20-YEAR SPATIAL FEASIBILITY ANALYSIS

OKANAGAN TREE FARM LICENCE (TFL 49)
MANAGEMENT PLAN NO. 4

Version 2

Prepared for:
Riverside Forest Products Limited
Kelowna, B.C.

Prepared by:
Timberline Forest Inventory Consultants Ltd.
Victoria, B.C.

Reference: 4041006
September 2004

RIVERSIDE
Forest Products Limited

Timberline
Forest Inventory Consultants

Timberline
Forest Inventory Consultants

August 31, 2004

File: 4041006.2

Riverside Forest Products Limited
Armstrong Division
Bag Service 5000
Armstrong BC
V0E 1B0

Attention: Robert Kennett, RPF
Operations Forester

Reference: *TFL 49 MP No. 4 20-Year Spatial Feasibility Analysis*

Enclosed please find the *20-Year Spatial Feasibility Analysis* in support of the Management Plan No. 4 for Riverside's TFL 49. Assumptions for this portion of MP No. 4 are based on the Base Case option of the MP No. 4 timber supply analysis as outlined in the *Timber Supply Analysis Information Package Okanagan Tree Farm Licence (TFL 49) Management Plan No. 4*. The 20-year analysis document has been placed on the Management Plan No. 4 website for viewing by interested parties. A paper copy has been forwarded to MoF Timber Supply Branch in Victoria.

Please call if you have any questions or comments related to the document or any other aspect of the 20-year analysis. Thank you for your input during the preparation of this report.

Yours truly,
TIMBERLINE FOREST INVENTORY CONSULTANTS LTD.

Bill Kuzmuk, RPF
Resource Analyst

Suite 310 - 1207 Douglas Street, Victoria, BC V8W 2E7
Tel: (250) 480-1101 ▪ Fax: (250) 480-1412
www.timberline.ca

DOCUMENT HISTORY

Revision Number	Description	Submitted Date	Submitted By:
1	First Draft	August 2004	Bill Kuzmuk
2	Final submission to MP No. 4	September 2004	Bill Kuzmuk

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

A timber supply analysis for the Okanagan Tree Farm Licence (TFL 49) has been completed on behalf of Riverside Forest Products Limited of Kelowna (Riverside) as part of the Management Plan No. 4 (MP No. 4) submission. The analysis has considered current management requirements, and guidelines associated with the Forest Practices Code (FPC) and the Okanagan-Shuswap Land and Resource Management Plan (OS-LRMP; B.C. MSRM 2001a). Documentation related to the MP No. 4 timber supply analysis is provided in the following reports:

- *Timber Supply Analysis Information Package Okanagan Tree Farm Licence (TFL 49) Management Plan No. 4* (Timberline 2004a) (*Information Package*); and
- *Timber Supply Analysis Report Okanagan Tree Farm Licence (TFL 49) Management Plan No. 4* (Timberline 2004b) (*Analysis Report*).

In addition to the timber supply analysis for MP No. 4, an analysis of the spatial feasibility of the Base Case harvest level during the initial 20-years of the planning horizon has been completed. This report presents the methodology and results of the spatial feasibility analysis, which satisfies the requirement for a 20-year plan (20YP) in MP No. 4.

As required by the Ministry of Forests (MoF) guidelines for the preparation of 20YPs, the spatial plan sets out a hypothetical sequence of harvesting in five-year intervals for a period of 20 years. The 20YP analysis tests the feasibility of achieving a harvest level that conforms to the current management practices as defined in the Base Case analysis by augmenting the aspatial Base Case constraint formulation with spatially explicit adjacency constraints (cutblock adjacency rules).

The 20YP for TFL 49 has been prepared with these objectives in mind. It is not intended to be an operational plan, but a test of timber availability given the current structural characteristics and spatial orientation of resources on the landscape, and the spatial and structural management objectives associated with current management regulations and guidelines. It is only one of many possible spatial solutions for locating 20 years of harvesting on TFL 49. It is not expected to be an optimal solution.

