Appendix B: Timber Supply Analysis

Western Forest Products Inc.
Corporate Forestry

File: T-19-04-10

July 22, 2009

via email only

Ministry of Forests and Range
Forest Analysis and Inventory Branch
6th Floor 727 Fisgard Street
Victoria, BC V8W 1R8

ATTN.: Doug Layden, Timber Supply Forester

Re: TFL 19 Timber Supply Analysis

Thank you for your letter dated June 26, 2009 in which you accepted the TFL 19 Timber Supply Analysis (TSA) that I submitted on January 30, 2009. Your acceptance was subject to receiving clarification regarding the modeling of factors which were of concern to the Ministry of Environment. Please accept this letter as that clarification.

MoE Item of Concern	MoE Concern	WFP Response
Ungulate Winter Ranges	Total area in U-1-014 should be 6,264 ha.	If one does the math, the Information Package (IP) states that there are 6,257 ha of UWR in TFL 19 (6231-163+189): 7ha less than the MoE website. The areas listed in the IP are based on the areas in the resultant data used in the analysis – spatially the UWR are the same as the UWRs posted on the MoE FTP site – minor tenure differences may account for the 7 ha difference. The area listed in Table 16 of the IP refers to the UWRs within the WFP portion of TFL 19 (i.e. excludes the BCTS area).
Wildlife Habitat Areas	Existing WHAs encompass 695.3 ha and have a 300 ha THLB impact. 14 proposed MaMu WHAs going forward with total area of 961.7 ha and 265.6 ha THLB impact. Full 1% of THLB should be netted out for WHA impacts.	Again, the areas listed in the IP (689 ha gross and 348 ha THLB) are based on the areas in the resultant data used in the analysis for WFP's portion of TFL 19 – spatially the established WHAs are the same as the WHAs posted on the LRDW site – minor tenure differences may account for the 6.3 ha gross area difference. The draft MaMU WHAs used in the analysis were the best available information as of December 2007 when the data was prepared and the draft IP created. Area impact changes of the final draft WHAs can be determined and brought forward in the AAC determination rationale. Without WHAs the THLB in TFL 19 as estimated in the analysis would be 76,974 ha

MoE Item of Concern	MoE Concern	WFP Response
		(79,448-3,178(WTRA)+348(established WHAs)+356(draft WHAs)). 1% of this is 770 ha. The WHAs used in the analysis reduced the THLB by 704 ha (348+356) or 0.91% – a difference of 66 ha. Also see the discussion after this table on the 1% IWMS budget.
Marbled Murrelet	Sec. 7 Notice states that an amount equal to the amount of current suitable MaMu habitat in the non-contributing (NC) landbase of TSR 2 should be protected. Nootka FSP commits to maintaining 12,336 ha plus an amount in THLB.	The Nootka FSP covers an area much larger (roughly twice) than WFP's TFL 19 and commits to maintaining 12,336 ha in NC plus, with no order or agreement stating otherwise, 700 ha within the THLB within the area subject to the FSP. For TFL 19, TSR 2 is MP #9. The MP#10 analysis uses assumptions very similar to those used in MP #9 – the main differences are associated with additional wildlife habitat netdowns (UWRs and WHAs); therefore, the amount of MaMu habitat in the NC landbase will have increased since MP 9 (with a corresponding reduction in the THLB). In December 2007 the best estimate of the THLB impact within TFL 19 was as represented by the draft WHA's incorporated into the data set. Again, changes to draft WHA's since December 2007 can be brought forward and discussed in the AAC rationale.
Red-legged Frogs	Nootka FSP commits to manage for Red-legged frog habitat within RMZs but they have not modeled W4 RMZs, which is where Red-legged frogs breeding ponds would occur.	There are no W4 wetlands within the data used for TFL 19. The THLB impact of retention in wetland RMZs to address Red-legged frog habitat management is managed on a site-specific basis and at this time is thought to be addressed by the riparian reserve and WTRA netdowns; if the FSP strategies results in significant retention levels within RMZs then the next analysis can reflect that practice.
Old Growth Management Areas (OGMAs)	WFP has applied an old seral cover constraint to meet the non-spatial Old Growth Order requirements. However, in the Nootka FSP, it states that in some Landscape Units, they will require recruitment to meet old seral targets for some BEC variants. I don't see that this has been modeled as a constraint in the base case? Please confirm.	If there is currently insufficient old growth to meet the OGMA requirement in moderate and high BEO LUs the model is constructed such that there are penalties imposed as long as there is insufficient old growth (this is done using _GOAL in the Woodstock model). This drives the model to meet the requirement as soon as possible – in effect, through recruitment. This was applied to the CWHxm2 variant in the Gold LU. No other variants by LU were in deficit.

MoE Item of Concern	MoE Concern	WFP Response
Community Watershed	WFP has applied a cover constraint so no more than 5% of the productive area within the watershed will be covered in stands <5 yrs old. How does this compare to the FSP commitment of no more than 30% ECA?	Under the assumptions in the 1999 WAP Guidebook, 90% recovery is reached at 9m stand height (Table A2.2). According to the TFL 19 height curves, on average this height is reached in 25 years. Since the model is built in 5-year periods this equates to 5 periods. 5% per period times 5 periods divided by 0.9 equates to 27.8% - more conservative than the FSP and does not account for the partial hydrologic recovery obtained at shorter stand heights. FYI - the FSP allows for ECAs to exceed 30% if a professional assessment determines that a material adverse impact is unlikely.
Terrain Stability	How much Terrain Class IV and V were included as part of the operable land base for the base case? It is unclear to me how this was modeled…	Of the 34,385 ha of productive forest classified as Class 4 terrain within TFL 19, 17,699 (51%) is within the THLB used for the TSA. The corresponding figures for Class 5 terrain are 10,403 ha and 2,314 ha (22%) respectively. Table 15 of the IP provides a summary of the proportion of the THLB that falls within Class IV and Class V terrain by slope class and a summary of the recent performance within the same classes. It indicates that we have been harvesting within Class IV and V polygons roughly proportional to their contribution to the THLB.
Riparian	1. The DRAFT Management Plan does not mention anything around streams, riparian reserve zones or riparian management zones. This is a little disconcerting. 2. The Nootka FSP commits to retain RMZs in various situations; however, RMZs have not been included explicitly in the base case because they state that current RMZ retention has been minimal and it is not expected to change in the future. I would like to see some amount modeled within the base case for RMZs or at least a reporting out on the amount of windthrow within RRZs that has occurred, suggesting that more RMZs should be left to buffer RRZs. WFP has not accounted for any L2 or W4. Within the FSP WFP has committed to manage for Red-legged frog habitat within RMZs but again, they have not modeled W4 RMZs, which is where Red-legged frogs breeding ponds would occur.	1. Section 5 of the draft MP states broad objectives for riparian management. Section 1.5 of the draft MP states that the FSP is the document to refer to for detailed strategies. 2. There are neither L2 lakes nor W4 wetlands within the data used for TFL 19. As stated in Section 9 of the IP windthrow has not been a significant issue in TFL 19. The assumptions used in the timber supply analysis reflect recent practice; if the FSP strategies result in significant retention levels within RMZs then the next analysis can reflect that practice.

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MoE Item of Concern	MoE Concern	WFP Response
Wildlife Tree Retention Areas	The MP and FSP have committed to 7% WTR on average. They have modeled only 4% as a deduction for this because the other 3% is assumed to be met through RRZs. As well, 4% netdown for WTR is also expected to address gully management areas, basal retention in RMZs, and Red-legged frog breeding pond protection (W4, unclassified wetlands). I'm not sure that this is a reasonable assumption and would like to see some amount factored in for terrain stability in gullies and for RMZs.	RMZs are discussed in previous section. Most large gullies are removed from the THLB by the operability inventory (classified as inoperable). Again, if the FSP strategies result in significant retention levels within the THLB then the next analysis can reflect that practice.
Operability mapping	Also refer to terrain stability comments. The sensitivity analysis around operability shows that the assumption around how much non-conventional wood contributes to the harvest volume has a large impact. Are the assumptions reasonable? As well, WFP mentions how much more land base is considered operable in this TSA compared to 2001 and this has large implications for management of Marbled Murrelet habitat in the TSR 2 defined non-contributing landbase, as mentioned above under Marbled Murrelets.	The Base Case includes a heli volume restriction of 50,000 m^3/year that reflects recent performance. The IP states that significantly more productive area is netted out as inoperable due to the VRI replacing the previous forest cover inventory. It does not state that there is significantly more operable area. Also see WFP response to Marbled Murrelet concern and IWMS "budget" discussion below.

<u>IWMS 1% "Budget"</u>

My understanding is that the MoE's position is the "budget" for WHAs is 1% of the THLB of TSR 2. For TFL 19, TSR 2 equates to the analysis associated with MP #9. Since the MP #9 THLB was estimated the following landbase changes have occurred to TFL 19:

- Private land was withdrawn;
- Areas were removed to form two woodlots; and,
- An area has been identified (and very recently removed) for BCTS' AAC allocation within TFL 19.

The following table indicates the approximate impact to the THLB within TFL 19 (based on MP #9 assumptions) of these landbase removals:

Landbase	THLB Impact (ha)	Net TFL 19 THLB (ha)
Total TFL 19 in MP #9	N/A	94,702
MP #9 WTP Area reduction	- 3,545	91,157
MP #9 Recreation netdown	- 4,627	86,530
TFL 19 private land removal	- 1,421	85,109
TFL 19 woodlots removals	- 1,320	83,789
TFL 19 BCTS area removal	- 6,799	76,990

If the WHA "budget" is 1% of the TSR 2 THLB, then the corresponding number for the area subject to the TFL 19 TSA would be 770 ha (1% of 76,990 ha) – note that this is the same as determined with the MP #10 data.

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The WHAs incorporated in the TSA had a THLB impact of 704 ha – a difference of 66 ha. In my opinion this is the maximum incremental impact that meeting the full 1% “budget” would have when compared to the data used for the MP #10 analysis..

If you have any questions or require any clarification, please contact me at (250) 286-4117 or mdavis@westernforest.com.

Yours truly,
Western Forest Products Inc.

Mike Davis, RPF
Planning Forester

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BRITISH COLUMBIA
The Best Place on Earth

File: 12850-20/TFL 19
CLIFF 120886

June 26, 2009

Mr. Mike Davis, R.P.F.
Planning Forester
Western Forest Products Inc.
118 – 1334 Island Highway
Campbell River, British Columbia
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Dear Mr. Davis:

Thank you for the Tree Farm Licence (TFL) 19 Timber Supply Analysis for Management Plan 10 that you submitted on January 30, 2009.

I have reviewed the report along with Ministry of Forests and Range (MFR) regional, and district staff and Ministry of Environment specialists. As the MFR timber supply forester responsible for reviewing this report, I accept the report subject to the attached note.

Please note that this letter does not mean that the MFR endorses every aspect of the information package and analysis report. During the allowable annual cut (AAC) determination meeting, MFR staff will advise the deputy chief forester of the technical validity of the information and the implications the assumptions. The deputy chief forester will consider this advice as he develops the rationale for his determination of the AAC for TFL 19.

Sincerely,

Doug Layden, R.P.F.
Timber Supply/Geomatics Forester
Forest Analysis and Inventory Branch

Attachment

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Jim Brown, Timber Supply Forester, Coast Forest Region
Jill Werk, Stewardship Forester, Campbell River Forest District

Notes on Acceptance of the Timber Supply Analysis Report for TFL 19

Please provide clarification regarding the modelling of the following factors which were of concern to Ministry of Environment. The specific concerns were sent to you by email on June 26, 2009.

- Ungulate Winter Range
- Wildlife Habitat Areas
- Marbled Murrelet
- Red-legged Frogs
- Old-growth Management Areas
- Community Watershed
- Terrain Stability
- Riparian
- Wildlife Tree Patches
- Operability Mapping

WESTERN FOREST PRODUCTS INC.

Tree Farm Licence 19

Timber Supply Analysis

MANAGEMENT PLAN 10

January 2009

REGISTERED PROFESSIONAL FORESTER PROVINCE OF BRITISH COLUMBIA MICHAEL J. DAVIS NO. 2465

Mike Davis, *R.P.F*
Planning Forester
Western Forest Products Inc.

Executive Summary

This analysis examines timber supply projections for Tree Farm Licence 19 located on west-central Vancouver Island.

Woodstock, a pseudo-spatial harvest model, was used to model current management practices for protection and maintenance of ecological values and to estimate the residual timber potential through the year 2256.

After allowances for non-recoverable losses, the modelling of current management practice as set out in the associated Information Package suggests an AAC of 762,152 m^3/year (a 10% reduction) for the term of the Management Plan #10. This represents a reasonable harvest level that accommodates ecological and social concerns in the short and longer terms. The modelling suggests that a minimum of 45,300 ha (32%) of productive forest area will be maintained in old forests (>250 yrs) and a minimum 20,000,000 m^3 of merchantable growing stock will be retained throughout the 250-year planning horizon. These forests are expected to contribute significantly to biodiversity conservation and complement protected areas within and adjacent to the Tree Farm Licence.

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Acknowledgements

Dave Coster, Craig Mistal, and Rene de Jong of Timberline Natural Resource Group prepared the Woodstock model and the various yield tables. At Western Forest Products, Mike Fowler handled data preparation and yield table queries. Peter Kofoed provided valuable guidance and review comments.

1.0 Introduction

1.1 Background

Tree Farm Licence (TFL) 19 is located on the west coast of central Vancouver Island in the vicinity of Gold River and Nootka Sound. This analysis does not include areas recently removed from TFL 19 to create two woodlots with a total AAC of 10,000 m^3; nor does it include the area that will eventually be removed from TFL 19 to create an operating area for BC Timber Sales (BCTS) – see Figure 1. All references to TFL 19 in this document refer to the portion of TFL 19 managed by WFP on an on-going basis (i.e. excludes the BCTS area). The TFL encompasses 171,722 ha of which 75,312 ha is estimated to be available for long term timber production. The TFL was acquired from Pacific Forest Products in 1997. The allowable annual cut (AAC) for this landbase is currently set at 845,947 m^3 per annum.

1.2 Objective

The primary objective of this report is to estimate reasonably achievable timber flows for the consideration of the Provincial Chief Forester in making his determination of Allowable Annual Cut for the term of Management Plan 10. More specifically:

1. The management of non-timber values such as fish and wildlife habitat, biodiversity, recreation, visual quality, and terrain stability is accounted for. Protection of non-timber values will be satisfied by land base removals, yield net downs and/or by maintaining a percentage of the landbase in older stands.
2. Residual timber flow is to be estimated by considering harvestable inventory, growth potential of present and future stands, silvicultural treatments, potential timber losses, operational and legislative constraints.
3. Impacts of declining timber flow on community stability and employment are to be lessened by keeping rates of decline per decade as low as possible without inducing undue impacts on other values or long term timber sustainability.

1.3 Timber Supply Model

Timber supply optimizations were completed with Woodstock software developed by Remsoft. Woodstock is a pseudo-spatial supply model and is described in more detail in the associated Information Package (IP).

The inventory database was current to January 1, 2007 for harvesting depletion and January 1, 2006 for silviculture treatments and assessments. The model was constructed using 50 5-year periods for a total optimization horizon of 250 years.

Analysis units and associated yield curve parameters are described in more detail in the associated Information Package.

