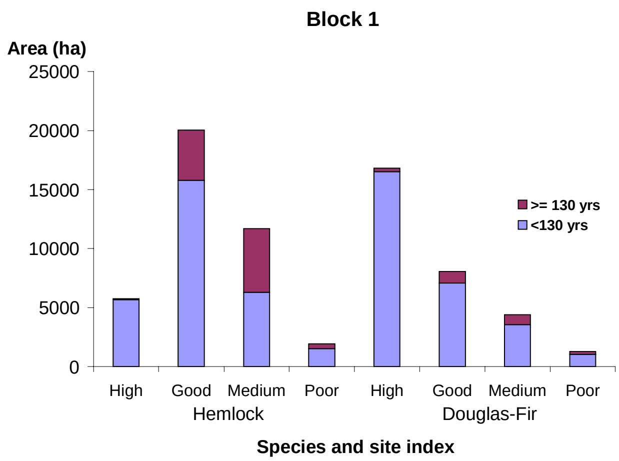


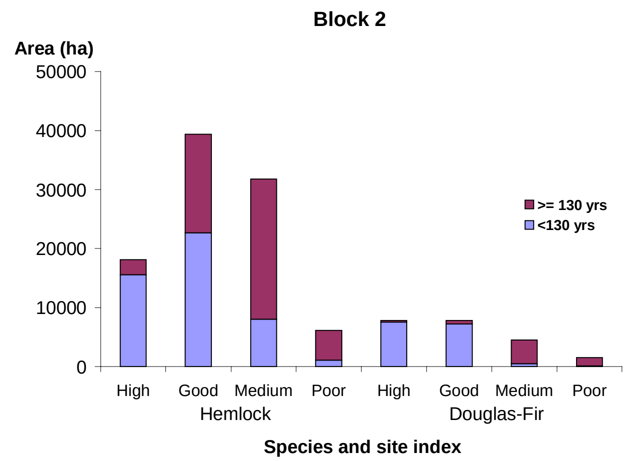


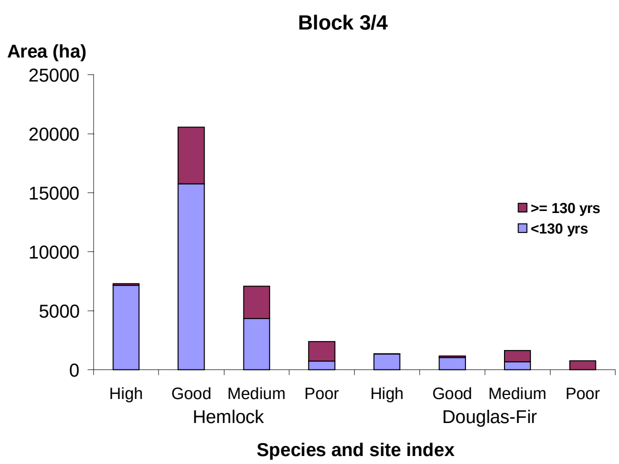


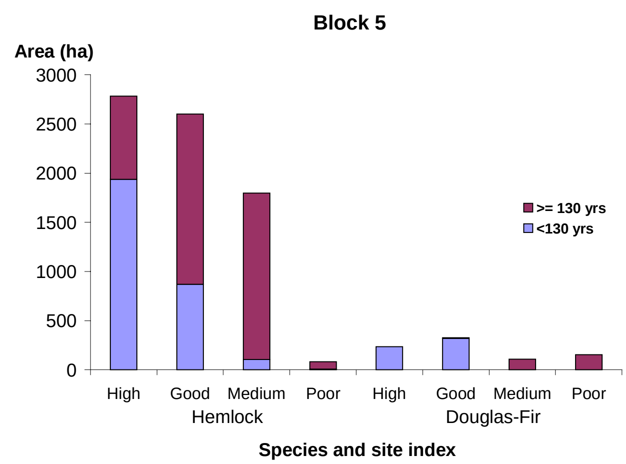


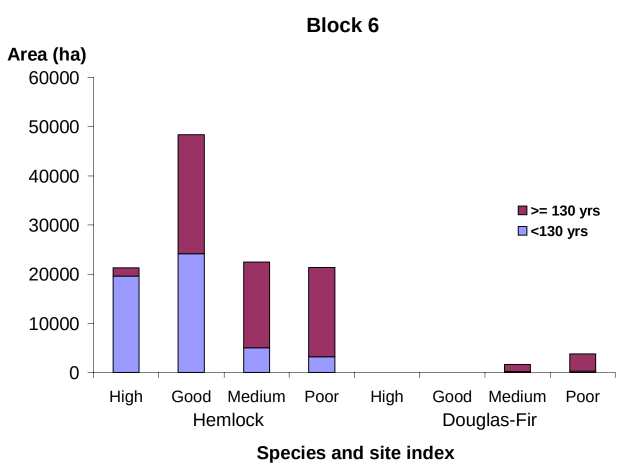
APPENDIX 2b. THLB area by species and site index

