Integrated Stewardship Strategy for the Mackenzie TSA

Tactical Plan

Version 1.0

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Project 419-35

Prepared by:

Forsite Consultants Ltd.
330 – 42nd Street SW
PO Box 2079
Salmon Arm, BC V1E 4R1
250.832.3366

FORSITE
Forest Management Specialists

Prepared for:

BC Ministry of Forest, Lands and Natural Resource Operations
Resource Practices Branch
PO Box 9513 Stn Prov Govt
Victoria, BC V8W 9C2

BRITISH COLUMBIA

Executive Summary

The tactical plan document is the fifth in a series of documents developed through the Integrated Stewardship Strategy (ISS) for the Mackenzie TSA initiated by the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. The Tactical Plan integrates three plans generated by the Combined Scenario analysis for the Mackenzie ISS: reserve, harvest, and silviculture plans. Ultimately, it provides operational direction and bridges strategic, forest-level analyses, and operational planning processes.

This document describes the approach used to develop the tactical plan and summarizes the key results for the first 20 years of the planning horizon. In addition to this document, spatial datasets were prepared for scheduled and eligible activities, along with detailed statistics in an accompanying MS Excel file that includes detailed statistics of the key indicators that can be monitored over time.

In the first 5 years of the tactical plan, the forest estate model harvested approximately 95,000 ha. By the end of year 20, the harvested area declined to 69,000 ha. With an annual budget of $3 million, the modelled results indicated that the enhanced basic silviculture tactic treated the most area overall. It helped ameliorate the mid-term trough by increasing the volume available for harvest, lowering minimum harvest ages, and shifting stands throughout the planning horizon. The reserve plan locked a total of 10,494 ha (<1%) of the total timber harvesting landbase from being harvested over the first 40 years of the planning period; including the entire 20 years for Tactical Plan.

TSB	Harvested Area (ha)				Rehabilitation (ha)				Fertilization (ha)				Enhanced Silviculture (ha)			
	Years 1-5	Years 5-10	Years 11-15	Years 16-20	Years 1-5	Years 5-10	Years 11-15	Years 16-20	Years 1-5	Years 5-10	Years 11-15	Years 16-20	Years 1-5	Years 5-10	Years 11-15	Years 16-20
16A	7,865	2,451	2,514	3,074	138	176	210	282	26	69	317	656	8	153	826	1,020
16B	3,531	2,648	3,534	4,488	401	416	402	274	7	51	55	30	55	171	522	691
16C	2,219	3,007	3,211	2,122	287	210	244	137	74	97	136	162	77	336	403	492
16D	3,891	6,619	6,739	4,184	588	962	686	306	102	130	134	108	206	625	1,855	1,139
16E	685	974	842	521	12	26	12	26	0	0	0	0	5	15	80	95
16F	64	25	84	189	0	0	0	0	0	1	0	0	0	0	0	0
16G	2,521	2,336	3,595	7,150	50	0	18	0	0	0	0	0	0	0	0	2
16H	8,843	13,059	12,809	6,078	192	227	233	141	59	82	8	60	66	599	1,539	1,081
16I	10,939	13,533	7,976	9,445	1,015	984	691	766	77	282	541	520	178	788	1,096	1,439
16J	8,861	10,064	2,526	3,508	592	624	308	225	22	84	131	35	80	489	177	306
16K	7,513	5,775	2,337	2,880	485	446	231	302	0	3	22	329	22	95	70	24
16L	5,041	6,208	4,791	3,443	947	873	371	461	73	208	551	423	39	278	471	488
16M	8,738	7,035	6,699	9,919	1,186	1,565	1,952	1,618	282	258	350	542	129	680	1,614	2,998
16N	17,054	10,846	8,605	4,216	3,202	1,961	637	618	186	105	273	343	199	379	1,455	673
16O	7,229	5,378	9,562	7,470	1,633	796	697	823	104	381	657	815	39	518	1,707	2,572
16P	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Total	**94,996**	**89,957**	**75,823**	**68,689**	**10,727**	**9,266**	**6,694**	**5,978**	**1,011**	**1,750**	**3,175**	**4,024**	**1,103**	**5,127**	**11,815**	**13,020**

These results are intended to guide planners towards stands where more detailed fieldwork can be done to assess potential treatment opportunities. Documenting the assumed operational criteria now and tracking how these are implemented over the next few years will assist in improving future modelling exercises that explore strategies to improve timber and non-timber values throughout the Mackenzie TSA.

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Document Revision History

Version	Date	Notes/Revisions
1.0	March 31, 2018	First version distributed to project team for review and comment.

1 Introduction

The British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) initiated an Integrated Stewardship Strategy (ISS) – sustainable forest management analysis – in the Mackenzie Timber Supply Area (TSA). This document is the fifth in a series of seven documents prepared through the ISS process and describes the tactical plan developed over the first 20 years of the planning horizon. The Tactical Plan integrates three plans generated by the Combined Scenario analysis for the Mackenzie ISS: reserve, harvest, and silviculture plans. Ultimately, it provides operational direction and bridges strategic, forest-level analyses, and operational planning processes. In addition to this document, spatial datasets were prepared for scheduled and eligible activities, along with detailed statistics in an accompanying MS Excel file that includes detailed statistics of the key indicators that can be monitored over time.

2 Data Gathering and Preparations

Data used for this project were derived from modelling outputs of the Combined Scenario analysis. Results were queried and linked to generate spatial data for the first 4 periods of the planning horizon (i.e., total of 20 years grouped into 5-year periods; labelled in all tables as the last year of each period). These results included treatment availability, as well as, the full extent of treatment areas scheduled. The spatial datasets were prepared similarly to operational planning datasets where scheduled blocks can be analyzed on additional operational criteria (e.g., potential benefits to non-timber values, the amount of remaining green volume, site productivity, distance from communities, access difficulties, and proximity to appropriate seed sources). Given the large number of landscape units and timber supply block numbers with Mackenzie TSA (Figure 1), this document includes succinct summaries of the indicators. Detailed statistics for each of the indicators are included in the accompanying MS Excel document.

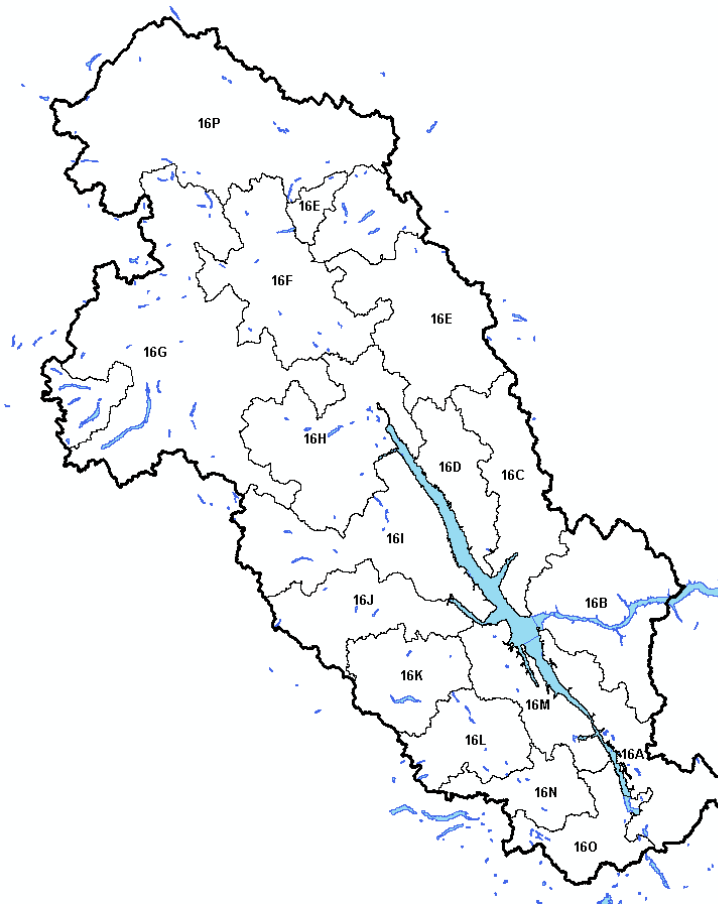


Figure 1 Timber Supply Blocks within Mackenzie Timber Supply Area

3 Reserve Plan

The Reserve Plan was designed to answer the question, "Where and how should we reserve forested stands to address landscape-level biodiversity and non-timber values while minimizing impacts to the working forest?" The underlying purpose of this scenario was to explore tactics aimed at maintaining the harvest area while providing a wide range of values on the land base (i.e., co-location). Candidate reserves were selected through a forest modelling exercise that assessed the combined score for each stand relative to multiple landscape-level thresholds and grouped them to maintain an appropriate spatial patter. In the Combined Scenario, these candidate reserves were locked from harvesting for the first 40 years of the planning period; including the entire 20 years of the Tactical Plan.

