# TWENTY YEAR SPATIAL FEASIBILITY ANALYSIS FOR TREE FARM LICENSE 8

**Pope & Talbot Ltd.**

**Boundary Timber Division**

**Management Plan No. 10**


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# 1. INTRODUCTION

An analysis of timber supply has been completed as a component of Management Plan (MP) No. 10 for Pope & Talbot Ltd. (P&T) Tree Farm License (TFL) 8. The analysis evaluates how current management practices with respect to timber and non-timber resource objectives affects the supply of harvestable timber over a 250-year period. MP No. 10 also includes an analysis of the spatial feasibility of the base case harvest level over the initial 20-years of the planning horizon. This report presents the methodology and results of the spatial feasibility analysis, thus constituting the Twenty-Year Plan (TYP) component of MP No. 10.

As required by the MoF guidelines for the preparation of TYPs, the spatial plan sets out a hypothetical sequence of harvesting in five (5) year intervals for a period of twenty years. The TYP 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.

The TYP for TFL 8 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 juxtaposition of resources on the landscape, and the spatial and structural management objectives associated with current management regulations and guidelines.

# 2. 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 landbase is then subdivided into "pseudo-blocks," 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 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 Ministry of Forests FSSIM timber supply model. In addition, CASH6 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 "pseudo-blocks"[1] 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 Landbase Classification*

Based on the criteria outlined in the Information Package (included in the MP No. 10 document as an appendix to the Timber Supply Analysis Report), the forest was classified into non-productive, productive-but-excluded, and harvestable components. The resulting landbase classification is illustrated cartographically in Appendix I.

Once all polygons in the forest cover inventory were thus classified, the landbase was generalized to produce a classification coverage in which only the contributing and non-contributing components of the landbase 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 were employed in this analysis, as summarized below:

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

1. 1-20;
2. 21-40;
3. 41-60;
4. 61-80;
5. 81-100;
6. 101-120;
7. 121-140;
8. 141-250; and
9. 251+

### *2.1.4 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 known scenic areas, mule deer wintering areas, forest connectivity corridors and unstable terrain polygons into a single REA coverage.

### *2.1.5 Biodiversity Units*

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

### *2.1.6 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 qualified manner so as to preserve the integrity of blocks with respect to attributes that determine harvest eligibility during the simulation. Therefore, certain lines within the initial block layer are considered inviolable during the final sliver elimination. For this analysis, these “hard” lines were those which:

1. Define the boundaries of an approved block from the current FDP;
2. Separate the THLB from the non-contributing portion of the landbase (originating from the classification coverage);
3. Define the boundaries between stands of different age class (originating from the age class coverage);
4. Define the boundaries between different ecological units, since these were critical components in representing future growth and yield relationships; and
5. Define the boundaries of the mule deer winter range areas, since these were critical areas in defining silvicultural regimes for future growth and yield relationships.

With these qualifications on which lines within the coverage could be modified, sliver polygons less than two (2) hectares in size were eliminated. This step reduced the total number of polygons

in the data set from approximately 39,900 to 24,800. Following the sliver elimination, it was found that the resulting block layer also contained a significant number of block polygons with area larger than 40 hectares. The maximum opening size normally allowed within the Nelson Forest Region[2] is 40 hectares. Furthermore, the presence of too many large blocks in the analysis dataset generally restricts the model's flexibility in determining a feasible harvest schedule. Therefore a regular grid of twenty (20) hectare rectangular cells was overlaid onto all non-FDP blocks over 40 hectares in size in order to break them into smaller pieces. The size distribution characteristics of the final block layer are summarized in the following figures.

