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# Slocan Forest Products Ltd.

## TFL 3

### Silviculture Strategy (Type 1)

**March 2000**

funded by





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The consultants also wish to thank the participants in the workshop whose contributions are the basis of this strategy, and are listed below.

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## Preface

The development of silviculture strategies for TSAs and TFLs is motivated by the desire to clarify the relationship between investments in silviculture and the critical forest-level issues specific to the management unit.

The Type 1 analysis is workshop-based. It draws on the expert knowledge of the participants to identify the critical issues, derive objectives with respect to those issues, specify regimes to meet those issues, and identify the regime activities that can be implemented in the next five years. After consideration of the benefits and costs of each of the activities on each of the forest-level objectives, the participants rank the silviculture activities by priority. The result is a prioritized list of silviculture activities that are explicitly linked to the critical issues of the management unit.

Type 2 analyses are model-based, but the analysis process is fundamentally identical to the Type 1 analysis. A forest-level model is used to evaluate the impacts of regimes on the forest-level objectives, to identify the silviculture activities constituting the “preferred management scenario”, and to rank those activities.

The Type 2 (model-based) analysis will result in a silviculture strategy that is considerably more appropriate and robust than the Type 1 approach, but it is more expensive and demanding of scarce modeling expertise. Hence the Type 1 (workshop-based) approach has been designed to produce an interim silviculture strategy that will serve until a Type 2 analysis can be completed.

In the absence of a silviculture strategy for a management unit, the Ministry of Forests’ provincial level strategy *Incremental Silviculture Strategy For British Columbia (Interim)* has provided interim guidance. A summary of this document is included as an appendix to this report.



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## Strategy Summary

The workshop participants developed a silviculture strategy that addressed a total of 12 issues, summarized below. Table S-1 lists the regimes identified by the participants and the rank (priority) assigned to each regime.

### Elements of the Strategy

- #1. Maintain or increase the current AAC of 80 000 m<sup>3</sup>/year by undertaking management practices that increase the timber supply. Restock backlog NSR, convert 191 ha of NCB<sub>r</sub> to Engelmann spruce, plant with improved seed where available for all reforestation, use enhanced regeneration methods for prompt reforestation, and mitigate age class imbalances by commercial thinning 50 - 70 year old Fd, Pw and Lw stands. Initiating these management practices in the next 5-year management period will help to increase AAC and offset any operational constraints that may arise in the future.
- #2. Produce high value forest products based on site capability, risk assessment and product objectives. Implement a program to produce clear wood, large diameter logs and other specific products (eg. poles, house logs) on good and medium sites with good access and operability.  

The development of product objectives will aid comprehensive planning, maintain management options and contribute the flexibility required to meet future product demand.
- #3. Use harvesting and silvicultural practices that reduce the high frequency of Armillaria root disease in the ICH.
- #4, #5. Maintain and enhance ungulate winter range and grizzly bear habitat through appropriate practices.
- #6. Use silviculture methods to minimize time to hydrological green-up in domestic watersheds.
- #7. Ensure that white pine is a component of future harvests by planting disease-resistant stock and conducting sanitation practices throughout stand development, by spacing, pruning and commercial thinning. Leave disease-resistant trees at harvest for natural regeneration of the next stand.
- #8. Reduce damage from the spruce leader weevil by promoting mixed conifer stands and maintaining some of any natural deciduous component.
- #9. Minimize damage from spruce, fir and mountain pine bark beetles by promoting mixed stands and harvesting attacked stems.
- #10. Decrease the time to VEG in VSAs.
- #11. Minimize time to free-growing on ESSF sites above 1700 m elevation through "aggressive reforestation" practices (mounding, prompt planting with large stock, brushing).
- #12. Maintain or enhance biodiversity attributes in mature and old seral stands.

**Table S-1. Issues, regimes, targets, and their priority as determined by the workshop.**

P	Issue	Regime	Target	Rank
#1	H Desire to maximize potential supply (quantity)	Restock backlog	Backlog	3
		Convert NC Br to Engelmann Spruce	Backlog	15
		Regenerate deciduous stands	Deciduous outside of riparian zones	16
		Use improved seed	As available (spruce and Larch)	2
		Enhanced regeneration	All conifer species on all sites, as appropriate	1
#2	H Desire to maximize potential supply (quality)	Commercial thinning	Existing age 50-70 yrs - Fd, Pw, Lw	17
		Density control and pruning	Managed stands: pines (Pl, Pw), Fd, Lw, M&G sites with good access and high operability	5
		Density control	M&G sites with good access (managed or natural)	12
#3	H High frequency of Armillaria root rot in ICH at endemic levels	Species preferences and density management	Pw, Cw, Fd, Lw on M&G sites	6
		Silvicultural systems - partial cutting and clear cut with reserves	ICH	4
		Harvest method - push-over logging		4
#4	M Treatment to maintain or enhance and keep UWR active (harvestable)	Reforestation strategies		4
		Harvesting and reforestation	UWR	9
		UWR enhancement regime	UWR; multistory; critical late winter; location - Hoderface	
#5	M Treatment to maintain or enhance and keep GBH active (harvestable)	Harvesting and reforestation	Grizzly bear habitat - edges of avalanche zones, hanging valleys, ESSF high elevation	14
#6	M Long time to hydrological greenup reduces rate of harvest	Minimize time to hydrological green up	Domestic watersheds	10
#7	M Intention that Pw be commercially viable	Russell Graham	Managed: ICH M-G sites with Pw component; easy access	13
#8	M Pure spruce plantations have high incidence of spruce weevil infestation	Plan mixed species	ICH; ESSF transition; 1400-1600 m	11
#9	L Spruce, fir and mountain pine bark beetles are low level endemic	Salvage and regenerate	Attacked and vulnerable stands	19
#10	L Long time to Visually Effective Green-up (VEG) reduces rate of harvest	Minimize time to VEG	VSA	8
#11	L Regenerating high elevation forests	Aggressive reforestation	>1700 m	7
#12	L Maintain/enhance biodiversity (old seral)	Maintain and enhance mature and old growth characteristics while recovering timber	Mature and old seral stands	18



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## 1. Introduction

The Silviculture Strategy (Type 1) workshop draws on the expert knowledge of the participants to identify the key issues that should guide silvicultural planning on the TFL, derive objectives with respect to those issues, specify regimes to meet those issues, and identify the regime activities that can be implemented in the next five years. The key idea is that this line of logic from issues to silvicultural activities can be retraced when evaluating funding levels, ensuring that activities are funded that address critical TFL issues.

The first step in developing this line of logic is to identify the key issues that should guide silvicultural planning on the TFL. Next, the participants' objectives with respect to these issues are clearly stated. Strategies for meeting these objectives are identified, together with the silvicultural target (stand types) to which these strategies are to be applied. A plan of action, most often a silvicultural regime, is then developed to implement each strategy. This sequence constitutes the "strategic analysis" part of the workshop and the resulting compilation of issues, objectives, strategies and regimes is the silviculture strategy.