The area of the candidate reserves in the Timber Harvesting Land Base (THLB) that were locked for the first 40 years is 10,494 ha (<1% of the total THLB) (Table 2, seral stage definition in Table 1). Note that approximately 75 ha did not have an assigned BEC (i.e., 21 ha THLB; 54 ha Non-Harvestable Land Base (NHLB)). While the seral stage classification could not be determined accurately for these areas, the age of these areas at time zero was over 117 years. The spatial location of the candidate reserves is included in the accompanying GIS layers.

Table 1 Seral Stage Definition

BEC Grouping	Zone	Subzone	Variant	SPP	Young	Mid	Mature	Old
1,2,3	Any	Any	Any	Any	<20	20-120	>120	>140
4	Any	Any	Any	Any	<20	20-100	>100	>120
5	Any	Any	Any	Any	<20	20-100	>100	>140
6	BWBS	mw	1	Any	<20	20-80	>80	>140
6	BWBS	wk	2	con	<20	20-80	>80	>140
7	BWBS	dk	1	con	<20	20-100	>100	>140
6&7	BWBS	x	x	dec	<20	20-80	>80	>100

Table 2 Locked Candidate Reserve Areas by BEC Group and Seral Stage

Land Base Definition	BEC Group	Seral Stage				Total
		Young	Mid	Mature	Old	
THLB	1	0	2	0	0	3
	2	0	12	8	185	207
	3	0	6	5	5	19
	4	15	41	16	3,997	4,073
	5	5	14	56	1,501	1,581
	6	0	9	18	839	872
	7	1	12	31	1,863	1,914
	67	0	3	23	1,805	1,898
	Total THLB	21	98	157	10,196	10,472
NHLB	1	34	41,446	15,664	56,660	113,805
	2	3,825	211,295	132,328	567,622	915,072
	3	208	33,328	18,499	140,062	192,100
	4	3,431	39,546	17,228	59,388	119,597
	5	1,215	24,146	17,822	33,947	77,135
	6	25	4,574	4,804	1,812	11,221
	7	528	64,169	82,502	122,661	269,867
	67	4	34,317	11,637	4,979	51,004
	Total Non-THLB	9,269	452,820	300,485	987,131	1,749,705
	Grand Total	9,290	452,918	300,642	997,328	1,760,177

4 Harvest Plan

The Harvest Plan aimed to answer the question, "Which stands should be prioritized for harvest/salvage in the short-term (and what are the mid/long-term consequences of not following this strategy)?" The underlying purpose of this plan was to improve timber harvesting opportunities while mitigating the risk of economic loss to natural disturbances like insects and fire.

Mitigating risk of loss due to insects was managed via harvest partitions. A second goal of the harvest partitions was to limit harvesting of species with lower economic potential (e.g., deciduous). For these purposes, 5 harvest partitions were established through the last timber supply review process:

1. for the first 15 years, min 67% from pine-leading stands,
2. for the first 15 years, max non-pine leading at 905,000 m^3/yr,
3. for the first 15 years, max non-pine leading at 300,000 m^3/yr from the SW portion of the TSA,
4. for the entire planning horizon, max 100,000 m^3/yr deciduous, and
5. for the entire planning horizon, even-flow balsam leading stands at 92,000 m^3/yr.

Harvesting was also prioritized in stands impacted by the spruce beetle, identified by consolidated Aerial Overview Surveys (AOS); to year 2017.

Mitigating risk of loss due to fire was managed by influencing the forest estate model to prioritize harvesting stands identified with extreme risk of wildfire, for the first 10 years. To avoid harvest priority conflicts, weights were carefully balanced so that the model would favour stands impacted by insects over fire-impacted stands with an acceptable impact on harvest flow (i.e., up to 1.6%).

Harvest opportunities were explored to a maximum 5-hour, one-way haul time to the nearest log dump or processing facility, from stands that can produce a minimum of 200 m^3/ha (average) over the entire planning horizon. Also, in each 5-year period, harvest opening sizes were controlled to reduce small openings and favour larger ones. Weights were carefully set for each size category to maintain an acceptable impact on harvest flow (i.e., up to 1.6%).

The Harvest Plan includes the following indicators:

- Harvested area relative to the 5 harvest partitions (Table 3). Note that total harvested area by year does not match other tables because there are overlaps between partitions (e.g., non-pine leading includes non-pine from SW TSA, deciduous leading, and Balsam-leading) and partitions do not cover the entire harvestable THLB.
- Harvested area by Landscape Unit, BEC Group, and Biodiversity Emphasis Option is included in the accompanying MS Excel file. Here, for reference, it is included only as harvested area by Timber Supply Block and BEC Group (Table 4 and Figure 1) and by Landscape Unit and BEC Group (Appendix 1).
- Harvested area by harvest system (Ground – slope<=35%, Cable – slope 35-46%, Cable Steep – slope >46%) (Table 5).
- Harvested area from stands identified with extreme wildfire threat (Table 6). Total THLB area with extreme wildfire threat stands is 119,715 ha.

Table 3 Harvested Area (ha) by Harvest Partition

Partition	Year 5	Year 10	Year 15	Year 20
Pl-Leading	62,477	58,783	51,025	45,468
Non-Pl-Leading	20,037	21,825	21,411	21,996
Non-Pl-Leading from SW TSA	3,846	3,928	6,962	9,413
Deciduous-Leading	2,154	2,182	2,126	2,116
Balsam-Leading	2,564	2,696	2,295	2,273
Total	91,078	89,413	83,820	81,268

Table 4 Harvested Area (ha) by BEC Group and Timber Supply Block

BEC Group	TSB	Year 5	Year 10	Year 15	Year 20
1	16B	0	4	10	4
1	16C	0	3	4	0
1	16D	4	0	2	0
1	16E	0	0	0	0
1	16G	38	11	91	92
1	16H	0	1	4	2
1	16I	0	0	0	0
1	16J	1	13	2	5
1	16K	0	0	1	0
1	16L	0	0	0	0
1	16M	0	0	0	0
1 Total		43	32	113	103
2	16B	446	498	521	556
2	16C	71	107	707	349
2	16D	603	1,197	1,151	519
2	16E	117	197	254	164
2	16F	12	0	0	0
2	16G	1,822	1,768	2,909	6,204
2	16H	1,804	3,122	3,950	2,147
2	16I	4,493	6,590	2,667	3,289
2	16J	4,753	6,168	1,466	2,203
2	16K	2,587	2,820	1,333	1,655
2	16L	1,576	2,387	1,890	1,394
2	16M	864	414	566	808
2	16N	2,145	2,084	1,663	1,488
2	16O	627	368	1,883	1,013
2 Total		21,920	27,721	20,958	21,790
3	16A	2,046	442	264	193
3	16B	925	257	233	362
3	16C	96	189	73	197
3	16D	363	609	848	433
3 Total		3,430	1,497	1,417	1,185
4	16A	593	831	763	1,447
4	16B	0	21	21	46
4	16C	1,653	2,249	1,946	1,099
4	16D	992	1,947	1,332	1,420
4	16I	3,249	3,801	1,981	2,194
4	16J	199	147	148	116
4	16L	2,724	3,396	2,734	1,928
4	16M	4,699	4,043	4,190	5,221
4	16N	14,403	8,337	6,412	2,460
4	16O	5,798	4,262	6,242	4,733

