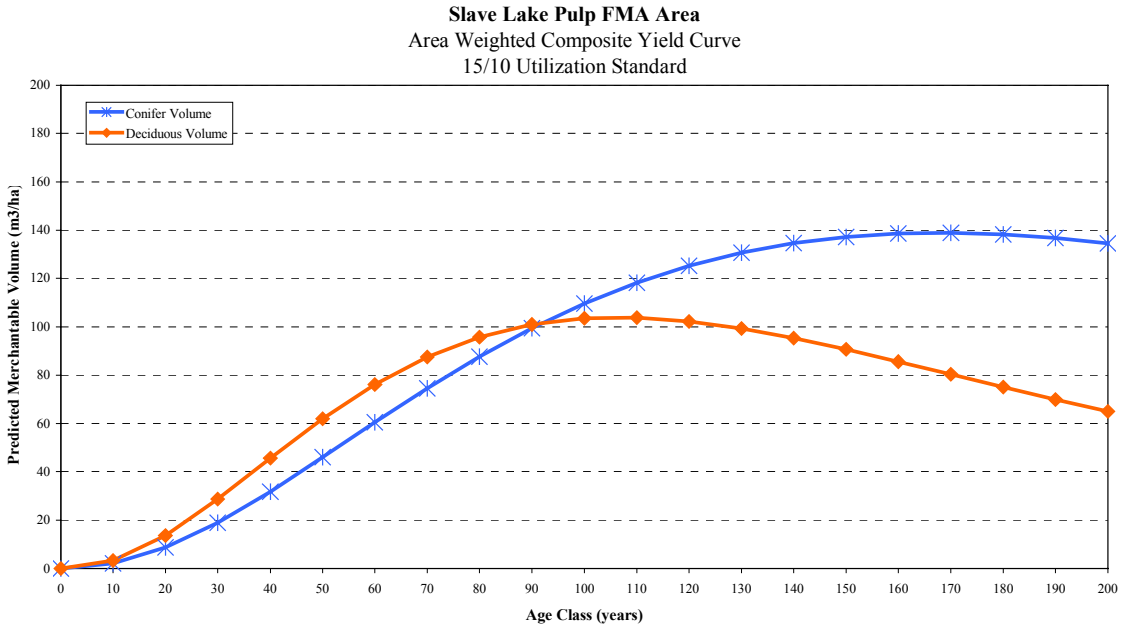
Figure H-4: FMA Area-Weighted Composite Yield Curve



H.2.2 Cull Deductions

The DFMP planning team was consulted regarding the cull factors historically encountered in the FMA area. The following cull deductions were applied to the yield curves in the timber supply analysis.

Table H-2: Cull Deductions

FMU	Conifer Cull Deductions	Deciduous Cull Deductions
S1S	2.0%	10.0%
S1	2.0%	N/A
S2S	2.0%	10.0%
S2	2.0%	N/A
S6S	1.5%	10.0%
S6	1.5%	N/A

H.2.3 Yield Curve Transition

Three yield strata transitions were applied in the analysis:

- *The status quo transition assumes all stands regenerate to the same yield strata;*
- *The DFMP transition used in this analysis was determined by the DFMP planning team and is presented below (Table H-3).*
- *The DFMP transition was revised to incorporate managed stand (stand density management) regenerated yields for approximately half of the pure conifer, pine dominant stands (see Table H-4).*

Table 3: DFMP Yield Strata Transitions

Yield Curve Number	Species Group	Natural[1] Region	Crown Closure	Yield Curve Strata	Transition Curve Strata	Transition Curve Number	Moisture Regime	Non-forested[2] Understorey
1	C-SW	10	ALL	C-SW-10	C-SW-10-FS	101	N/A	N/A
2	C-SB	10	ALL	C-SB-10	C-SB-10	2	N/A	N/A
3	C-PL	10	ALL	C-PL-10	C-PL-10-FS	103	N/A	N/A
4	C-SW	1, 2, 11	ALL	C-SW-MX	C-SW-MX-FS	104	N/A	N/A
5	C-SB	1, 2, 11	ALL	C-SB-MX	C-SB-MX-FS	105	N/A	N/A
6	C-PL	1, 2, 11	ALL	C-PL-MX	C-PL-MX-FS	106	N/A	N/A
7	CD	ALL	A, B	CD-AB	CD-CD	8	N/A	N/A
8	CD	ALL	C, D	CD-CD	CD-CD	8	N/A	N/A
9	DC	ALL	A, B	DC-AB	DC-CD	10	N/A	N/A
10	DC	ALL	C, D	DC-CD	DC-CD	10	N/A	N/A
11	D	ALL	A, B	D-AB	D-CD	12	N/A	N/A
12	D	ALL	C, D	D-CD	D-CD	12	N/A	N/A
13[3]	D	ALL	A, B	D-AB	D-AB	13	Wet	Yes

[1] Natural subregions defined as follows: 1 = Central Mixedwood, 2 = Dry Mixedwood, 10 = Upper Foothills, and 11 = Lower Foothills.
[2] Non-forested understories identified as: SSP1 = 'SC' or 'SO' or SNONFOR = 'HG' or 'HF'.
[3] The predicted volumes for this yield curve are identical to yield curve 11. This yield curve is only identified for transition purposes.