After developing the strategy, the workshop identifies opportunities to implement the regimes in the next five years and develops a program of silvicultural activities that is consistent with the strategy and is feasible with respect to the operational realities of the TFL. The impacts of these silvicultural activities on selected objectives are estimated by the workshop participants, and in a final step, the activities are ranked as to their importance with respect to the TFL issues. Development of the 5-year plan of silvicultural activity and estimating impacts and evaluating ranks of the activities constitutes the "tactical analysis" part of the workshop.

This report documents the results of a workshop to develop a strategy and a 5-year plan for TFL 3. Following this introduction, section 2 summarizes the results of the strategic analysis and section 3 presents the analysis of the 5-year plan. Issues that influence silviculture planning on the TFL were obtained through discussion with the TFL staff and review of Management Plan 9 and related documents. These issues were compiled prior to the workshop and are described in Appendix 1. Appendix 2 contains a detailed examination of the timber supply situation on the TFL, also prepared prior to the workshop, as some aspect of timber supply is often a guiding issue for silviculture planning.



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## 2. Analysis of Issues and Strategies

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### 2.1 Identification of Issues and Strategies

This section identifies the critical issues that guide silviculture planning in the TFL 3 and the strategies developed in the workshop for addressing them. Related “to do” tasks are included with the relevant issue.

#### Issue 1: Timber Supply – Quantity (H)

Slocan Forest Products Ltd. (SFP) desires to maximize the potential timber supply available from TFL #3. The AAC for the TFL increased from 65 000 m<sup>3</sup> under Management Plan (MP) 8 to 80 000 m<sup>3</sup> under MP 9, which includes a 4 000 m<sup>3</sup> partition for non-roaded harvesting methods. However, SFP’s sawmill remains dependent on private operators for 15% of its timber supply. This uncertainty in timber supply may be further restricted by biodiversity and OGMA constraints.

#### Strategies:

1. Increase the timber harvesting land base. Restock backlog NSR including conversion of 191 ha of NCB<sub>r</sub> to Engelmann Spruce. Some deciduous stands outside riparian zones will be regenerated as deciduous stands.
2. Utilize improved seed (as available) for spruce and larch.
3. Ensure prompt regeneration of all conifer types on all sites (as appropriate) through a program of enhanced regeneration.
4. Mitigate age class imbalances by commercial thinning existing 50-70 year old Fd, Pw and Lw.

#### To Do:

1. Investigate the efficacy of fertilization at planting using a fertilizer “tea bag” near the seedling.
2. Confirm minimum harvest age. The value of 150 m<sup>3</sup>/ha used in the timber supply analysis may be too low for economical harvest, and may not, in fact, reflect the actual volume of a 70-year-old stand (which is believed to be higher). Economical harvest requires a minimum of approximately 270 m<sup>3</sup>/ha.

#### Issue 2: Timber Supply – Quality (H)

Slocan Forest Products Ltd. wishes to optimize timber quality in stands currently under management. This requires careful planning to determine achievable product objectives based on site capability and projected future demand for high quality, high value forest products.



#### Strategies:

1. Manage to produce clear wood on managed stands of lodgepole pine and white pine, Douglas-fir and western larch growing on good and medium sites. Conduct juvenile spacing and pruning on sites with good access and high operability.
2. Manage for large piece size on good and medium sites (with the capability to grow large piece size), on either managed or natural stands with good access. Density control will be the main treatment for medium and good sites.
3. Manage for specific products, such as poles and house logs. Plant higher densities of Pw, Cw, and Lw on good and medium sites.

#### To Do:

1. Develop quality and product objectives for TFL #3. Potential products include clear wood premium, J grade, and spruce and hemlock clears. Need to reconcile product objectives with site capabilities and risk.
2. Undertake espacement trials for cedar, hemlock and larch to develop regimes that meet quality objectives.

#### **Issue 3: Armillaria Root Disease (H)**

TFL #3 has a high frequency of Armillaria root rot of endemic levels in the ICH. Growth potential must be fully utilized and volume losses mitigated.

#### Strategies:

1. Identify silvicultural systems that provide alternatives to conventional clearcutting without exacerbating Armillaria-induced mortality (eg. partial cutting, clearcutting with reserves).
2. Conduct push-over logging, where possible, as the harvest method to remove all root inoculum.
3. Reforest with mixtures of resistant species (including deciduous), using avoidance planting (planting away from known inoculum sources) with increased stocking where possible.

#### To Do:

Investigate partial harvesting growth and yield research in the ICH, including effects of different levels of root disease, with respect to basal area retention.

#### **Issue 4: Ungulate Winter Range (M)**

Winter range for mule deer, white-tailed deer and elk requires management practices that maintain or enhance ungulate winter range (UWR) integrity. Slovan Forest Products has avoided harvesting on UWR but needs to maintain harvesting access to these areas to minimize their impact on the AAC.



**Strategies:**

1. Employ harvesting and reforestation methods that meet UWR requirements.
2. Enhance critical UWR sites (eg. in the HoderFace) by maintaining multi-story stands through appropriate silvicultural systems and management methods.

**To Do:**

Review/investigate methods for harvesting and reforestation on UWR and produce a silviculture strategy that outlines options for appropriate silvicultural systems and recommended practices to maintain or enhance UWR attributes.

**Issue 5: Grizzly Bear Habitat (M)**

Management practices on grizzly bear habitat must maintain or enhance the integrity of the habitat. Slokan Forest Products has avoided harvesting on grizzly bear habitat but needs to maintain harvesting access to these areas to minimize their impact on the AAC.

**Strategies:**

1. Use harvesting and reforestation practices in grizzly bear habitat (avalanche zone edges, hanging valleys, ESSF high elevation) that produce clumpy conifer stocking with openings to stimulate forage production.
2. Road access management.

**Issue 6: Watersheds (M)**

Timber harvesting in domestic watersheds requires management practices to maintain water quality and quantity. SFP wishes to minimize the operational impacts created by the long time period to achieve hydrological green-up (conifer height of 9m) to avoid reducing the rate of harvest in adjacent areas.

**Strategies:**

Use silvicultural methods that minimize time to hydrological green-up, such as planting large stock from improved seed, and brushing treatments to promote survival and growth.

**Issue 7: White Pine Blister Rust (M)**

SFP is committed to maintaining white pine as a commercially viable species on TFL #3 despite the threat of white pine blister rust. SFP wishes to ensure that healthy white pine will be available for harvest at rotation.

**Strategies:**

Use the regime recommended by Russell Graham (USDA): plant disease-resistant stock, then follow up with sanitation spacing, pruning and commercial thinning to maintain a low incidence of white pine blister rust in the stand. Leave disease-resistant seed trees at harvest.



### **Issue 8: Spruce Weevil (M)**

The Operational Adjustment Factor (OAF2) pertaining to forest health was increased from the usual 5% to 10% for regenerated spruce-leading stands to account for anticipated volume losses from the spruce leader weevil. Measures to reduce damage and volume losses from the spruce weevil would contribute to an increased harvest level.

#### **Strategies:**

Promote mixed species of conifers and maintain a natural deciduous component that provides protection for spruce from the spruce weevil.

### **Issue 9: Bark Beetles (L)**

Maintain the endemic levels of spruce, fir and mountain pine beetle populations on TFL #3 and prevent outbreaks.

#### **Strategies:**

Encourage mixed species stands and harvesting of attacked stems to salvage mortality and minimize beetle spread to healthy stands.