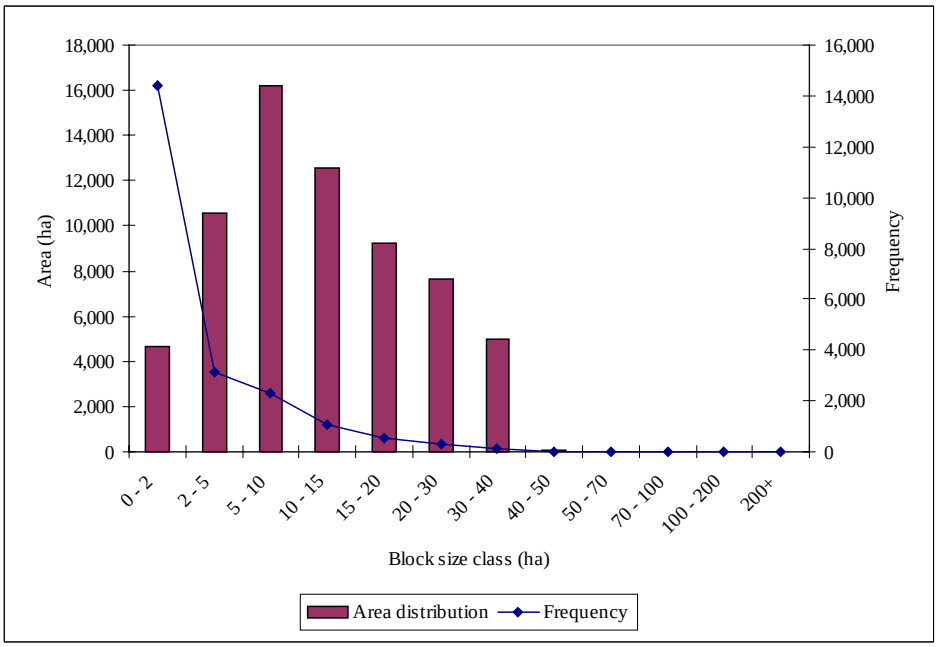


**Figure 2.1 Size class distribution, all blocks**

[2] Operational Planning Regulation 21(2)(a)

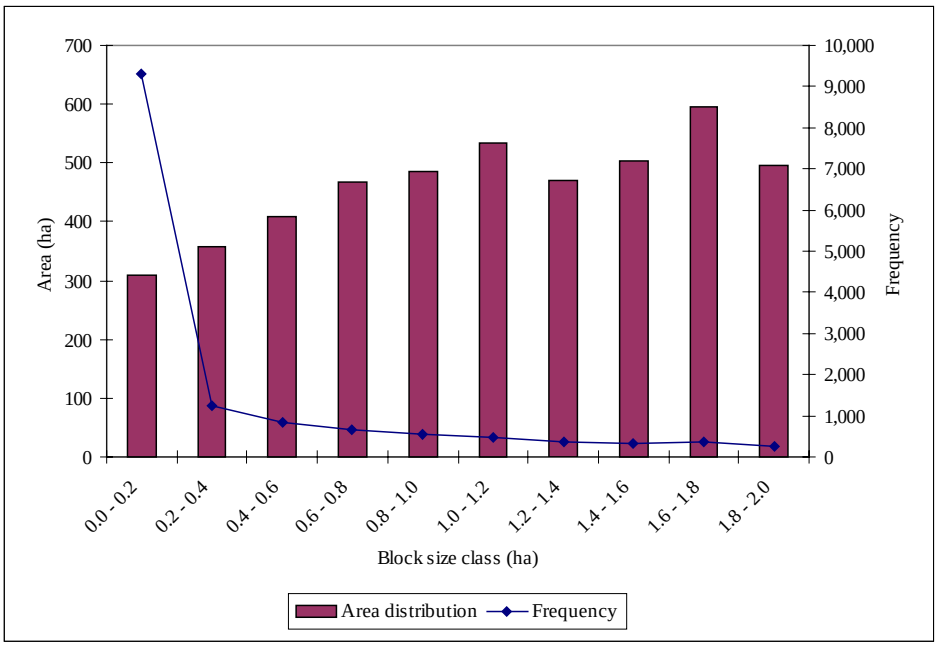


**Figure 2.2 Size class distribution, blocks less than 2 hectares**

### *2.1.7 Preserving Stand Level Detail*

"Blocks" are the fundamental, indivisible harvest units in CASH6. However, blocks can contain varying stand conditions, each with its own pattern of growth and regeneration. Analysis unit characteristics, as described in *Timber Supply Analysis Information Package for Tree Farm License 8*, are defined at the forest cover polygon level. Overlaying the pseudo-block layer onto the forest cover captured this stand-level detail within the harvest blocks.

