Appendix VIII Twenty Year Plan

CANADIAN FOREST PRODUCTS LTD.
NIMPKISH TREE FARM LICENCE 37
MANAGEMENT PLAN #8

20-YEAR SPATIAL FEASIBILITY ANALYSIS REPORT

Prepared by:

Canadian Forest Products Ltd.
&
Timberline Forest Inventory Consultants Ltd.

98.08.14

Reference: 9640060.4.1

1.0 INTRODUCTION

The 20-Year Spatial Feasibility Timber Supply Analysis (20-year analysis) evaluates whether the timber supply developed in the non-spatial timber supply analysis for TFL 37 can be located on the ground using additional operational requirements. These results are submitted to the provincial Chief Forester along with the non-spatial analysis results as part of the AAC determination process. The main aspects of the 20-year analysis that not included in the non-spatial analysis are:

- Identification of cutblocks which are selected for harvest as discrete units during modelling.
- Adjacency requirements based on operational silviculture green-up.
- Ability to map simulation results for review.

Traditionally, 20-year plans submitted as part of TFL management plans involved extensive hand mapping of potential harvest locations for the next 20 years. This approach is extremely time-consuming and results in only one solution. In addition, it was difficult to understand the implications of the harvest location on non-timber resources such as wildlife habitat, visual quality objectives and more recently, landscape level biodiversity. By using the spatial version of the forest estate model CASH6, the model used for the non-spatial timber supply analysis, non-timber interests are accounted for in the same manner for both analyses. In addition, a number of possible 20-year harvesting scenarios can be considered in a more efficient manner than with the traditional hand-mapping approach.

An important factor that should always be considered while reviewing results of the 20-year analysis is that it is not intended to be an operational plan. The harvest schedule and cutblock selection presented is one reasonable solution to the harvest locations over the next 20 years, given the modelling rules included in the process. In this exercise, Canfor engineers provided approximate boundaries for cutblocks on the majority of the timber expected to reach maturity during the next 20+ years (stands currently aged 50 years and older). As a result, areas harvested within the 20-year analysis resemble operational blocks.

The methods used to prepare the data for the 20-year analysis, including departures from the non-spatial analysis, are outlined within this report. Fewer scenarios were reviewed in this analysis compared with the non-spatial analysis. The scenarios considered were:

- MoF Base Case – similar inputs and assumptions to those used in the MoF Base Case non-spatial analysis.
- 2.25m Silviculture Green-up – represents achieving 3.0m silviculture green-up on 75% of harvested areas in the Nimpkish HIA (high intensity area).
- Enhanced Green-up – includes additional treatments that reduce silviculture green-up ages.

The most important output from this analysis is the attached map (Appendix I) showing the harvest locations over the next 20 years. In addition the actual harvest level achieved is provided. The following sections summarise the inputs and results of the 20-year analysis for TFL 37.

2.0 20-YEAR ANALYSIS INPUTS

The majority of inputs and assumptions used in the 20-year analysis are identical to those used in the non-spatial analysis as documented in the Timber Supply Analysis Information Package (Draft Management Plan for TFL 37 - Appendix V), which was accepted by MoF Timber Supply Branch on 98.03.12. An overview of the 20-year analysis inputs is listed in the following sections.

2.1 Net Operable Landbase Determination

The same netdowns were used in developing the gross productive and net operable (timber harvesting) landbase as reported for the non-spatial MoF Base Case option in the Information Package. Partial netdowns for some ESA categories were imposed during the timber supply modelling rather than during the analysis database preparation. This is due to the requirement to link all polygons back to the GIS as either net operable, productive forest outside the net operable landbase (non-contributing forest) or non-productive. The same non-contributing forest areas that contribute to forest cover requirements were also included in the analysis landbase.

2.2 Growth and Yield

All growth and yield inputs associated with the non-spatial MoF Base Case option, were also used for the 20-year analysis. This includes existing and managed stand yield tables for stand volumes, minimum harvest ages, regeneration delay after harvest and regeneration assignment after harvest.