2.0 METHODOLOGY

In general, all approved blocks from the existing 5-year forest development plan (FDP) are the starting point for spatial analysis. The balance of the net timber harvesting land base is then subdivided into "treatment units" or "TUMs"[1] employing spatial data features that would be expected to define logical block boundaries. The FDP blocks and the GIS-generated "pseudo-blocks" are combined to form a set of spatially defined harvest blocks which are then used to test the spatial feasibility of the base case timber supply scenario using the CASH6.2 (version 6.2l) timber supply model.

This model is a simulation tool, which can be used to model the forest cover and seral stage requirements defined by the Forest Practices Code and related current operational guidelines using a problem formulation similar to that employed by the MoF FSSIM timber supply model. In addition, CASH6.2 has the ability to operate in fully spatial mode, enabling the spatially explicit modelling of cut block adjacency requirements.

2.1 GIS Data Preparation

Sections 2.1.1 to 2.1.7 describe in general terms the various spatial data themes that were used to define TUMs for the TFL. The rationale for employing these spatial data themes was that at some point any or all of these feature boundaries could conceivably define a limit to harvesting and therefore would define harvest block boundaries.

2.1.1 Land Base Classification

Based on the criteria outlined in the *Information Package* (included in the MP No. 4 document as an appendix to the *Analysis Report*), the forest was classified into non-productive, productive-but-excluded, and harvestable components. The resulting land base classification is illustrated cartographically in Appendix I.

Once all polygons in the forest cover inventory were classified, the land base was generalized to produce a classification coverage in which only the contributing and non-contributing components of the land base were distinguished.

2.1.2 Forest Development Plan

Approved blocks from the current forest development plan (FDP) were combined into a single seamless coverage to serve as a starting point in the harvest scheduling assignments.

2.1.3 Age Class Definition

Forest cover data was generalized to define age-class polygons for the purpose of constructing blocks of relatively homogeneous age. The standard MoF inventory age class categories (0 – 9) were employed in this analysis.

[1] For analysis purposes, these TUMs constitute the indivisible harvest units scheduled by the CASH6 spatial timber supply model.

2.1.4 Species Groups

Species groupings were developed which combined similar species based on growth characteristics and silviculture regimes. The groupings are as follows:

- Douglas-fir and larch;
- All pine species;
- Spruce, balsam, and western redcedar; and
- All deciduous species.

2.1.5 Resource Emphasis Areas

Several data layers were combined to produce a composite spatial coverage of resource emphasis areas (REA). Specifically, this procedure combined the spatial data for the following non-timber resources:

- Visually sensitive areas (VQO);
- Lakeshore management zones (LMZ);
- Community watersheds (CWS);
- Mule deer winter range (MDWR);
- Bighorn sheep;
- Mountain goat winter plateau habitat; and
- Moose winter habitat.

2.1.6 Biodiversity Units

Individual spatial data themes defining biogeoclimatic ecosystem classification (BEC) polygons and landscape units with the associated biodiversity emphasis options were combined into a single intermediate resultant coverage.

2.1.7 GIS Overlays

The purpose of creating the intermediate spatial coverages described in the preceding sections is to provide an early opportunity for the removal of small sliver polygons, while maintaining greater control over the loss of information inherent in the sliver elimination process. The intermediate coverages were combined to define an initial block layer for the spatial analysis.

The resulting initial block layer was then subjected to a final sliver elimination procedure to reduce the number of small undersized polygons. At this stage of the data preparation, the elimination of sliver polygons must be performed in a manner which preserves the integrity of blocks with respect to attributes that determine harvest eligibility during the analysis simulations. Therefore, certain lines within the initial block layer cannot be altered during the final sliver elimination. For this analysis, these "hard" lines were those which:

- Define the boundaries of an approved block from the current FDP;
- Separate the THLB from the non-contributing portion of the land base (originating from the classification coverage);
- Define the managed stand site index as defined for each BEC site series;
- Define the boundaries between stands of different age class (originating from the age class coverage);
- Define the boundaries between species groupings;
- Define elevation bands required for identifying seed zones and seed planning units; and
- Define the boundaries between different ecological units, since these were critical components in representing future growth and yield relationships.