## 2.2 Development of Twenty Year Harvest Schedule

### *2.2.1 Harvest Level*

Using CASH6, a simulation was performed using four time steps of five years each to establish a twenty-year schedule of harvested blocks at a net annual harvest level of 163,535 cubic meters. An allowance was made for non-recoverable losses of 900 $m^3$/yr to be consistent with the base case analysis formulation, resulting in a gross harvest level of 164,435 $m^3$/yr. In reality, harvest blocks would exclude these areas.

### *2.2.2 Forest Cover Rules*

This analysis incorporates all of the landscape level biodiversity and REA forest cover requirements modeled in the base case analysis, as described in *Timber Supply Analysis Information Package for Tree Farm License 8*.

### *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 2.5 metres.

### *2.2.4 Harvest Priorities*

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

1. Five-year FDP blocks;
2. Single tree selection blocks and non-plan blocks.

With the exception of 5-year FDP 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. RESULTS

## 3.1 Overview

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 1:50,000 consistent with other operational plans.

The following figures complement the harvest schedule map. Figure 3.1 shows the source of harvested volume in each of the four periods. Figure 3.2 illustrates the distribution of harvested area in each period. These figures show that the majority of the harvest in the first five years comes from forest development plan blocks, and that the majority of the FDP blocks are harvested by the end of the second period. As in the base case forecast (*Timber Supply Analysis for Tree Farm License 8*), a small but relatively constant proportion of the harvest comes from single tree selection (STS) blocks. Although FDP blocks were assigned a higher priority for harvest than STS blocks in the present analysis, the first period harvest still has a contribution from the STS blocks in spite of the fact that FDP blocks remain available in the second period. This occurs because the CASH6 timber supply model, when operated in spatial mode, does not permit a block to be split when it's harvestable volume would exceed the periodic volume target. Thus at a certain point in the first 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 the STS blocks.