### **Issue 10: Visually Sensitive Areas (L)**

Minimize the operational impacts created by the long time period to achieve visually effective green-up (VEG) to help avoid reducing the rate of harvest in adjacent areas.

#### **Strategies:**

Harvest in VSAs while managing for Visual Quality Objectives (VQOs) by minimizing the time to achieve VEG.

### **Issue 11: Extreme High Elevation Reforestation (L)**

Minimize the time to free-growing on harsh, high elevation sites in the ESSF above 1700 m elevation.

#### **Strategies:**

Use “aggressive reforestation” measures, such as site preparation to increase soil temperatures (eg. mounding), prompt planting with large stock, and brushing to help achieve FG.

#### **To Do:**

Design and implement an adaptive management strategy to explore alternatives for successful reforestation and achievement of free-growing status on these harsh sites.

### **Issue 12: Biodiversity (L)**

Maintain or enhance biodiversity attributes in mature and old seral stands.



#	P	Issue Name	Issue Description	Objective	S Strategy	T Target	R Regime Description	A Activities	Area ha/year	Timber Supply Effects				Habitat Effects	Jobs Pd/ha	Cost \$/ha	Rank
										Shrt	Mid	Long	Qual				
					2 Enhance critical UWR habitat	UWR; multistory; critical late winter; location - Hoderface	UWR enhancement regime	partial cutting; slashing; single tree selection	10/5 years	+	+	+		+++			
5	M	Grizzly bear habitat	Treatment to maintain or enhance and keep it active (harvestable)	Minimize impact on AAC	Harvesting within grizzly bear habitat	Grizzly bear habitat - edges of avalanche zones, hanging valleys, ESSF high elevation	Harvesting and reforestation	1 harvesting within grizzly bear habitat 2 burn to stimulate forage production 3 planting in clusters (open canopy for forage)	25 12 25	+	+	+		+			14
6	M	Watersheds	Long time to hydrological greenup reduces rate of harvest	Minimize operational impact	Harvest in dom. watersheds while managing for water quality and quantity	Domestic watersheds	Minimize time to hydrological green up	1 site prep 2 plant with improved seed, large stock 3 brushing (survival) 2x 4 brushing (growth) 1x	25	M	M	M	+	+			10
7	M	White pine blister rust	Intend that Pw be commercially viable on the TFL	Capitalize on potential	Ensure healthy Pw at rotation	Managed: ICH M-G sites with Pw component; easy access	Russell Graham	plant disease resistant stock; space out diseased trees (sanitation spacing); prune remaining Pw; CT infected Pw; at final harvest leave seed trees	10	+	+	+	+				13
8	M	Spruce weevil	Pure spruce plantations have high incidence of infestation	Minimize damage	Ensure quality spruce component at rotation	ICH; ESSF transition; 1400-1600 m	Mixed species	plant mixed species; higher non-spruce percentage; selective brushing to manage overstory	50	+	+	+	+	+			11
9	L	Spruce, fir and mountain pine bark beetles	Low level endemic	Maintain endemic levels	Salvage log and manage to reduce risk	Attacked and vulnerable stands		salvage harvest; plant mixed	100/5yr	+	+	+					19
10	L	Visually Sensitive Areas (VSA)	Long time to Visually Effective Green-up (VEG) reduces rate of harvest	Reduce time to VEG	Harvest within VSA while managing for VQO	VSA	Minimize time to VEG	1 site prep 2 plant with improved seed, large stock 3 brushing (survival) 2x 4 brushing (growth) 1x	25	M	M	M	+	+			8
11	L	Extreme high elevation reforestation	Regenerating high elevation	Minimize time to FG	Reforestation of ESSF areas in timely and cost effective manner	>1700 m	aggressive reforestation	1 site prep to warm soil 2 prompt planting with large stock 3 brushing 1x	25 25 25	+	+	+		+			7
12	L	Biodiversity	Maintain/enhance biodiversity (old seral)	Minimize impact on AAC and operationally	Maintain critical attributes	Mature and old seral stands	Maintain and enhance mature and old growth characteristics while recovering timber	partial harvesting with up to 30% removal	20/5 years	+	+	+	-	+			18

Notes:

+, - indicates, respectively, a positive or negative impact on the indicated objective.

+/- indicates that the activity could have a positive or negative effect, depending on its circumstances of application

Costs and employment effects were obtained from the Merritt TSA or Regional averages.



**Strategies:**

Maintain and enhance mature and old growth characteristics while recovering timber, possibly through low levels of partial harvesting.

**2.2 Identification of Targets, Regimes and Activities**

Table 2-1 documents the workshop's analysis of the issues and strategies identified in section 2.1. In some situations the workshop participants rejected some strategies after identifying their silvicultural target and the activities required to implement the strategy. The participants developed the table from left to right and their identification for each issue of objectives, strategies, targets and regimes constitutes the strategic analysis component of the workshop.



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## 3. Silviculture Impacts and Priorities

After identifying regimes to implement the strategies identified in Table 2.1, the workshop participants determined the opportunity area (i.e., the area available for treatment for the next 5 years), the impacts on timber supply quantity and quality, and habitat effects for each treatment. The employment effects and costs are based on district and regional records. The rank (priority) of each treatment was determined through consideration of the impacts of each activity on each objective, and represents a consensus of the participants. The identification of opportunity area, the potential impact on TFL objectives, and the establishing priorities constitutes the tactical analysis component of the workshop.

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## 4. Silviculture Program

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### 4.1 Tactical Priorities

The rankings of Table 2.1 represent a balance between the participant's strategic concerns and the silvicultural opportunities available on the TSA in the next 5 years.

The highest ranked activities are enhanced regeneration of all conifers and all sites (1), followed by the use of improved seed (2) and the restocking of backlog NSR (3). Each of these activities address the issue of maximizing the potential timber supply of the TFL.

The next priority identified by the participants was the treatment of stands infected with *Armillaria* root rot (4), which also has an impact on timber supply.

Density control and pruning (5) and planting to higher stocking with preferred species (6) address the timber quality issue, but it was noted that lack of product objectives for the TFL hampered silvicultural planning in this regard. Consequently, the development of product objectives was ranked 4<sup>th</sup> on the list of tasks and investigations (the "to-do" list; Appendix 3).

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### 4.2 Program Costs and Benefits

Table 4-1 contains the area treated by activity and year.

Table 4-2 contains the expenditure by activity and year, based on the unit costs recorded in the treatment table (Table 4.1).

Table 4-3 contains the silviculture employment benefits associated with the program.

The cost and employment assumptions used in creating these tables are listed in Appendix 4.

Table 4-1. Area (ha) treated by activity and year.

Year	Surveys*	Surveys	Site Prep	Plant	Fertilize	Brush	Space	Prune	Total
	General	Backlog			@ Plant				
1	1,342	1	116	631	14	257	75	25	1,559
2	1,342	1	116	631	14	257	75	25	1,559
3	1,342	1	116	631	14	257	75	25	1,559
4	1,342	1	116	631	14	257	75	25	1,559
5	1,342	1	116	631	14	257	75	25	1,559
Subtot Yr 1 - 5	6,708	5	581	3,155	70	1,286	375	125	7,794
6 - 10	6,708	5	581	3,155	70	1,286	375	125	12,305
Total Yr 1 - 10	13,415	10	1,163	6,310	140	2,573	750	250	24,610

\* Includes prescription and layout

Table 4-2. Expenditure ('000 \$) by activity and year.