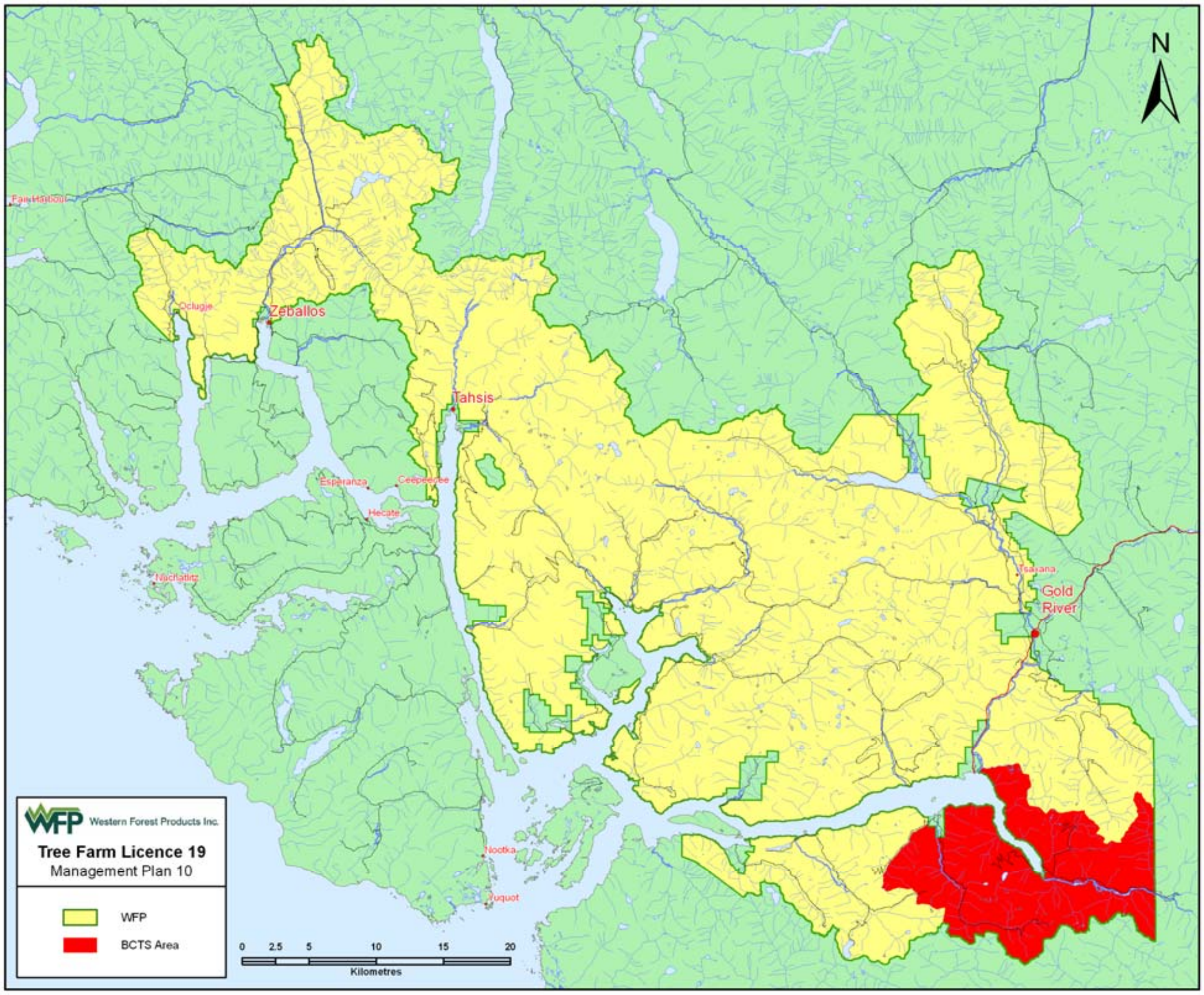

Figure 1 - TFL 19

2.0 Current Management or Base Case

The Base Case or Current Management option includes the following assumptions and modelling parameters that are described in more detail in the associated Information Package (note that as a result of preliminary model runs using the criteria in the original Information Package from February 2008, some modelling parameters have been revised and will be explained in this document):

- Future stand level retention is projected to be in the order of 14% (on an area basis) and have an incremental impact of 4% to the THLB[1] (i.e. 10% is assumed to be located in areas constrained for management of other non-timber resources). Old seral stage targets are maintained based on the *Order Establishing Provincial Non-Spatial Old Growth Objectives* effective June 30, 2004 (NSOG). Mature seral targets are incorporated for the two Special Management Zones within TFL 19.

- Designated wildlife habitat areas such as ungulate winter ranges are not included for timber production. 356 hectares of suitable Marbled Murrelet habitat are removed from the THLB to account for the *Forest Planning and Practices Regulation* (FPPR) section 7(2) notice for the Campbell River District and the strategy in the approved FSP.

- Green-up heights are assigned based on Resource Management Zoning established in the Vancouver Island Land Use Plan.

- The operable land base includes stands accessible to helicopter and conventional cable or ground-based harvesting systems.

- All harvested stands are planted promptly; a 1-year regeneration delay is incorporated into the yield tables (the 1-year regeneration delay was not included in the original IP). Future plantations are assumed to use seed orchard stock. Yield reductions are based on standard OAFs of 15% and 5%. Future medium and poor site Douglas-fir stands in the CWHxm2 subzone are assumed fertilized twice per rotation.

- Visual quality restrictions are based on the VQOs established for the Campbell River Forest District on December 14, 2005 with upper range disturbance assumed. Recreation constraints are applied based on the *Order to Identify Recreation Resource Features for the Campbell River Forest District* dated April 12, 2006. Karst features management is based on the karst vulnerability potential (KVP) identified in the TFL 19 Planning-Level Karst Inventory dated March 31, 2003.

- Minimum harvest age varies by leading species (a change from the original IP) and site productivity and the minimum harvestable volume is 350m^3 per hectare (see Table 1). Both

[1] As the 4% is applied as a yield reduction, growing stock and age class distributions and summaries do not reflect this reserved area or volume.

minimum age and minimum volume requirements must be met before a stand can be harvested. Minor deciduous leading stands are included in the THLB and any volume in these stands contributes to the analysis.

Table 1 – Minimum harvest ages

	Minimum Harvest Age by Leading Species (years)		Minimum Volume (m^3/ha)
Site Productivity	**Douglas fir**	**Other**	
Good	50	60	350
Medium	60	80	350
Poor	70	100	350

- For the first 5-year period of the analysis, a net 300,000 m^3 is added to reflect the awarding of licences to first nations for undercut volume in TFL 19 less the portion of the Hisnit woodlot that remains within TFL 19 until March 31, 2010 (see Table 2). This additional volume in period 1 is a change from the original IP.

Table 2 - Additional Volume for First Period of Analysis

Description	Volume (m^3)
Total TFL 19 undercut volume awarded or in discussion	350,000
Less: TFL 19 undercut volume harvested to October 2008	(17,000)
Less: Estimated WFP harvest in Hisnit woodlot area	(33,000)
Total volume to add to first period of analysis	**300,000**

- Also as the first period of the analysis is 2007-2011 and the new AAC will be determined in early to mid 2009, the harvest volume for the first period is set to reflect two years at the current AAC (845,947 m^3/year) plus 3 years at the new lower harvest level (see Table 3). Subsequent harvest levels are based on changes from the average value for the first period. This additional volume (2 years at the current AAC) is a change from the parameters in the original IP.

Table 3 - First Period Harvest Level

Description	Rounded Volume (m^3)
2 years at current AAC (2 x 845,947 m^3)	1,690,000
plus: 3 years at 93% of 845,947 m^3	2,360,000
plus: 300,000 m^3 from above	300,000
Total volume for first period of analysis	**4,350,000**
Yearly average for first period of analysis	**870,000**

- Recent harvest within the non-conventional portion of the THLB has been approximately 6.0% of the total harvest area whereas it represents approximately 12% of the THLB and contains approximately 17% of the current THLB volume. The level of performance in the non-conventional THLB is not anticipated to increase significantly in the near future. Therefore, a 50,000 m^3/year constraint is applied in the timber supply model. This value represents approximately 6% of the initial harvest level. This is an additional constraint added since the original IP was submitted.

- Woodstock is set up to maximize harvest volume over the first half of the 250-year analysis period subject to maintaining a relatively stable (± 5%) growing stock on the THLB over the final 150 years.

The Base Case flow is presented in Table 4 and Figure 2. All harvest volume figures are net of non-recoverable losses of 6,335 m^3/year.

Table 4 - Base Case Harvest Levels

Period	Start Year	End Year	Harvest Volume (m^3)
1	2007	2011	870,000
2	2012	2016	753,000
3	2017	2021	699,800
4	2022	2026	650,400
5	2027	2031	604,400
6 - 14	2032	2076	561,700
15 - 17	2077	2091	595,700
18 - 50	2092	2256	650,500

The optimization suggests that immediate declines in AACs need to be initiated and maintained for the next 25-30 years. A decline of about 14% per decade will allow for an orderly transition to the mid-term harvest level estimated to be about 561,700 m^3/year. A few decades after the 561,600 m^3/year level is reached, AACs are expected to increase as stands planted today with higher yielding seed orchard stock reach harvestable ages. Yield gains through tree planting and particularly tree improvement to date are expected to eventually contribute to a long-term harvest level (LTHL) of approximately 650,500 m^3/year. The total volume harvested over the 250 years is roughly 159.4 million m^3.

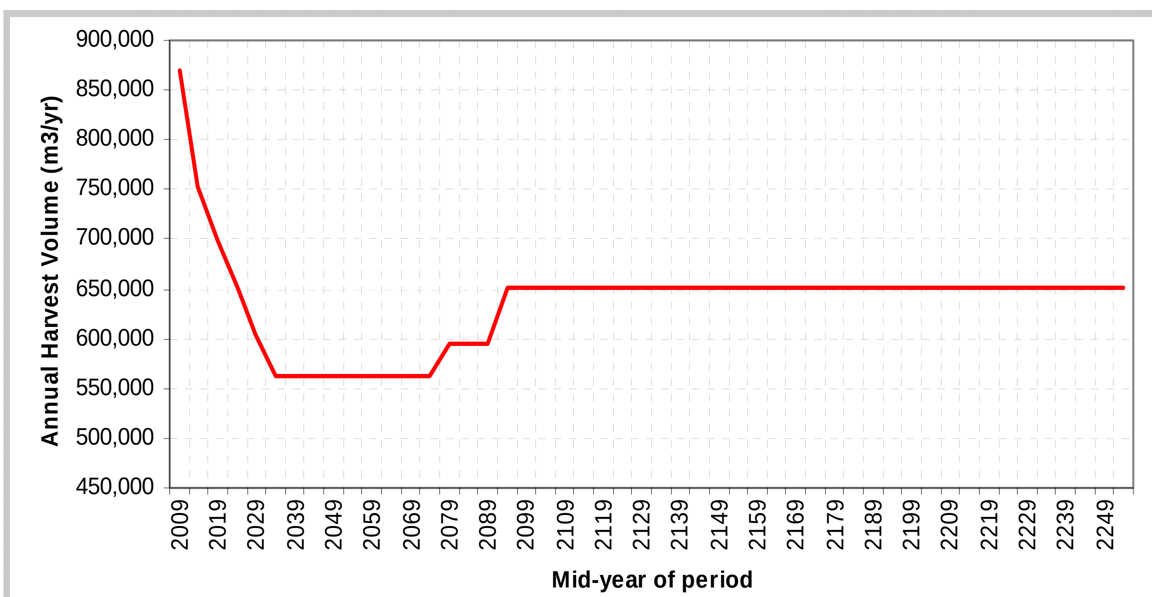

Figure 2 - Base Case Harvest Schedule 2007-2256

Figure 3 indicates the contribution from each of the four different age classes used to define the analysis units to the total harvest volume by period. As expected, old growth stands contribute the greatest proportion of volume in the first 6 periods (30 years). In the following 30 years current managed stands provide the greatest volume. Starting in period 13 (61-65 years into the future) future managed stands provide the majority of the harvest volume.

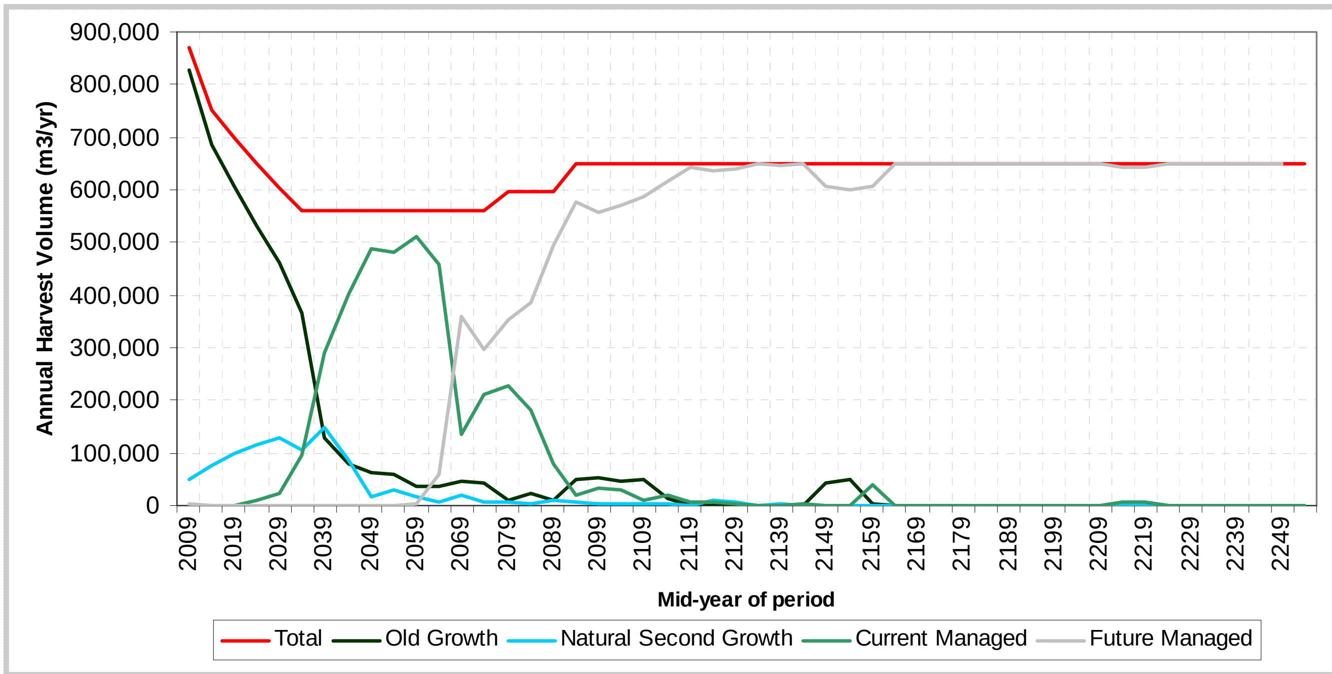

Figure 3 – Analysis Units age classes' contribution to Base Case harvest

Age class distributions are examined in Figure 4 and Figure 5. Note that the age classes are offset from standard age classes due to the Woodstock model being constructed with 5-year periods with the mid-point of the period being set at ages that are multiples of 5. This also explains why the areas in each age class differ from those shown in Table 5 of the Information Package. Generally the youngest age class remains stable through the simulation; it is slightly higher in the first time period (2007) due to the presence of NSR lands whereas in future time periods the model "regenerates" harvested stands immediately. Within the productive forest the oldest age class initially declines by about one-fifth and then increases as younger reserved timber ages into the old growth age class (see Figure 4). Zero to sixty-two year old stands increase initially until a relatively balanced age class distribution is achieved on the timber harvesting land base (THLB) (refer to Figure 5).