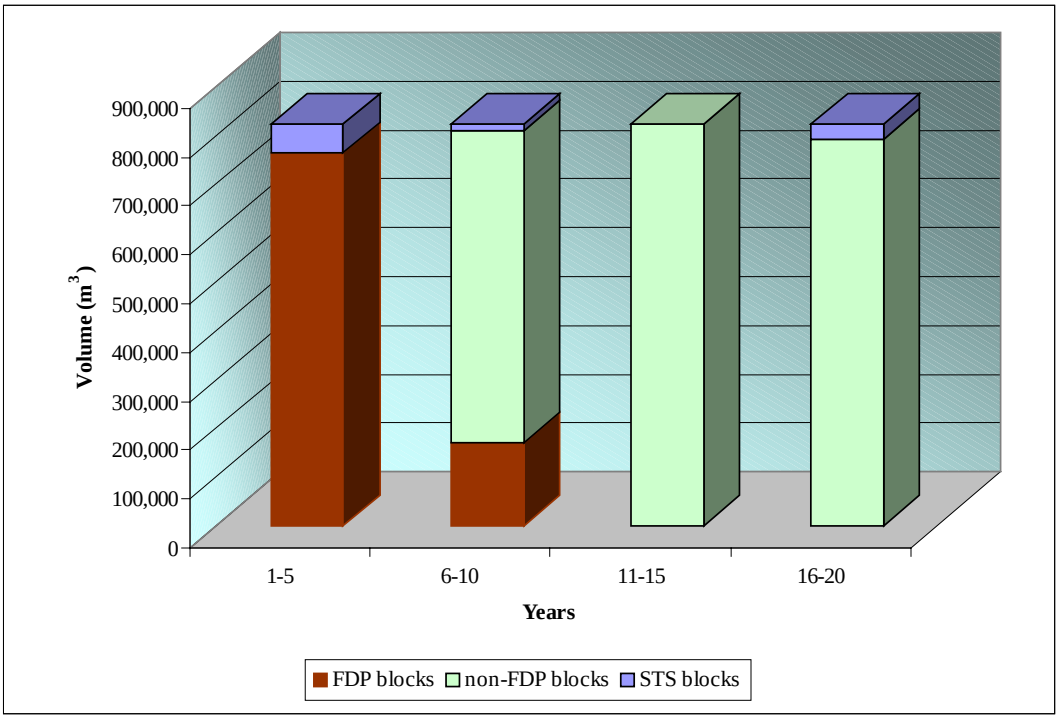


**Figure 3.1 Harvested volume by block type**

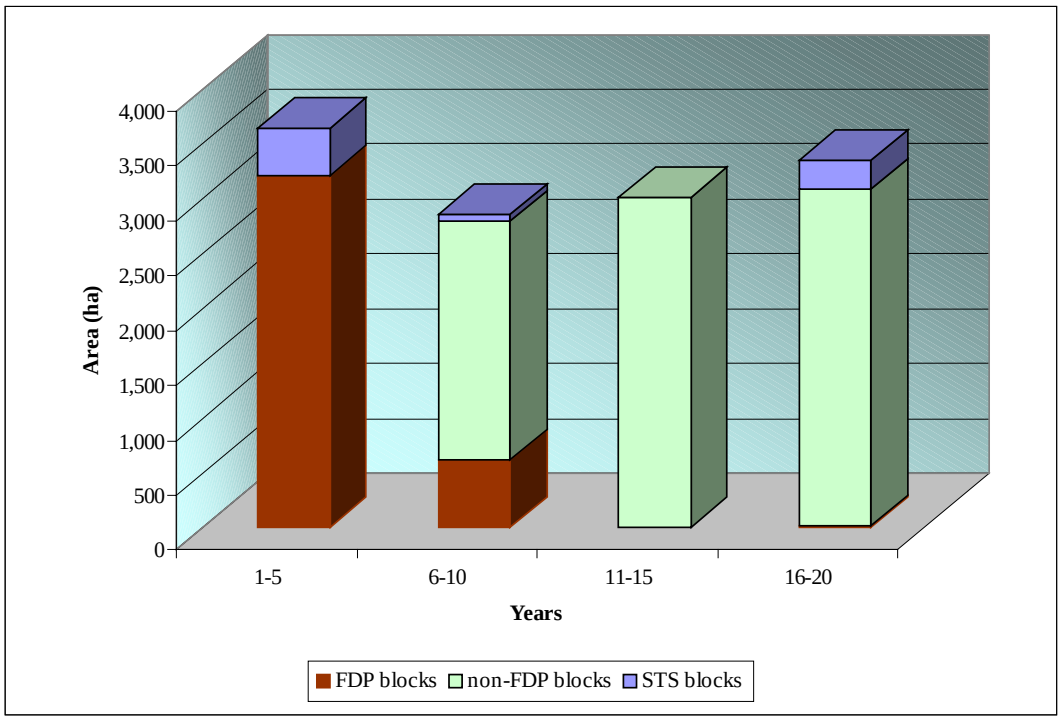


**Figure 3.2 Harvested area by block type**

Figure 3.3 shows how the total volume harvested over the entire twenty year planning horizon is distributed among blocks of different sizes. The number of blocks harvested in each size class is also shown.