Year	Surveys*	Surveys	Site Prep	Plant	Fertilize	Brush	Space	Prune	Total
	General	Backlog			@ Plant				
1	43	0	98	187	2	249	85	18	682
2	43	0	98	187	2	249	85	18	682
3	43	0	98	187	2	249	85	18	682
4	43	0	98	187	2	249	85	18	682
5	43	0	98	187	2	249	85	18	682
Subtot Yr 1 - 5	215	0	491	936	11	1,246	424	91	3,412
6 - 10	215	0	491	936	11	1,246	424	91	3,412
Total Yr 1 - 10	429	0	982	1,871	21	2,491	848	181	6,824

Table 4-3. Short term employment benefits (person-years) of the silviculture program, by year and activity.

Year	Surveys*	Surveys	Site Prep	Plant	Fertilize	Brush	Space	Prune	Total
	General	Backlog			@ Plant				
1	134.2	0.1	232.5	315.5	7.0	958.1	262.5	150.0	2,060
2	134.2	0.1	232.5	315.5	7.0	958.1	262.5	150.0	2,060
3	134.2	0.1	232.5	315.5	7.0	958.1	262.5	150.0	2,060
4	134.2	0.1	232.5	315.5	7.0	958.1	262.5	150.0	2,060
5	134.2	0.1	232.5	315.5	7.0	958.1	262.5	150.0	2,060
Subtot Yr 1 - 5	670.8	0.5	1,162.5	1,577.5	35.0	4,790.6	1,312.5	750.0	10,299
6 - 10	670.8	0.5	1,162.5	1,577.5	35.0	4,790.6	1,312.5	750.0	10,299
Total Yr 1 - 10	1,341.5	1.0	2,325.0	3,155.0	70.0	9,581.3	2,625.0	1,500.0	20,599

Note: Assumes 200 days of harvesting, silviculture work, and timber processing = 1 person-year



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# Appendix 1

## Issues Reviewed in the TFL 3 Slokan Forest Products Workshop

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### TSA Issues Guiding Silviculture Planning

Issues that influence silviculture planning were obtained from the most recent Management Plan (MP 9) and the Chief Forester's AAC Rationale (1998). These issues were reviewed and expanded during the workshop.

#### A1.1 Timber Supply Issues

A1.1.1 Opportunities exist to increase timber supply.

*Issue:* The AAC increased from 65 000 m<sup>3</sup> under MWP 8 to 80 000 m<sup>3</sup> under MP 9, including a 4 000 m<sup>3</sup> partition for non-conventional harvesting methods. However, Slokan's sawmill remains dependent on private operators for 15% of timber supply. Also, biodiversity and OGMA constraints are expected to restrict timber supply.

*Strategies:*

- address age class distribution problems,
- increase the productivity of the forest land base through appropriate management regimes in order to augment the long term timber supply,
- ensure prompt regeneration to maintain the productive growing capacity,
- plant larger, genetically improved stock to reduce green-up period, meet VQOs, ECAs and general green-up objectives
- minimize current NSR and restock backlog,
- reduce regen delay on high elevation spruce-balsam sites (currently 4 years) through site preparation and planting sooner after harvest, or by planting with larger stock and/or fertilizing at the time of planting,
- introduce thinning and commercial thinning activities to improve densities and increase yields; SFP has developed a policy on commercial thinning that will be used to select potential stands and install growth and yield plots
- increase forest land base by harvesting and regenerating deciduous stands,
- convert NCC Br to Englemann Spruce
- multiple fertilizations
- establish fertilization trials to identify target species, sites, treatments, and application rates; investigate fertilization following commercial thinning
- use genetically improved seed for second-growth spruce plantations and for other leading species



#### A1.1.2 Minimum harvest age

*Issue:* Minimum harvest ages for the TFL 3 timber supply analysis are assigned according to the stand's expected age when it reaches 150 m<sup>3</sup>/ha and may be overestimated in the analysis.

*Strategies:*

- confirm minimum harvest age parameters
- decrease the time required for stands on good and medium sites to reach 150 m<sup>3</sup>/ha to allow for earlier harvesting by increasing juvenile spacing (the MP 9 timber supply analysis records 331 ha of juvenile spacing) (total to date?)

#### A1.1.3 Uncertainty with respect to inventory

*Issue:* The initial inventory carried out in 1965-66 has been updated and augmented in 1978, 1983 and 1993. An inventory audit was undertaken coincidental with the development of MP 9.

*Strategy:* not identified

#### A1.1.4 Uncertainty with respect to ESAs

*Issue:* Previous inventories have classified ESAs based on photo-interpretation with insufficient field verification.

*Strategies:* Studies are underway to confirm or reclassify ESAs, with the objective of confirming the corresponding net-down factors for future timber supply analyses.

#### A1.1.5 ICH Growth and Yield

*Issue:* Knowledge of the stand dynamics of managed and partially harvested stands is inadequate in the ICH zone.

*Strategy:* not identified

#### A1.1.6 Product objectives

*Issue:* (MP 9 p72, mentions "goals for future product objectives" – what are these goals?)

*Strategy:* not stated

### A1.2 Habitat Issues

#### A1.2.1 Fisheries

*Issue:* Riparian management areas have been classified on TFL 3 facilitating operational planning of reserve and management zones.

*Strategy:* On some historically fish-bearing streams, the licensee has undertaken a Fish Habitat Assessment Procedure (FHAP) which will identify target areas and identify restoration strategies.



#### A1.2.2 Slocan River Restoration

*Issue:* The fishery on the Slocan River is in decline. [Issue?]

*Strategy:* The *Slocan River Restoration Project* (FRBC funded) will attempt to improve the fishery, water quality, and ecosystem health within the Slocan River.

#### A1.2.3 Connectivity

*Issue:* Maintenance of connectivity of late successional ecosystems throughout various topographical conditions and disturbance patterns in order to provide a continuous occurrence of specific ecosystems.

*Strategy:* A connectivity strategy has been developed for the TFL. Late successional attributes will be stressed on the connecting areas and immature forest will be managed to ensure desirable structural components.

#### A1.2.4 Ungulate Winter Range

*Issue:* Winter range for deer and elk is important in the TFL and past operations have avoided harvesting in these areas.

*Strategy:* not stated

#### A1.2.5 Grizzly Bear

*Issue:* Grizzly bear habitat and population densities are not well understood in the Slocan Valley. [Issue? Impact on cut? Retention?].

*Strategy:* SFP has initiated a study to assess grizzly bear populations through DNA analysis across a portion of the Selkirk Mountains that includes TFL 3 and SFP's forest licences.

### A1.3 Watersheds

#### A1.3.1 Water Quality

*Issue:* not stated

*Strategy:* The Slocan Forest Products Water Quality Inventory was undertaken as part of a program to assess the impacts of forest harvesting on water quality, assess general water quality trend, and develop water quality objectives. Paired-plot sampling of similar watersheds will be used to assess the impacts of forest practices.