BEC Group	TSB	Year 5	Year 10	Year 15	Year 20
4 Total		34,311	29,033	25,770	20,664
5	16A	5,226	1,178	1,487	1,434
5	16B	1,644	1,169	1,616	1,961
5	16C	400	459	482	477
5	16D	1,604	2,457	3,142	1,713
5	16I	568	829	233	238
5	16J	186	405	109	203
5	16L	50	0	20	14
5	16M	3,175	2,579	1,943	3,890
5	16N	505	425	530	268
5	16O	804	749	1,437	1,724
5 Total		14,161	10,248	10,999	11,923
6	16B	514	698	1,134	1,559
6 Total		514	698	1,134	1,559
7	16B	0	0	0	0
7	16D	325	408	265	99
7	16E	566	771	586	351
7	16F	52	25	84	189
7	16G	660	556	595	853
7	16H	6,809	9,611	8,594	3,795
7	16I	2,629	2,280	3,051	3,720
7	16J	3,687	3,320	801	969
7	16K	4,799	2,905	1,000	1,222
7	16L	691	425	126	107
7 Total		20,219	20,302	15,102	11,305
6&7	16B	2	0	0	0
67	16D	0	0	0	0
67	16E	2	6	3	7
67	16F	0	0	0	0
67	16G	0	0	0	0
67	16H	230	325	261	134
67	16I	0	33	43	4
67	16J	36	10	0	12
67	16K	128	50	3	3
67	16L	0	0	21	0
67 Total		397	425	330	160
Grand Total		94,996	89,957	75,823	68,689

Table 5 Harvested Area (ha) by Harvest System and Timber Supply Block

System	TSB	Year 5	Year 10	Year 20	Year 30
Ground	16A	6,167	2,195	2,219	2,868
Ground	16B	2,981	2,171	3,089	3,325
Ground	16C	2,054	2,837	2,725	1,643
Ground	16D	3,803	6,229	5,865	3,655
Ground	16E	645	887	722	383
Ground	16F	63	20	84	189
Ground	16G	2,490	2,293	3,441	6,910
Ground	16H	8,724	12,740	11,872	5,564
Ground	16I	10,602	12,507	7,639	8,993
Ground	16J	8,376	8,591	2,311	3,098
Ground	16K	7,468	5,642	2,282	2,790
Ground	16L	5,018	6,111	4,465	3,224
Ground	16M	8,548	7,006	6,625	9,670

System	TSB	Year 5	Year 10	Year 20	Year 30
Ground	16N	17,019	10,806	8,402	4,141
Ground	16O	7,216	5,351	9,392	7,321
Ground	16P	0	0	0	1
Ground Total		91,174	85,387	71,132	63,775
Cable	16A	1,448	231	255	184
Cable	16B	408	320	383	940
Cable	16C	121	160	468	404
Cable	16D	61	330	811	469
Cable	16E	35	86	96	127
Cable	16F	1	5	0	0
Cable	16G	30	43	152	236
Cable	16H	115	304	919	490
Cable	16I	309	906	306	402
Cable	16J	416	1,212	201	392
Cable	16K	46	124	55	89
Cable	16L	21	91	311	203
Cable	16M	154	29	69	213
Cable	16N	34	37	189	74
Cable	16O	11	26	143	132
Cable Total		3,212	3,905	4,358	4,354
Cable Steep	16A	250	25	41	22
Cable Steep	16B	142	157	63	222
Cable Steep	16C	43	10	17	76
Cable Steep	16D	27	59	63	61
Cable Steep	16E	5	1	24	11
Cable Steep	16F	0	0	0	0
Cable Steep	16G	1	0	2	4
Cable Steep	16H	4	14	18	24
Cable Steep	16I	28	120	31	50
Cable Steep	16J	69	261	14	19
Cable Steep	16K	0	9	0	0
Cable Steep	16L	2	5	14	16
Cable Steep	16M	37	0	5	36
Cable Steep	16N	0	3	14	2
Cable Steep	16O	3	1	27	17
Cable Steep Total		**611**	**665**	**333**	**560**
Grand Total		**94,996**	**89,957**	**75,823**	**68,689**

Table 6 Harvested Area (ha) from Stands with Extreme Risk of Wildfire by Timber Supply Block

TSB	Year 5	Year 10	Year 15	Year 20
16A	1,531	1,518	4	27
16B	536	920	0	9
16C	1,684	1,706	68	68
16D	952	1,596	76	110
16E	249	266	2	4
16F	23	14	0	0
16G	1,014	712	0	6
16H	2,187	3,100	67	66
16I	6,082	7,995	135	262
16J	6,899	7,920	133	118
16K	3,684	2,589	15	16
16L	540	498	7	2
16M	3,363	3,584	460	436
16N	2,833	1,092	48	15
16O	559	491	2	25
Total	32,137	34,002	1,019	1,163

5 Silviculture Plan

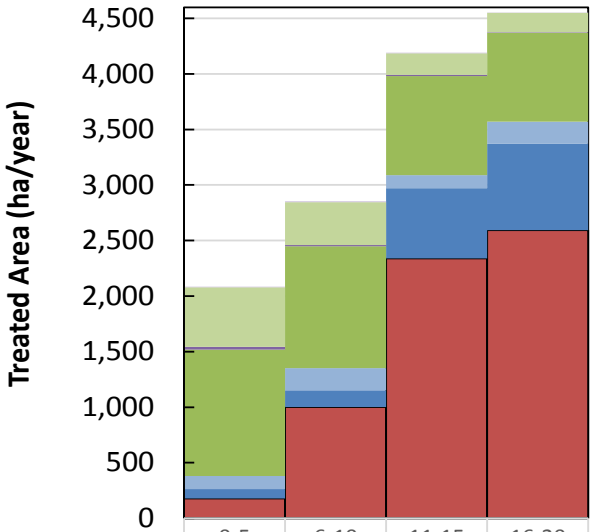
The Silviculture Plan was designed to answer the question, "Are there alternatives to current basic silviculture practices that would benefit future outcomes (both timber and non-timber)?" The underlying purpose of this plan was to explore tactics aimed to enhance timber quantity and quality over the mid- and long-term, as well as, improve biodiversity, wildlife habitat, and cultural interests. The Project Team identified 3 tactics to be explored: 1) rehabilitation of MPB/IBS impacted stands, 2) fertilization, and 3) enhanced basic silviculture. These tactics were explored by applying average treatment costs (Table 7) and a funding level of $3 million per year for the first 20 years.