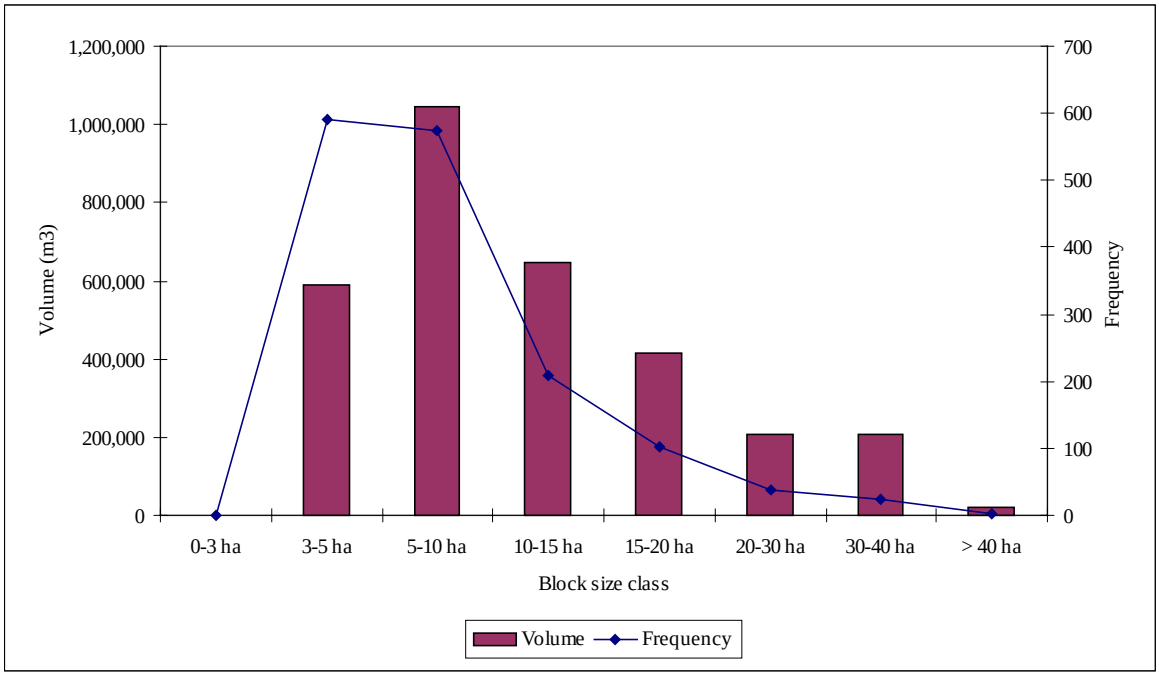


**Figure 3.3 Harvested volume by block size class**

Distributions of harvested volume and area by landscape unit (LU) in each period of the twenty year plan area summarized in Table 3.1 and Table 3.2, respectively. Note that the numbers reported here are gross values, in that they include the allowance for non-recoverable losses (NRL). Note also that, while the harvest target including the NRL was 164,435 m3/yr, or 822,175 cubic meters in each five-year period, the achieved harvest levels are generally less than the target by a small amount as a result of the indivisible character of CASH6 harvest blocks.

**Table 3.1 Gross harvested volume ($m^3$/period) by landscape unit**

| | Years | | | | |
|---|---|---|---|---|---|
| **Landscape Unit** | 1-5 | 6-10 | 11-15 | 16-20 | **Total** |
| B1 | 198,007 | 72,248 | 62,120 | 51,130 | 383,506 |
| B7 | 412,666 | 534,987 | 384,881 | 538,737 | 1,871,271 |
| B8 | 211,225 | 214,762 | 375,087 | 232,161 | 1,033,235 |
| **Total** | **821,897** | **821,998** | **822,089** | **822,028** | **3,288,012** |

**Table 3.2 Gross harvested area (ha/period) by landscape unit**

| | Years | | | | |
|---|---|---|---|---|---|
| **Landscape Unit** | 1-5 | 6-10 | 11-15 | 16-20 | Total |
| B1 | 833 | 296 | 258 | 218 | 1,606 |
| B7 | 1,746 | 1,781 | 1,434 | 2,143 | 7,104 |
| B8 | 1,054 | 775 | 1,312 | 977 | 4,118 |
| **Total** | **3,633** | **2,852** | **3,004** | **3,338** | **12,827** |

The following sections of this chapter present LU-specific tabular summaries of gross harvested volume and area by resource emphasis area in each period of the twenty-year plan. Because REAs overlap each other, individual REA harvest values are not additive. Retention levels for old seral habitat are also presented.