Using these rules regarding which lines within the coverage could be modified, "soft lines", sliver polygons less than 2.5 hectares in size were eliminated. Following the sliver elimination, it was found that the resulting block layer also contained a number of block polygons with area larger than 40 hectares. These were divided into units no larger than 40 hectares using the "grid" functionality in the GIS. This step produced 46,820 blocks in the final data set.

Figure 2.1 provides a summary of the final block size distribution and frequency for the TFL 49 MP No. 4 20YP.

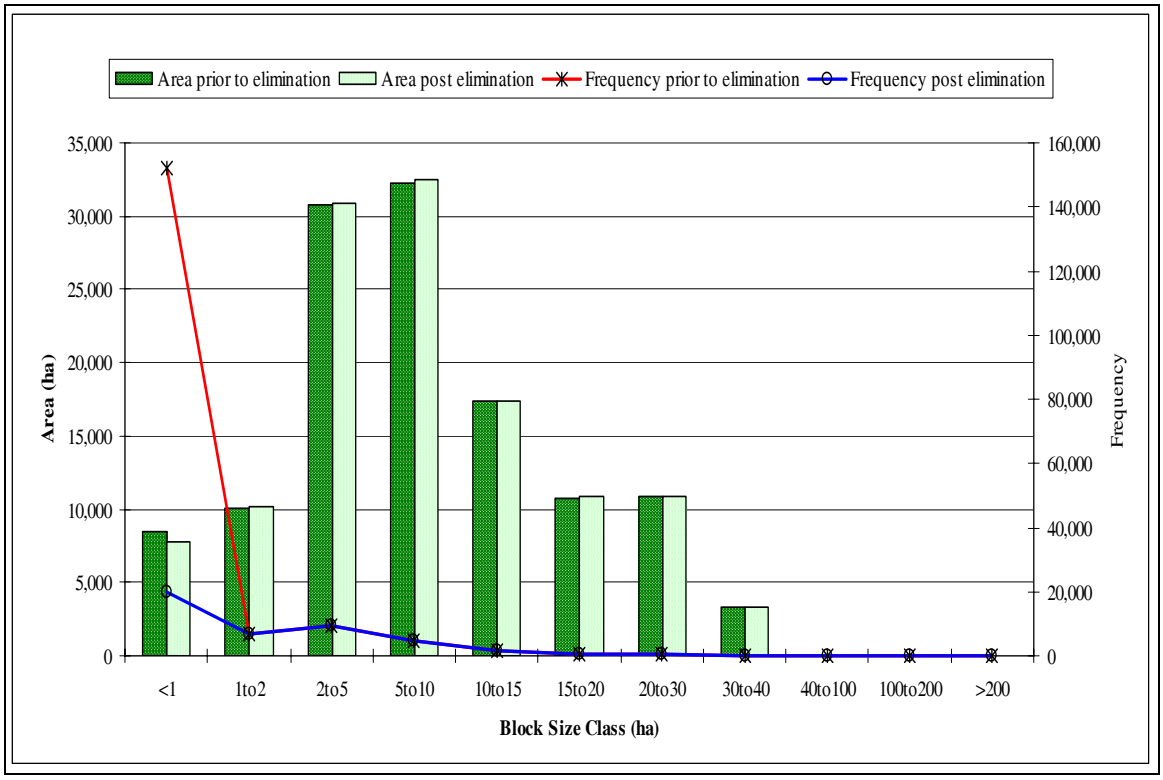

Figure 2.1 - Size class distribution and frequency

2.1.8 Preserving Stand Level Detail

"Blocks" are the fundamental, indivisible harvest units in CASH6.2. However, blocks can contain varying stand conditions, each with its own pattern of growth and regeneration. Analysis unit characteristics, as described in *Information Package* are assigned at the resultant polygon level, incorporating species, productivity and BEC site series.