Table 7 Unit costs applied for silviculture tactics

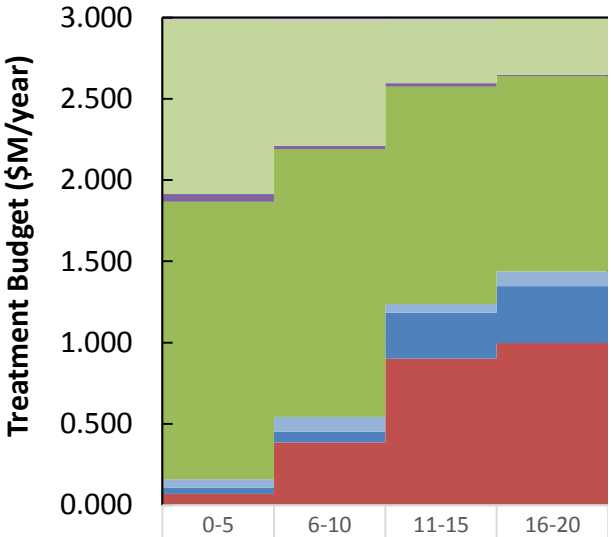
Treatment	Unit Cost	Distance Cost
Marginally Economic Rehab (≥50m³/ha)	$1,500/ha	$50/ha each extra 2 hours (one way)
Uneconomic Rehab (<50m³/ha)	$2,000/ha	$50/ha each extra 2 hours (one way)
Fertilization (1 or 2 treatments)	$450/ha each application	$25/ha each extra 2 hours (one way)
Enhanced Silviculture	$285/ha	N/A

The Silviculture Plan includes the following indicators:

- Annual funding of $3 million per year spent to support silviculture investments (Figure 2). ENH – Enhanced Silviculture, FERT_1 – Fertilization one application, FERT_2 – Fertilization two consecutive applications, RHB_ME – Rehabilitation Marginal Economic, RHB_UN – Rehabilitation Uneconomic, RHB_ME+ENH – Rehabilitation ME + Enhanced, RHB_UN+ENH – Rehabilitation UN + Enhanced.
- Area treated by BEC group and LU for each tactic: fertilization, enhanced basic silviculture, and rehabilitation (Appendix 2). Note that area fertilized twice is showed only in Years 5 and 10 because areas treated in years 15 and year 20 are identical to those in years 5 and year 10, respectively.



	0-5 years	6-10 years	11-15 years	16-20 years
RHB_UN+ENH	7	8	7	1
RHB_UN	535	384	193	176
RHB_ME+ENH	25	11	12	4
RHB_ME	1,138	1,099	891	800
FERT_2	118	200	118	200
FERT_1	84	150	631	777
ENH	179	1,001	2,340	2,592



	0-5 years	6-10 years	11-15 years	16-20 years
RHB_UN+ENH	17,031	19,583	16,674	1,757
RHB_UN	1,069,871	768,977	386,114	351,658
RHB_ME+ENH	46,653	20,617	22,014	8,125
RHB_ME	1,706,575	1,647,960	1,336,759	1,200,323
FERT_2	53,170	90,064	53,170	90,064
FERT_1	37,842	67,470	284,042	349,872
ENH	68,815	385,329	900,906	998,175

Figure 2 Silviculture Plan – Treated Area and Budget Spent

The sections below briefly describe elements considered for modelling and subsequent mapping of treatment opportunities and priorities for each of the three tactics modelled (i.e., rehabilitation, fertilization, and enhanced basic silviculture), and summarize results for area treated (e.g., in each 5-year period and by Timber Supply Block).

5.1 Rehabilitation

Rehabilitation focuses on ameliorating poorly performing stands severely impacted by MPB to provide more harvest opportunities during the forecasted timber supply shortage (mid-term) while increasing the effective landbase in the long-term.

Following the salvage period, some modelled stands do not reach the minimum harvest criteria (151 m^3/ha) to become available again for harvesting within the planning horizon. These stands effectively cease to contribute to the harvest flow (i.e., they are excluded from the THLB) unless they are rehabilitated. A continuum of stands exists within this profile where rehabilitation treatments are expected to provide uneconomic to marginally economic returns. The uneconomic stands are typically younger, small-diameter trees, higher percent dead, and require long haul distances. Marginally economic stands include some green merchantable volume, larger piece sizes to produce lumber, pulp chips, or possibly bio-fuel feed stocks. The Combined Scenario analysis showed that focusing rehabilitation on these poorly performing stands that are severely impacted by MPB provide more harvest opportunities during the forecasted timber supply shortage (mid-term) while increasing the productive THLB in the long-term.

Objectives

Rehabilitation typically involves the removal of standing and fallen trees, site preparation and reforestation of productive stands of suitable tree species. Key objectives of rehabilitation activities include:

- Accelerate the recovery of stands into productive forests that will be available for harvest sooner (e.g., younger stands without merchantable volume, including fire-damaged areas).
- Recover some merchantable (green) volume from unsalvaged stands that would not otherwise be harvested – particularly in the mid-term.
- Abate fire hazards associated with standing dead trees and damage to understory trees as the dead material falls.

Eligibility, Costs, and Responses

Criteria applied to identify and prioritize eligible stands, apply costs, and implement responses are detailed in Table 8.

Table 8 Rehabilitation Eligibility, Costs, and Responses

Element	Description	Criteria
Eligible Stands	Unlogged existing natural stands by the end of the salvage period	○ Conifer Leading ○ Slope <=35% (i.e., Ground Harvest System) ○ >=40% stand percentage dead ○ <=150m³/ha live volume at the end of salvage period, or live + dead volume during the salvage period ○ Stand Age >=40 yrs at time of MPB attack ○ BEC: SBS, ESSF ○ Inventory SI >=11
Timing	Period within the planning horizon	○ First 20 years
Treatment Response	Transition stands onto future managed stands as if harvested	○ Regular future AUs, or enhanced future AU (where stand eligibility overlaps)
Costs	Marginally Economic (>= 50m³/ha) - Harvest/Knockdown/Site Prep/Plant	○ $1,500/ha (Knockdown and Site Prep ($500/ha) and Planting ($1,000/ha))
	Uneconomic (<50m³/ha) - Knockdown/Site Prep/Plant	○ $2,000/ha (Knockdown and Site Prep ($1,000/ha) and Planting ($1,000/ha))
	Distance cost beyond 2 hrs (one way)	○ $50/ha each 2 hrs (one way)

In the field, other criteria that should be used to identify or prioritize stands include, but are not limited to: potential benefits to non-timber values, the amount of remaining green volume, site productivity, distance from communities, access difficulties, and proximity to appropriate seed sources.

Volume harvested through these rehabilitation treatments was not included in the overall harvest rate. However, some timber could be removed from these stands.

Stand response for rehabilitation was modelled by transitioning stands onto future managed stands from the treatment date. Accordingly, these responses take advantage of improved stocking, lower regeneration delay, and select seed to produce higher yields that achieve minimum harvest volumes much sooner. The Combined Scenario analysis showed that these stand regeneration improvements contribute to the harvest rate in the long-term and at the end of mid-term period. Moreover, some of the rehabilitated stands may undergo enhanced basic silviculture options that provide additional contributions to the harvest flow.

Challenges

A significant challenge with this strategy involves the identification of stands that would not otherwise regenerate into merchantable stands on their own, while maximizing return on investment. This is because the analysis data does not include some spatially-explicit, stand-level criteria required to distinguish the viability of some treatments.

Very little direct information was available to develop stand-level assumptions for rehabilitating non-salvaged stands so some aspects of the applied assumptions may not be operationally appropriate in all cases.

Operational plans for rehabilitation treatments should carefully consider potential issues related to non-timber values such as water quality where additional disturbance could exacerbate impacts from increased sedimentation.

The success of this activity depends, in part, on the proponents developing opportunities to improve utilization of merchantable material, improve markets for low quality fibre, and potentially claim carbon credits.

Results

Table 9 shows the area rehabilitated under the silviculture plan steadily decreases over the 20 year planning period.