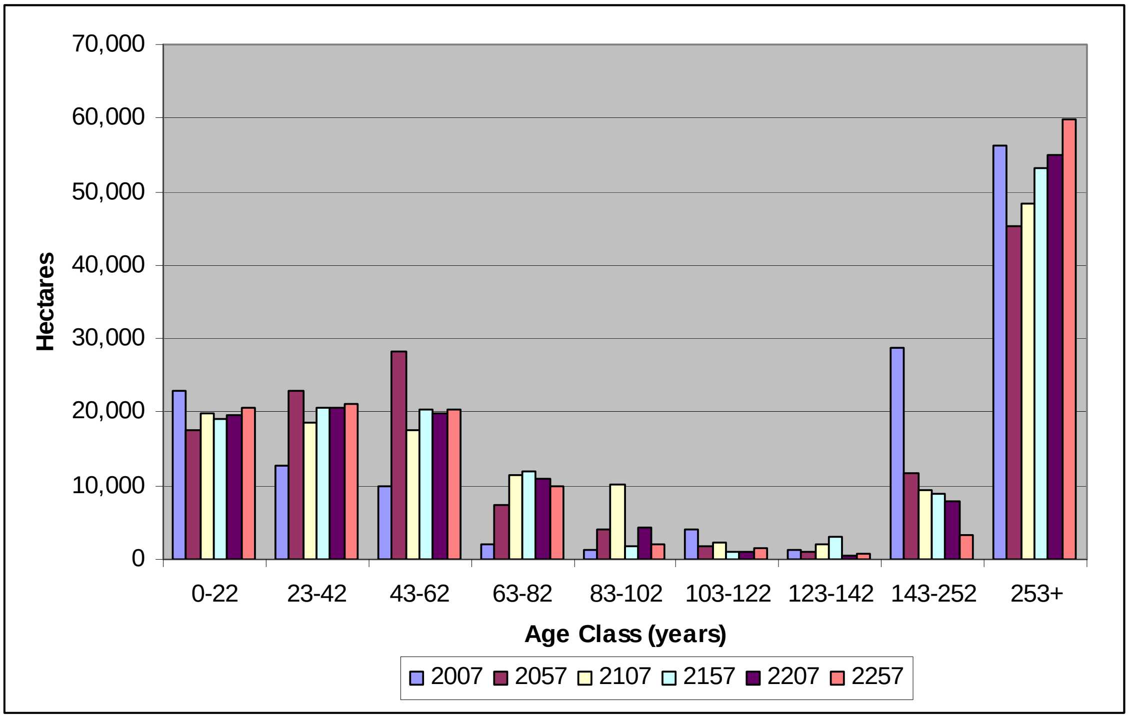

Figure 4 - Age class distribution on productive forest area

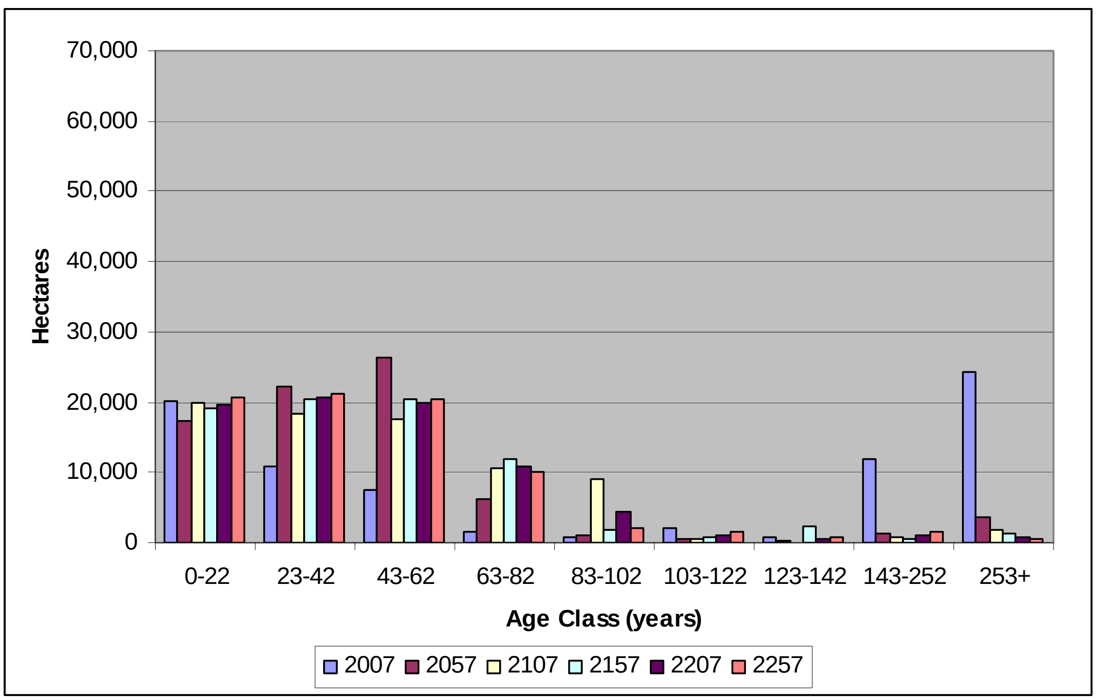

Figure 5 - Age class distribution on timber harvesting land base

Figure 6 illustrates harvestable (i.e. meets minimum harvest age criteria) and gross growing stock levels for the THLB. Growing stock declines until the transition to second growth harvesting is completed and then rises as tree improvement gains take effect. Growing stock on the THLB declines by 21% through the transition to second growth and then climbs back to approximately

90% of current levels and at no time through the simulation does growing stock fall below 20 million cubic metres.

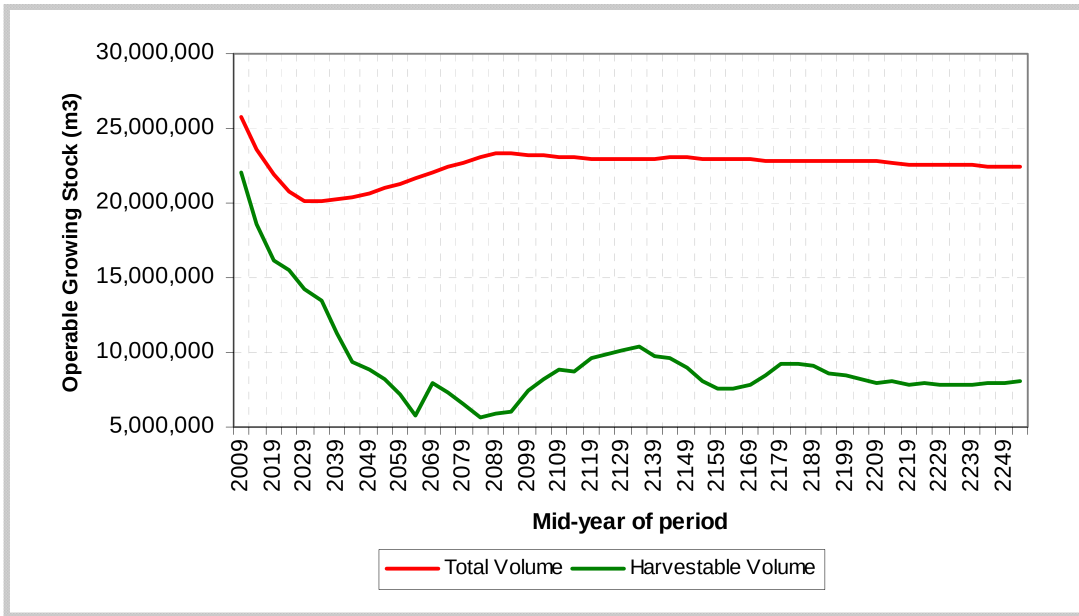

Figure 6 -THLB Growing stock

Figure 7 provides average statistics for timber harvested through the optimization. As expected, mean age of stands harvested declines rapidly as the transition to second growth harvesting occurs and by 2062 averages 80 years.

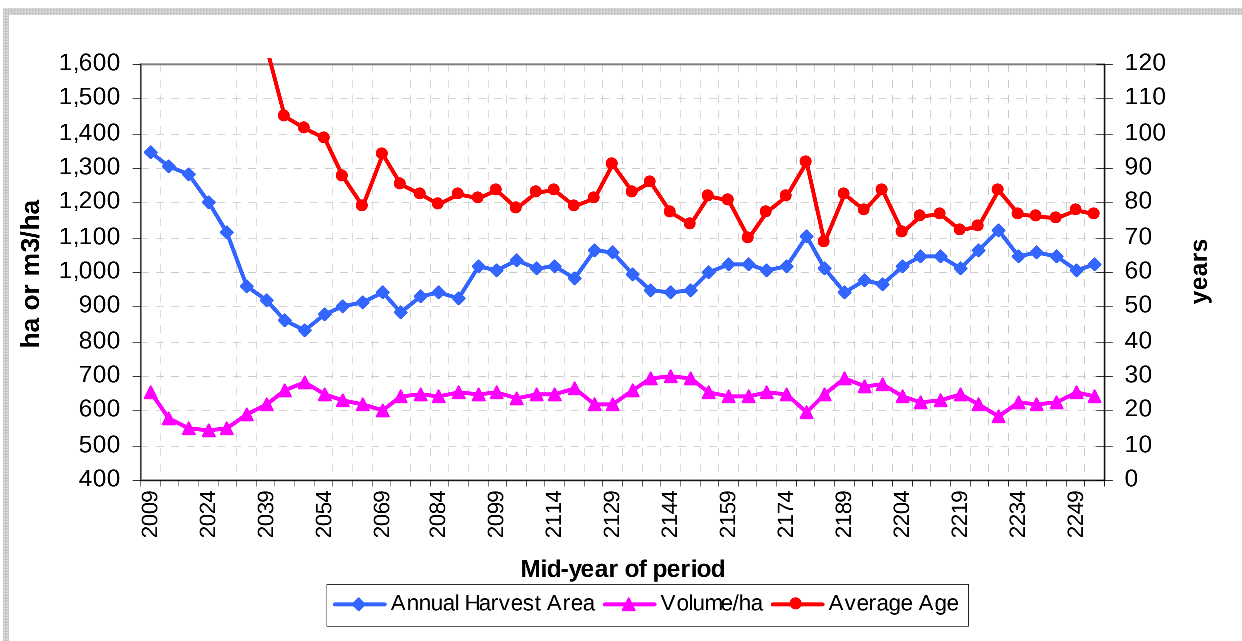

Figure 7 - Harvest Statistics 2001 – 2250

Annual area harvested declines for the next few decades in conjunction with the proposed decline in harvest levels. Once the transition to second growth harvesting is completed, annual area harvested fluctuates between 900 to 1100 hectares per annum. Merchantable volume/hectare remains relatively stable through the simulation at around 640 m^3/ha.

The minimum harvest age modelled for Douglas fir leading stand on good sites is 50 years. All other stands must be at least 60 to 100 years old depending on site quality (see Table 1). Concern was raised by the MoFR with the minimum age of 50 years and a request was made to report the contribution of stands less than 60 years old. Figure 8 indicates the contribution of stands less than 60 years old to total annual harvest volume.

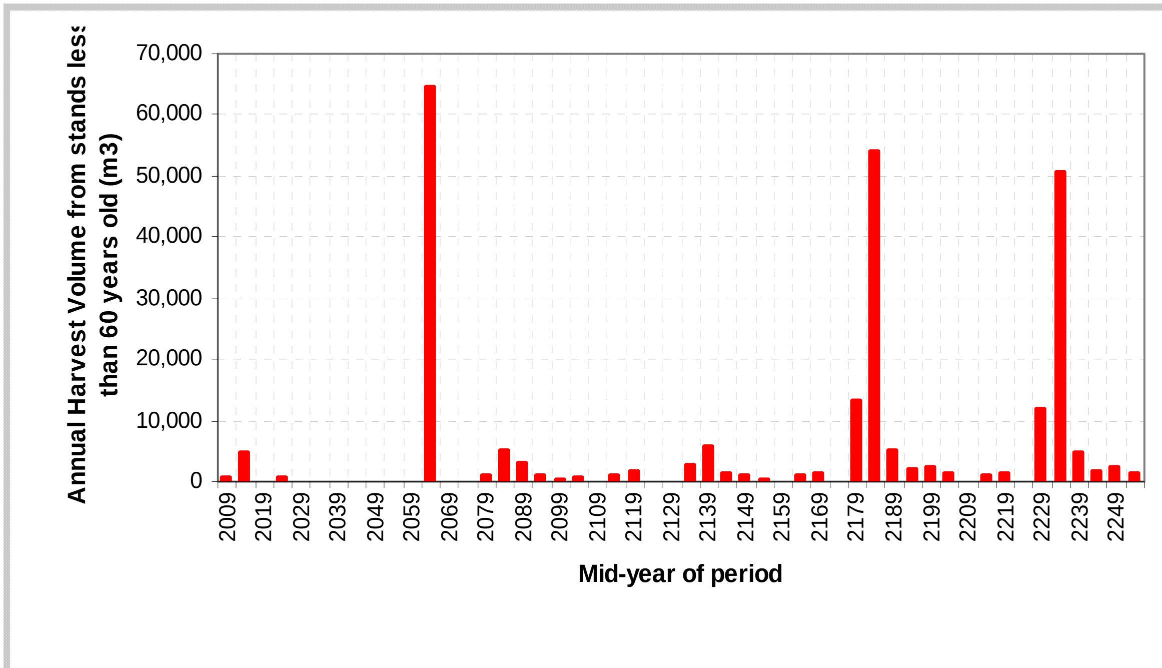

Figure 8 - Volume Contribution from Stands less than 60 years old

These young stands provide little volume in the short term. The largest contribution occurs in period 12 (2062-2066) when they contribute 64,488 m^3/year or approximately 11.4% of the total volume. Subsequent peaks occur in period 36 (2182-2186) and 46 (2232-2236) when these young stands supply 8.3% and 7.7% of the annual volume respectively. Otherwise, on average these stands generally provide less than 1% of the annual volume.

3.0 Alternate Harvest Flows

Table 5, Table 6, Figure 9 and Figure 10 examine alternate flow scenarios.

Table 5 and Figure 9 represent an attempt to maintain the current harvest level for the first 10 years (2 periods). Note that the drop in the second period is due to the removal of the undercut volume accounted for in the first period. The results indicate that, compared to the Base Case, an additional 1.1 million m3 can be harvested over the next 25 years with a total of approximately 2.0 million m3 less being harvested over the following 50 years. Over the entire 250 years, the overall harvest volume is 800,000 m^3 less. The lower harvest levels in the mid-term are required to allow the total operable inventory to recover to levels capable of supporting the long term harvest level.

Table 5 - Harvest levels with maintaining current AAC for 10 years

Period	Start Year	End Year	Annual Harvest Volume (m^3) Base Case	Maintain current AAC
1	2007	2011	870,000	906,000
2	2012	2016	753,000	846,000
3	2017	2021	699,800	760,700
4	2022	2026	650,400	684,000
5	2027	2031	604,400	615,000
6	2032	2036	561,700	552,800
7 - 14	2037	2076	561,700	513,700
15 - 17	2077	2091	595,700	595,500
18 - 50	2092	2256	650,500	650,500

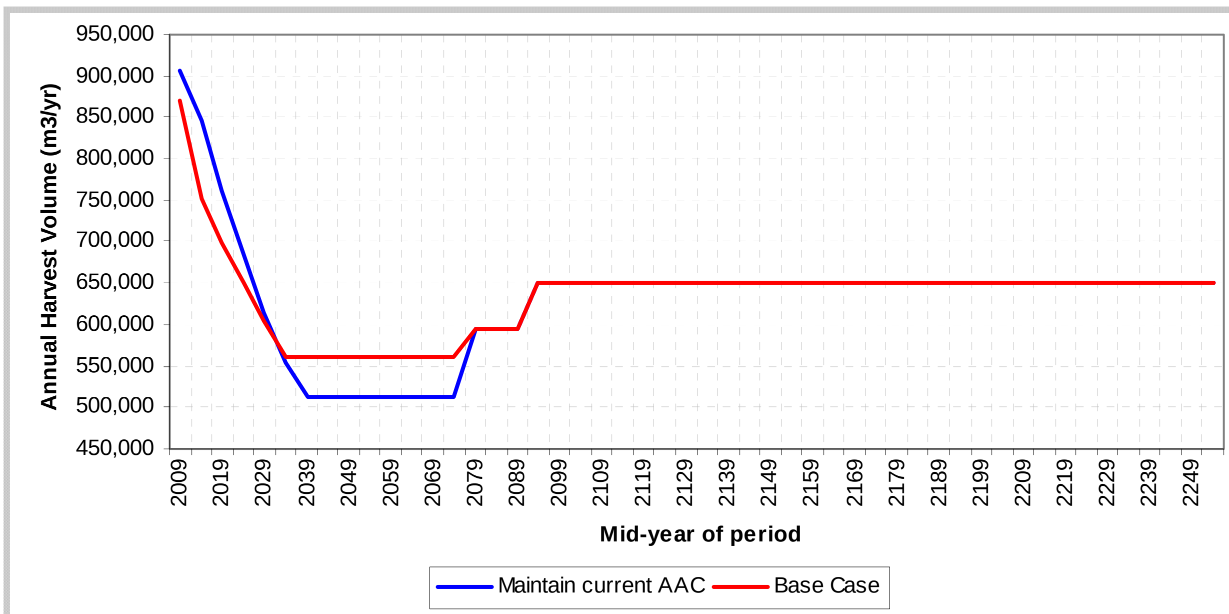

Figure 9 – Harvest levels with maintaining current AAC for 10 years

Table 6 and Figure 10 show the impact of immediately dropping to a non-declining even flow (NDEF) harvest level. This run results in approximately 3.6 million m^3 less (~2.3%) being harvested over the 250 year planning horizon, with 2.4 million m^3 being in the first 20 years. The large drop in short term harvest levels would have dramatic social and economic impacts. While this immediate drop eliminates a mid-term timber supply decline, the long term harvest level of 623,400 m3/year is approximately 27,100 m3/year (4.1%) lower than achieved in the Base Case.