#### A1.4 Employment Issues (none supplied)

#### A1.5 First Nations Issues (none supplied)

#### A1.6 Forest Health

##### A1.6.1 White Pine Blister Rust

*Issue:* SFP is committed to having white pine as a commercially viable species on the TFL



*Strategies:*

- planting disease resistant stock to regenerate white pine on ICHmw2 and ICHdw sites
- treatment (pruning?).
- SFP will combine a “hazard and risk” survey with stocking surveys to develop a knowledge base of white pine on the unit. In order to study the productivity, dynamics and resistance of white pine on the TFL, sample plots will be established in natural and planted stands.

#### A1.6.2 Armillaria

*Issue:* Root rot has been identified by the MoF as a concern in TFL 3.

*Strategies:*

- Avoidance planting -- SFP is investigating regenerating white pine within areas of Armillaria infection due to its resistance to infection.
- Stumping or push-over harvesting to reduce inoculum.
- Plant alternative species, including hardwoods.
- Biological control (eg. *Hypholoma fasciculare*)

#### A1.6.3 Spruce Bark Beetle

*Issue:* Spruce bark beetle are endemic throughout the TFL.

*Strategies:*

- Avoid high stumps, windthrown trees, logs left in the woods, extensive soil damage, improper cutting boundary layout.
- Reduced rotation ages
- Sanitation logging of infested areas

#### A1.6.4 Mountain Pine Beetle

*Issue:* Mountain pine beetle are endemic throughout the TFL

*Strategies:*

- Trapping
- Felling and burning, or treatment with insecticide of individual trees
- Small patch logging and clearcutting

#### A1.6.5 Spruce Weevil

*Issue:* The Operational Adjustment Factor (OAF2) pertaining to forest health was increased from the usual 5% to 10% for regenerated spruce-leading stands to account for volume losses from the



spruce weevil. Measures to reduce damage and volume losses from the spruce weevil would contribute to an increased harvest level.

*Strategies:*

- Reduce planting of spruce.
- Use weevil-resistant stock if available
- Sanitation spacing
- Allow for overtopping of spruce by brush to reduce weevil infestation
- Conduct trials on the efficacy of alternative strategies

#### A1.6.6 Douglas-fir Beetle

*Issue:* Douglas-fir beetle are endemic throughout the TFL.

*Strategies:* to be discussed at the workshop



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## Appendix 2

# The Timber Supply Context of Silviculture in the TFL 3

The objective of this section is to identify aspects of the timber harvesting land base and its management that govern the supply of timber from the TFL. This information provides the basis for identifying the constraining mechanisms that shape the timber supply forecast for the unit and for specifying possible silvicultural remedies. Unless otherwise indicated, the data in section is drawn from the TFL 3 Timber Supply Analysis (1993) and Addendum (1995).

Timber supply is the rate at which timber is made available for harvesting, and it is “made available” through natural, administrative, and economic processes. The forest economy draws timber from the land base in response to consumer demand, and this flow of timber is limited by the rate at which the forest can physically grow trees, and by a variety of administrative constraints. The combined effect of these administrative constraints is incorporated in the Annual Allowable Cut (AAC).

The base case of the timber supply review (MP 9) forecasts future timber supply subject to current administrative constraints and assuming present market conditions. The purpose of this section is to identify the “pinch points” and constraining mechanisms that shape the timber supply forecast for the unit. Observations drawn from the MP 9 base case and selected sensitivity analyses are used to describe the timber supply dynamics of the management unit and to suggest how silviculture treatments might enhance timber supply.

### A2.1 TFL 3 Timber Supply History

#### Pre Management Plan 9

TFL 3 was originally awarded to Passmore Lumber Co. Ltd. in 1950. The original TFL 3 was allocated 79 652 hectares, of which 30 466 hectares was considered the timber harvesting land base (THLB), with a harvest of 50 970 m<sup>3</sup> per year (Figure A2-1, dashed line).

In 1963 TFL 3 was assigned to Pacific Logging Ltd. who in turn constructed a new sawmill near the town of Slokan. By 1970 the TFL was assigned to Triangle Pacific Forest Products Ltd. Between 1969 and 1971 the AAC increased from 65 129 m<sup>3</sup> per year to 126 693 m<sup>3</sup> per year (Figure A2-1, dashed line). The increase can be credited to the change from intermediate utilization to close utilization standards.

Slokan Forest Products Ltd (Slokan) was assigned TFL 3 in 1978. In 1979 MP No. 6 was issued allowing a harvest of 119 618 m<sup>3</sup> per year (Figure 2-3, dashed line) from a THLB of 37 539 hectares – 79 687 for the productive land base. The increase in the THLB can be accounted by improved inventory techniques resulting in the re-classification of the TFL land base.

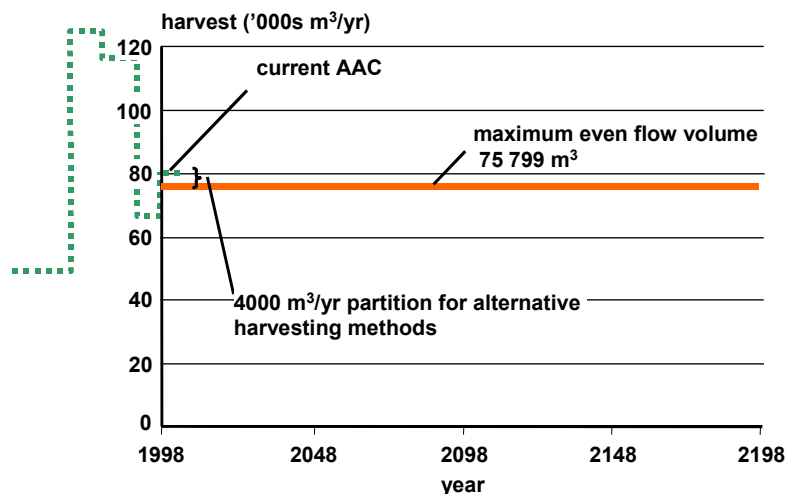
MP No. 8 was drafted for the periods between June 30, 1993 and December 31, 1997, with an AAC of 65 000 m<sup>3</sup> per year (Figure A2-1, dashed line). The large decrease in the harvest level from 119 618 m<sup>3</sup> per year (MP No. 6) to 65 000 m<sup>3</sup> per year (MP No. 8) was attributed to forest cover considerations brought about by the Nelson Region Habitat Guidelines – now replaced by the Forest Practices Code Guidelines (Figure A2-1, dashed line). Guidelines coupled with the spatial distribution of stands in 1993 restricted the short-term timber supply. Under MP No. 8, 5 400 m<sup>3</sup> was administered under the Small Business Forest Enterprise Program (SBFEP).