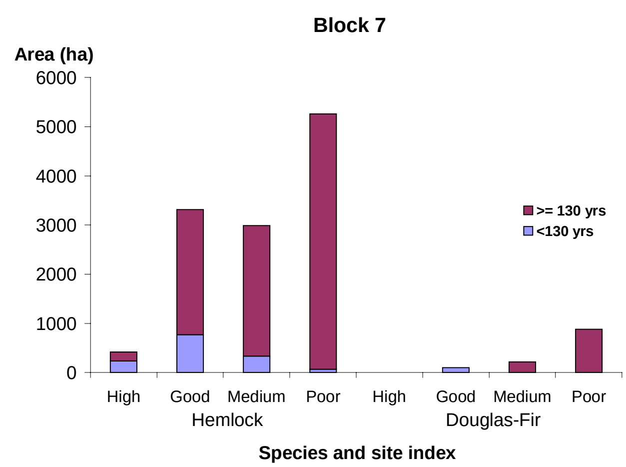




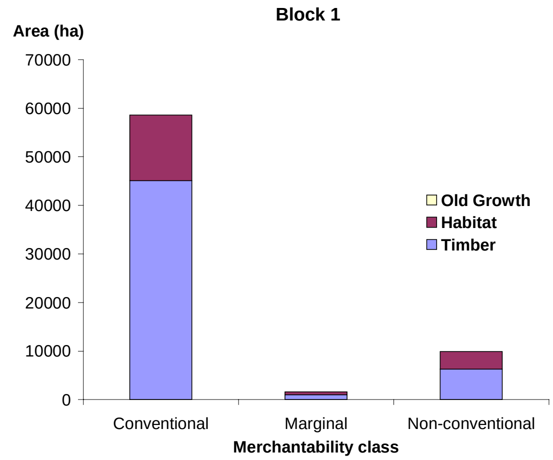


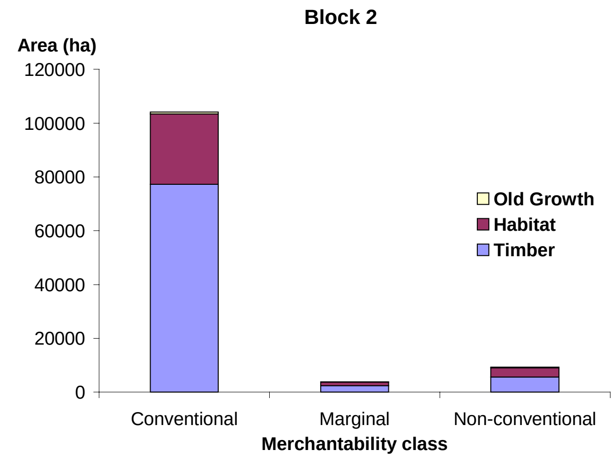


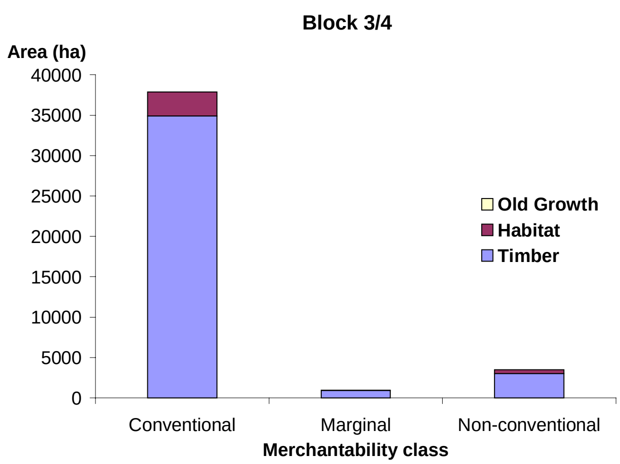


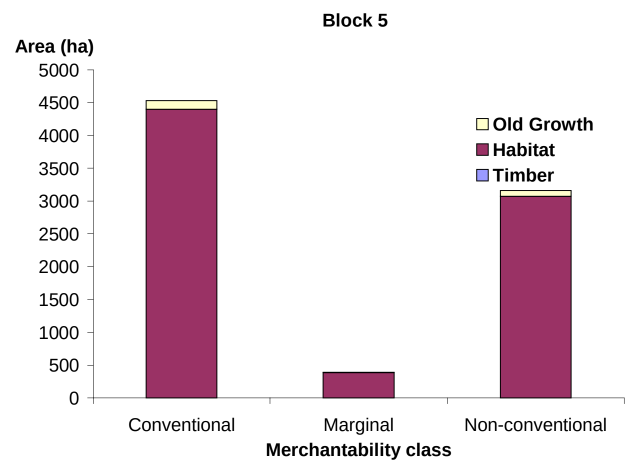


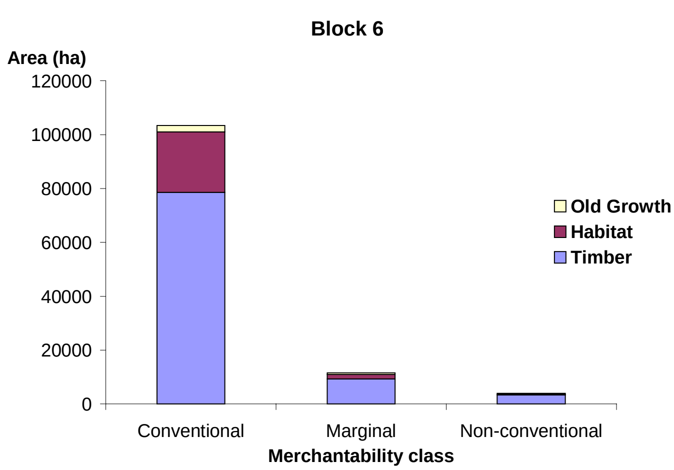
APPENDIX 2c. THLB area by stewardship zone and merchantability class