Table 6 – Harvest levels with non-declining even flow

Period	Start Year	End Year	Annual Harvest Volume (m^3)	
			Base Case	NDEF
1	2007	2011	870,000	623,400
2	2012	2016	753,000	623,400
3	2017	2021	699,800	623,400
4	2022	2026	650,400	623,400
5	2027	2031	604,400	623,400
6 - 14	2032	2076	561,700	623,400
15 - 17	2077	2091	595,700	623,400
18 - 50	2092	2256	650,500	623,400

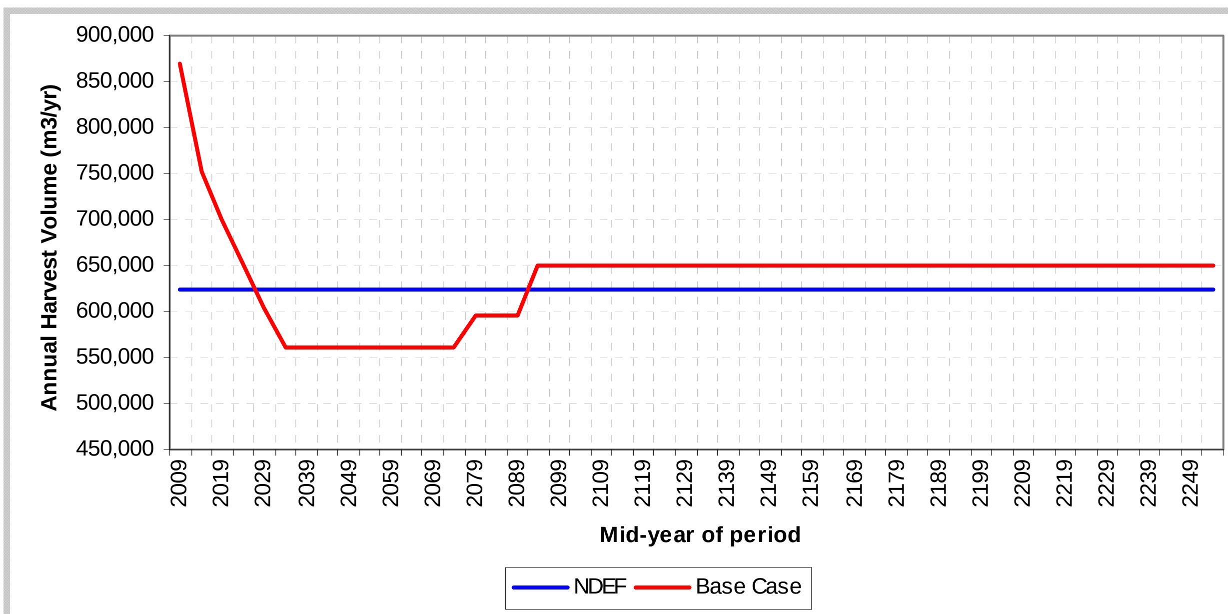

Figure 10 – Harvest levels with non-declining even flow

4.0 Sensitivity Analyses

Sensitivity analysis provides a measure of the upper and lower bounds of the Base Case harvest forecast, reflecting the uncertainty of assumptions made in the Base Case. By developing and testing a number of sensitivity issues, it is possible to determine which variables most affect results. This in turn facilitates the management decisions that must be made in the face of uncertainty. As Woodstock was used as an optimization tool to generate the Base Case, it is expected that the results will be sensitive to any changes to the inputs. The issue is how sensitive – more or less than changes to the inputs?

To allow meaningful comparison of sensitivity analyses, they are performed using the Base Case option and varying only the assumption being evaluated.

In general, sensitivities with negative impacts were run with the goal of keeping the short term rate of decline as close as possible to the rate of decline in the Base Case; mid and long term harvest level goals were not considered. Where impacts were positive, flow request adjustments were made to (1) raise the medium term flow, and optionally (2) lessen the short term decline slope.

Sensitivity issues are summarized in Table 7. The timber supply impacts are illustrated in Sections 4.1 through 4.13.

Table 7 – Current Management Sensitivity Analyses

Issue	Sensitivity level tested	Section
Operability	Remove non-conventional areas	4.1
	Include economically marginal areas	4.2
Growth and Yield	Natural stands yields overestimated by 10%	4.3
	Natural stands yields underestimated by 10%	4.4
	Managed stands yields overestimated by 10%	4.5
	Managed stands yields underestimated by 10%	4.6
	Globally reduce SIBEC Site Index estimates by 3m	4.7
	Use Timberline NRG Potential Site Index estimates	4.8
Minimum Harvest Ages	Increase minimum ages by 10 years and volumes by 100 m^3/ha	4.9
Visual Quality	Reduce the percent disturbed within each VQO polygon	4.10
Tree Improvement	Remove benefits of genetic gain and fertilizing	4.11
Western Forest Strategy	Impact of implementing use of retention silviculture system	4.12
Summary	Summary of sensitivity impacts	4.13

4.1 Remove non-conventional areas

The MP #9 analysis base option included no constraints on rate of harvest from areas classified as helicopter accessible (“heli areas”). At that time plans were to harvest significant volumes from heli areas

In the MP #10 heli areas were included in the landbase but their harvest contribution was restricted to 50,000 m^3 per year to reflect recent performance (from 2001 to 2005 approximately 6.3% of the harvest area was classified as non-conventional). This sensitivity tests the impacts of removing these heli areas from the landbase. These areas represent approximately 12% of the THLB and contain approximately 17% of the current THLB volume (approximately 4.9 million m^3).

In theory harvest levels would be 50,000 m^3/year lower than the Base Case with the removal of the heli areas due to this being their contribution in the Base Case. The question is how to distribute this loss of volume – uniformly or variably? These results (Table 8, Figure 11) indicate one possible result where the impact of this reduced volume is minimized in the short term. This creates a mid-term impact larger than 50,000 m^3/year and a long term impact of 53,600 m^3/year. The total volume harvested over the 250 years is 12.9 million m^3 (~8%) less than the Base Case – slightly greater than 50,000 m^3/year overall.

Table 8 – Harvest levels with heli stands removed

Period	Start Year	End Year	Annual Harvest Volume (m^3)	
			Base Case	Heli Stands Removed
1	2007	2011	870,000	865,300
2	2012	2016	753,000	740,900
3	2017	2021	699,800	681,100
4	2022	2026	650,400	626,100
5	2027	2031	604,400	575,500
6	2032	2036	561,700	529,000
7	2037	2041	561,700	486,200
8 - 11	2042	2061	561,700	446,800
12 - 14	2062	2076	561,700	506,900
15 - 17	2077	2091	595,700	596,900
18 - 50	2092	2256	650,500	596,900

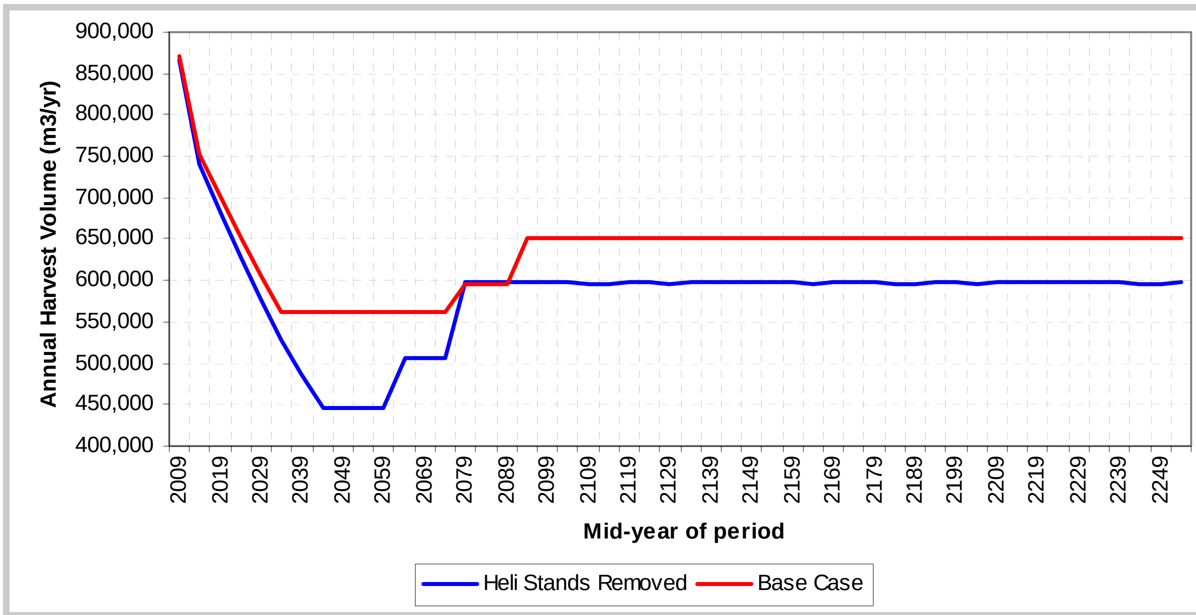

Figure 11 – Harvest levels with heli stands removed

As recent performance in the heli operable stands has been reflected in the Base Case (i.e. an annual restriction on volume sourced from these stands), the removal of this portion of the THLB (12%) has a small impact in the short term. The impact is greatest in the mid-term as there is insufficient growing stock to maintain a higher harvest level and meet the objective of a stable growing stock on the THLB in the long-term. This indicates that the harvest levels achieved in the Base Case are sensitive to the inclusion of the heli operable stands.

There is uncertainty that all heli areas will be harvested (due to economic considerations) – to the extent that this occurs there will be some downward pressure on mid and long term harvest levels. Note that 6.9% of harvest area in 2001 to 2006 has been from inoperable and economically marginal areas (outside the analysis THLB), providing a buffer (offset) for additional areas that may be removed from the THLB for OGMAs, further WHAs etc.

4.2 Include economically marginal areas

The Base Case excludes stands identified as economically marginal. This sensitivity tests the impact of including these stands in the THLB. The total THLB area added is 4,418 ha of which 374 ha is conventional yarding and 4,044 ha is helicopter yarding. The total volume added is 1.78 million m^3.

Due to the 50,000 m^3/year heli restriction being maintained the additional heli area and volume has no impact. The additional conventional yarding area and volume results in a further 310,000 m^3 being harvested over the 250 years – all in the mid and long term (Table 9, Figure 12). Essentially in times of higher timber values these marginal areas provide more operational flexibility to locate the AAC but their inclusion in the THLB should not result in a higher AAC.

Table 9 – Harvest levels with marginal stands added

Period	Start Year	End Year	Annual Harvest Volume (m^3) Base Case	Annual Harvest Volume (m^3) Marginal Stands added
1	2007	2011	870,000	870,000
2	2012	2016	753,000	753,000
3	2017	2021	699,800	699,800
4	2022	2026	650,400	650,400
5	2027	2031	604,400	604,400
6 - 14	2032	2076	561,700	561,700
15 - 17	2077	2091	595,700	599,600
18 - 50	2092	2256	650,500	652,000

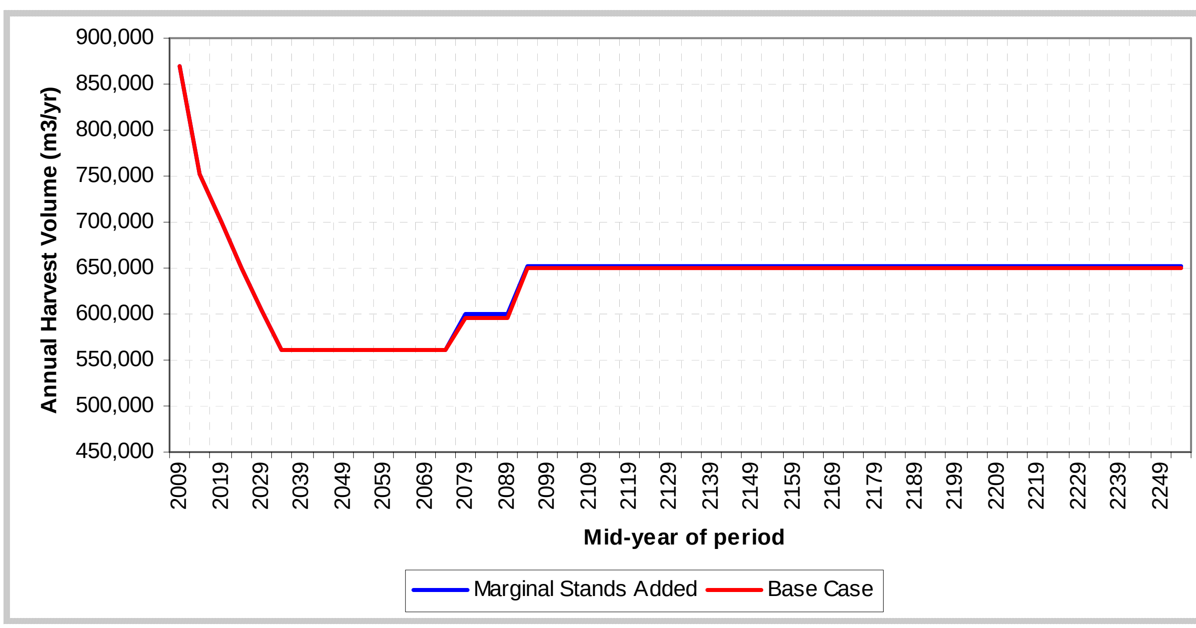

Figure 12 - Harvest levels with marginal stands added

4.3 Natural stands yields overestimated by 10%

The sensitivity of timber supply to natural stands (old growth and older second growth) volume estimates was tested by decreasing (this Section) and increasing (Section 4.4) these volumes by 10%. The volumes in these stands are estimated from the Vegetation Resource Inventory (VRI) attributes and the Ministry of Forests and Range (MoFR) Variable Density Yield Prediction system (VDYP).

The reduced yields result in approximately 2.6 million m^3 less inventory on the THLB today when compared to the Base Case. It also reduces the volume of growth on the second growth stands impacted in this sensitivity. Table 10 and Figure 13 indicate the results of trying to minimize the short term impact of these reduced volumes. The total volume harvested in the 250 years is reduced by approximately 2.8 million m^3 with the greatest impact being in the first 50 years (as this is when the majority of the volume harvested is from these natural stands – refer to Figure 3).