### Post Management Plan 9

The 1998 MP 9, upon which the current AAC determination was based, forecasts an even-flow harvest level of 75 799 m<sup>3</sup> per year maintained in perpetuity (Figure A2-1, solid line). The even-flow harvest level is maintained by an even-flow harvest constraint – at no time in the planning horizon can the harvest level be above or below the previous period. The solid line does not include 4 000 m<sup>3</sup> associated with alternative areas, or 5 400 m<sup>3</sup> administered under the SBFEP program. The partitioned harvest associated with alternative areas accounts for harvesting occurring in varying forest types, operability classes, or distinct areas. The 4 000 m<sup>3</sup> per year associated with alternative areas is from 1 860 hectares located outside of the THLB. The sensitivity analysis run for this area demonstrated that harvesting this partition was sustainable, and it was decided to add this volume to the current AAC. SFP has identified 42 000 m<sup>3</sup> for harvest in their current forest development plan.

Figure A2-1. Pre and Post Management Plan 9 harvest forecasts, TFL 3



### A2.2 Rationing of Current Mature Timber

Figure A2-2 illustrates the estimated accelerated harvest resulting from removing the even-flow constraint. The predicted volume falls until 60 years from now. At this time the harvest level evens out when managed stands start to come on-line. This indicates that mature timber must be rationed until this time - 60 years from now - when managed stands start to contribute to the harvest forecast.



Figure A2-2. Predicted accelerated harvest, TFL 3 1998

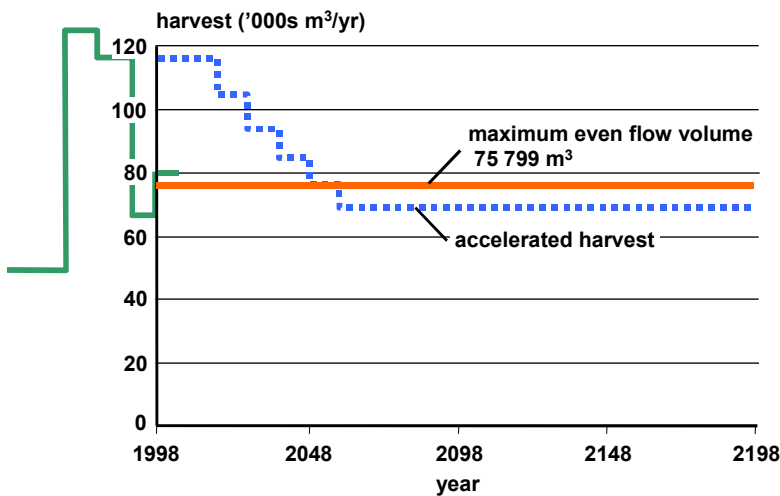
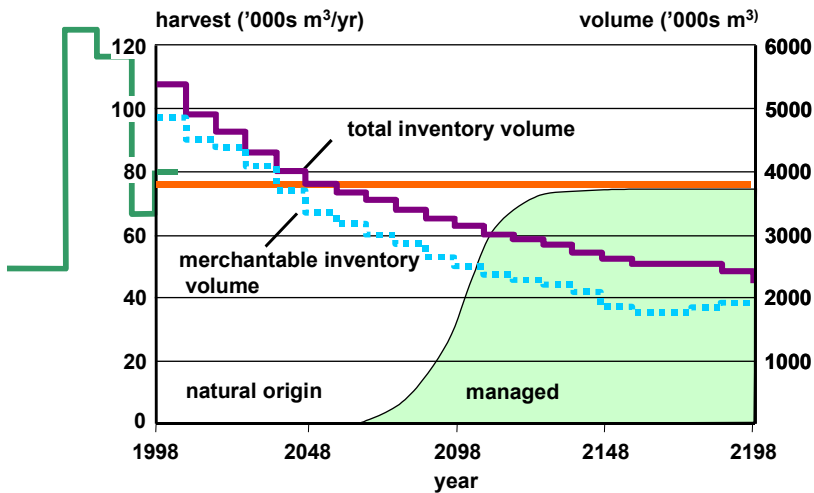


Figure A2-3. Total merchantable and available growing stock, TFL 3 1998



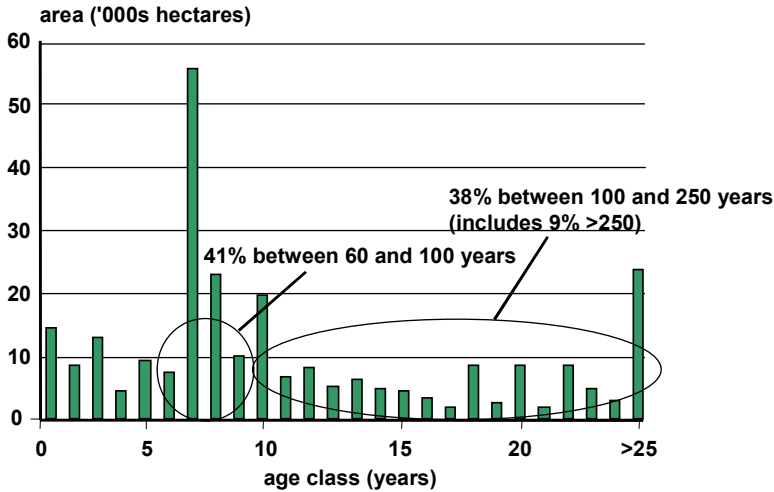
### A2.3 Transition from Natural to Managed Stands

The transition of the harvest from old growth to predominantly second growth is also plotted on Figure A2-3. Note that this transition line is an estimate – this information was not reported from the MP 9 analysis. The transition curve helps identify the response framework for Type 1 and Type 2 Silviculture Analyses– the end of the mid term and beginning of the long term is the point at which the harvest is predominantly dependent on managed stands. We have identified year 2098 (100 years from now) as the end of the mid-term for the TFL. The short term is arbitrarily defined as the first 20 years.



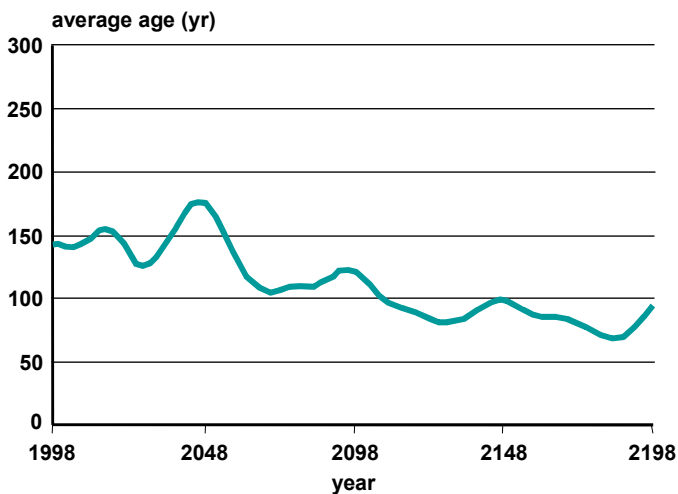
To maintain the current harvest level, the existing mature stands must be rationed until later periods when the transition from natural to managed stands occurs. There is sufficient mature timber which allows the harvest level to be maintained until managed stands come on-line (Figure A2-4).

**Figure A2-4. Current dominant age class ranges, THL 3 1998**



The average harvest age declines during the planning horizon (Figure A2-5). As the harvest shifts from mature stands to managed stands; average harvest age will decline.