2.2 Development of Twenty Year Harvest Schedule

2.2.1 Harvest Level

Using CASH6.2, a simulation was performed using four time periods of five years each to establish a twenty-year schedule of harvested blocks at a net annual harvest level of 380,000 m^3. An allowance was made for non-recoverable losses of 15,600 m^3/yr to be consistent with the Base Case analysis formulation, resulting in a gross harvest level of 401,500 m^3/yr. In reality, harvest blocks would exclude these non-recoverable losses.

2.2.2 Forest Cover Rules

This analysis incorporates all of the landscape level biodiversity and REA forest cover requirements modelled in the Base Case analysis, as described in *Information Package*.

2.2.3 Cut Block Adjacency

Blocks are considered adjacent if they touch at any point on their perimeters. A block cannot be harvested as long as any adjacent block is below the minimum acceptable green-up height, defined for this analysis as 3.0 metres. To avoid unnecessary exclusion of small blocks, adjacency was not considered for blocks less than two hectares in size.

2.2.4 Harvest Priorities

The following harvest block priorities were assigned in descending order of importance:

- Five-year FDP blocks;
- Non-FDP Block A of the TFL; and
- Non-plan blocks.

All stands within a block must be above minimum harvest age, and all forest cover objectives must be satisfied before the block can be harvested. In the case of 5-year FDP blocks, it is assumed that they have been assessed operationally and meet minimum volume and piece size requirements regardless of stand age or potentially binding forest cover requirements.

2.2.5 Minimum Block Size

Initial simulations of spatial feasibility were found to produce harvest schedules with an operationally unrealistic number of blocks less than 3 hectares in size. Harvesting is typically limited in such blocks because the total volume is small and the administration and development costs to permit them are high. Therefore, blocks less than 3 hectares were excluded from consideration as harvest candidates throughout the spatial feasibility analysis.

3.0 SPATIAL ANALYSIS RESULTS

The blocks scheduled for harvest in each five-year period of the 20-year planning horizon are depicted cartographically in Appendix I of this report. The harvest schedule is mapped separately for each block of the TFL, in order to allow presentation at a scale of 1:100,000.

The figures below compliment the harvest schedule map. Figure 3.1 shows the source of harvested volume in each of the four periods with breakdowns for FDP and other blocks.