2.3 Management Assumptions

The majority of the management assumptions provided for the MoF Base Case were also imposed in the 20-year analysis. These include:

- Maximum disturbance forest cover constraints in REAs (resource emphasis areas).
- Minimum old growth in the LU-BEC/NDTs (landscape unit – biogeoclimatic ecological classification / natural disturbance type).
- Net non-recoverable losses of 3,165m^3/year.
- Harvest rules and harvest flow.

The harvest profile objectives described for the MoF Base Case were not assigned in the 20-year analysis because the cutblocks designed by Canfor engineers did not always consider the profiling objectives. During the simulation process cutblocks are either harvested completely or not at all, so having a profile objective that does not correspond to block boundaries introduces an unrealistic constraint.

2.4 Cutblocks and Adjacency

As previously noted, Canfor engineers designed the majority of the cutblocks within the mature or near mature timber for the 20-year analysis. This approach was expected to provide the most acceptable results compared with alternative methods such as designating forest cover polygons as cutblocks or breaking the landbase into a grid format and assigning each grid cell to a cutblock. Canfor cutblock boundaries were added to the existing TFL 37 information in the GIS database. These cutblocks were generally 20 to 40 ha in size in keeping with current operational guidelines. A review of stands within Canfor cutblocks was conducted to ensure that fragments of young stands were excluded from otherwise mature cutblocks. Otherwise cutblocks might be unnecessarily excluded from harvest because of immature timber within the block boundary.

The forest estate model requires that all forestland included in the simulation be assigned to a cutblock regardless of classification as net operable or non-contributing. This allows the forest estate model to review silviculture green-up for all potential harvest situations. In addition to these hand-drafted block boundaries, all remaining areas were aggregated into "GIS-cutblocks" based on similar age categories. The GIS-cutblocks do not always resemble operational blocks although some reflect recently harvested areas and therefore have shapes and sizes associated with operational cutblocks.

Cutblock adjacency was also modelled in the 20-year analysis. Any cutblocks that share a common boundary (even for as little as 0.1m) are considered to be adjacent by the model. A cutblock is only available for harvest when the following conditions have been met:

- All stands within the cutblock have reached minimum harvest age.
- There are no adjacent cutblocks younger than the minimum silviculture green-up age.
- Harvesting the cutblock will not violate any forest cover constraints related to maximum disturbance or minimum old growth for the REAs and LU-BEC/NDTs within which the cutblock is located.

"Operations zones" were added for the 20-year analysis. Silviculture green-up is assigned to these zones in the simulation model. Operations zones are a combination of REA type (visual quality, LIA, etc.) and BEC subzone. This allows differences in productivity to be reflected in the silviculture green-up requirements for various areas on the TFL. Table 2.1 summarises the silviculture green-up ages for the operation zones defined for the 20-year analysis.

Table 2.1 – Silviculture Green-Up Ages by Operations Zone

Operations Zone	20-Year Analysis Scenario		
	MoF Base Case (All 3m Green-up)	HIA 2.25m Green-up	Enhanced Treatments 3m Green-up
2-Goshawk Foraging – CWHvm1	8	8	7
3-Goshawk Fledgling – CWHvm1	8	8	7
4-Visual 2 – CWHvm1	8	8	7
5-LIA – CWHvm1	8	8	7
6-GFA – CWHvm1	8	8	7
7-HIA – CWHvm1	9	5	8
12-Goshawk Foraging – CWHvm2	10	10	9
13-Goshawk Fledgling – CWHvm2	10	10	9
15-LIA – CWHvm2	10	10	9
16-GFA – CWHvm2	10	10	9
17-HIA – CWHvm2	10	6	9
21-Visual 1 – CWHxm	7	7	6
22-Goshawk Foraging – CWHxm	8	8	7
23-Goshawk Fledgling – CWHxm	8	8	7
24-Visual 2 – CWHxm	7	7	6
25-LIA – CWHxm	8	8	7
26-GFA – CWHxm	8	8	7
27-HIA – CWHxm	8	5	7
33-Goshawk Fledgling – MH	15	15	14
35-LIA – MH	15	15	14
36-GFA – MH	16	16	15
37-HIA – MH	15	11	14

It is important to note that silviculture (adjacency) green-up height requirements of 2.25m and 3.0m are separate from the 3.0m and 6.5m "green-up" associated with REA maximum disturbance. Maximum disturbance green-up is related to larger areas over which a general constraint is applied. Silviculture green-up is associated with neighbouring cutblocks.