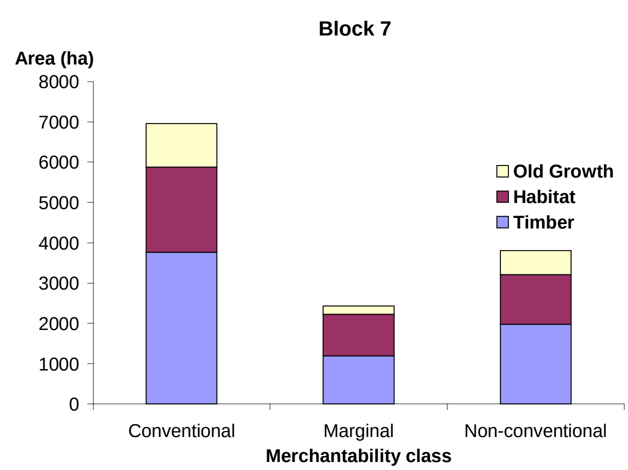






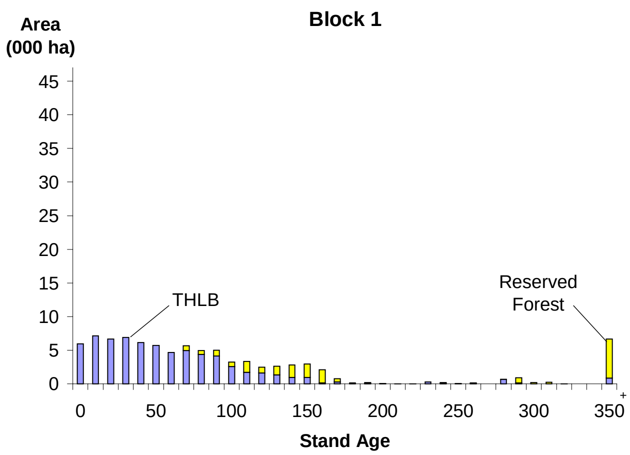


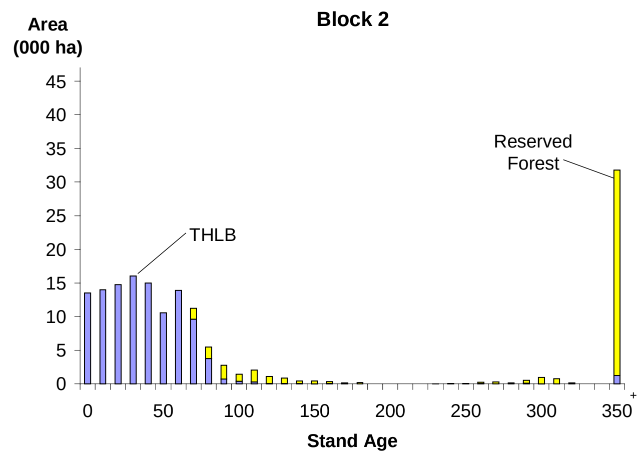


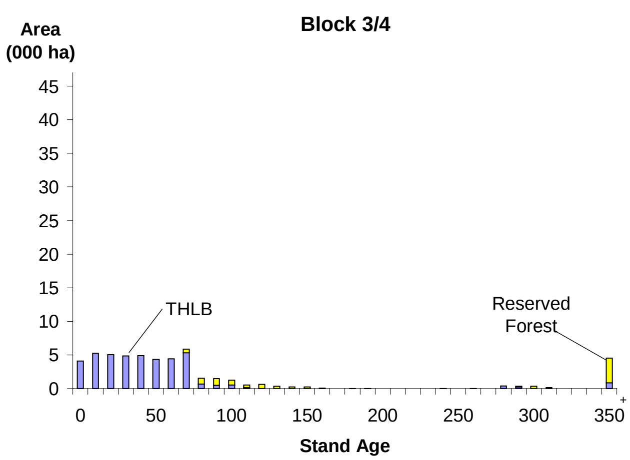


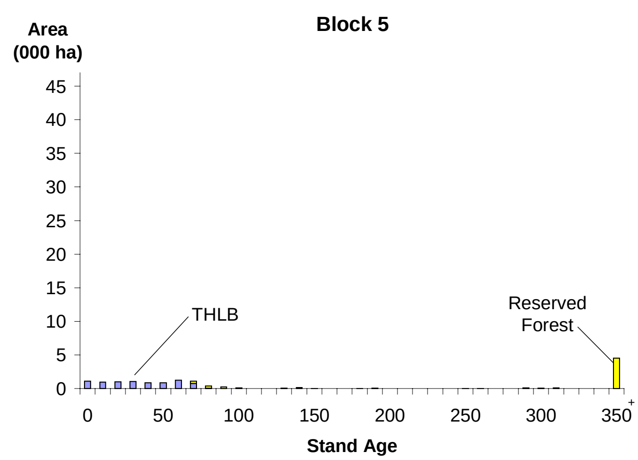
APPENDIX 2d. Projected base case age-class distribution at year 70