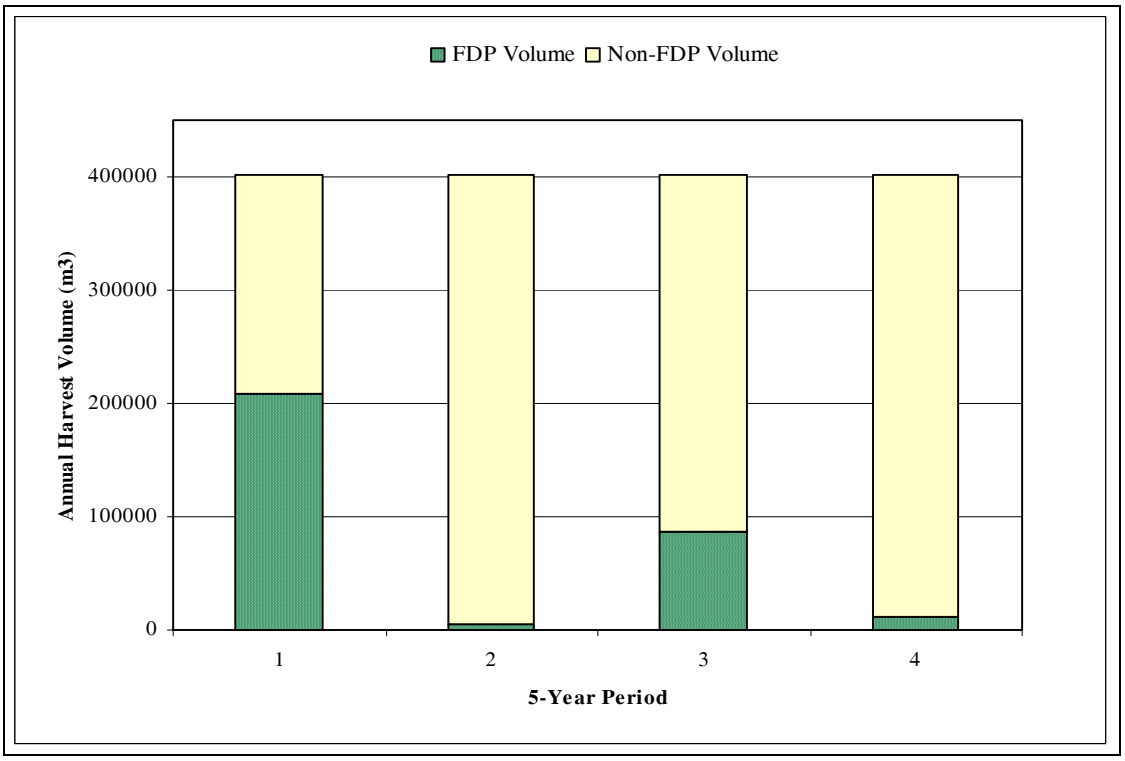

Figure 3.1 - Annual harvest volume by block type

Figure 3.2 illustrates the distribution of harvested area in each period.

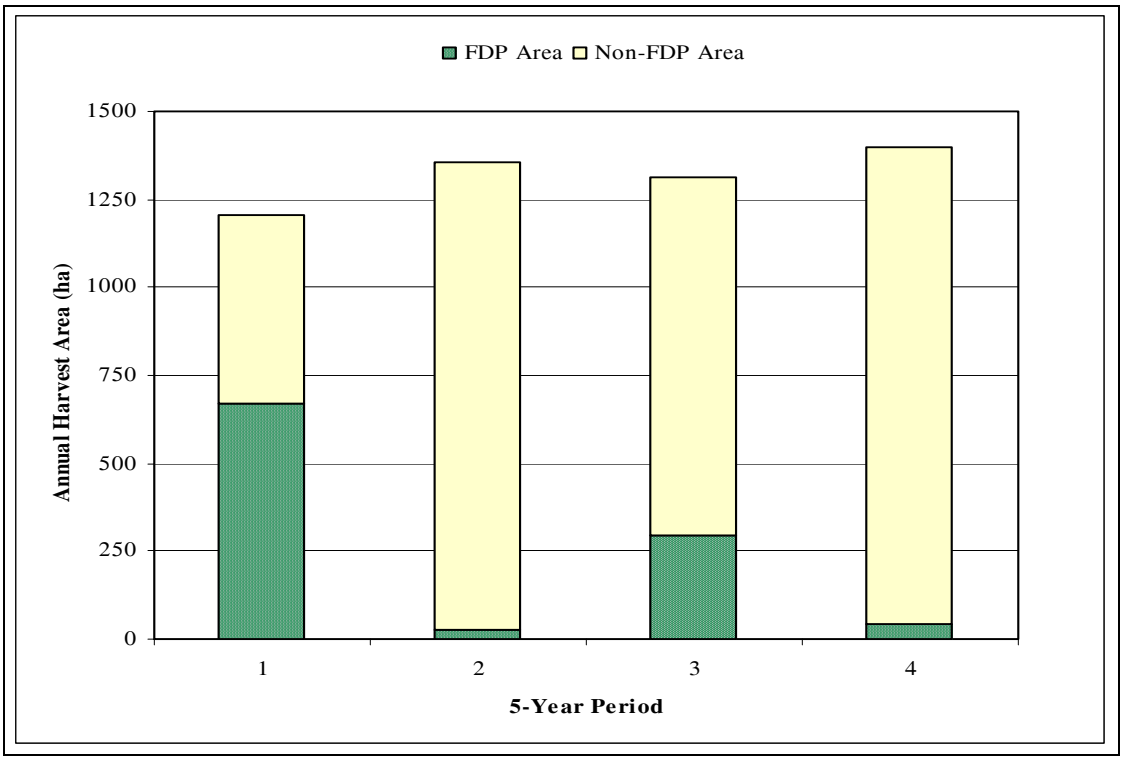

Figure 3.2 - Annual harvest area by block type

These figures show that the approximately 52% of the harvest in the first five years comes from forest development plan blocks, and that 78% of the FDP blocks are harvested by the end of the 20-year planning period. Although FDP blocks were assigned a higher priority for harvest than other blocks, the model is not always able to select these areas for harvest due to rules established for the spatial analysis.