Table 9 Rehabilitated Area by Timber Supply Block

TSB	Rehabilitation Marginally Economic (≥50 m³/ha)				Rehabilitation Uneconomic (<50 m³/ha)			
	Year 5	Year 10	Year 15	Year 20	Year 5	Year 10	Year 15	Year 20
16A	113	147	190	259	25	30	20	23
16B	347	271	314	220	54	145	89	54
16C	279	190	208	137	8	21	36	0
16D	401	828	587	282	187	134	99	24
16E	8	25	7	26	4	1	5	0
16F	0	0	0	0	0	0	0	0
16G	0	0	3	0	50	0	15	0
16H	111	193	196	131	81	34	38	10
16I	802	769	598	733	212	216	93	34
16J	479	410	205	213	113	214	103	12
16K	413	356	218	253	72	90	12	49
16L	557	608	240	283	391	265	131	178
16M	949	1,305	1,783	1,241	237	260	169	377
16N	1,785	1,141	383	325	1,417	820	254	293
16O	1,023	547	548	756	610	249	150	67
16P	0	0	0	0	0	0	0	0
Total	**7,266**	**6,789**	**5,481**	**4,859**	**3,462**	**2,477**	**1,213**	**1,119**

5.2 Fertilization

Despite the limited number of stands currently available to treat, fertilization treatments play an important role in the overall strategy. The Combined Scenario analysis showed that while fertilized stands significantly contribute to the harvest flow in the mid-term (i.e., years 35 to 55 of the planning horizon), there is no immediate incentive to fertilize since there is a time gap between the fertilization

application and final harvest. However, early and successive applications of fertilizer can improve mid-term harvest flows even more.

Objectives

Key objectives of fertilization activities include:

- Accelerate the rate of stand development, and
- Increase merchantable yield and value of stands harvested within the mid-term.

Eligibility, Costs, and Responses

Criteria applied to identify and prioritize eligible stands, apply costs, and implement responses are detailed in Table 10. Within this 20-year tactical plan, eligible stands can undergo one or two consecutive applications 10-years apart. To maximize return on investment, harvesting fertilized stands is avoided for 10 years following application.

Table 10 Fertilization Eligibility, Costs, and Responses

<table>
<tr><th>Element</th><th>Description</th><th>Criteria</th></tr>
<tr><td>Eligible Stands</td><td>Existing natural stands not impacted by MPB/IBS</td><td>○ Age 26 to 60
○ Sx + Pl >=80%
○ BEC: SBS, ESSF
○ Inventory SI >=14
○ Slope <= 35%</td></tr>
<tr><td></td><td>Existing managed stands not impacted by MPB/IBS</td><td>○ Age <=25
○ Sx + Pl >=80%
○ SBS, ESSF
○ Managed SI >=14
○ Slope <= 35%</td></tr>
<tr><td>Timing</td><td>Minimum and Maximum age defining opportunity window, for up to 2 applications, every 10 years</td><td><table><tr><th>Applications (every 10 yrs)</th><th>Age Window (yrs)</th></tr><tr><td>1</td><td>25 - 75</td></tr><tr><td>2</td><td>25 - 65</td></tr></table></td></tr>
<tr><td>Treatment Response</td><td>Growth increase 10 years after application (entire stand) – existing natural stands</td><td>10m³/ha for each application.</td></tr>
<tr><td></td><td>Growth increase 10 years after application (entire stand) – existing managed stands</td><td><table><tr><th>Applications (every 10 yrs)</th><th>Sx-Leading (m³/ha)</th><th>Pl-Leading (m³/ha)</th></tr><tr><td>1</td><td>17</td><td>17</td></tr><tr><td>2</td><td>36</td><td>34</td></tr></table></td></tr>
<tr><td></td><td>Transitions to future stands</td><td>Locked from harvesting, 10 years after last application.</td></tr>
<tr><td>Costs</td><td>Fertilization costs for all stands</td><td>$450/ha for each application.</td></tr>
</table>

Challenges

Operational plans for fertilization treatments should carefully consider potential issues related to non-timber values such as fish and water quality where riparian buffers are required to prevent fertilizer from entering streams and lakes. Additional buffers from other features and other measures may be required to address First Nations' concerns with applying fertilizer to stands within their traditional territories.

Results

Table 11 shows that fertilization activities under the silviculture plan steadily increase over the 20 year planning period.

Table 11 Fertilized Area by Timber Supply Block

TSB	One Application				Two applications*	
	Year 5	Year 10	Year 15	Year 20	Year 5/15	Year 10/20
16A	14	16	317	656	12	52
16B	5	25	55	30	2	25
16C	27	68	136	162	47	30
16D	52	41	134	108	50	89
16E	0	0	0	0	0	0
16F	0	0	0	0	0	1
16G	0	0	0	0	0	0
16H	0	17	8	60	59	65
16I	22	144	541	520	55	138
16J	2	21	131	35	20	63
16K	0	2	22	329	0	1
16L	35	57	551	423	38	150
16M	128	163	350	542	154	95
16N	37	81	273	343	149	24
16O	98	114	657	815	6	267
16P	0	0	0	0	0	0
Total	**420**	**750**	**3,175**	**4,024**	**591**	**1,001**

**The same areas treated by the end of Year 5 and Year 10, are later treated by the end of Year 15 and Year 20, respectively.*

5.3 Enhanced Basic Silviculture

Enhanced basic silviculture activities are most attractive on stands regenerated from salvage harvesting as the incremental volumes are expected to contribute to the harvest at the end of the mid-term trough. In addition to the timber supply benefits, the higher density stands developed through these treatments are expected to improve timber quality through lower knot size, reduced risk of damage from agents and climate change, and increased opportunities for future stand management.

Objective

Key objectives of enhanced silviculture activities include faster growth and increased volume from planting stands with improved seed at higher densities.

Eligibility, Costs, and Responses

Criteria applied to identify and prioritize eligible stands, apply costs, and implement responses are detailed in Table 12.

Table 12 Enhanced Silviculture Eligibility, Costs, and Responses

Element	Description	Criteria
Eligible Stands	Existing natural and managed stands.	○ Leading Species: Pl, Sx ○ BEC: SBS, BWBS ○ SI (inventory or managed): Pl stands >=17; Sx stands >=14
Timing	Period within the planning horizon	First 40 years
Treatment Response	Transition to future enhanced managed stands that remain enhanced after the 20-yr period	
	Regeneration method	100% planted
	Density	Increase to 1,700 stems/ha
	Genetic gains	No changes from current
	Regeneration delay	From 2yrs to 1yr
	OAF1	From 85% to 89%
Costs	Incremental planting of trees sown with select seed	$385/ha

Challenges

While there is currently no direct funding allocated for the enhanced basic silviculture activities, other regions have developed processes to utilize operational cost allowances through the stumpage appraisal system. Implement a similar approach here may take up to 5 years to develop.

Results

Table 13 shows that enhanced basic silviculture activities under the silviculture plan significantly increase over the 20 year planning period.

Table 13 Enhanced Basic Silviculture Treated Area (ha) by Timber Supply Block

TSB	Year 5	Year 10	Year 15	Year 20
16A	8	153	826	1,020
16B	55	171	522	691
16C	77	336	403	492
16D	206	625	1,855	1,139
16E	5	15	80	95
16F	0	0	0	0
16G	0	0	0	2
16H	66	599	1,539	1,081
16I	178	788	1,096	1,439
16J	80	489	177	306
16K	22	95	70	24
16L	39	278	471	488
16M	129	680	1,614	2,998
16N	199	379	1,455	673
16O	39	518	1,707	2,572
16P	0	0	0	0
Total	**1,103**	**5,127**	**11,815**	**13,020**

6 Discussion

This tactical plan provides guidance to forest professionals in developing operational plans that identify specific stands for treatment. It was developed using modelling outputs from the ISS Combined Scenario. It must be stressed that the spatial data used to develop the Combined Scenario were typically forest-level inventories and direct applications for operational and stand-level planning are limited. Rather, these data are appropriate for guiding planners to areas where more detailed fieldwork can be done to assess potential treatment opportunities. Ultimately, following the tactical plan should provide the best chance for achieving the future forest condition presented in the Combined Scenario.

The exercise of incorporating operational criteria into the tactical plan highlighted new constraints that could be added to future stewardship strategies. Documenting the assumed operational criteria now and tracking how these are implemented over the next few years will assist in improving future modelling exercises that explore strategies to improve timber and non-timber values throughout the Mackenzie TSA.