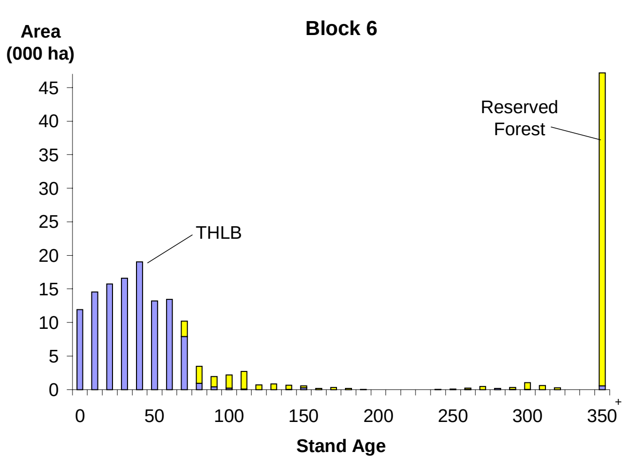
(Note that these graphs are all to the same scale)

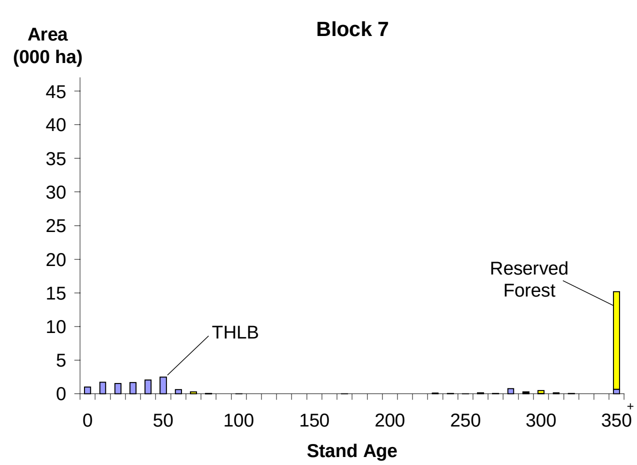












Addendum to the Timber Supply Analysis

- Option 13d
- Submission Letter
- Letter of Approval
- Response to Questions in the Approval Letter

March 2001

OLIVOTTO TIMBER

Forest Modelling Consultants

February 26, 2001

Peter J. Kofoed
Weyerhaeuser Company Limited
BC Coastal Group
Nanaimo Woodlands
65 Front St.
Nanaimo, B.C.
V9R 5H9

Re: Option 13d for Block 7

Dear Peter

You requested an additional Option 13d for Block 7 in the TFL 39, MP#8 timber supply analysis. The added option is to exclude Fougnar Bay and the Koeye Watershed from the timber harvesting land base (THLB), and is to assume that marginal timber stands in the remainder of Block 7 will remain inoperable and not contribute to the THLB. This is a combination of land base Options 13a and 13b from the analysis report. Additionally, you requested that a number of alternative harvest flows be inspected for this option.

The alternative harvest flows are:

Flow 1. Starting harvest level of 150,000 m³/yr, followed by a steep decline
Flow 2. Starting harvest level as high as possible, followed by 10% per decade declines
Flow 3. A harvest flow intermediate between 1 and 2

The base case FSSIM model for Block 7 was modified to exclude Fougnar Bay, the Koeye Watershed, and identified marginal stands from the THLB. These areas contribute to forest cover requirements within the model, but are considered unavailable for timber harvesting. Yield tables, old seral requirements, avalanche zone harvest restrictions, visual quality requirements and an objective of spreading out harvest of stands in the Old Growth stewardship zone over 80 years (maximum 12.5% less than 10 years old) were maintained in the model, as were Forest Practices Code and Variable Retention harvesting objectives.

The area exclusions reduce the THLB area 31%, from 13,196 ha in the base case to 9,098 ha for Option 13d. The present merchantable inventory on the Option 13d THLB area is 5.98 million m³.

Figure 1 illustrates the results of the analysis. With the combination of Option 13a and 13b area removals from the THLB, the long-term harvest level for Block 7 is reduced 25%, to 58,000 m³/yr from the base case level of 77,189 m³/yr. The first 20 years, by 5-year period, of harvest schedules for the three scenarios are:

Flow 1. 150,000, 120,000, 100,000, 80,000 m³/yr
Flow 2. 97,200, 92,600, 88,200, 84,000 m³/yr
Flow 3. 125,000, 105,000, 90,000, 80,000 m³/yr

As you can see in the graph, lower starting harvest levels provide a more gradual transition to the long-term harvest level, by saving some presently mature volume for harvesting in the period 20–60 years from now.

Suite 203-733 Johnson Street, Victoria, B.C. V8W 3C7 tel (250) 920-6749 fax (250) 386-3892 email go@olivotto.com