Table 10 – Harvest levels with reduced natural stands yields

Period	Start Year	End Year	Annual Harvest Volume (m^3) Base Case	Annual Harvest Volume (m^3) Natural Stands Yields Reduced
1	2007	2011	870,000	860,300
2	2012	2016	753,000	728,300
3	2017	2021	699,800	662,200
4	2022	2026	650,400	602,000
5	2027	2031	604,400	547,300
6	2032	2036	561,700	497,400
7	2037	2041	561,700	452,100
8	2042	2046	561,700	444,600
9 - 11	2047	2061	561,700	544,600
12 - 14	2062	2076	561,700	551,400
15 - 17	2077	2091	595,700	595,500
18 - 50	2092	2256	650,500	650,500

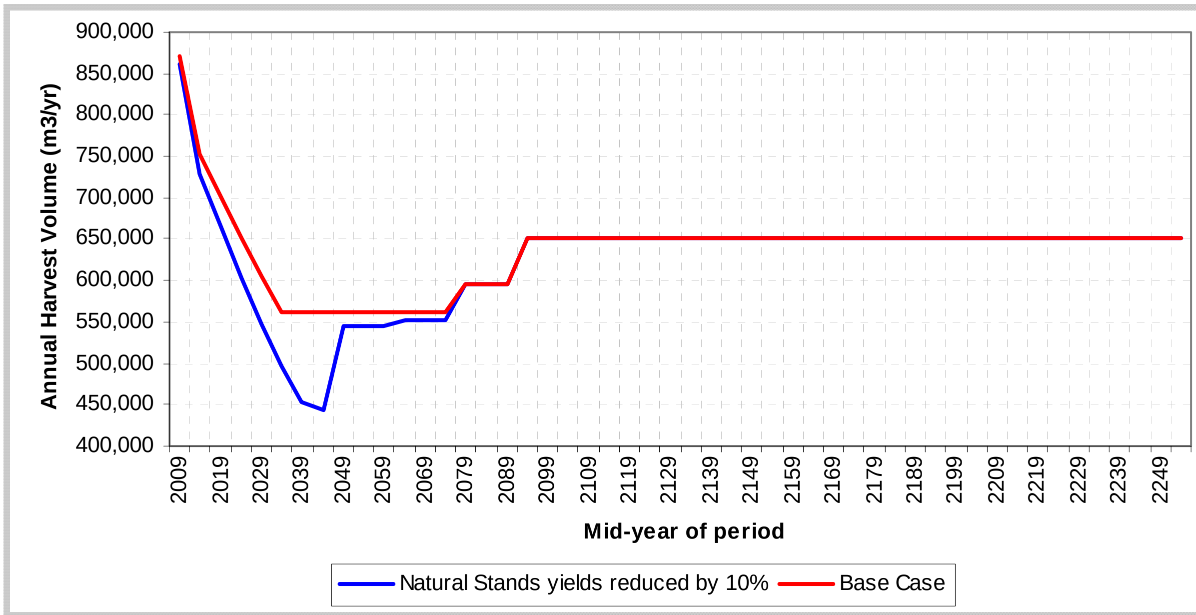

Figure 13 – Harvest levels with reduced natural stands yields

Minimizing the impact in the short term has a significant impact on the mid-term as the inventory is drawn down faster and the current managed stands can not provide adequate volume to maintain harvest levels at or near the Base Case levels.

4.4 Natural stands yields underestimated by 10%

This sensitivity adds 2.6 million m^3 to the current inventory and increases the total harvest in the first 80 years by 3.2 million m^3. The additional volume is in the short and mid term when natural stands are providing the majority of the volume. Long term harvest levels are marginally lower than the Base Case as stands are harvested at slightly younger ages on average due to maximization of the short and mid-term harvest levels somewhat at the expense of the long term.

Table 11 – Harvest levels with increased natural stands yields

Period	Start Year	End Year	Annual Harvest Volume (m^3) Base Case	Annual Harvest Volume (m^3) Natural Stands Yields Increased
1	2007	2011	870,000	875,500
2	2012	2016	753,000	766,600
3	2017	2021	699,800	722,200
4	2022	2026	650,400	678,300
5	2027	2031	604,400	637,200
6 - 11	2032	2061	561,700	598,600
12 - 14	2062	2076	561,700	645,200
15 - 17	2077	2091	595,700	645,200
18 - 50	2092	2256	650,500	645,200

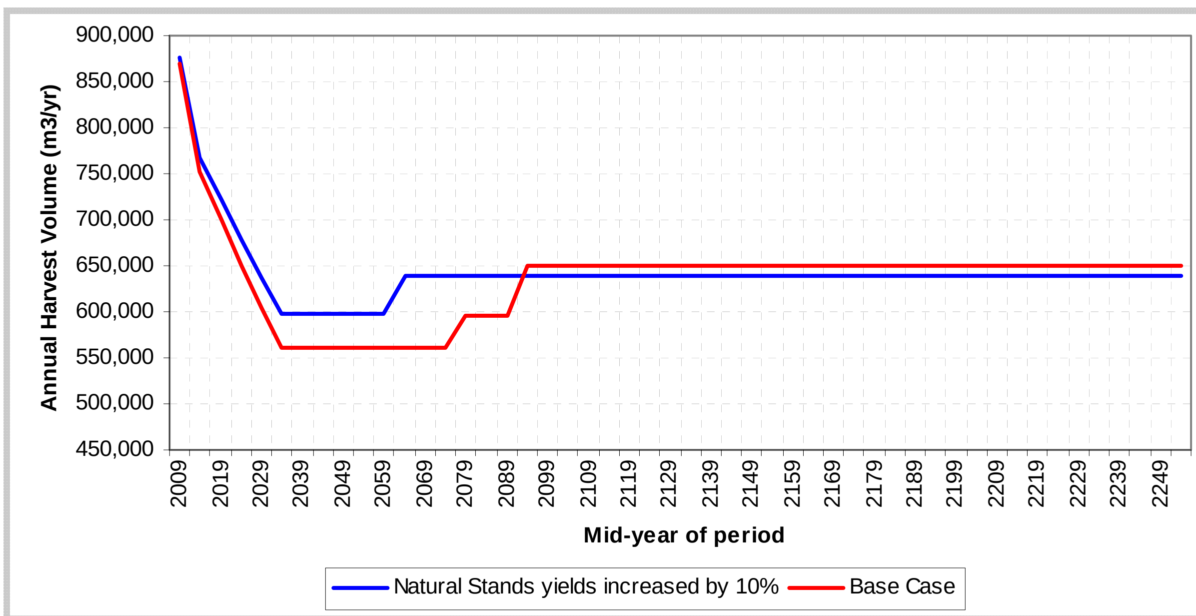

Figure 14 – Harvest levels with increased natural stands yields

There is general comfort with the overall volume estimates for old-growth natural stands. Similar average volumes for the mature productive forest are reported in the current inventory (see areas and volumes in table 5 and Table 7 of the IP), the previous inventory and MoFR audits (553 m^3/ha, 562 m^3/ha, and 556 m^3/ha respectively).

Volume estimates for younger natural stands (current ages 46 to 120 years) appear low. One small unquantified contributing factor is the utilization limits used to generate the volume estimates. The volume in these stands was generated using VDYP. Operationally for these stands the minimum DBH for utilization is 12.5 cm whereas the VDYP volume estimates are based on a 17.5 cm minimum; VDYP does not accept the smaller DBH utilization limit. This discrepancy results in a slight timber supply underestimation.

An additional factor is that impacts of completed fertilization have not been included. Since 1980 approximately 8,400 ha of nitrogen fertilization has occurred, mostly on Douglas fir leading stands aged 21-40 years at time of application. Much of the fertilized area is in young natural stands (with the rest in the current managed age range). Increased yields from these fertilization treatments are estimated to be between 100,000 m^3 and 200,000 m^3. The higher estimate assumes an average response of 25 m3/ha and the lower estimate assumes no response from the hemlock component in the fertilized stands. This additional volume would be available in the mid-term when timber supply is at its lowest levels.

4.5 Managed stands yields overestimated by 10%

The sensitivity of timber supply to managed stands (younger second growth and future stands) volume estimates was tested by decreasing (this Section) and increasing (Section 4.6) these volumes by 10%. The volumes in these stands are estimated from attributes and assumptions detailed in the Information Package (see Section 8.8 of the IP) and the MoFR's Table Interpolation Program for Stand Yields (TIPSY).

Table 12 and Figure 15 indicate that the first 6 periods (30 years) of the Base Case harvest schedule can be achieved even with managed stand yields reduced by 10%. This is logical as managed stands do not provide any significant volume to the Base Case harvest levels until period 6 (see Figure 3). This run results in approximately 13.2 million m3 (8.3%) less harvest than in the Base Case over the 250 year planning horizon. The long term harvest level is 9.5% less than in the Base Case.

Table 12 – Harvest levels with reduced managed stands yields

Period	Start Year	End Year	Annual Harvest Volume (m^3)	
			Base Case	Managed Stands Yields Reduced
1	2007	2011	870,000	870,000
2	2012	2016	753,000	753,000
3	2017	2021	699,800	699,800
4	2022	2026	650,400	650,400
5	2027	2031	604,400	604,400
6	2032	2036	561,700	561,700
7	2037	2041	561,700	521,900
8 - 14	2042	2076	561,700	516,600
15 - 17	2077	2091	595,700	516,600
18 - 50	2092	2256	650,500	588,700

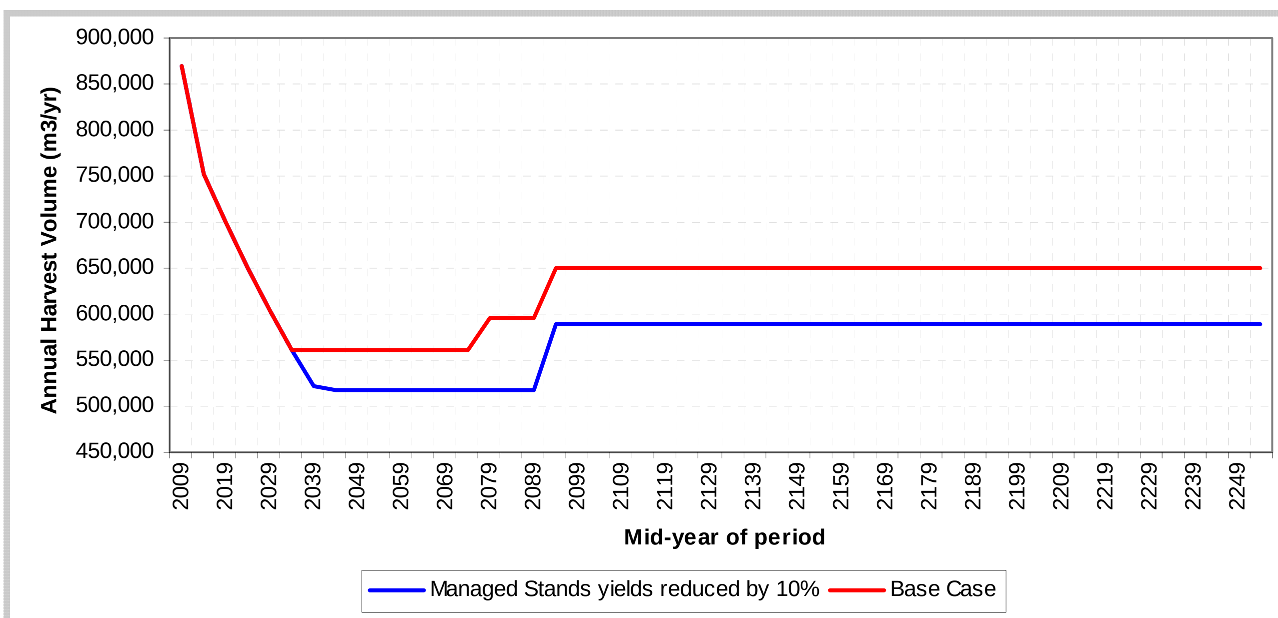

Figure 15 – Harvest levels with reduced managed stands yields

4.6 Managed stands yields underestimated by 10%

With managed stands yields increased by 10%, this sensitivity adds inventory volume in the critical mid-term. This additional inventory supports an additional 3.9 million m^3 of harvest between 2047 and 2091 (periods 9 to 17). The long term harvest level is 51,900 m^3/year (8.0%) higher than the Base Case results (see Table 13 and Figure 16). The long term harvest level is less than 10% higher as there is sufficient inventory to maintain higher harvest levels in the mid term that results in stands being harvested, on average, at younger ages in the long term with the corresponding reduction in yield.

Table 13 – Harvest levels with increased managed stands yields

Period	Start Year	End Year	Annual Harvest Volume (m^3) Base Case	Annual Harvest Volume (m^3) Managed Stands Yields Increased
1	2007	2011	870,000	870,000
2	2012	2016	753,000	753,000
3	2017	2021	699,800	699,800
4	2022	2026	650,400	650,400
5	2027	2031	604,400	604,400
6 – 8	2032	2046	561,700	561,700
9 - 11	2047	2061	561,700	592,800
12 - 14	2062	2076	561,700	692,800
15 - 17	2077	2091	595,700	702,400
18 - 50	2092	2256	650,500	702,400

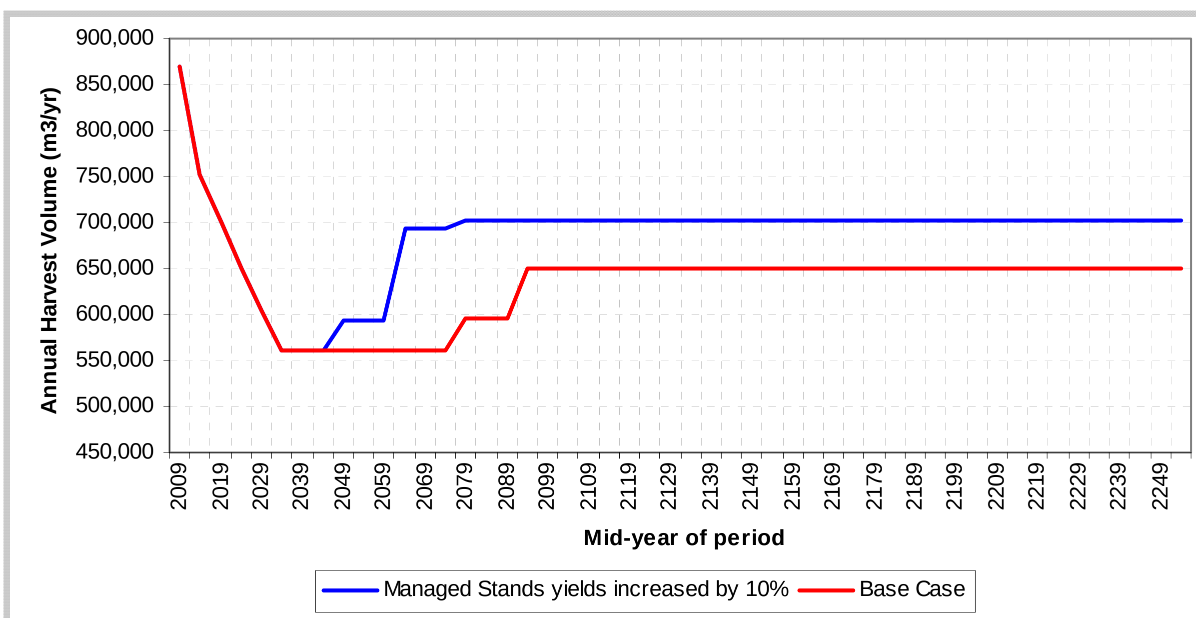

Figure 16 – Harvest levels with increased managed stands yields

4.7 Globally reduce SIBEC Site Index estimates by 3m

This sensitivity is run at the request of the MoFR's Forest Analysis and Inventory Branch. Normally the use of Terrestrial Ecosystem Mapping (TEM) and the associated SIBEC site index estimates depends on an accuracy assessment having been done for the TEM. As no such assessment has been done for the TFL 19 TEM, this sensitivity is run to approximate the use of adjusted inventory (VRI) site indices for managed stands. It is widely understood from past studies that site index estimates based on old growth stands significantly underestimate the growth of managed stands.

The lower site indices result in an 890,000 m^3 (3.1%) reduction in operable inventory at the beginning of the analysis and reduce managed stands yields by approximately 20-25% on average. These reduced yields create timber supply shortages in the mid and long term (when comparing against the Base Case). The short term is impacted to a lesser degree but reduced harvest levels are necessary to transition down to the lower mid-term harvest levels. In the short term (first 20 years) 600,000 m^3 less is harvested; in the mid-term (21-100 years) 6.2 million m^3 less is harvested; and in the long term (101-250 years) 20.8 million m^3 less is harvested. Overall, there is 27.6 million m^3 (17.3%) less harvested. The long term harvest level is approximately 21.3% less than the Base Case level.