In addition to this document, this tactical plan includes spatial datasets prepared for scheduled and eligible activities, along with detailed statistics in an accompanying MS Excel document.

Appendix 1 Harvested Area by BEC Group and Landscape Unit

BEC Group	LANDSCAPE UNIT NAME	Year 5	Year 10	Year 15	Year 20
1	Aiken	0	0	0	0
1	Akie	0	0	0	0
1	Akie River	0	0	0	0
1	Blackwater	0	0	0	0
1	Buffalohead	0	1	0	1
1	Chunamon	0	0	0	0
1	Collins - Davis	4	0	2	0
1	Connaghan Creek	0	0	0	0
1	Discovery	0	0	0	0
1	Duckling	0	0	0	0
1	Eklund	0	0	0	0
1	Gaffney	0	0	0	0
1	Germansen Mountain	0	0	0	0
1	Ingenika	0	0	0	0
1	Jackfish	0	0	0	0
1	Klawli	0	0	0	0
1	Lower Akie	0	0	0	0
1	Lower Ospika	0	3	4	0
1	Mesilinka	0	0	0	0
1	Nabesche	0	0	0	2
1	Nina Creek	0	0	1	0
1	Obo River	0	0	13	15
1	Osilinka	1	13	2	5
1	Pelly	0	0	2	3
1	Pesika	0	0	0	0
1	Schooler	0	3	0	1
1	Swannell	0	0	2	2
1	Thutade	38	11	78	74
1	Tutizza	0	0	0	0
1	Twenty Mile	0	0	0	0
1	Upper Ospika	0	0	0	0
1	Wicked River	0	2	10	0
1 Total		**43**	**32**	**113**	**103**
2	Aiken	205	46	45	219
2	Akie	10	71	203	31
2	Akie River	13	9	120	57
2	Blackwater	421	424	548	746
2	Buffalohead	923	1,685	2,008	749
2	Chase	0	0	0	1
2	Chunamon	2,942	4,374	1,009	869
2	Clearwater	344	251	205	241
2	Collins - Davis	691	1,314	1,422	619
2	Connaghan Creek	12	80	33	4
2	Discovery	184	244	24	262
2	Duckling	223	241	81	281
2	Eklund	141	230	146	177
2	Finlay-Russel	0	0	0	2
2	Gaffney	1,774	1,814	1,540	2,023
2	Germansen Mountain	432	254	238	366
2	Gillis	478	925	631	651
2	Ingenika	146	213	291	279
2	Jackfish	340	406	8	38
2	Klawli	677	655	799	390
2	Lower Akie	52	67	8	12
2	Lower Ospika	12	44	299	159
2	Lower Pesika	0	7	18	1
2	Manson River	154	151	192	56

BEC Group	LANDSCAPE UNIT NAME	Year 5	Year 10	Year 15	Year 20
2	McCusker	0	0	0	0
2	Mesilinka	1,014	1,764	1,287	1,743
2	Nabesche	0	70	47	160
2	Nina Creek	136	122	294	122
2	North Ingenika	522	633	603	285
2	Obo River	145	344	849	755
2	Omineca	18	80	6	4
2	Osilinka	4,638	5,984	1,422	1,903
2	Pelly	484	461	877	687
2	Pesika	83	169	183	105
2	Philip	1,707	1,457	2,362	1,017
2	Philip Lake	44	36	104	48
2	Schooler	102	175	253	154
2	Selwyn	0	1	15	1
2	South Firesteel	0	0	0	0
2	South Germansen - Upper Manson	373	449	252	336
2	Swannell	126	189	224	392
2	Thutade	1,182	1,126	1,711	5,091
2	Tutizza	363	459	339	413
2	Twenty Mile	802	689	121	189
2	Upper Ospika	5	8	138	152
2 Total		**21,920**	**27,721**	**20,958**	**21,790**
3	Clearwater	833	94	175	80
3	Collins - Davis	363	609	848	433
3	Heather Dina Lake	10	0	0	0
3	Kennedy	29	18	94	42
3	Lower Ospika	66	140	17	92
3	Misinchinka	897	337	75	57
3	Morfee	79	0	8	10
3	Nabesche	54	74	86	280
3	Parsnip	1,031	91	87	85
3	Pine Pass	0	0	0	0
3	Selwyn	41	89	18	36
3	Wicked River	27	46	10	71
3 Total		**3,430**	**1,497**	**1,417**	**1,185**
4	Blackwater	4,811	4,097	4,480	5,326
4	Chunamon	3,238	3,795	1,977	2,193
4	Collins - Davis	1,589	2,888	1,520	1,646
4	Connaghan Creek	222	302	407	5
4	Eklund	106	143	112	43
4	Gaffney	7,644	5,918	5,028	2,527
4	Gillis	7	0	0	0
4	Heather Dina Lake	0	0	0	0
4	Jackfish	0	0	2	1
4	Kennedy	0	0	7	4
4	Klawli	715	383	363	304
4	Lake	9	22	14	28
4	Lower Ospika	911	1,256	1,351	767
4	Manson River	504	867	647	197
4	Misinchinka	65	34	182	237
4	Morfee	51	128	80	54
4	Muscovite	0	16	12	5
4	Nabesche	125	53	256	70
4	Nation	2,365	1,125	690	333
4	Osilinka	173	85	29	10
4	Parsnip	464	584	446	659
4	Philip	10,355	7,032	7,305	4,940
4	Philip Lake	819	260	458	794

BEC Group	LANDSCAPE UNIT NAME	Year 5	Year 10	Year 15	Year 20
4	Selwyn	0	6	20	13
4	South Germansen - Upper Manson	84	22	76	4
4	Tudyah A	26	2	134	298
4	Tudyah B	9	13	35	174
4	Tudyah Lake	0	2	0	0
4	Upper Ospika	20	0	140	32
4 Total		**34,311**	**29,033**	**25,770**	**20,664**
5	Bijoux Falls	4	6	0	1
5	Blackwater	3,755	3,185	3,341	5,757
5	Chunamon	568	829	233	238
5	Clearwater	1,252	576	798	692
5	Collins - Davis	1,777	2,556	3,310	1,829
5	Eklund	31	96	16	29
5	Gaffney	609	555	225	104
5	Heather Dina Lake	0	0	0	0
5	Kennedy	43	31	26	27
5	Lake	3	5	19	19
5	Lower Ospika	205	305	120	282
5	Manson River	1	0	14	12
5	Misinchinka	2,038	777	712	982
5	Morfee	107	30	45	59
5	Nabesche	35	143	380	282
5	Nation	26	38	10	43
5	Omineca	0	0	0	6
5	Parsnip	3,036	358	774	395
5	Philip	298	281	401	128
5	Pine Pass	1	1	0	3
5	Selwyn	355	397	555	795
5	Wicked River	18	81	20	240
5 Total		**14,161**	**10,248**	**10,999**	**11,923**
6	Lake	0	0	0	2
6	Nabesche	71	59	411	871
6	Schooler	439	638	694	644
6	Selwyn	4	1	29	43
6 Total		**514**	**698**	**1,134**	**1,559**
7	Aiken	275	280	244	328
7	Akie	302	215	476	145
7	Akie River	31	36	168	143
7	Blackwater	0	12	33	0
7	Buffalohead	1,835	3,725	4,371	1,271
7	Chase	15	7	0	1
7	Chunamon	734	900	444	992
7	Collins - Davis	472	593	594	425
7	Discovery	665	349	103	195
7	Duckling	1,187	285	215	92
7	Ed Bird Estells Lake	0	0	2	1
7	Eklund	222	33	9	0
7	Finlay-Russel	52	14	4	0
7	Germansen Mountain	60	45	82	15
7	Gillis	665	744	94	158
7	Ingenika	1,623	2,142	1,108	986
7	Jackfish	1,409	1,071	108	112
7	Lower Akie	397	336	10	92
7	Lower Pesika	167	271	218	50
7	Mesilinka	1,593	1,092	2,335	2,336
7	Nina Creek	434	119	303	709
7	North Ingenika	1,428	2,186	1,080	273
7	Obo River	263	160	229	327