2.5 CASH6 Spatial Model

Timberline's forest estate simulation model CASH6 (version 2) was used for all of the scenarios in the 20-year analysis. Model functionality is the same as the version used for other non-spatial analysis scenarios. All stand ageing and harvesting, regeneration and management considerations related to forest cover constraints are implemented in the same way for both model versions. Spatial CASH6 also has the ability to review cutblock adjacency. In the spatial model, a cutblock must be harvested completely, whereas the non-spatial model will take individual stands in the simulation process. For the 20-year analysis, the simulation period was set at five years compared with 10-year periods in the non-spatial analysis. This was done to reflect standard 5-year planning periods associated with management plans and forest development plans.

3.0 20-YEAR ANALYSIS RESULTS

Results of the 20-year analysis are presented in Table 3.1 for the scenarios described in Section 1.

Table 3.1 – 20-Year Analysis Annual Harvest Schedules

Simulation Period (years)	20-Year Analysis Scenario			Non-Spatial MoF Base Case [1]
	MoF Base Case (All 3m Green-up)	Nimpkish HIA (2.25m Green-up)	Enhanced Treatments (3m Green-up)	
1 – 5	1,068,000	1,068,000	1,068,000	1,068,000
6 – 10	1,020,200	1,068,000	1,068,000	1,068,000
11 – 15	1,020,200	1,048,900	1,048,900	1,048,900
16 – 20	1,020,200	1,048,900	1,048,900	1,048,900

[1] From Draft Management Plan 8 for TFL 37 – Appendix VI

An initial harvest level of 1,068,000m^3/year – the current TFL 37 AAC, was developed for the MoF Base Case non-spatial analysis option. The results of this 20-year analysis indicate that this initial harvest level can be carried for at least 5 years in all of the 20-year analysis scenarios. A reduction of 4.5% between the first and second periods in the MoF Base Case spatial analysis is required to meet the 3.0m silviculture green-up requirements. All other forest cover requirements are met during the 20 years of simulation as they were in the non-spatial analysis.

The attached map (Appendix I) shows the locations of harvest blocks selected by the model for each 5-year period. Additionally, recent harvesting and the remaining forest landbase are identified on the map. Again, some of the cutblocks may not have boundaries, shapes or sizes of true operational blocks but this analysis is not expected to meet the same level of operational scrutiny as a forest development plan. It does indicate that the current AAC of 1,068,000m^3/year can be located on the ground with silviculture

green-up requirements in place.

Silviculture green-up is a key issue in developing the short-term harvest rate on TFL 37. This issue was not clearly indicated in the non-spatial analysis because of the model's ability to harvest forest stands as small as 0.25 hectares, compared with the larger units selected for harvest in the spatial analysis.

Reducing silviculture green-up in the Nimpkish HIA to 2.25m allows the non-spatial MoF Base Case harvest schedule to be carried for the entire 20-year planning horizon. Similarly, reducing silviculture green-up ages by approximately one year in the Enhanced Green-up scenario allows the harvest schedule to match that of the MoF Base Case non-spatial analysis.

Table 3.2 summarises the 20-year analysis harvest volume by species for each period in actual volume and the total percentage of periodic harvest. Note that the periodic volume and area summaries represent the annual harvest contribution. The "20-Year Harvest Total" represents all area and volume harvested over the 20 year simulation. "Remaining Volume" is the area and volume not harvested during the 20-Year plan. No "ageing" of stand volumes has been included in this "Remaining Volume" summary, so it is a conservative estimate of what will be present on TFL 37 in 20 years time.