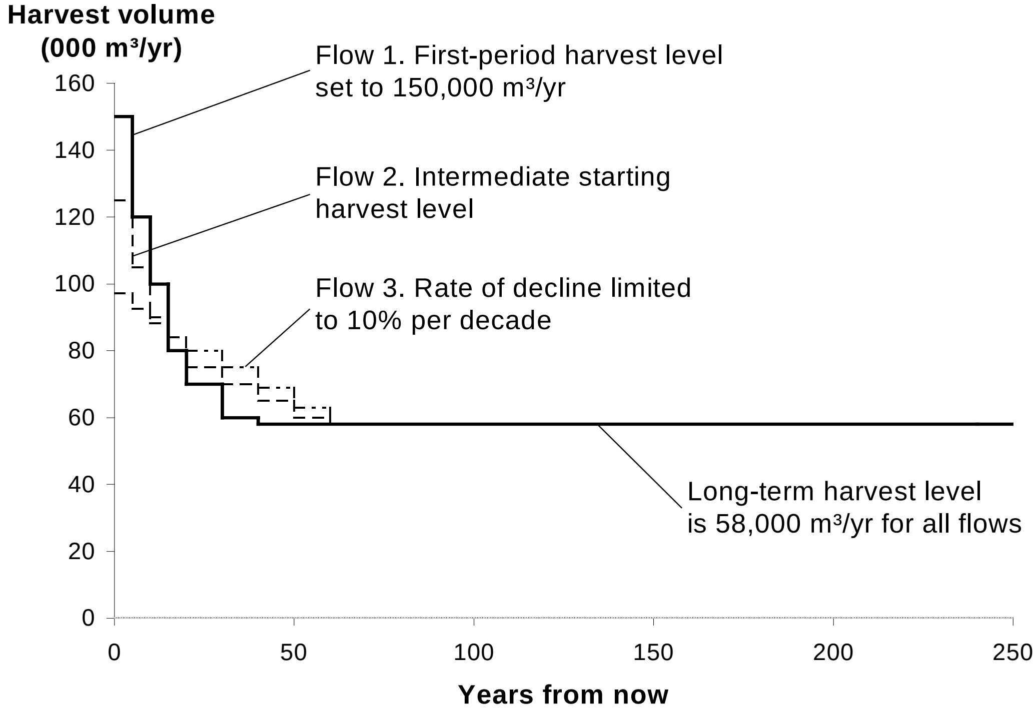


FIGURE 1. Alternative harvest flows for Block 7, Option 13d.

All three harvest flows result in essentially the same growing stock levels in the long term, although growing stock is depleted more rapidly under harvest flow #1. The long-term merchantable growing stock on the THLB stabilizes at approximately 2.0 million m³. This represents 34.5 years supply at the long-term harvest level, in line with the 35-year long-term supply for TFL 39 overall (MP#8 analysis, Section 4.1).

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Forest Modelling Consultants

Figure 2 compares Flow 1 from Figure 1 with Option 13c from the MP#8 analysis report. Both Options start at the same harvest level of 150,000 m³/yr.

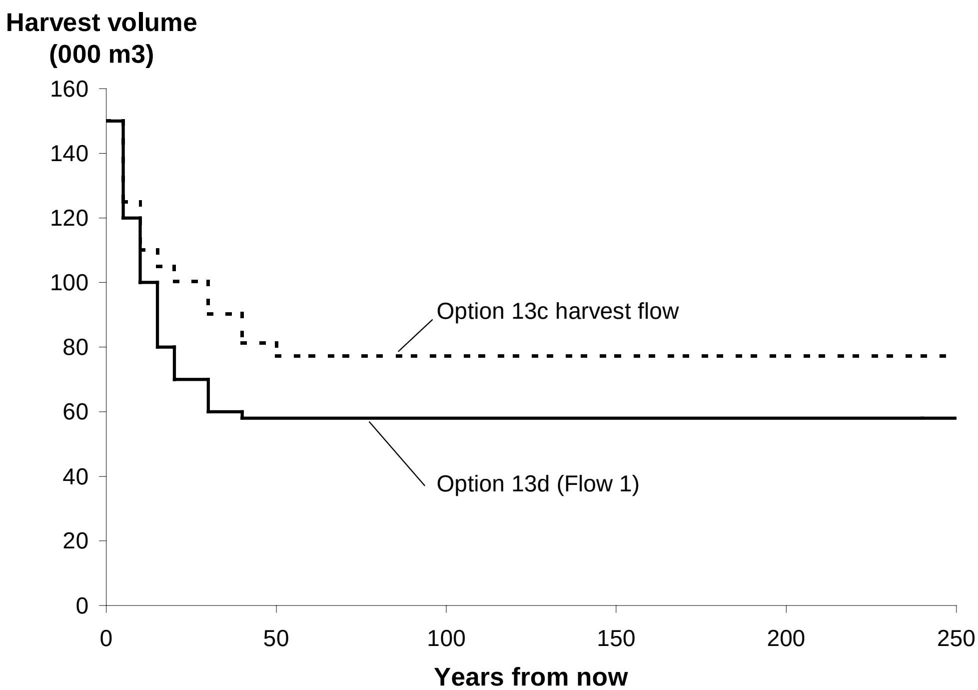

FIGURE 2. Comparison of Options 13c and 13d.

With the reduced land base, anticipated harvest flows diverge within five years, and are 20% lower by 20 years from now. The long-term harvest level is 25% lower, as noted previously.

I trust that this brief analysis will meet your requirements. Please contact the undersigned if further scenario inspection is required.

Yours truly,

G.O.

Gerrard Olivotto

BC Coastal Group

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September 20, 2000

Janna Jessee
Timber Supply Forester
Timber Supply Branch
Ministry of Forests
PO Box 9512 Stn. Prov. Govt.
Victoria, BC V8W 3E7

Dear Janna Jessee:

Re: Submission of the Timber Supply Analysis for Tree Farm Licence (TFL) 39, Management Plan (MP) #8.

The Timber Supply Analysis report is attached. The analysis and report were completed by the forestry consultant firm, Olivotto Timber Co.