Table 4: Stand Density Management (SDM) Yield Strata Transitions

Yield Curve Number	Species Group	Natural[4] Region	Crown Closure	Yield Curve Strata	Transition Curve Strata	Transition Curve Number	Timber Prod. Rating	Moisture Regime	Non-forested[5] Understorey
1	C-SW	10	ALL	C-SW-10	C-SW-10-FS	101	ALL	N/A	N/A
2	C-SB	10	ALL	C-SB-10	C-SB-10	2	ALL	N/A	N/A
3	C-PL	10	ALL	C-PL-10	C-PL-10-FS	103	ALL	N/A	N/A
3[6]	C-PL	10	ALL	C-PL-10	C-PL-10-SDM	203	Good & Medium	N/A	N/A
4	C-SW	1, 2, 11	ALL	C-SW-MX	C-SW-MX-FS	104	ALL	N/A	N/A
5	C-SB	1, 2, 11	ALL	C-SB-MX	C-SB-MX-FS	105	ALL	N/A	N/A
6	C-PL	1, 2, 11	ALL	C-PL-MX	C-PL-MX-FS	106	ALL	N/A	N/A
6[7]	C-PL	1, 2, 11	ALL	C-PL-MX	C-PL-MX-SDM	206	Good & Medium	N/A	N/A
7	CD	ALL	A, B	CD-AB	CD-CD	8	ALL	N/A	N/A
8	CD	ALL	C, D	CD-CD	CD-CD	8	ALL	N/A	N/A
9	DC	ALL	A, B	DC-AB	DC-CD	10	ALL	N/A	N/A
10	DC	ALL	C, D	DC-CD	DC-CD	10	ALL	N/A	N/A
11	D	ALL	A, B	D-AB	D-CD	12	ALL	N/A	N/A
12	D	ALL	C, D	D-CD	D-CD	12	ALL	N/A	N/A
13[8]	D	ALL	A, B	D-AB	D-AB	13	ALL	Wet	Yes

A summary of the procedures employed to develop the stand density management (SDM) yield curves is available under separate cover. A map illustrating the location of the stands allocated to the SDM transition is provided on the next page.

[4] Natural subregions defined as follows: 1 = Central Mixedwood, 2 = Dry Mixedwood, 10 = Upper Foothills, and 11 = Lower Foothills.
[5] Non-forested understories identified as: SSP1 = 'SC' or 'SO' or SNONFOR = 'HG' or 'HF'.
[6] Approximately 50% of the pure conifer, pine dominant stands were assigned to managed stand (stand density management) regenerated yield curves.
[7] Approximately 50% of the pure conifer, pine dominant stands were assigned to managed stand (stand density management) regenerated yield curves.
[8] The predicted volumes for this yield curve are identical to yield curve 11. This yield curve is only identified for transition purposes.

Rge 16 | Rge 15 | Rge 14 | Rge 13 | Rge 12 | Rge 11 | Rge 10 | Rge 9 | Rge 8 | Rge 7 | Rge 6 | Rge 5 | Rge 4 | Rge 3

Ranger

SLAVE LAKE PULP

STAND DENSITY MANAGEMENT AREAS

Scale = 1:375 000

Twp 73 | Twp 72 | Twp 71 | Twp 70 | Twp 69 | Twp 68 | Twp 67

LESSER SLAVE LAKE

KINUSO

EAST PRAIRIE METIS SETTLEMENT

GRIZZLY RIDGE WILDLAND PARK

SKI HILL

MITSUE LAKE

LESSER SLAVE RIVER

LESSER SLAVE LAKE PROVINCIAL PARK

FMU S1S

FMU S2S

FMU S17W

FMU S6S

GOOSE MOUNTAIN ECOLOGICAL RESERVE

SWAN HILLS

Fawcett River

ATHABASCA RIVER

PLANIMETRIC LEGEND

- Village/Hamlet
- Campgrounds
- Paved Roads
- Gravel Roads
- Tertiary Roads
- Perennial Stream
- Intermittent Stream
- Indefinite Stream
- Lakes/Major Rivers
- Towns
- Parks
- First Nations Reserves
- Metis Settlements
- Net Landbase Deletions
- Net Landbase - Not Selected For Cut
- Cutblocks
- 1998 Burn Boundary
- Chisholm Burn Boundary