## 3.2 Landscape Unit B1

**Table 3.3 Gross harvested volume ($m^3$/period) by REA, B1 landscape unit**

| | Years | | | | |
|---|---|---|---|---|---|
| **REA** | **1-5** | **6-10** | **11-15** | **16-20** | **Total** |
| UWR | 82,112 | 3,733 | 7,887 | 6,573 | 100,305 |
| Vqc-R | 0 | 0 | 0 | 0 | 0 |
| Vqc-PR | 0 | 0 | 0 | 0 | 0 |
| Vqc-M | 0 | 0 | 0 | 0 | 0 |
| IRM | 115,894 | 68,516 | 54,234 | 44,557 | 283,201 |

**Table 3.4 Gross harvested area (ha/period) by REA, B1 landscape unit**

| REA | Years | | | | Total |
|---|---|---|---|---|---|
| | 1-5 | 6-10 | 11-15 | 16-20 | |
| UWR | 357 | 24 | 28 | 58 | 467 |
| Vqc-R | 0 | 0 | 0 | 0 | 0 |
| Vqc-PR | 0 | 0 | 0 | 0 | 0 |
| Vqc-M | 0 | 0 | 0 | 0 | 0 |
| IRM | 476 | 272 | 231 | 160 | 1,139 |

**Table 3.5 Old seral retention, B1 landscape unit**

| BEC variant | NDT | BEO | Old (% > age) | Achieved (Old) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Year 1-5 | Year 6-10 | Year 11-15 | Year 16-20 |
| ICH mk 1 | 3 | I | 14 > 140 | 84 | 84 | 84 | 84 |
| IDF dm 1 | 4 | H | 19 > 250 | 4 | 4 | 4 | 4 |
| IDF dm 1 | 4 | I | 13 > 250 | 0 | 1 | 1 | 1 |
| MS dm 1 | 3 | H | 21 > 140 | 36 | 26 | 21 | 21 |
| MS dm 1 | 3 | I | 14 > 140 | 42 | 20 | 17 | 14 |

## 3.3 Landscape Unit B7

**Table 3.6 Gross harvested volume ($m^3$/period) by REA, B7 landscape unit**

| REA | Years | | | | Total |
|---|---|---|---|---|---|
| | 1-5 | 6-10 | 11-15 | 16-20 | |
| UWR | 116,433 | 48,126 | 89,334 | 39,227 | 293,121 |
| Vqc-R | 972 | 14,976 | 0 | 1,105 | 17,053 |
| Vqc-PR | 0 | 0 | 0 | 0 | 0 |
| Vqc-M | 0 | 0 | 0 | 0 | 0 |
| IRM | 296,233 | 475,534 | 295,547 | 499,509 | 1,566,823 |

**Table 3.7 Gross harvested area (ha/period) by REA, B7 landscape unit**

| REA | Years | | | | Total |
|---|---|---|---|---|---|
| | 1-5 | 6-10 | 11-15 | 16-20 | |
| UWR | 578 | 184 | 301 | 218 | 1,281 |
| Vqc-R | 8 | 61 | 0 | 8 | 76 |
| Vqc-PR | | | | | 0 |
| Vqc-M | | | | | 0 |
| IRM | 1,168 | 1,549 | 1,133 | 1,925 | 5,775 |