The analysis was conducted separately for each of the following six separate geographical areas in the TFL. This is consistent with the approach followed in MP #7:

Supply Block	Block Name	Weyerhaeuser Timberlands Operation	Ministry of Forests Forest District
Block 1	Powell River	Stillwater	Sunshine Coast
Block 2	Adam River	North Island	Campbell River
Blocks 3 & 4	Coast Islands / Port Hardy	Port McNeill	Port McNeill
Block 5	Phillips River	Stillwater	Campbell River
Block 6	Queen Charlotte Islands	Queen Charlotte	Queen Charlotte Islands
Block 7	Namu	Port McNeill	Mid Coast

The TFL 39 harvest projections are obtained by adding together the results for each of these six sub-units.

Report

Several items are included to assist in review of the Timber Supply Analysis. They include:

- A bound paper copy of the report.
- A Compact Disc (CD) that contains:

- The MS Word file of the written report.
- An organized presentation of graphs of all option results for all blocks in HTML format.

- The Information Package (October 1999) and an Addendum to the Information Package (September 2000) in MS Word format.
- FSSIM input files for all options for all blocks. These files are included only in the CDs sent to yourself and to Albert Nussbaum of Research Branch.

The attached table shows distribution of the report and supporting information.

The draft Management Plan will include recommendations on a TFL Annual Allowable Cut (AAC) for MP #8 and an allocation of this AAC between the six working circles. The draft Management Plan will be submitted in November 2000.

If you have any questions please contact me at:

- Phone – (250) 755-3450
- E-mail – Peter.Kofoed@Weyerhaeuser.com

Yours truly,

P. J. (Peter) Kofoed
Planning Forester
Weyerhaeuser, B.C. Coastal Group

Distribution List – Timber Supply Analysis for TFL 39, MP #8:

Bound and digital copies of the report have been sent to Timber Supply Branch and Research Branch.

Digital copies (on a CD) have been sent to all recipients of the report – these include the report, the graphical presentation of option results by block, the Information Package and an Addendum to the Information Package.

	Letter	Report	FSSIM Files
Ministry of Forests			
Janna Jessee, Timber Supply Forester, Timber Supply Branch	X	X	X
Ken Collingwood, Regional Manager, Vancouver Forest Region	X	X	
Albert Nussbaum, Growth & Yield Applications Specialist, Research Branch	X	X	X
Rob Drummond, Officer Growth & Yield (Predictions), Resource Inventory Branch	X	X	
Jacques Bousquet, TFL Forester, Resource tenures & Engineering Branch	X		
Rory Annett, District Manager, Queen Charlotte Islands Forest District	X	X	
Jack Dryburgh, District Manager Port McNeill Forest District	X	X	
Greg Hemphill, District Manager, Sunshine Coast Forest District	X	X	
Otto Pflanz, District Manager, Mid Coast Forest District	X	X	
Don Slugget, District Manager, Campbell River Forest District	X	X	
Ministry of Environment Lands and Parks			
Alvin Cober, Forest Ecologist Specialist, Queen Charlotte Islands Forest District	X	X	
Ron Diederichs, Forest Ecosystem Specialist, Campbell River Forest District	X	X	
Ken Dunsworth, Forest Ecosystem Specialist, Mid Coast Forest District	X	X	
Steve Gordon, Forest Ecosystem Specialist, Sunshine Coast Forest District	X	X	
Rob Stewart, Forest Ecosystem Specialist, Port McNeill Forest District	X	X	
Weyerhaeuser, BC Coastal Group			
Tom Holmes, Vice-President Timberlands	X		
Stan Coleman, Manager Nanaimo Woodlands	X		
Bill Waugh, Operations Forester, Nanaimo Woodlands	X		
Mike Hooper, Planning Coordinator, Nanaimo Woodlands	X		
Joe Duckworth, Manager Queen Charlotte Timberlands	X		
Don Murray, Division Engineer, Queen Charlotte Timberlands	X	X	
Bob Brough, Manager, Port McNeill Timberlands	X		
John Foster, Division Engineer, Port McNeill Timberlands	X	X	
Jim Jackson, Manager North Island Timberlands	X		
Gord Eason, Division Engineer, North Island Timberlands	X	X	
Ray Balogh, Manager, Stillwater Timberlands	X		
Walt Cowlard, Division Engineer, Stillwater Timberlands	X	X	

BRITISH COLUMBIA

MAR 14 2001

MAR 14 2001

File: 12850/20-39

March 8, 2001-03-07

Peter Kofoed, RPF
Planning Forester
Weyerhaeuser, BC Coastal Operations
65 Front St.
Nanaimo, BC V9R 5H9

Dear Peter Kofoed:

I have reviewed the Timber Supply Analysis dated September 20, 2000, and the Addendum to the Information Package dated September, 2000, for Management Plan No. 8 of Tree Farm Licence 39 (TFL 39). I hereby accept the timber supply analysis.

Thank you for the thorough response to the comments attached to my acceptance letter for the Timber Supply Analysis Information Package.

My review concentrated on the model input information for the base case of the analysis. I may request output information for the base case and some of the sensitivity analyses to assist me in developing the presentation for the allowable annual cut (AAC) determination information session. I appreciate any help you can give me in this regard.

I have the following comments about the timber supply analysis:

In this analysis, forest cover requirements for visual quality objectives and adjacency were applied broadly across entire blocks. I believe these objectives would have been more accurately modelled by applying forest cover requirements for adjacency within each landscape unit, and applying forest cover requirements for visual quality within each visually sensitive area. For the determination meeting, I hope to clarify how the timber supply of TFL 39 is affected by this modelling approach.