STAND DENSITY MANAGEMENT (SDM)

- Good and Medium Pine Stand - Stand Selected for SDM
- Good and Medium Pine Stand - No SDM
- Good and Medium Pine Stand - No SDM (Cutblock)

Map Version 1.00
Map Date May 13, 2002
Silvacom Ref #: H-018
Map File:
../maps_new/sdm_map

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H.3 Timber Supply Analysis

This section summarizes the results and assumptions applied in the determination of the annual allowable harvest levels for the Slave Lake Pulp Forest Management Agreement area.

H.3.1 Models Used

H.3.1.1 LRSYA

Long run sustained yield average (LRSYA) is a measure of forest productivity and is calculated as the sum of growth per year of regenerated stands at a selected rotation age. It is derived from the theoretical concept of a regulated forest with a static and uniform age class distribution, a single rotation age and a single yield function operating across equally productive sites. Under this assumption, the annual harvest equates to the annual growth in the oldest age class. LRSYA was calculated using the following formula:

$$LRSYA = \sum_{1}^{i} MAI_i \bullet A_i$$

Where:

LRSYA=		long run sustained yield average (m^3/yr)
MAI_i	=	mean annual increment (m^3/ha/yr) for yield class 'i'
A_i	=	net area (ha) for yield class 'i'
i	=	yield class

H.3.1.2 Harvest Simulation

SILVASYM is Silvacom's proprietary timber supply simulation model. The model simulates the effect of management strategies on sustainable harvest levels over a specified planning horizon. In its most basic form, SILVASYM is a model, which cuts and grows each stand in the forest, according to user-defined yield functions and forest policy constraints. SILVASYM maintains a full spatial link to the net landbase GIS coverage and attribute file over the entire planning horizon. Operating unit sequencing can also be introduced to reflect "real-world" limitations such as accessibility and multi-pass harvesting rules. Adjacency constraints can also be applied on a stand-by-stand basis to:

- *Control the distribution (or concentration) of the harvest and;*
- *Mimic operational planning strategies.*

A number of sorting rules are available which define the harvest priorities assigned to each stand (e.g. cut oldest first). The simulation model uses binary search methods to assess harvest levels. Average harvest age and post harvest forest conditions are evaluated at the end of each simulation to determine whether the even-flow harvest levels are too low or too high. Reports and GIS map products can be produced for each scenario to evaluate the condition of the forest throughout, and at the end of the planning horizon.

H.3.2 Harvest Simulation Parameters

A brief summary of some of the run control parameters that were available for use in the timber supply analysis is provided in Table H-5.

Table H-5: Run Control Parameter Definitions Used in Analysis

CONSTRAINT	DEFINITION
FMA/FMU	Description of the administrative area under analysis.
Planning horizon:	Total time period for the analysis scenario (years).
Targeted average harvest age at the end of the planning horizon:	Average age (years) of stands scheduled for harvest in the last twenty years of the planning horizon, typically with a specified tolerance.
Minimum harvest age:	Minimum age of stands that are eligible for harvest scheduling, may vary by yield stratum (years).
Landbase:	Landbase available for analysis (discrete, single…).
Sorting rules:	Factors used to prioritize stands for harvest sequencing (e.g. oldest first).
Harvest flow constraint:	Scheduled harvest level of the primary species between harvest periods (may have tolerances applied).
Yield curve sets:	Predicted yields for individual strata (15/10-utilization standard).
Cull deductions:	Percent reduction of predicted yields, to account for losses due to defect.
Regeneration transition:	Assumptions applied for the regeneration of stands scheduled for harvest.
Introduce harvest plans:	Incorporation of existing harvest plans into the harvest sequence.
Spatial stand adjacency:	The process of protecting other resource values by spatially identifying and scheduling inventory polygons (stands) that share a boundary.
Adjacency: Time horizon:	Total time period that stand adjacency is incorporated into the analysis (years).
Adjacency: Green-up:	The time period applied restricting the harvest of adjacent polygons (years).
Adjacency: Accumulate adjacent stands:	Maximum total area of adjacent stands scheduled for harvest in the same harvest period.
Modulation	Reduces the annual variability in the harvest of the secondary species by distributing the "peaks" in secondary harvest flow to periods with little or no secondary harvest.
Operating unit sequencing:	Prioritization of administrative planning units for harvest scheduling.
Number of operating units open simultaneously:	Number of operating units available for harvest scheduling at any given time.