Table 14 – Harvest levels with yields based on reduced SIBEC values

Period	Start Year	End Year	Annual Harvest Volume (m^3) Base Case	Annual Harvest Volume (m^3) Reduced SIBEC Estimates
1	2007	2011	870,000	860,300
2	2012	2016	753,000	728,300
3	2017	2021	699,800	662,200
4	2022	2026	650,400	602,000
5	2027	2031	604,400	547,300
6 - 8	2032	2046	561,700	497,400
9 - 11	2047	2061	561,700	500,800
12 - 14	2062	2076	561,700	512,000
15 - 17	2077	2091	595,700	512,000
18 - 50	2092	2256	650,500	512,000

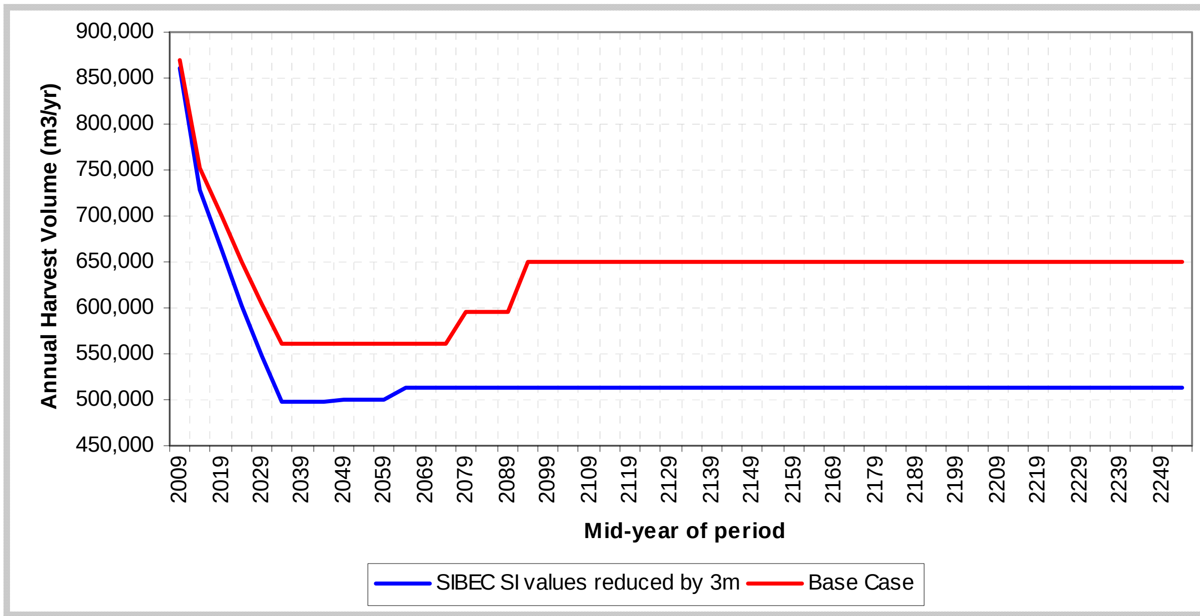

Figure 17 – Harvest levels with yields based on reduced SIBEC values

4.8 Use Timberline Preliminary Site Index (PSI) estimates

Timberline Natural Resource Group has completed 25 Site Index Adjustment (SIA) projects on management units across BC including 11 coastal units, two of which were WFP's TFL 6 and TFL 37. The data gathered in the coastal SIA projects provides Timberline with a data set that can be used to predict estimates of site productivity of managed stands in ecologically similar areas. These site index estimates were labelled as "preliminary site index". The average PSI for hemlock in the CWHvm1 was about 10% higher than the SIBEC estimate. This accounts for the majority of the difference between the two overall average estimates. See Appendix G of the IP for more details.

Some PSI estimates are lower than SIBEC estimates (see Appendix H of the IP for some comparisons) and a large proportion of the current managed stands happen to be composed of species located in those variants where the PSI estimates are lower. When compared to the Base Case this creates a brief timber supply shortfall in the mid-term (periods 7 and 8). Afterwards the overall higher site productivity estimates from the PSI allows long term harvest levels to be approximately 8% higher than that of the Base Case (very similar to the results of increasing managed stands yields by 10% - see Section 4.6). This results in approximately 11.3 million m^3 (~7%) more being harvested over the 250 years.

Table 15 – Harvest levels with yields based on PSI values

Period	Start Year	End Year	Annual Harvest Volume (m^3)	
			Base Case	PSI Estimates
1	2007	2011	870,000	870,000
2	2012	2016	753,000	753,000
3	2017	2021	699,800	699,800
4	2022	2026	650,400	650,400
5	2027	2031	604,400	604,400
6	2032	2036	561,700	561,700
7 - 8	2037	2046	561,700	521,900
9 - 11	2047	2061	561,700	558,100
12 - 14	2062	2076	561,700	658,100
15 - 17	2077	2091	595,700	703,200
18 - 50	2092	2256	650,500	703,200

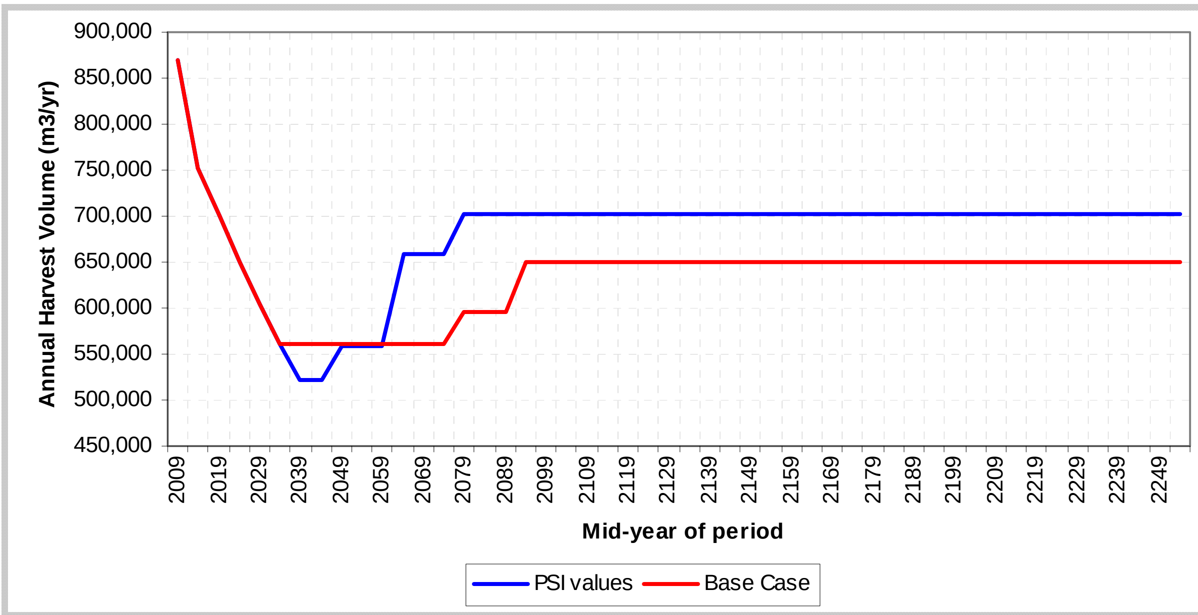

Figure 18 – Harvest levels with yields based on PSI values

The Timberline approach for assigning SIBEC site indexes was conservative. SIBEC values were assigned to each site series in the Terrestrial Ecosystem Mapping (TEM) within the THLB based on the leading species for current and future stands. Within the CWHvm1 and CWHvm2 variants, the TEM did not distinguish between Site Series 01 and Site Series 06 and classified these areas as Site Series 01. The yields for analysis units within these two variants were generated using an arithmetic average of the SIBEC values for these two site series (i.e. the presence of the 01 and 06 series were assumed equal).

Table 16 – SIBEC values for Site Series 01 within CWHvm1 and CWHvm2

Site Series	Hw Site Index (SIBEC)	
	CWHvm1	CWHvm2
01	27.7 m	28.0 m
06	25.2 m	24.0 m
Average	26.5 m	26.0 m

A summary of TEM data for the productive forest in TFL 39 and TFL 44 shows the site series 06 to be approximately 9% of the total for 01 and 06 in the CWHvm1 and 6% in the CWHvm2. Using these percentages to calculate weighted averages for TFL 19 results in 27.5 m for CWHvm1 (+1.0 m) and 27.8 m for CHWvm2 (+1.8 m). Approximately 34% of the TFL 19 operable productive forest is estimated to be in the CWHvm1 01 site series and 17% in the CWHvm2 01 site series. Applying these adjustments would increase the average SIBEC site index from 23.9 m to 24.6 m and increase managed stand yields. Additional managed stand yields would provide greater timber supply in the mid and long term and would partially alleviate the mid-term "trough" present in the Base Case.

4.9 Increase minimum ages by 10 years and volumes by 100 m³/ha

To test the impact of minimum harvest age criteria on timber supply, the minimum ages are increased by 10 years and the minimum volume is increased by 100 m^3/ha to 450 m^3/ha.

These changes remove approximately 2.5 million m^3 (~11%) of available inventory from the forest at the beginning of the analysis. For the majority of the older second growth stands (natural stands) the minimum volume per hectare is the limiting factor and the increased minimum volume used in this sensitivity creates a timber supply shortage (relative to the Base Case) in the short and medium term: approximately 900,000 m^3 less is harvested in the short term (~6%) and approximately 3.9 million m^3 less is harvested in the mid term (~8.4%). For the majority of managed stands (current and future) the minimum age is the limiting factor; therefore, in the longer term the minimum ages become the limiting factor. The long term average harvest age increases by about 8 years. This longer effective rotation age generates higher yields but less area meets the minimum age criteria in any given year with the net effect being a slightly lower (~0.8%) long term harvest level. Overall this sensitivity results in approximately 5.6 million m^3 (~3.5%) less harvest than the Base Case (Table 17, Figure 19).

Table 17 – Harvest levels with older minimum harvest ages

Period	Start Year	End Year	Annual Harvest Volume (m^3)	
			Base Case	Older MHA
1	2007	2011	870,000	855,200
2	2012	2016	753,000	715,700
3	2017	2021	699,800	643,500
4	2022	2026	650,400	578,500
5	2027	2031	604,400	520,000
6	2032	2036	561,700	467,400
7 - 8	2037	2046	561,700	420,000
9 - 11	2047	2061	561,700	469,500
12 - 14	2062	2076	561,700	551,400
15 - 17	2077	2091	595,700	595,500
18 - 50	2092	2256	650,500	645,300

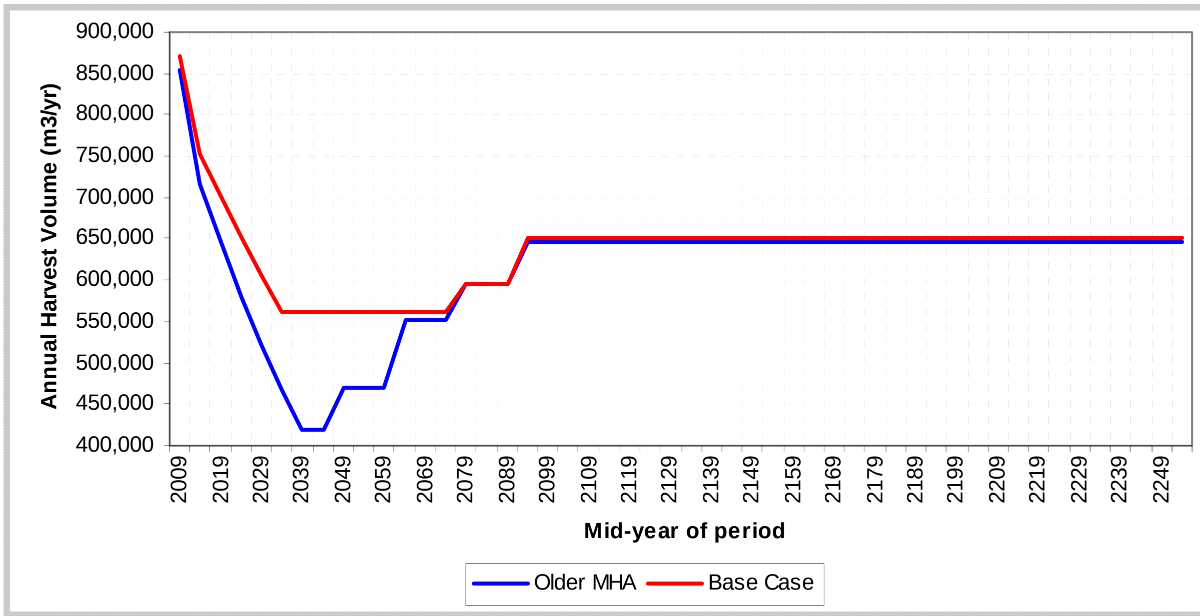

Figure 19 – Harvest levels with older minimum harvest ages

A minimum harvestable age of 60 years (and 350 m^3/ha) was used in the previous two analyses (MP #8 and MP #9). The minimum harvest ages used in this analysis (see Table 1) were selected to reflect the expectation that stands on poorer sites take longer to reach an economically viable condition (DBH and height distributions) than a similar stand on a better site. Short and mid-term timber supply is sensitive to minimum harvest ages. This is a consequence of the low yields from the young natural stands (see discussion in Section 4.4) – the harvest eligibility of these stands is delayed significantly when 450 m3/ha minimum volume is required. Long term timber supply is unaffected as the future managed stand yields are great enough that the 10 year delay can be accommodated and the higher minimum volume requirement is already met.

4.10 Reduce the percent disturbed within each VQO polygon

To test the sensitivity of timber supply to the assumptions used for managing visual quality objectives (VQO), this sensitivity uses the mid-point of the disturbance range for each VQO class rather than the upper limit as in the Base Case (Table 18). The model was set such that no more than the applicable listed percentage of each VQO polygon could be occupied by stands less than 15 years old (i.e. visually effective green-up (VEG) is reached in 15 years). An alternative approach would be to hold the maximum disturbance percentage the same but lengthen the time to reach VEG to say 20 years.

Table 18 – Maximum disturbance by VQO class

VQO	Maximum disturbance %	
	Base Case	Sensitivity
Modification (M)	25%	20%
Partial Retention (PR)	15%	10%
Retention (R)	5%	2.5%

Table 19 and Figure 20 indicate the results of this sensitivity. Short term harvest levels are unaffected as there is sufficient inventory outside the visually sensitive areas to maintain the Base Case harvest levels. Commencing in 2037 (period 7) the more restrictive visual quality management assumptions (relative to the Base Case) begin having a timber supply impact. This impact continues until 2076 (period 14) with approximately 1.6 million m^3 less harvested over that 40 year period. The reduced harvest level over this period allows inventory to accumulate such that harvest levels basically equal to the Base Case are possible for a short time between 2077 and 2091 (periods 15 – 17). In the long term the more restrictive VQO assumptions reduce the harvest level by 5,000 m^3/year or approximately 0.8%. Over the 250 years approximately 2.4 million m3 (~1.5%) less volume is harvested.