Ministry of Forests Timber Supply Branch

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3rd Floor, 595 Pandora Avenue
Victoria, British Columbia

Mailing Address:
PO Box 9512 Stn Prov Govt
Victoria, BC V8W 3E7

Tel: (250) 953-3836
Fax: (250) 953-3838

Peter Koefed, RPF
Weyerhaeuser, BC Coastal Operations

In the information package, you indicate that forest cover constraints were to be applied within avalanche run-out zones in each block. In further conversation, you indicated that the constraints were only modelled in block 2 and 7 since in all of the other blocks, forests outside the timber harvesting land base could fully meet the requirements. However, upon examination of the input files for block 2, I noticed that the avalanche forest cover constraints did not get applied. For the determination meeting, please provide an explanation for this omission, and an estimate of the timber supply impact of this omission.

For Option 3, which examines the timber supply impacts of increased variable retention, it would have been useful to not just decrease the size of the timber harvesting land base, but also to decrease stand yields to account for additional shading from higher retention levels. As a result, I believe this option understates the impact of higher levels of retention.

It would have been preferable to have more explanation of timber supply interactions. For example, in Option 9 it is not clear from the text why reducing the size of the timber harvesting land base by 5% decreases the long-term harvest level by 5.4%. Similarly, in Option 13a there is a larger impact on the long-term harvest level from excluding the Koeye Watershed and Fougnar Bay than one would expect given that the Koeye is mostly in the old-growth stewardship zone, and therefore has reduced stand yields in the long term. Also, I would expect that increasing second-growth stand yields (Option 16) would have a direct proportional effect on the long-term harvest level. Instead of the expected 10% increase in long-term harvest level, it is only increased by 8.2%. Additional explanation, particularly about harvest flow choices, would have provided greater depth to the analysis.

It has come to my attention that much of the proposed protected area "Confederation Lake" in block 1 is now part of Inland Lake Park. For the determination meeting, please provide the approximate area affected by the new Inland Lake Park so that it can be related to the timber supply impacts shown in Option 10.

It has also come to my attention that a pilot project has been undertaken in block 1 that, among other management changes, may result in the addition of old-growth stewardship zone to the block. To assess the uncertainty about the addition of old-growth stewardship area in block 1, please provide an estimate of the area affected for the determination meeting. I believe the options provided in the analysis will provide enough information to estimate the resulting timber supply impacts.

For Option 18, which examines the timber supply impacts of using the inventory site indexes to determine stand yields, the impact of using inventory site indexes would have been more realistically represented if minimum harvestable ages and green-up ages had also been adjusted to reflect the site productivity difference.

Overall, the analysis is extremely well done and clearly described. Having digital access to all input files, as well as all harvest forecast graphs, was very useful. In addition, the range of uncertainty examined through the options presented will provide a strong foundation for the upcoming chief forester's determination of the AAC for the TFL.

Peter Koefed, RPF
Weyerhaeuser, BC Coastal Operations

I wish to point out that this letter does not mean that the Ministry of Forests (MoF) and the Ministry of Environment, Lands and Parks (MELP) endorse every aspect of this analysis. During the AAC determination information session, MoF and MELP staff will advise the Deputy Chief Forester regarding the technical validity of the analysis and the implications of its assumptions and results. The Deputy Chief Forester will consider this advice as he develops the rationale for his determination of the AAC for TFL 39.

If you have any questions, please call me at 356-2693.

Yours truly,

Janna Jessee, RPF
Timber Supply Forester
Timber Supply Branch

cc: Ken Baker, Deputy Chief Forester
Greg Gage, TFL Officer, Vancouver Forest Region
Nelson Harrison, TSA/TFL Planning Forester, Vancouver Forest Region
Doug Herchmer, Recreation Forester, Vancouver Forest Region
Barry Miller, Planning Forester, Sunshine Coast Forest District
Alan Shaw, Timber Forester, Sunshine Coast Forest District
Steve Gordon, Forest Ecosystem Specialist, Sunshine Coast Forest District
Maddalena Di Iorio Dunn, District Planner, Campbell River Forest District
Ron Diederichs, Forest Ecosystem Specialist, Campbell River Forest District
Bill McMullan, Timber Forester, Port McNeill Forest District
Rob Stewart, Forest Ecosystem Specialist, Port McNeill Forest District
Dan Biggs, Timber Forester, Queen Charlotte Island Forest District
Alvin Cober, Forestry Ecologist, Queen Charlotte Island Forest District
Nancy Colpitts, Senior Planning Officer, Midcoast Forest District
Ken Dunsworth, Forest Ecosystem Specialist, Midcoast Forest District
Bud Koch, Senior Analyst, Tree Farm Licenses, Timber Supply Branch
Charlie Klasen, Timber Tenures Forester, Resource Tenures & Engineering Branch
Albert Nussbaum, Growth & Yield Applications Specialist, Research Branch
Rob Drummond, Officer, Growth & Yield (Predictions), Resources Inventory Branch
Gerrard Olivotto, Olivotto Timber, Forest Modelling Consultants, 203-733 Johnson Street, Victoria, BC, V8W 3C7

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April 2, 2001

Ms Janna Jessee
Timber Supply Forester
Timber Supply Branch
Ministry of Forests
PO Box 9512 Stn. Prov. Govt.
Victoria, BC
V8W 3E7

Dear Ms Jessee:

Thank you for your letter of March 8, 2001. The following items are in response to your requests and other comments in your letter.