**Table 3.8 Old seral retention, B7 landscape unit**

| BEC variant | NDT | BEO | Old (% > age) | Achieved (Old) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Year 1-5 | Year 6-10 | Year 11-15 | Year 16-20 |
| ESSFdc 1 | 3 | L | 4.7 > 140 | 47 | 47 | 44 | 46 |
| ICH mk 1 | 3 | L | 4.7 > 140 | 30 | 23 | 20 | 17 |
| ICH mw 2 | 2 | L | 3 > 250 | 4 | 4 | 4 | 4 |
| IDF dm 1 | 4 | L | 4.3 > 250 | 3 | 2 | 3 | 3 |
| MS dm 1 | 3 | L | 4.7 > 140 | 28 | 19 | 15 | 12 |

## 3.4 Landscape Unit B8

**Table 3.9 Gross harvested volume ($m^3$/period) by REA, B8 landscape unit**

| REA | Years | | | | Total |
|---|---|---|---|---|---|
| | 1-5 | 6-10 | 11-15 | 16-20 | |
| UWR | 39,634 | 11,892 | 23,016 | 14,018 | 88,560 |
| Vqc-R | 0 | 0 | 0 | 0 | 0 |
| Vqc-PR | 0 | 2,517 | 0 | 705 | 3,222 |
| Vqc-M | 0 | 0 | 0 | 0 | 0 |
| IRM | 171,591 | 200,354 | 352,071 | 218,142 | 942,159 |

**Table 3.10 Gross harvested area (ha/period) by REA, B8 landscape unit**

| REA | Years | | | | Total |
|---|---|---|---|---|---|
| | 1-5 | 6-10 | 11-15 | 16-20 | |
| UWR | 192 | 41 | 87 | 102 | 421 |
| Vqc-R | 0 | 0 | 0 | 0 | 0 |
| Vqc-PR | 0 | 10 | 0 | 6 | 16 |
| Vqc-M | 0 | 0 | 0 | 0 | 0 |
| IRM | 862 | 724 | 1,226 | 875 | 3,686 |

**Table 3.11 Old seral retention, B8 landscape unit**

| BEC variant | NDT | BEO | Old (% > age) | Achieved (Old) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Year 1-5 | Year 6-10 | Year 11-15 | Year 16-20 |
| ESSFdc 1 | 3 | L | 4.7 > 140 | 43 | 48 | 48 | 48 |
| IDF dm 1 | 4 | L | 4.3 > 250 | 1 | 1 | 2 | 2 |
| MS dm 1 | 3 | L | 4.7 > 140 | 14 | 12 | 9 | 9 |

# 4. SUMMARY

The results of the spatial analysis presented in the preceding chapter demonstrate a feasible arrangement of harvest units that provide the base case short-term harvest level of 163,535 cubic meters per year for a period of twenty years. The twenty-year schedule incorporated full green-up requirements for spatially adjacent blocks, and all forest cover constraints as modelled in the aspatial base case analysis were met. Approved blocks from the current FDP were given highest priority, and thus constitute the majority of scheduled blocks in the first five (5) years of the plan.

The harvest schedule presented in this report represents only one of many spatially feasible solutions for achieving the base case harvest level.

# 5. REFERENCES

J.S. Thrower & Associates (JST), 2001a. Yield Tables for Natural and Managed Stands: Management Plan 10 on TFL8. November 15, 2001. 42 pp.

J.S. Thrower & Associates (JST), 2001b. Potential Site Index Estimates for Major Commercial Tree Species on TFL 8. Contract Rep. To Pope & Talbot. March 30, 2001. 17 pp.

# APPENDIX I - Cartographic products

1. Harvest Schedule, Block 1 and Block 2
2. Landbase Classification, Block 1 and Block 2
3. Forest Cover (Rank 1), Block 1 and Block 2
4. Resource Emphasis Areas 1, Block 1 and Block 2
5. Resource Emphasis Areas 2, Block 1 and Block 2