Also, CASH6.2, when operated in spatial mode, does not permit a block to be split when it's harvestable volume would exceed the periodic volume target. Therefore at a certain point in each period all remaining FDP blocks are too large to be harvested without exceeding the harvest target, so they are deferred until the second period and the remaining volume is found instead in other blocks.

Table 3.1 summarizes the annual harvest for each period in the 20YP analysis by species. Note that this is the total volume of a species whether it is the leading species or only a minor component of the stand. Also the harvest volumes include the non-recoverable losses of 15,600 m^3/year.

Table 3.1 – 20-Year Plan annual harvest by species

Five-Year Period	Area (all species)	Annual Harvest Volume by Species (m3)						Total Volume (m^3)
		Balsam	Cedar	Douglas-fir & Larch	Lodgepole pine	Yellow pine	Spruce	
1	1,207	88,566	2,844	44,868	125,244	433	139,681	401,500
2	1,357	71,154	2,914	92,423	128,584	764	105,806	401,500
3	1,313	67,251	2,146	52,926	184,877	507	93,900	401,500
4	1,401	58,186	2,052	69,389	193,166	656	78,091	401,500
Total	5,278	285,158	9,956	259,606	631,871	2,360	417,478	1,605,999

Table 3.2 summarizes the annual harvest for each period by landscape unit.

Table 3.2 – 20-Year Plan annual harvest by landscape unit

Landscape Unit	Area (all LUs)	Annual Harvest Volume by Five-Year Period (m3)				Total Volume (m^3)
		1	2	3	4	
OK_WSide	1,545	153,358	123,230	93,374	102,978	472,940
Trepanier	1,283	114,758	104,788	96,698	102,665	418,910
U_Salmon	2,450	133,383	173,480	211,428	195,857	714,149
Total	5,278	401,500	401,499	401,500	401,500	1,605,999

Table 3.3 summarizes the annual harvest for each period by landscape unit.

Table 3.3 – 20-Year Plan annual harvest by TFL block

TFL Block	Area (all Blocks)	Annual Harvest Volume by Five-Year Period (m3)				Total Volume (m^3)
		1	2	3	4	
Armstrong-A	1,540	153,280	123,118	93,267	101,879	471,544
Armstrong-B	2,012	67,770	154,711	173,237	176,463	572,181
Armstrong-C	443	65,451	18,556	38,732	20,493	143,232
Kelowna-A	1,284	114,999	105,114	96,264	102,665	419,042
Total	5,278	401,500	401,500	401,500	401,500	1,605,999

4.0 DISCUSSION

The results of the TFL 49 20-year analysis demonstrates one possible arrangement of harvest blocks that provide the Base Case harvest level of 385,900 m^3/year (plus 15,600 m^3/year non-recoverable losses). This feasible solution included all Base Case assumptions for non-timber resources. In addition, requirements for cutblock adjacency were modelled to ensure sufficient time was given for new managed stands to achieve the specified green-up height.

Forest development plan blocks were assigned the highest priority for harvest, but were not always selected due to requirements for other forest resources.

The harvest schedule presented in this analysis represents only one of many spatially feasible solutions for attaining the Base Case harvest target over the next 20 years.

5.0 REFERENCES

Timberline Forest Inventory Consultants Ltd. 2004a. *Timber Supply Analysis Information Packae – Okanagan Tree Farm Licence (TFL 49) Management Plan No.4 (Version 7).* August 2004. 77 pp.

Timberline Forest Inventory Consultants Ltd. 2004b. *Timber Supply Analysis Report – Okanagan Tree Farm Licence (TFL 49) Management Plan No.4 (Version 1).* August 2004. 40 pp.

Appendix I
Map Presentation

1) Twenty-year Spatial Feasibility – Base Case
2) Land Classification
3) Forest Cover
4) Resource Emphasis Areas 1
5) Resource Emphasis Areas 2