Forest cover requirements for visual quality objectives and adjacency.

As you noted, these were applied broadly by Block in the timber supply analysis. They were, however, applied more specifically in the twenty-year plan (refer to Appendix IV in the Management Plan). The twenty-year plan output summarizes results for each visual landscape inventory polygon, comparing the area less than Visually Effective Greenup (VEG) to the maximum allowed.

In addition, the model used to generate the twenty-year plan approximated adjacency by not allowing harvest within 300 m of a cutblock until 10 years or more after harvest.

Constraints applied to avalanche run-out zones.

The omission of the avalanche run-out zones in the Block 2 analysis was an error. It was not intentional. The timber harvesting land base within these zones is small (282 ha). Gerrard has re-run the base option with the constraint for avalanche run-out zones. There was no impact on harvest levels, and long-term growing stock was stable as in the initial base option.

Option 3 – The sensitivity on impacts of variable retention.

Any such additional impacts would occur in future rotations (not the current rotation) and hence would be long-term.

Explanation of timber supply interactions.

In the MP #8 analysis, forest level growing stock was used as a major criterion for achieving an appropriate Long Term Harvest Level (LTHL). The intent was to achieve a relatively constant level of growing stock (harvest equal to forest growth) during the second hundred years of the analyses. Figures depicting growing stock over time are included for all options in the CD graphical presentation, submitted as part of the Timber Supply Analysis report.

Approximating this rule was considered sufficient for the resolution of the analysis. This accounts for much of the difference in LTHLs that you observed - i.e. if the growing stock for option [b] increases or decreases over time (the second hundred years) relative to that for option [a], then the LTHL for option [b] is slightly lower or higher relative to the LTHL for option [a] when the growing stock projections are parallel.

In Option 9 the TFL 39 growing stock curve increases over time relative to that for the Base Option, indicating that the LTHL for Option 9 could be slightly higher if the growing stock levels were parallel over time. Given the approximate resolution of the growing stock constraint, a 5.4% change in LTHL for a 5% change in THLB is reasonable.

Similarly the growing stock curve for Option 16 increases over time relative to that for the Base Option, indicating that the Option 16 LTHL could be a little higher with precisely parallel curves for growing stock. Again it is suggested that, given the approximate resolution of the flow constraints, an 8.2% change in LTHL corresponds well with a 10% change in second-growth yields.

In Option 13a, both flow constraints and available volumes contribute to LTHL impacts (a 14.5% reduction) that are larger than expected, given the reduced second-growth yield in old-growth stewardship zones. The Koeye Watershed is primarily old-growth and hence, compared to the rest of Block 7, has a higher level of growing stock per ha of THLB. The Option 13a THLB is 14.1% lower, and the current growing stock (volume) is more than 18% lower than for the Base option. In addition, harvest levels in Option 13a (relative to the Base Option) were reduced less in the first 50 years than in the longer term, transferring some more of the timber supply impacts to the longer term. Finally, the LTHL in Option 13a could be slightly higher if the curve of growing stock against time was precisely parallel to that for the Base Option.

Confederation Lake – now part of the Inland Lake Park.

Option 10 corresponds to the timber supply impacts of excluding the Confederation Lake Park. The Duck Lake Protected Area occupies less than 1 ha of THLB in Block 1. The Block 1 portion of the Confederation Lake Park includes approximately 2,371 ha of forested land, of which 2,167 ha is productive forest and 1,424 ha is in the THLB.

Block 1 Pilot Project

We have made a commitment in the Proposed MP #8 to re-determine the Block 1 THLB when the current planning initiatives (including landscape unit planning) are complete. If the revised THLB is more than 10% different from the MP #8 THLB, we propose discussing the timber supply and AAC contribution implications with the Chief Forester.

Block 1 planning actions that have occurred since the MP #8 data set was created include the designation of old-growth stewardship zones; some changes in habitat zones; the designation of recreation zones and reserve and/or management zones around defined trails, and wider buffers around large lakes.

A rough preliminary estimate of the impacts on the THLB is a reduction of approximately 3%. This is based on consideration of productive areas in old-growth zones and general descriptions of trail and lake reserve and management areas.

- For example, the productive forest area in old-growth zones is estimated at 2020 ha. After making some allowances for existing net-downs in these areas - recognizing that some will be 100% reserved and harvesting activity will occur in one- third of others - the incremental net-down is estimated at 1,100 ha.

- It is further estimated that additional retention in recreation zones, some habitat zones, and zones adjacent to large lakes and trails will result in additional incremental net-downs of approximately 1,000 ha.

Old Growth Management Areas (OGMAs) are currently being defined as Landscape Planning proceeds in Block 1.

Option 18 – Impacts of using inventory site indexes.

Most of the changes in site index resulted from the change in distribution of areas by the four site index classes; high, good, medium and poor. In this context, the minimum harvest ages reflect the different site index assignments. Minimum harvest ages were not adjusted for the small changes in average site indexes for each of the site index classes. Green-up ages were not adjusted.

If you have any further questions, please call me at (250) 755-3450.

Yours truly,

P.J. (Peter) Kofoed
Planning Forester
Weyerhaeuser BC Coastal Group

cc: Greg Gage, TFL Officer, Vancouver Forest Region
Gerrard Olivotto, Olivotto Timber, Forest Modelling Consultants