H.3.3 Timber Supply Analysis Results

The results of the final timber supply scenarios are presented in this section. A summary of the final TSA sensitivity scenarios is provided in the following table.

Table H-6: TSA Sensitivity Analysis Results

Section	Description	Conifer AAC (m^3/yr – 15/10 utilization standard)	Deciduous AAC (m^3/yr – 15/10 utilization standard)
H.3.3.2	Single Pass	586,000	549,230
H.3.3.3	Two Pass	549,000	501,599
H.3.3.4	Two Pass step up to FS LRSYA	549,000 (yr. 1-80) 567,787 (yr. 81-160)	502,579
H.3.3.5	Single pass with harvest constraints*	586,000	547,587
H.3.3.6	Single pass with harvest constraints and SDM	593,500	543,132
H.3.3.7	Single pass with harvest constraints and SDM and carry-over volume	722,000 (yr. 1-5) 593,500 (yr. 6-160)	543,194
H.3.3.8	Single pass with harvest constraints and SDM and carry-over volume, for 10 years then step down to two pass	722,000 (yr. 1-5) 593,500 (yr. 6-10) 549,000 (yr. 11-160)	503,307
H.3.3.9	Single pass with harvest constraints and SDM for 10 years then step down to single pass	593,500 (yr. 1-10) 586,000 (yr. 11-160)	547,785

* ***Harvest constraints*** refers to the introduction of spatial constraints to the harvest sequence. The constraints were introduced to accomplish the following:

- *Introduce existing harvest plans into the sequence,*
- *Restricting harvest in burn islands for 20 years,*
- *Introduce sequence of stands in the southwest portion of S6 for DFMP phase-in,*
- *Balance of 20 year cover type harvest profile*
- *Re-distribution of harvest in the vicinity of Mooney Creek over 20 year period,*
- *Ensure that the 50% watershed threshold constraint is achieved,*
- *Deferral of harvest in four operating units with little scheduled harvest (i.e. operating units with less than 200 ha sequenced for harvest in first ten years).*

The scenario presented in section H.3.3.7 is the Preferred Forest Management Strategy. This strategy is described in detail in Chapter 8.

H.3.3.1 Required Analysis - LRSYA Estimates by FMU

Table H-7: Long Run Sustained Yield Average Estimates (15/10 utilization standard)

FMU	Net Area (ha)	Net Conifer LRSYA (m^3/yr)		Net Deciduous LRSYA (m^3/yr)	
		Status Quo Regeneration Transition	Fully Stocked Regeneration Transition	Status Quo Regeneration Transition	Fully Stocked Regeneration Transition
S1	179	83	95	0	0
S1S	181,615	197,171	229,432	202,451	228,242
S2	619	755	800	0	0
S2S	172,839	205,413	245,305	135,704	151,490
S6	1,814	2,355	2,598	0	0
S6S	78,298	77,518	89,557	107,515	117,863
FMA	435,364	483,295	567,787	445,671	497,595

H.3.3.2 Required Analysis – Single Pass

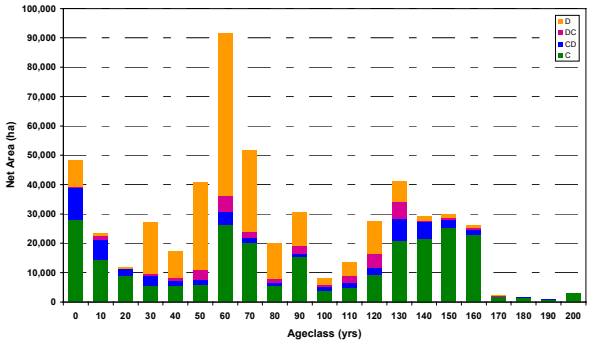
Table H-8: Run Control Parameters – Single Pass

CONSTRAINT	SIMULATION PARAMETER
FMU	FMA (S1S, S2S, S6S) + S1, S6, S2
Planning horizon	160 years
Targeted average harvest age at the end of the planning horizon:	80+/-5
Minimum harvest age:	1) Conifer 70 Years 2) Deciduous 50 Years
Landbase	Single Landbase
Sorting rules:	1) Oldest First 2) Modulate deciduous flow 3) Maximize conifer harvest
Harvest flow constraint:	Dual Even flow
Yield curve sets:	Nonlinear plot based - 15/10 utilization
Cull deductions:	Applied – 2% Conifer (1.5% conifer in S6S + S6), 10% deciduous
Yield curves:	Net yield curves
Regeneration transition:	DFMP Team Transition
Introduce harvest plans:	Yes
Spatial stand adjacency:	Not applied
Adjacency: Time horizon:	Not applied
Adjacency: Green-up:	Not applied
Adjacency: Accumulate adjacent stands:	Not applied
Modulation	Applied
Operating unit sequencing:	Not applied
Number of compartments open simultaneously:	Not applied