Table 19 – Harvest levels with more restrictive visual quality management

Period	Start Year	End Year	Annual Harvest Volume (m^3)	
			Base Case	VQOs more restrictive
1	2007	2011	870,000	870,000
2	2012	2016	753,000	753,000
3	2017	2021	699,800	699,800
4	2022	2026	650,400	650,400
5	2027	2031	604,400	604,400
6	2032	2036	561,700	561,700
7 - 14	2037	2076	561,700	521,900
15 - 17	2077	2091	595,700	595,500
18 - 50	2092	2256	650,500	645,500

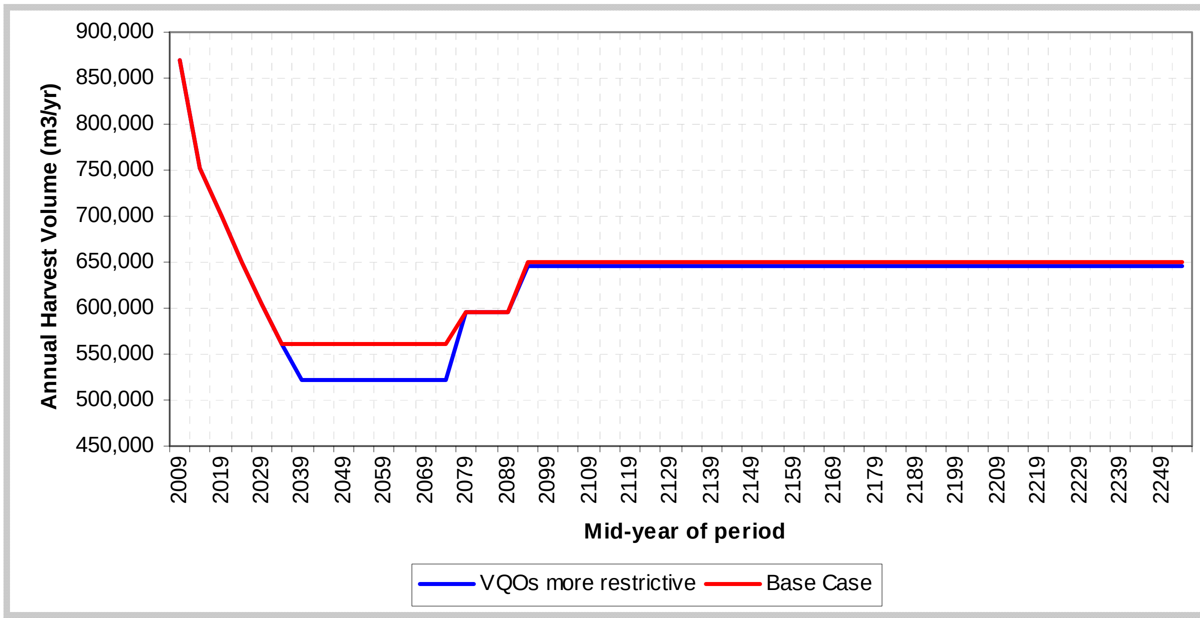

Figure 20 – Harvest levels with more restrictive visual quality management

Visual impact assessments are used to guide cutblock design in order to mitigate the visual impact of cutblocks and roads. The screening effect of strategically located stand level retention can be used to effectively reduce the visual impact of cutblocks. The forthcoming implementation of the Western Forest Strategy (see Section 4.12) aligns well with this visual management strategy.

4.11 Remove benefits of genetic gain and fertilizing

The Base Case includes yields from tree improvement (genetic gain that varies by the age of the managed stand) and two fertilization applications (at age 40 and 50) to future stands on medium and poor sites in the CWHxm2 (a total of approximately 2,000 ha). This sensitivity tests the impact on timber supply if these silviculture activities to improve yields do not occur.

Table 20 and Figure 21 indicate that in the short term these silviculture activities are not contributing to timber supply. This is logical as natural stands are providing almost the entire harvest volumes for the first 25 years (5 periods) and the yields from these stands are not influenced by genetic gain or fertilization. Lower harvest levels are required starting in 2037 (period 7) due to reduced yields from current managed stands (no genetic gain) and little remaining natural stands inventory. In the long term, the lack of genetic gain and fertilization generates harvest levels about 8.9% lower than the Base Case. Overall approximately 10.1 million m3 (~6.4%) less is harvested over the 250 years.

Table 20 - Harvest levels with no genetic gain or fertilization

Period	Start Year	End Year	Annual Harvest Volume (m^3) Base Case	No genetic gain or fert.
1	2007	2011	870,000	870,000
2	2012	2016	753,000	753,000
3	2017	2021	699,800	699,800
4	2022	2026	650,400	650,400
5	2027	2031	604,400	604,400
6	2032	2036	561,700	561,700
7 - 11	2037	2061	561,700	549,000
12 - 14	2062	2076	561,700	551,400
15 - 17	2077	2091	595,700	592,300
18 - 50	2092	2256	650,500	592,300

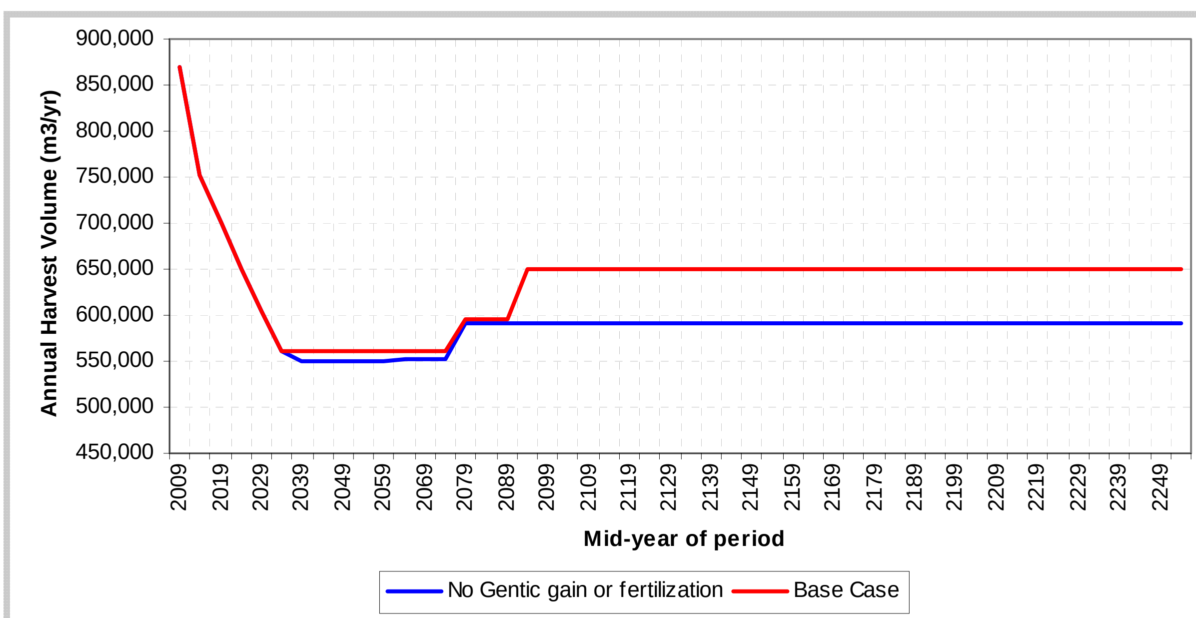

Figure 21 - Harvest levels with no genetic gain or fertilization

4.12 Impact of implementing use of retention silviculture system

Western Forest Products is in the process of developing and implementing a Forest Strategy. The first component of the strategy is a program for conserving biodiversity on the company's tenures. The approach is to vary the use of retention systems and the amount of stand level retention by Resource Management Zones of the Vancouver Island Land Use Plan and by ecosection and variant. It is being phased in over the next few years. As past practice is clearcut and clearcut-with-reserves the estimated impact (area and volume) of this strategy is not included in the Base Case. It is expected that the strategy will be implemented during Management Plan #10 such that preliminary impacts can be reflected in the Base Case associated with the next timber supply analysis.

Applying the retention system requirements to the Ecosection/VILUP Zone/BEC variant combinations present within TFL 19 results in an average overall stand level retention requirement of 5.6% for TFL 19. This sensitivity analysis reduces current stand yields by 3% to reflect the area retained to meet these retention targets. This assumes the other 2.6% is already accounted for by all other netdowns. In this sensitivity analysis, future stand yields are reduced by 5% to reflect the area retained (3%) and the impact of trees retained in the first harvest entry on growth and yield of the future stands (2%).

Table 21 and Figure 22 indicate that short term timber supply is affected by these reduced yields. Approximately 600,000 m^3 (~4.1%) less volume is harvested in the first 20 years (4 periods). Approximately 1.4 million m3 (~2.9%) less is harvested over the following 80 years. The long term harvest level is 33,600 m^3/year (~5.2%) lower than the Base Case. In total over the 250 years, 7.0 million m^3 (~4.4%) less is harvested.

Table 21 - Harvest levels with Western Forest Strategy assumptions

Period	Start Year	End Year	Annual Harvest Volume (m^3)	
			Base Case	Western Forest Strategy
1	2007	2011	870,000	860,000
2	2012	2016	753,000	728,300
3	2017	2021	699,800	662,200
4	2022	2026	650,400	602,000
5	2027	2031	604,400	547,300
6 - 11	2032	2061	561,700	547,300
12 - 14	2062	2076	561,700	551,400
15 - 17	2077	2091	595,700	595,500
18 - 50	2092	2256	650,500	616,900

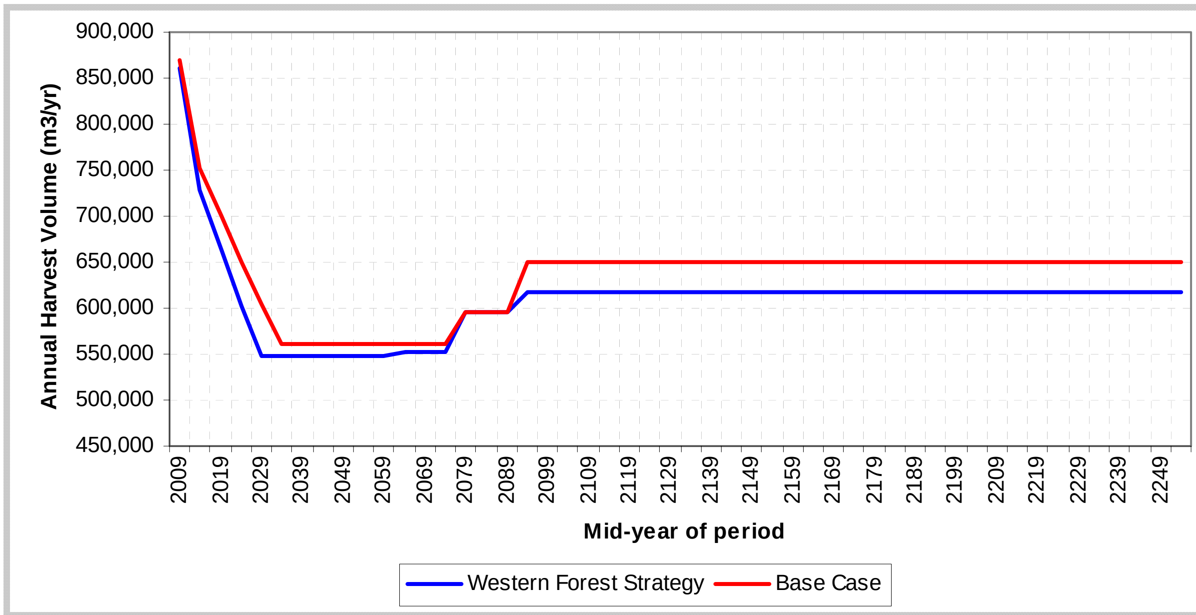

Figure 22 - Harvest levels with Western Forest Strategy assumptions

4.13 Summary of sensitivity impacts

Table 22 provides a summary of the impacts of the sensitivity issues explored. Impacts shown indicate the aggregate differences over the time periods indicated and are rounded to the nearest tenth of a percent.

Table 22 – Summary of sensitivity analyses harvest impacts

		Harvest Interval (years)		
		1 – 20	**21 – 100**	**101 - 250**
	Base Case total net harvest level (m^3)	14,866,245	46,991,885	97,577,051
Issue tested	**Sensitivity**	**Percentage Impact**		
Operability	Remove non-conventional areas	-2.0%	-9.8%	-8.2%
	Include economically marginal areas	0.0%	+0.2%	+0.2%
Growth and Yield	Natural stands yields reduced by 10%	-4.1%	-4.6%	0.0%
	Natural stands yields increased by 10%	+2.3%	+6.2%	-1.8%
	Managed stands yields reduced by 10%	0.0%	-8.3%	-9.5%
	Managed stands yields increased by 10%	0.0%	+10.2%	+8.0%
	Globally reduce SIBEC Site Index estimates by 3m	-4.1%	-13.3%	-21.3%
	Use Timberline Preliminary Site Index estimates	0.0%	+7.2%	+8.1%
Minimum Harvest Ages	Increase minimum ages by 10 years and volumes by 100 m^3/ha	-6.1%	-8.4%	-0.8%
Visual Quality	Reduce the percent disturbed within each VQO polygon	0.0%	-3.6%	-0.8%
Tree Improvement	Remove benefits of genetic gain and fertilizing	0.0%	-3.0%	-9.0%
Western Forest Strategy	Impact of implementing use of retention silviculture system	-4.1%	-2.9%	-5.2%

5.0 Base Case Evolution

This section provides some details for other Base Case options that were reviewed and considered before deciding upon the option described in Section 2.0.

All options reviewed were created with these general assumptions:

1. Decline in "even" steps to the mid-term harvest level and do not allow any further declines once the mid-term harvest level is reached.
2. Achieve a long-term even-flow harvest level that is approximately the same as the growth on the THLB (i.e. the volume of growing stock on the THLB is stable in the long-term).
3. Maximize volume harvested over the entire planning horizon. To reduce model solving times, a 100 year (20 periods) planning horizon was used to do these comparisons. 250 year runs are used for the final analyses.

5.1 Original Information Package Base Case

The original IP anticipated an initial decline of 3.8% and limiting future periodic declines to 5% per 5 year-period. In addition, the minimum harvest criteria was 50 years old and 350 m^3/ha for all analysis units. No allowance was contemplated for undercut volume as described in Section 2.0 nor was a helicopter operability constraint envisioned as described in Section 2.0. Figure 23 shows the results of this scenario.

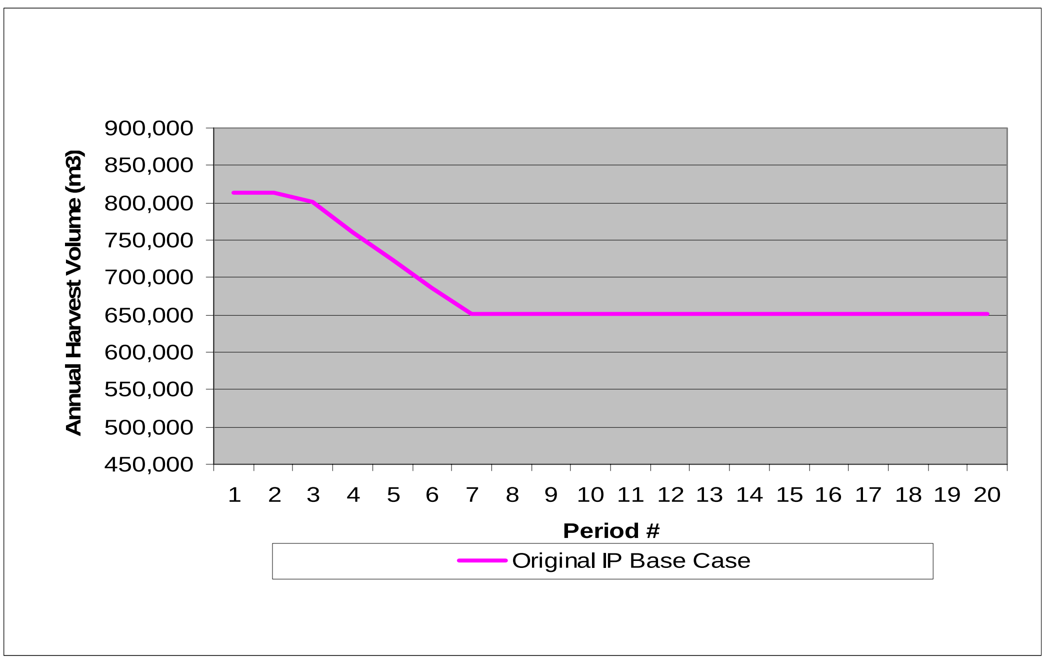

Figure 23 - Original Information Package Base Case Schedule

5.2 Revised Minimum Harvest Criteria and addition of Undercut volume

The revised IP introduced the varying minimum harvest age criteria described in Section 2.0. The Base Case option described in the revised IP still anticipated an initial decline of 3.8% and limiting future periodic declines to 5% per 5 year-period. Additionally, in order to account for undercut volume from a previous cut control period and WFP's short-term access to a portion of the Hisnit woodlot, a net 300,000m3 is added to the harvest level for the first period. Figure 24 indicates the harvest volume results of this run.