BEC Group	LANDSCAPE UNIT NAME	Year 5	Year 10	Year 15	Year 20
7	Omineca	180	112	49	16
7	Osilinka	3,404	3,260	724	868
7	Pelly	1,137	766	868	490
7	Pesika	352	651	558	241
7	South Germansen - Upper Manson	464	390	128	85
7	Swannell	166	86	59	87
7	Thutade	96	134	367	702
7	Tutizza	102	56	42	119
7	Twenty Mile	488	231	79	46
7 Total		**20,219**	**20,302**	**15,102**	**11,305**
67	Aiken	0	0	2	2
67	Akie	96	42	31	32
67	Akie River	0	2	0	1
67	Blackwater	0	0	0	0
67	Buffalohead	66	93	98	28
67	Chase	0	0	0	0
67	Chunamon	0	34	2	0
67	Collins - Davis	2	28	61	45
67	Discovery	0	0	0	0
67	Duckling	0	0	0	0
67	Ed Bird Estells Lake	0	0	0	0
67	Eklund	0	0	0	0
67	Finlay-Russel	0	0	0	0
67	Gillis	42	0	0	0
67	Ingenika	37	26	34	23
67	Jackfish	33	33	0	2
67	Lake	0	0	0	0
67	Lower Akie	25	4	2	0
67	Lower Pesika	0	6	0	0
67	Mesilinka	0	33	38	2
67	Nabesche	0	0	0	0
67	Nina Creek	0	0	0	0
67	North Ingenika	5	88	34	3
67	Omineca	47	18	0	0
67	Osilinka	36	10	0	12
67	Pelly	0	7	0	0
67	Pesika	0	0	3	9
67	Schooler	2	0	0	0
67	Selwyn	0	0	0	0
67	South Germansen - Upper Manson	0	0	23	0
67	Swannell	0	0	0	0
67	Thutade	0	0	0	0
67	Tutizza	0	0	4	0
67	Twenty Mile	5	0	0	0
67 Total		**397**	**425**	**330**	**160**
Grand Total		**94,996**	**89,957**	**75,823**	**68,688**

Appendix 2 ***Silviculture Plan Treated Area by BEC Group and Landscape Unit***

BEG Group	LANDSCAPE UNIT NAME	Enhanced Silviculture				Fertilization One Application				Fert Two App		Rehabilitation ME				Rehabilitation UN			
		Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20
0	No Treatment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	No Treatment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Aiken	0	0	0	0	0	1	9	32	0	0	88	0	10	0	17	0	8	0
2	Akie	0	0	0	0	0	0	0	0	0	0	0	0	14	0	1	0	0	0
2	Akie River	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0
2	Blackwater	0	0	0	0	0	0	19	87	0	0	4	52	9	3	50	6	9	0
2	Bluff Creek	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Braid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Buffalohead	0	0	0	0	0	17	2	60	57	61	42	51	124	49	87	13	31	0
2	Chase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Chunamon	0	0	0	0	0	23	9	12	0	7	172	191	174	86	57	52	12	12
2	Clearwater	0	0	0	0	0	0	0	0	0	0	79	53	42	35	14	51	31	3
2	Collins - Davis	0	0	0	0	18	21	32	40	0	4	32	100	111	14	42	67	23	1
2	Connaghan Creek	0	0	0	0	0	0	0	0	0	0	0	1	19	0	0	0	8	0
2	Discovery	0	0	0	0	0	0	0	0	0	0	20	11	0	22	6	2	0	1
2	Duckling	0	0	0	0	0	0	0	0	0	1	14	2	6	46	0	0	0	0
2	Ed Bird Estells Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Eklund	0	0	0	0	0	0	0	0	2	1	10	15	0	5	2	2	20	4
2	Finlay-Russel	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2	Frog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Frog-Gataga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Gaffney	0	0	0	0	4	0	116	220	0	9	232	213	80	178	141	95	8	123
2	Germansen Mountain	0	0	0	0	0	0	0	0	0	0	132	68	113	121	18	29	0	0
2	Gillis	0	0	0	0	0	0	0	329	0	0	110	183	56	18	5	33	8	54
2	Ingenika	0	0	0	0	0	0	0	0	2	4	5	31	14	0	3	3	0	0
2	Jackfish	0	0	0	0	0	2	0	0	0	0	29	1	0	0	0	2	0	12
2	Klawli	0	0	0	0	1	1	76	0	0	0	78	44	11	6	44	13	0	0
2	Kwadacha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Kwadacha Addition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Lower Akie	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0
2	Lower Ospika	0	0	0	0	2	7	0	7	0	0	6	9	77	19	0	0	0	0
2	Lower Pesika	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2	Manson River	0	0	0	0	0	0	2	37	0	2	3	31	3	0	0	2	7	0
2	McCusker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Mesilinka	0	0	0	0	0	2	58	51	26	11	310	213	226	181	23	42	32	13
2	Nabesche	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0
2	Nina Creek	0	0	0	0	0	0	0	1	0	0	32	0	9	0	0	0	0	1
2	North Firesteel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	North Ingenika	0	0	0	0	0	0	6	0	0	0	21	23	19	59	34	10	22	0
2	Obo River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Omineca	0	0	0	0	0	0	0	0	0	0	8	6	0	0	1	0	0	0
2	Osilinka	0	0	0	0	1	14	98	35	19	33	431	301	167	153	87	99	93	3

BEG Group	LANDSCAPE UNIT NAME	Enhanced Silviculture				Fertilization One Application				Fert Two App		Rehabilitation ME				Rehabilitation UN			
		Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20
2	Ospika Cones	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Pelly	0	0	0	0	0	0	0	0	0	0	2	0	2	5	0	0	0	7
2	Pesika	0	0	0	0	0	0	0	0	0	0	7	25	8	26	0	3	5	0
2	Philip	0	0	0	0	0	0	96	253	0	3	332	137	62	76	161	118	152	102
2	Philip Lake	0	0	0	0	0	0	6	8	2	0	9	0	10	0	2	0	0	0
2	Schooler	0	0	0	0	0	0	0	0	0	0	9	6	27	5	3	0	10	0
2	Selwyn	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
2	South Firesteel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	South Germansen - Upper Manson	0	0	0	0	0	0	0	0	0	0	75	147	56	69	1	2	0	18
2	Swannell	0	0	0	0	0	0	0	0	0	0	35	53	24	10	2	0	0	3
2	Tatlatui	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Thutade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Tutizza	0	0	0	0	0	0	0	0	0	0	35	109	6	81	2	9	0	0
2	Twenty Mile	0	0	0	0	0	0	22	0	0	0	129	54	2	42	32	43	2	16
2	Upper Akie River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Upper Gataga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Upper Ospika	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Upper Pelly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Total	**0**	**0**	**0**	**0**	**0**	**26**	**88**	**550**	**1,170**	**108**	**138**	**2,497**	**2,132**	**1,484**	**1,309**	**838**	**696**	**479**	**374**
3	Clearwater	0	0	0	0	0	1	0	0	0	0	10	2	20	0	0	0	0	0
3	Collins - Davis	0	0	0	0	0	2	2	16	16	6	38	114	131	5	86	22	22	0
3	Heather Dina Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Kennedy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Lower Ospika	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
3	Misinchinka	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
3	Morfee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Nabesche	0	0	0	0	0	0	0	0	0	0	21	5	1	0	0	0	0	0
3	Parsnip	0	0	0	0	0	0	0	1	0	0	0	4	1	0	0	0	0	0
3	Pine Pass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Selwyn	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
3	Upper Ospika	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Wicked River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Total	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**16**	**16**	**6**	**73**	**126**	**153**	**6**	**86**	**22**	**23**	**0**
4	Blackwater	91	416	984	1,357	81	139	266	329	24	37	787	812	1,338	1,019	99	109	127	343
4	Chunamon	117	560	542	642	20	90	326	340	6	79	173	273	174	356	108	110	34	9
4	Collins - Davis	129	469	732	618	51	0	21	78	21	31	139	412	219	192	3	6	17	8
4	Connaghan Creek	1	24	61	0	0	0	22	21	0	10	43	8	58	0	81	9	45	5
4	Eklund	2	9	38	28	0	0	0	0	0	76	2	2	1	0	3	0	2	0
4	Gaffney	163	251	985	596	68	51	425	286	172	60	686	596	240	177	515	351	79	122
4	Gillis	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
4	Heather Dina Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Jackfish	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Kennedy	0	0	1	4	0	0	0	0	0	0	0	0	6	0	0	0	0	0