Table 3.2 – 20-Year Analysis Harvest Volume Distribution by Species

Harvest Period & Age Class	Net Operable Area (ha)	Volume by Species (m^3)						Total Volume (m^3)	Total Percentages
		Balsam	Cedar	Doug. Fir	Hemlock	Y. Cedar	Others		
Period 1 (annual):									
41 - 60 years	14	226	247	232	6,247		1,036	7,989	0.7
61 - 80 years	72	1,319	3,197	13,133	29,041		2,627	49,317	4.6
81 - 100 years	27	4,434	562	1,645	11,742	42	898	19,324	1.8
101 - 120 years	14	2,695	473	1,036	7,923		1,071	13,198	1.2
121 - 140 years	25	639	3,984	4,276	8,995	32	121	18,046	1.7
141 - 250 years	121	10,231	11,861	18,913	50,953	1,538	771	94,266	8.8
251+ years	1,011	151,794	144,463	76,547	422,852	65,025	8,345	869,027	81.1
Total	1,286	171,340	164,787	115,781	537,752	66,637	14,869	1,071,166	100.0
Period 2 (annual):									
41 - 60 years	1		15	4	27		238	285	
61 - 80 years	30	1,055	1,977	2,843	11,635		952	18,462	1.8
81 - 100 years	9	576	343	142	3,846	3	394	5,304	0.5
101 - 120 years	9	611	1,819	1,009	2,887		501	6,827	0.7
121 - 140 years	8	1,112	488	1,240	2,858	70	4	5,771	0.6
141 - 250 years	80	5,425	5,742	16,978	27,403	1,680	607	57,835	5.7
251+ years	1,123	197,519	113,081	27,883	472,081	116,897	1,421	928,881	90.8
Total	1,260	206,298	123,465	50,099	520,736	118,650	4,118	1,023,366	100.0
Period 3 (annual):									
41 - 60 years	7	93	196	744	1,185		602	2,820	0.3
61 - 80 years	89	3,518	3,095	5,282	38,441		4,283	54,619	5.3
81 - 100 years	64	1,888	898	8,858	30,782	95	2,160	44,683	4.4
101 - 120 years	36	2,938	1,473	3,706	13,913	6	681	22,718	2.2
121 - 140 years	10	1,042	283	1,468	5,778	53	208	8,832	0.9
141 - 250 years	88	7,305	10,957	16,157	31,992	734	1,066	68,210	6.7
251+ years	936	160,479	120,672	68,971	411,106	59,439	816	821,484	80.3
Total	1,229	177,263	137,575	105,186	533,197	60,328	9,816	1,023,365	100.0

Harvest Period & Age Class	Net Operable Area (ha)	Volume by Species (m^3)						Total Volume (m^3)	Total Percentages
		Balsam	Cedar	Doug. Fir	Hemlock	Y. Cedar	Others		
Period 4 (annual):									
41 - 60 years	3		71	80	1,163		120	1,434	0.1
61 - 80 years	32	634	961	3,892	6,725		1,481	13,693	1.3
81 - 100 years	85	1,149	4,969	15,996	23,926	4	3,483	49,527	4.8
101 - 120 years	3	434	33	330	1,523		51	2,371	0.2
121 - 140 years	11	2,286	756	1,080	5,345		135	9,602	0.9
141 - 250 years	90	5,020	10,342	18,935	31,775	2,037	693	68,802	6.7
251+ years	1,031	184,611	112,246	37,164	440,947	102,708	260	877,937	85.8
Total	1,257	194,134	129,378	77,477	511,404	104,749	6,224	1,023,366	100.0
20-Year Harvest Total:									
41 - 60 years	129	1,599	2,648	5,302	43,108		9,982	62,639	0.3
61 - 80 years	1,116	32,629	46,151	125,752	429,211		46,713	680,456	3.3
81 - 100 years	926	40,241	33,861	133,202	351,484	719	34,676	594,183	2.9
101 - 120 years	316	33,394	18,988	30,407	131,227	31	11,523	225,569	1.1
121 - 140 years	271	25,394	27,560	40,317	114,879	772	2,336	211,257	1.0
141 - 250 years	1,893	139,903	194,510	354,914	710,610	29,949	15,684	1,445,570	7.0
251+ years	20,506	3,472,016	2,452,311	1,052,820	8,734,931	1,720,346	54,216	17,486,641	84.5
Total	25,157	3,745,176	2,776,029	1,742,714	10,515,449	1,751,817	175,130	20,706,315	100.0
Remaining Volume:									
21 - 40 years	24,481	318,492	186,961	120,631	709,207	150,269	1,807	1,487,366	6.2
41 - 60 years	22,856	20,848	24,221	139,541	175,927		26,479	387,015	1.6
61 - 80 years	8,015	113,285	191,249	889,456	1,622,182	1,503	138,561	2,956,236	12.3
81 - 100 years	3,741	49,045	229,974	362,784	1,229,052	4,670	101,096	1,976,620	8.2
101 - 120 years	248	34,723	5,828	8,549	99,511	1,343	1,507	151,463	0.6
121 - 140 years	82	4,845	8,286	12,581	31,342	1,669	4,511	63,234	0.3
141 - 250 years	1,432	109,860	137,957	268,872	545,772	31,411	8,663	1,102,535	4.6
251+ years	20,067	3,108,572	1,558,444	604,611	8,100,019	2,588,878	8,162	15,968,686	66.3
Total	80,923	3,759,670	2,342,918	2,407,025	12,513,011	2,779,744	290,786	24,093,155	100.0