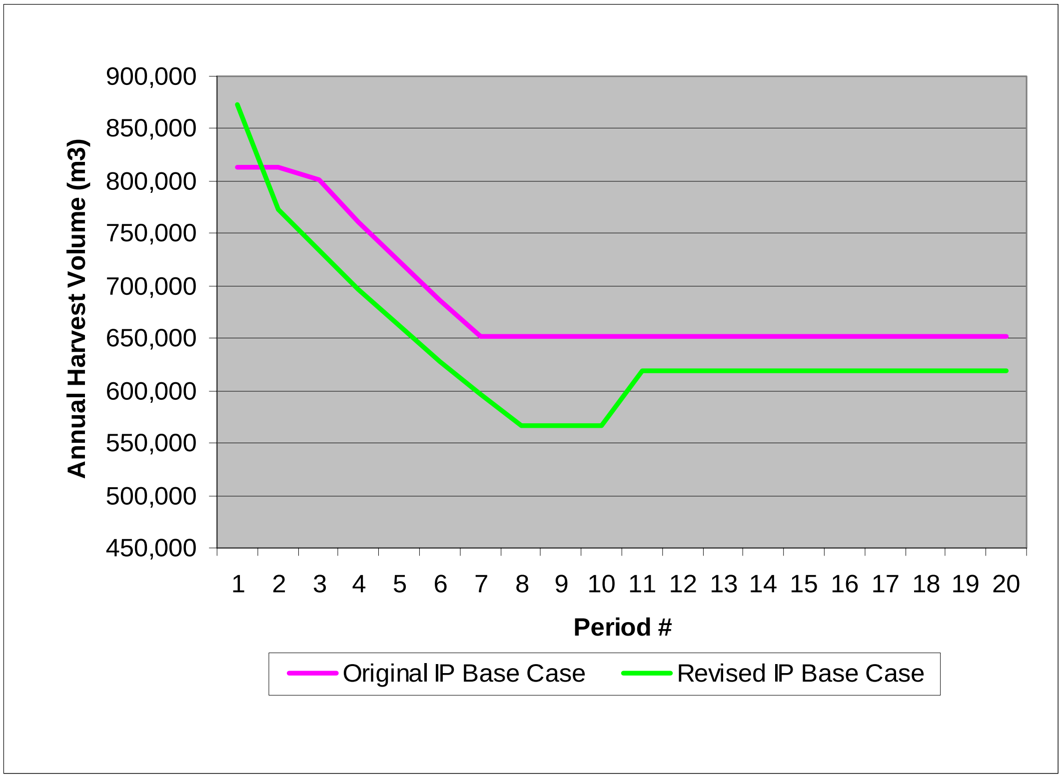

Figure 24 - Revised Minimum Harvest Criteria and addition of Undercut volume Schedule

This run required harvest levels to decline by 5% per period until period 8 (2042-2046). Limiting the decline to period 7 (2037-2041) resulted in an infeasible solution due to the requirements for a stable growing stock and even-flow harvest level in the long term (i.e. there is not enough growing stock to maintain a higher harvest level through the mid-term). The minimum harvest level achieved in this run (~566,600 m^3/year) was used as criteria for judging other possible base case options.

5.3 Addition of helicopter volume restriction

The revised IP included a harvest rule that limits the volume accessed from stands classified as helicopter in the operability inventory to 50,000 m^3/year (see section 10.4.3 of the revised IP). This additional constraint resulted in an infeasible solution when limiting harvest volume declines to 5% per 5-year period as used above; therefore, the harvest flow objective listed in the IP can not be achieved. By allowing the declines to be 6% per period starting after period 2 the solution indicated in Figure 25 was achieved.

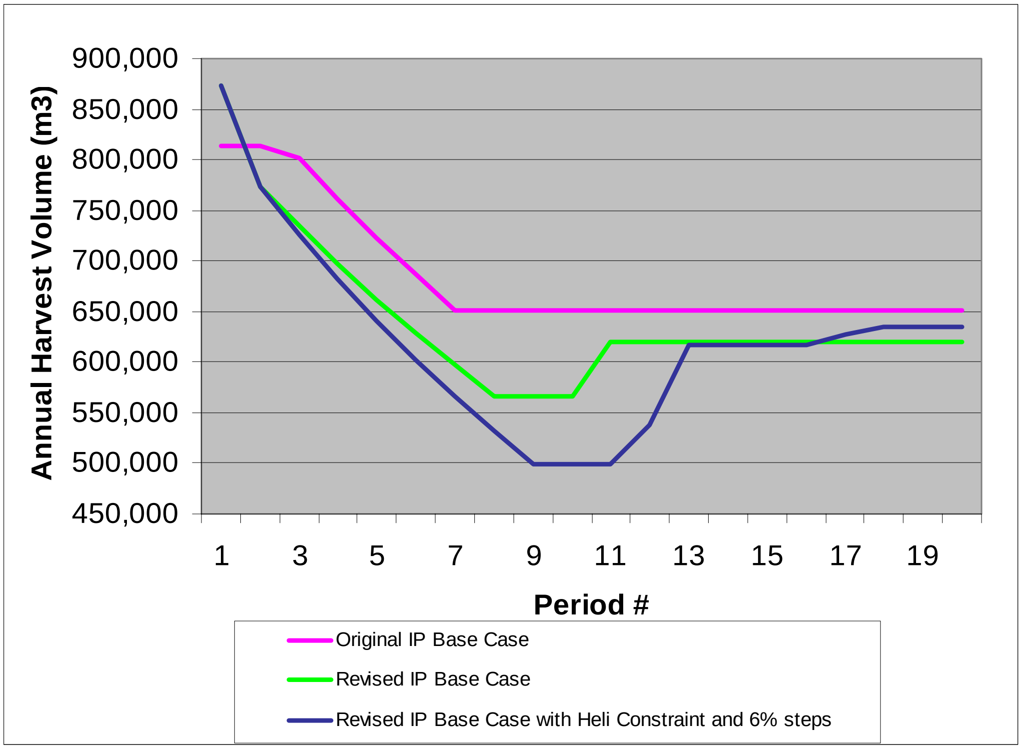

Figure 25 - Addition of heli constraint

This run required harvest levels to decline by 6% per period until period 9 (2047-2051). Limiting the decline to period 8 (2042-2046) resulted in an infeasible solution due to the requirements for a stable growing stock and even-flow harvest level in the long term (i.e. there is not enough growing stock to maintain a higher harvest level through the mid-term). Note that the long-term harvest level is slightly higher in this scenario as more growing stock is available as a result of the lower harvest levels in the mid-term.

5.4 Heli constraint and faster decline

In order to try to raise the mid-term harvest level, runs were made with a faster decline in the short-term: 7% per period rather than the 6% used above. Figure 26 shows the results of two different possible scenarios using this 7% decline criteria.

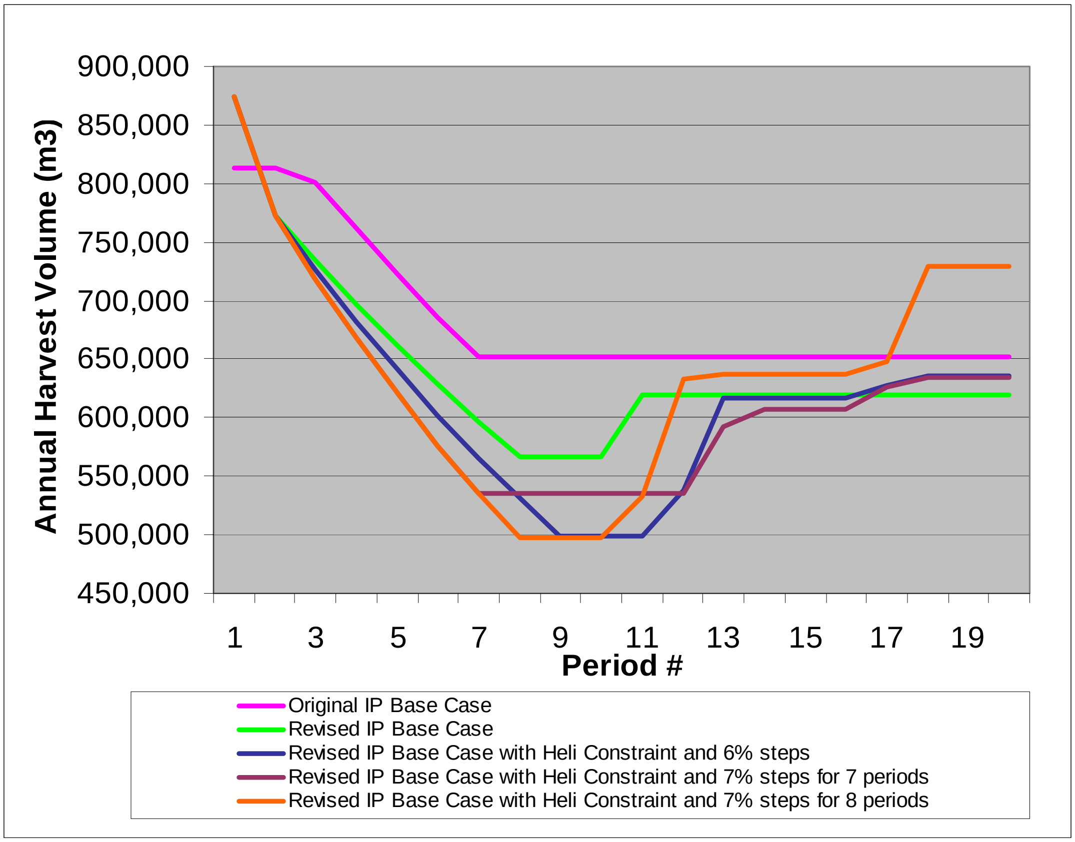

Figure 26 - Alternative step down rates

Again note that the long-term harvest level is higher in these scenarios as more growing stock is available as a result of the lower harvest levels in the mid-term. However the minimum harvest level achieved when the decline is allowed for 8 periods is approximately the same as when a 6% periodic decline was used – this run sacrifices short and mid-term harvest levels to achieve a higher long-term harvest level. When a 7% periodic decline is allowed for 7 periods a higher harvest level in the mid-term is achieved at the expense of the long-term. With the uncertainties associated with such long-term projections this is the preferable approach. Trying to restrict the 7% periodic decline to 6 periods resulted in an infeasible solution.

5.5 Final Base Case

Finally, with the timber supply model being built to start in 2007 yet the AAC determination will be made in early to mid 2009, the harvest volume for the first period is set to reflect two years at the current AAC (845,947 m^3/year) plus 3 years at the lower new harvest level. Subsequent harvest levels are based on changes from the average value for the first period. This is a change from the assumptions in the IP.

All runs discussed above had the harvest level in period 2 set at 95% of the harvest level in period 1 after accounting for the 300,000 m^3 of undercut volume. As the results of the above runs indicated that harvest levels should decline in the order of 7% per period, this scenario was constructed to assume a 7% decline from the current AAC for 3 years in period 1 and then 7% per subsequent period. Again the harvest level in period 2 was set to account for the 300,000 m^3 of undercut volume included in period 1. Figure 27 indicates the results of this run as compared to all the previously discussed runs.

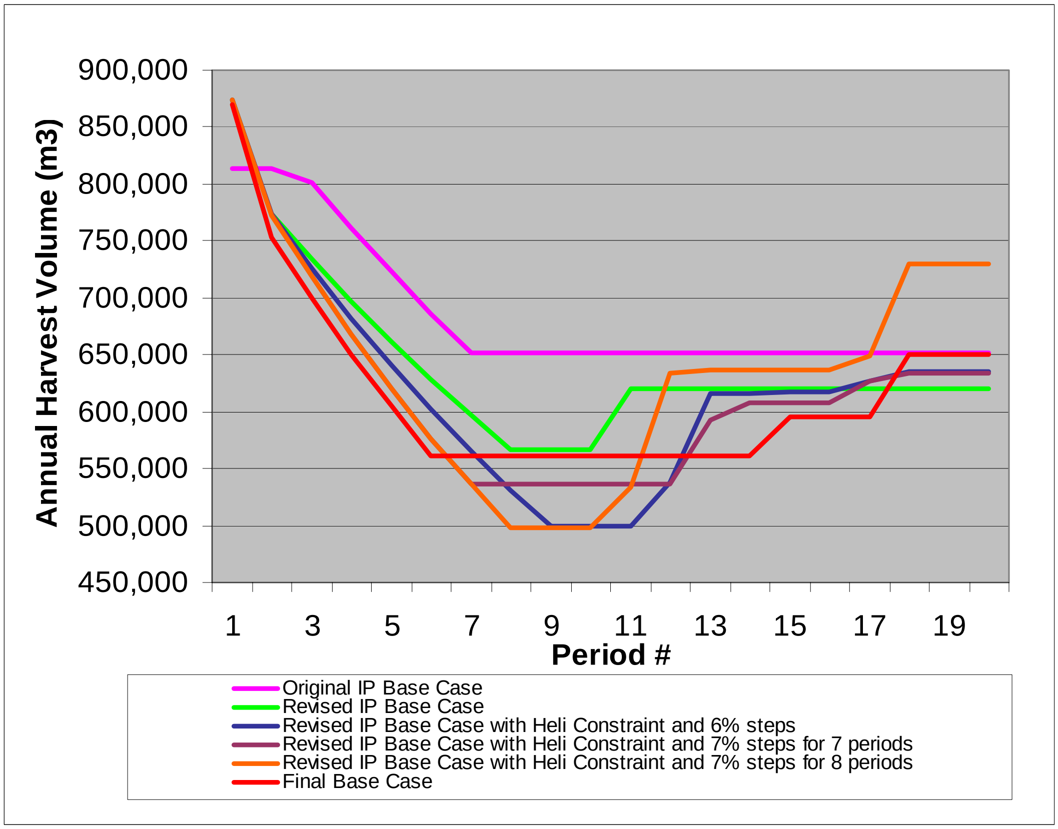

Figure 27 - Base Case Options Reviewed

The final base case provides for an orderly reduction to a mid-term harvest level that is approximately the same as the assumptions in the revised IP (although for a significantly longer time – 9 periods instead of 3) and achieves a long-term harvest level approximately equal to the original IP assumptions. This scenario balances short and long-term harvest levels without a mid-term harvest level significantly below the level achieved with the revised IP assumptions.

6.0 Recommendation

6.1 Allowable Annual Cut

Based on the analysis, it is proposed that the AAC for TFL 19 (excluding the BCTS area) be 762,152 m^3 for the next five years. This represents approximately a 10% reduction from the current AAC. This harvest may be maintained for the five years and then reduced by 26% over the next 25 years.

The recommended AAC differs somewhat from the 7% decline in harvest level indicated in the Base Case. The Base Case indicated a reduction in harvest levels of approximately 14 - 15% over the next 10 years. Given recent and current economic conditions in the forest industry and the downward pressures revealed by the sensitivities it seems appropriate to reduce harvest levels more in the first half of the next decade rather than the last half. This slightly reduced cut will provide more flexibility in both the short and mid-term to plan the annual harvest. Also, if the uncertainties associated with the sensitivities are found to warrant a lower mid-term harvest level the reduced short term harvest levels assist in making the transition to the lower mid-term harvest levels. If addressing the uncertainties leads to a higher mid-term harvest level, reduced short term harvest levels lessen the depth of the mid-term “trough”.

The recommended AAC has been reduced from that implied in the earlier MP #9 analysis because of changes in assumptions and results of the sensitivity analyses. These factors include:

- A THLB that is 3% smaller than in the MP #9 analysis
- A maximum harvest of 50,000 m^3/year from areas classified as accessible by helicopter. This reflects recent practice. No restriction was applied in the MP #9 base case.
- Older minimum harvest ages for medium and poor site second-growth hemlock stands than in the earlier analysis
- On average lower site indexes for managed stands than those applied in the MP #9 analysis.

The recommendation is consistent with the approach of moving in a regular manner towards current estimates of medium-term and long-term harvest projections.