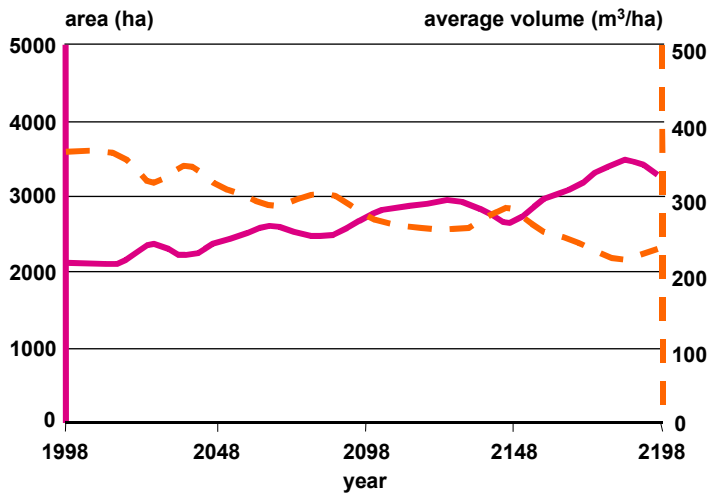
**Figure A2-5. Average harvest age, TFL 3 1998**





Average area harvested increases during the planning horizon (Figure A2-6). The reason for the increase is that increased area is required to account for less volume attained from younger stands. Average volume harvested decreases throughout the planning horizon. As the harvest shifts to younger stands the average volume harvested will decrease because the harvest will not capture as much volume as it did from harvesting older mature stands.

**Figure A2-6. Average area and volume harvested**



## A2.4 Sensitivity Analysis

### Sensitivity to Existing and Regenerated Volume Estimates

The even flow constraint means that that the harvest cannot be increased (decreased) at any point in the 200 year planning period without increasing (decreasing) the harvest over the entire planning period. Consequently, increasing the yields of managed timber should not, in itself, increase the level of harvest as managed timber will not be harvested until the mid term. However, increasing the yields from managed stands that will be harvested in the transition releases rationed currently mature timber that that can be harvested early in the planning period. In fact, the sensitivity analysis (Table A2-1) indicates that an increase of 10% in the yields of managed stands will increase the even-flow harvest level by 4.7%.

In theory, under the even-flow harvest rule, increasing the volume of existing stands should not have any effect of the rate of harvest as existing stands will be harvested only until the transition and the remainder of the planning period receives no benefit. However, the sensitivity analysis shows that increasing existing stand volumes by 10% increase the even-flow cut by 4.4%. This is probably an interaction of a short, fixed planning horizon and imbalances in the age class structure.

### Adjusting Minimum Harvest Age

The sensitivity analysis shows that as minimum harvest age is increased by 10 years, the even-flow harvest level rises 5%. One interpretation for this that during the transition, the average



harvest age drops close to the minimums (see Figure A2.5). If the minimums are less than age of culmination of MAI, then increasing the minimums will increase the even-flow harvest level.

**Table A2-1. Conventional land base sensitivity analysis results, TFL 3 1998**

description		% difference from base run
existing stand volume	+10% , -10%	+4.4 , -4.3
regenerated stand volume	+10% , -10%	+4.7 , -5.2
cover constraints	+10% , -10%	+1.1 , -2.3
minimum harvest age	+10yrs , -10yrs	+5.0 , -2.4
green-up height	+2m , -2m	-4.9 , +3.1
land base	+10% , -10%	+9.1 , -9.8
high elevation green up equals 2m		+0.2
adjusted old-growth site index		+6.0

#### Insensitivity to Cover Constraints

Sensitivity analyses were utilized to gauge the impacts of further cover constraints. When cover constraints were lessened or increased the percent difference from the base case did not significantly fluctuate. If forest cover constraints are tightened the constraints will be met without a drastic decline in the harvest level because of the abundance of mature stands. Additional mature stands can be set aside to meet cover constraints without significantly affecting the harvest level.

#### Sensitivity to Land Base Adjustments

Various silvicultural activities, shifts in forest product objectives and administrative constraints can be interpreted as bringing land into the timber harvesting land base and so the TSR sensitivity analyses of the effect of increasing the timber harvesting land base (Table A2-1) will provide information on the magnitude of the benefits. Increasing (decreasing) the timber harvesting land base by 10% increases the timber supply forecast by 9.1% (9.8%).

### A2.5 Timber Supply Dynamics – Summary

The main constraint on timber supply is the even-flow (TSR harvest flow constraint) rule imposed by the TSR analysis. This constraint rations substantial volumes of existing mature timber from unmanaged stands until managed stands are ready for harvest. The rationing mechanism (TSR harvest flow constraints) can also be used to convey back to the future timber supply benefits resulting from manipulating forest-level parameters. Silvicultural practices that modify minimum harvest ages, stand yields, and the extent of timber harvesting land base will have varying effects on timber supply.

Relaxing administrative constraints such as increasing access to additional portions of the TFL and timber harvesting land base could have far-reaching effects on the timber harvest forecast.



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## Appendix 3

# Summary of Issues Requiring Investigation

During the workshop's consideration of TSA issues, strategies and silvicultural regimes, a number of additional issues were identified that require investigation. These issues are listed in Table A3-1 in the order of priority established by the participants.

**Table A-3.1 Issues identified in the workshop that require investigation.**

Priority	Issue
1	<b>Non-commercial brush and deciduous stands.</b> Identify location of NCB <sub>r</sub> (non-commercial brush) and deciduous-leading stands.
2	<b>Fertilization at planting.</b> Investigate efficacy of fertilization at planting using fertilizer "tea-bag" near seedling.
3	<b>Ungulate winter range (UWR).</b> Review/investigate methods for harvesting and regeneration on UWR for mule deer, white-tailed deer and elk. Require silviculture strategy in UWR -- silvicultural systems and practices to maintain or enhance UWR attributes.
4	<b>Long-term product objectives.</b> Develop quality and product objectives for TFL 3. Potential products include clearwood premium, J grade, spruce and hemlock clears. Need to reconcile product objectives with site capabilities and risk.
5	<b>Very high elevation reforestation.</b> Design and implement an adaptive management strategy to explore alternatives for successful reforestation above 1700 m in ESSF.
6	<b>OGSI.</b> Confirm/investigate for TFL 3.
7	<b>Confirm minimum harvest age.</b> Some workshop participants are concerned that 150 m <sup>3</sup> (used in timber supply analysis) is too low, and believe that 270m <sup>3</sup> is a more realistic minimum volume to economically harvest. Need to determine if a 70 year old stand has 150 m <sup>3</sup> or if volume is actually higher at that age.
8	<b>Partial harvesting in ICH.</b> Investigate research in G&Y (including effects of different levels of root rot) with respect to basal area retention.
9	<b>Espacement trials.</b> Undertake trials for cedar, hemlock and larch to develop regimes that meet quality objectives.
10	<b>Inventory netdowns.</b> Develop appropriate netdowns for inventory to replace ESAs.
U <sup>1</sup>	<b>Fertilization trials.</b> Continue and expand fertilization trials to include other species and develop operational fertilization guidelines. Underway
U	<b>Vegetation Resources Inventory.</b> Complete phase 1 of VRI for TFL 3 and begin phase 2. Underway

<sup>1</sup>U – not ranked



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## **Appendix 4**

# **Summary of Cost and Employment Assumptions**

Table A4-1 Summary of cost and employment assumptions for silviculture activities, TFL 3 Slocan Forest Products Ltd.