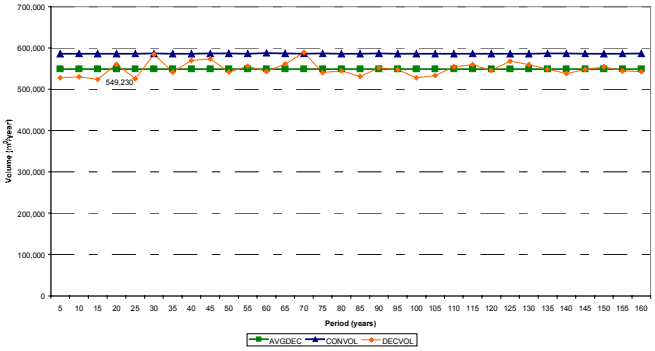
Table H-9: TSA Results – Single Pass

Conifer Harvest Level (m^3/yr – 15/10 utilization standard)	Deciduous Harvest Level (m^3/yr – 15/10 utilization standard)
586,000	549,230

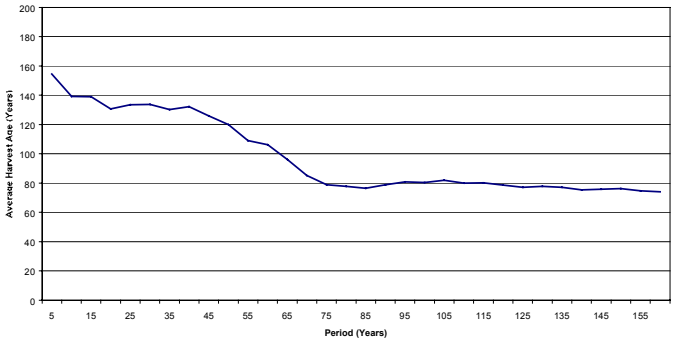
Initial Age Class Distribution



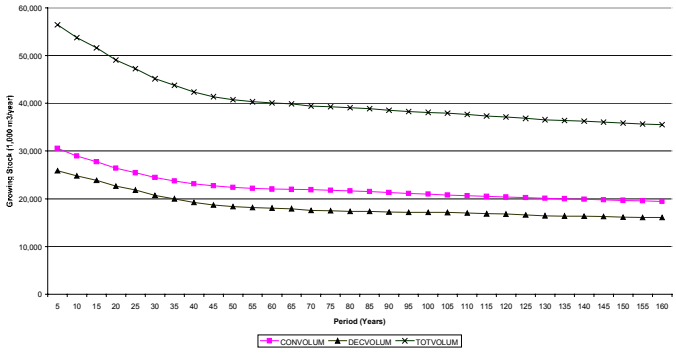
Harvest Flow Summary



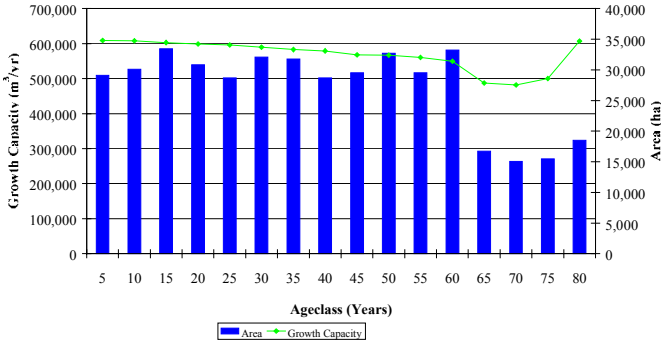
Average Harvest Age



Growing Stock



Forest Structure After 160 Years



Graph Descriptions

Initial age class distribution: Current net area in each ten-year age class, by cover group.

Harvest flow summary: Illustrates the scheduled coniferous and deciduous harvest volume by five-year period over the planning horizon.

Average harvest age: Summary of the area-weighted average age of all stands scheduled for harvest in each five-year period, over the planning horizon.

Growing stock: Summary of total, conifer and deciduous merchantable volume on the net landbase, by five-year period, over the planning horizon.

Forest structure after 160 years: Projected structure of the net landbase after 160 years. The age class distribution (bars) and harvest age volume (growth capacity – line symbol) associated with each age class are presented.