All volumes include non-recoverable losses (3,165m3/year)
"Others" includes Pl, Pw, Ss and deciduous
No stands younger than 60 years were harvested

4.0 DISCUSSION

Given all the rules imposed in forest estate modelling, non-spatial timber supply analyses are sometimes questioned as to whether the given harvest level can be realistically achieved on the ground. Similarly, 20-year plan exercises completed in the past have not necessarily addressed all non-timber concerns such as wildlife and biodiversity. Although the 20-Year Spatial Analysis is not a true operational plan, it does provide one of many possible short-term harvest solutions and reasonably applies the current operational rules associated with harvesting on TFL 37. This 20-year analysis provides the important visual output that illustrates exactly where the harvest is located over the four periods of the simulation.

The results of the TFL 37 MP 8 20-Year Spatial Feasibility Analysis demonstrate that a harvest rate of 1,068,000m^3/year can be located on the ground, at least over the next 5 years. This supports the non-spatial timber supply analysis completed for TFL 37. All simulation runs completed for the 20-year analysis included requirements for non-timber resources including visual quality and landscape level biodiversity through green-up and cutblock adjacency constraints. Other management considerations for wildlife habitat, riparian management areas and stand level biodiversity were addressed as in the non-spatial analysis, through landbase netdowns.

The management rules currently in place on TFL 37 were considered in the base case of this spatial analysis. Alternative scenarios were done to explore specific opportunities that could mitigate the spatial constraints applied to the base case. Both alternative scenarios support the non-spatial MoF Base Case harvest schedule over the initial 20 years.

The Nimpkish HIA (2.25m Green-up) scenario explored the effect of implementing revised minimum green-up requirements according to the Code's Operational Planning Regulation - Section 68. It also considered the Vancouver Island Resource Targets (VIRT) Team's[1] recommendation to provide for greater volumes of merchantable timber in the short term by enabling silviculture green-up of 1.0m within the Nimpkish HIA. This scenario applied a conservative approach by modifying silviculture green-up height within the Nimpkish HIA, from 3.0m to 2.25m (75% of the cutblock area must be 3.0m green-up).

The Enhance Treatments (3m Green-up) scenario explored the effect of implementing specific investments into enhanced basic silviculture activities that promote earlier green-up of young forest stands. This scenario applied a one-year reduction to the 3.0m green-up ages.

[1] *Completing the Vancouver Island Land-Use Plan – Resource Management Zones for Vancouver Island*, prepared by the Vancouver Island Resource Targets Team and submitted to Land Use Co-ordination Office, November, 1997.

Further opportunities to mitigate the spatial constraints may include enabling cutblock sizes greater than 40 hectares within the Nimpkish HIA (Recommended by VIRT) and implementing partial harvest systems that are ecologically suitable to the land base, including commercial thinning. These were not specifically explored in this analysis.

APPENDIX I

MoF Base Case 20-Year Spatial Feasibility Analysis Summary Map