BEG Group	LANDSCAPE UNIT NAME	Enhanced Silviculture				Fertilization One Application				Fert Two App		Rehabilitation ME				Rehabilitation UN			
		Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20
4	Klawli	0	0	3	7	0	0	0	6	0	3	122	65	27	51	125	37	9	6
4	Lake	3	4	5	5	0	9	4	1	0	3	4	2	1	1	0	0	0	1
4	Lower Ospika	31	116	228	209	1	27	63	105	45	0	160	58	54	102	8	15	29	0
4	Manson River	4	110	125	83	0	0	97	2	4	10	88	68	20	0	42	56	7	0
4	McCusker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Misinchinka	0	0	93	156	0	0	132	81	5	0	6	8	41	11	2	2	2	0
4	Morfee	0	3	65	42	0	0	1	44	0	0	4	29	12	9	0	0	0	0
4	Muscovite	0	0	5	0	0	0	0	4	0	0	0	8	0	5	0	0	0	0
4	Nabesche	6	0	58	35	0	8	0	0	0	3	33	5	7	12	0	0	0	0
4	Nation	35	48	156	146	0	0	3	4	11	0	188	71	40	21	391	34	12	46
4	Omineca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Osilinka	1	1	1	3	0	0	0	0	0	2	15	19	1	1	12	11	0	0
4	Parsnip	0	92	174	242	0	0	11	161	0	46	41	53	30	48	6	16	7	6
4	Philip	59	463	1,150	1,406	47	161	365	474	7	168	1,058	900	464	547	952	587	161	49
4	Philip Lake	3	21	17	160	51	34	92	9	0	83	304	25	17	22	0	0	12	23
4	Selwyn	0	0	7	7	0	0	0	0	0	0	0	3	0	0	0	0	0	0
4	South Germansen - Upper Manson	0	10	13	0	0	0	0	0	0	0	1	0	1	0	10	0	0	0
4	Tudyah A	0	0	65	112	0	0	1	93	0	17	6	2	3	15	0	0	0	0
4	Tudyah B	0	0	5	65	0	0	124	0	0	0	2	8	11	4	1	5	0	0
4	Tudyah Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Upper Ospika	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Total	**0**	**644**	**2,598**	**5,512**	**5,922**	**320**	**518**	**1,953**	**2,040**	**294**	**627**	**3,863**	**3,427**	**2,763**	**2,591**	**2,358**	**1,347**	**542**	**619**
5	Bijoux Falls	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Blackwater	55	418	1,345	2,712	48	22	178	277	121	70	238	498	522	496	49	237	57	44
5	Chunamon	42	43	22	81	1	28	139	86	23	41	25	14	8	4	6	8	8	0
5	Clearwater	3	60	155	36	3	0	22	4	0	11	68	107	85	33	12	44	19	20
5	Collins - Davis	94	335	1,102	584	4	38	150	26	15	75	243	272	195	81	60	44	44	14
5	Eklund	0	0	0	0	0	0	20	0	6	1	0	4	0	3	0	0	0	0
5	Gaffney	0	47	142	57	0	5	12	10	1	12	8	0	18	10	11	2	2	0
5	Heather Dina Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Kennedy	0	21	0	16	0	0	0	0	0	0	0	0	1	0	0	2	0	0
5	Lake	2	0	5	6	1	0	0	0	0	0	1	2	7	0	0	0	0	0
5	Lower Ospika	22	28	4	173	3	7	3	0	0	0	17	32	0	1	0	0	0	0
5	Manson River	0	0	0	0	0	0	27	0	1	0	0	0	0	0	0	0	0	0
5	Misinchinka	1	20	366	327	0	9	38	285	3	4	40	30	71	153	16	10	17	19
5	Morfee	0	0	37	34	0	0	0	5	0	0	0	12	5	5	0	0	1	0
5	Nabesche	0	19	94	28	0	25	20	5	0	11	8	11	2	2	0	0	1	0
5	Nation	0	0	1	16	0	0	6	0	0	0	0	0	0	1	0	3	0	0
5	Omineca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Parsnip	1	17	136	138	14	7	4	72	1	1	28	11	56	26	0	4	1	0
5	Philip	0	54	136	101	0	0	37	7	0	1	0	22	0	0	0	18	1	0
5	Pine Pass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Selwyn	7	22	113	239	1	0	13	21	2	2	156	79	112	138	25	39	20	30

BEG Group	LANDSCAPE UNIT NAME	Enhanced Silviculture				Fertilization One Application				Fert Two App		Rehabilitation ME				Rehabilitation UN			
		Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20
5	Wicked River	0	0	0	0	0	0	0	0	0	0	4	10	0	0	0	0	0	0
5 Total	**0**	**231**	**1,085**	**3,659**	**4,550**	**75**	**141**	**669**	**798**	**174**	**229**	**833**	**1,104**	**1,081**	**953**	**180**	**411**	**169**	**127**
6	Lake	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Nabesche	0	7	60	230	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Schooler	43	64	149	139	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Selwyn	0	0	12	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 Total	**0**	**43**	**71**	**220**	**383**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
7	Aiken	0	0	18	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Akie	0	1	37	77	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Akie River	0	0	2	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Blackwater	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Bluff Creek	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Braid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Buffalohead	35	134	798	381	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Chase	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Chunamon	21	104	181	407	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Collins - Davis	0	14	105	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Discovery	4	38	14	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Duckling	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Ed Bird Estells Lake	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Eklund	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Finlay-Russel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Frog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Frog-Gataga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Germansen Mountain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Gillis	3	29	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Ingenika	25	154	290	193	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Jackfish	15	7	15	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Kwadacha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Kwadacha Addition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Lower Akie	5	9	1	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Lower Pesika	0	73	71	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Mesilinka	0	82	332	279	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Nina Creek	0	1	37	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	North Ingenika	0	220	135	74	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Obo River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Omineca	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Osilinka	72	435	134	222	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Pelly	4	12	41	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Pesika	0	10	196	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	South Germansen - Upper Manson	0	48	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Swannell	0	0	3	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0

BEG Group	LANDSCAPE UNIT NAME	Enhanced Silviculture				Fertilization One Application				Fert Two App		Rehabilitation ME				Rehabilitation UN			
		Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 5	Yr 10	Yr 15	Yr 20	Yr 5	Yr 10	Yr 15	Yr 20
7	Thutade	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Tutizza	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Twenty Mile	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Upper Akie River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Upper Gataga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Upper Pelly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Total	**0**	**185**	**1,373**	**2,423**	**2,166**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
67	No Treatment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**1,103**	**5,127**	**11,815**	**13,020**	**420**	**750**	**3,175**	**4,024**	**591**	**1,001**	**7,266**	**6,789**	**5,481**	**4,859**	**3,462**	**2,477**	**1,213**	**1,119**