Activities	Area ha/year	Cost \$/ha	Jobs Pdays/ha	Cost Estimate Source
<b>Surveys</b>				
survey backlog current status	1	32	0.1	Arrow Forest District
survey (general, 3x program)		32	0.1	Arrow Forest District
	1,342	32	0.1	Area weighted average
<b>Site Preparation</b>				
site prep	79	845	2.0	Arrow Forest District
site prep to warm soil	25	845	2.0	Arrow Forest District
burn to stimulate forage production	12	845	2.0	Arrow Forest District
	116	845	2.0	Area weighted average
<b>Planting</b>				
plant large stock	296	153	0.5	Boundary Forest District
plant with improved seed	50	80	0.5	Boundary Forest District
plant with improved seed, large stock	50	233	0.5	Boundary Forest District
plant to higher stocking with preferred species	--	--	--	
plant mixed resistant species; allow percentage of deciduous; avoidance planting and increased stocking where possible	125	537	0.5	Nelson Forest Region average, Annual Report
plant larch, pines, Fd; vexar tubes; plant in slash	25	537	0.5	Nelson Forest Region average, Annual Report
planting in clusters (open canopy for forage)	25	537	0.5	Nelson Forest Region average, Annual Report
plant disease resistant stock; space out diseased trees (sanitation spacing); prune remaining Pw; CT infected Pw; at final harvest leave seed trees	10	537	0.5	Nelson Forest Region average, Annual Report
plant mixed species; higher non-spruce percentage; selective brushing to manage overstory	50	537	0.5	Nelson Forest Region average, Annual Report
	631	297	0.5	Area weighted average
<b>Fertilization</b>				
fertilization at planting	10	150	0.5	Arrow Forest District; Arrow TSA Workshop
fertilization at planting	4	150	0.5	Arrow Forest District; Arrow TSA Workshop
	14	150	0.5	Area weighted average
<b>Brushing</b>				
brush for survival 5x (assume max 2x per year)	76	1300	5.0	Arrow Forest District; Arrow TSA Workshop
brush for survival 1x	56	650	2.5	Arrow Forest District; Arrow TSA Workshop
brushing (survival) 2x	50	1300	5.0	Arrow Forest District; Arrow TSA Workshop
brushing 1x	25	650	2.5	Arrow Forest District; Arrow TSA Workshop
brushing (growth) 1x	25	650	2.5	Arrow Forest District; Arrow TSA Workshop
brushing (growth) 1x	25	650	2.5	Arrow Forest District; Arrow TSA Workshop
	257	968	3.7	Area weighted average
<b>Spacing</b>				
density control -- plant or space	25	1130	3.5	Arrow Forest District; Arrow TSA Workshop
spacing	50	1130	3.5	Arrow Forest District; Arrow TSA Workshop
	75	1130	3.5	Area weighted average
<b>Pruning</b>				
prune 2 lifts	25	725	6.0	Arrow Forest District; Arrow TSA Workshop
<b>Harvesting Activities</b>				
commercial thin				
harvest merch volumes	12			
partial cutting - patch cuts or group selection where feasible;	20			
clearcut with reserves	105			
push-over logging	10			
patch and small clearcuts	25			
partial cutting; slashing; single tree selection	2			
harvesting within grizzly bear habitat	25			
partial harvesting with up to 30% removal	4			
salvage harvest; plant mixed	20			



## Appendix 5 Workshop Feedback— TFL 3 Slocan Forest Products

Please circle the number that best represents your view.

	5	4	3	2	1
1 Length of session	too long		just right		too short
		(4)	(2)		
2 Level of detail of content	too much		just right		not enough
	(1)	(3)	(2)		
3 Instructional method (style, interaction, clarity)	excellent		adequate		poor
	(2)	(4)			
4 Relevance to your interests/needs	extremely		average		not at all
	(6)				
5 Extent to which your needs were met	entirely		average		not at all
	(1)	(5)			
6 Usefulness of the handout graphics and texts	very		adequate		useless
	(4)	(2)			
7 Usefulness of the workshop in general	very		adequate		useless
	(3)	(3)			

### What were the strengths of this workshop?

Very thorough. Allowed for thoughtful and important discussion.

Good local knowledge & broad input.

Great discussion. Provided silviculture directions and objectives covering multi-resources and issues. Forced to ask “why” have we been doing this? Is it right?

Extremely well constructed, prepared and organized and presented a difficult task that was presented very well and delivered very effectively.

Great use of computer graphics/excel program to record regime tables, etc.

Experience from other workshops. Interactions.

Very useful in current and future direction and planning that has been extremely beneficial.

### What were the weaknesses of this workshop?

Too much detail sometimes.

Sometimes drifted off-course. Missing mill/management perspective.

Move workshop along faster.

### How could this workshop be improved?

Maybe shorter.

Direct the discussion sometimes to speed progress.

Less complexity and detail in initial 2 hours of day one, as time was restrictive.

Shorten introduction – too much detail on what is to happen. Give basics and dive in.



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## Appendix 6

# Executive Summary of *The Incremental Silviculture Strategy For British Columbia (Interim)*

### STRATEGY AT A GLANCE

<b>Purpose</b>	This strategy provides guidance to the application of available funds for incremental silviculture activities. It is not tied to a specified funding level.
<b>Government's Goals</b>	<ul style="list-style-type: none"><li>• Sustainable Use</li><li>• Community Stability</li><li>• A Strong Forest Sector</li></ul>
<b>Key Principles</b>	<ol style="list-style-type: none"><li>1. Because the distant future cannot be foretold, the best and only course of action in managing the timber resource is that which minimizes risk and maintains options.</li><li>2. British Columbia's forests are important locally, provincially, nationally and globally and should be managed in this context.</li><li>3. Each generation of British Columbians becomes the steward of the province's forest resources and has a moral obligation to preserve this heritage for future generations.</li></ol>
<b>Working Targets</b>	<p>Within the context of the guiding principles:</p> <p>WT 1: Minimize the anticipated interim reduction in timber supply so that provincial annual harvests of at least 65 million m<sup>3</sup> can be achieved during this period.</p> <p>WT 2: Create a long term timber supply capable of supporting a steady long term provincial harvest level of at least 75 million m<sup>3</sup>.</p> <p>WT 3: Over the long term, maintain the production of premium quality logs at or above 10% of total harvest.</p>
<b>Major Silvicultural Strategies</b>	<ul style="list-style-type: none"><li>• Increase the use of alternative silvicultural systems and commercial thinning.</li><li>• Achieve earlier green-up of harvested areas.</li><li>• Increase regenerated stand volumes 20%.</li><li>• Eliminate all pre-1982 good and medium site backlog NSR and all 1982 to 1987 backlog NSR.</li><li>• Initiate a long rotation quality management program for stands where harvesting must be delayed.</li></ul> <p>Other silvicultural and non-silvicultural strategies must also be implemented to achieve the working targets.</p>
<b>Strategy Implementation</b>	Regional and management unit strategies must be developed, followed by programs and plans to implement them.