Morice and Lakes Timber Supply Area
Innovative Forest Practices Agreement

Lakes TSA Type 2 Silviculture Investment Strategy Information Package

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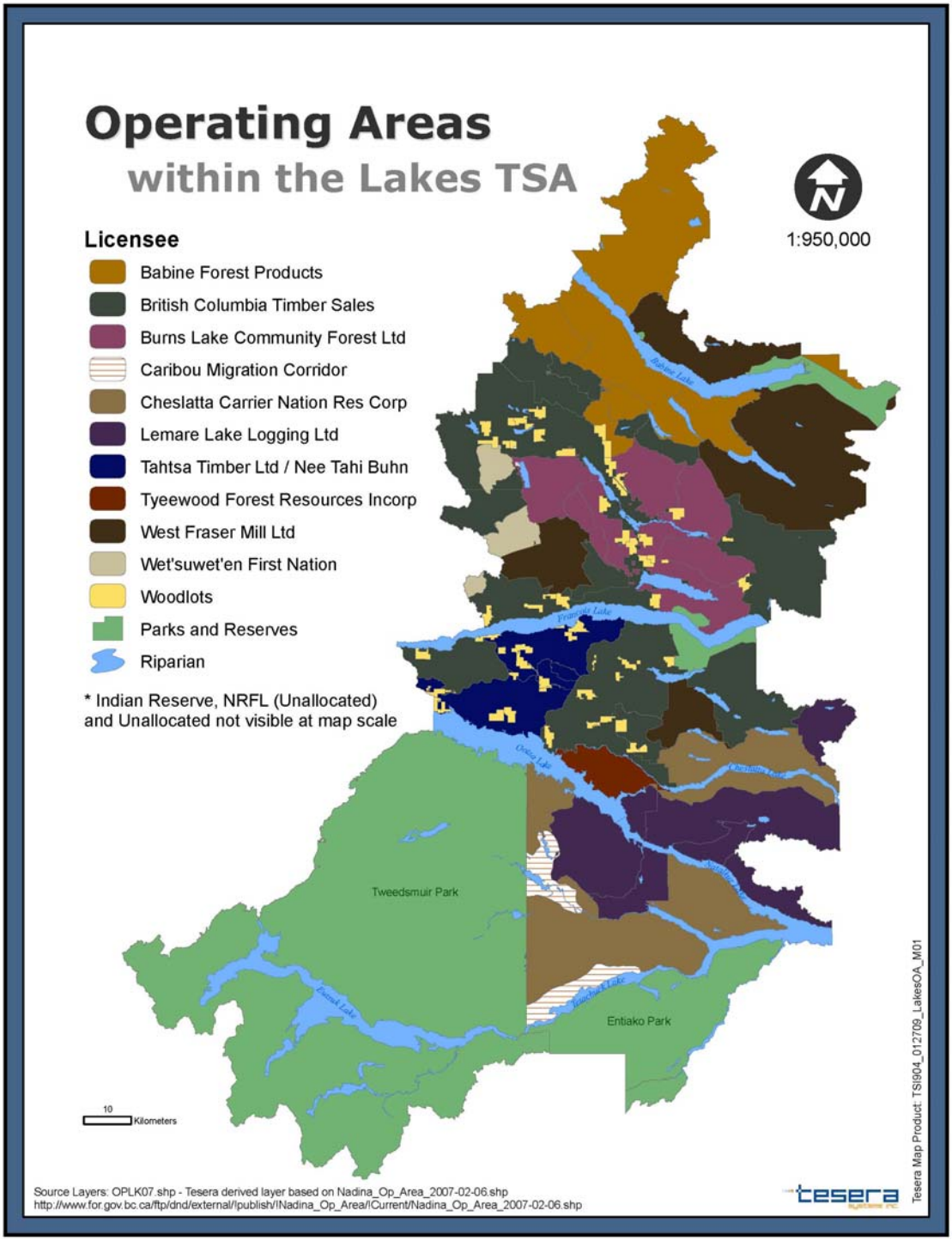
1.0 Introduction

This information package has been prepared to meet the standards and document the data inputs and assumptions used in the Lakes Type 2 Silviculture Investment Strategy Analysis (SIS). Currently, the Forest Inventory and Analysis Branch are performing a Timber Supply Review (TSR4) analysis for the Lakes TSA. Many of the parameters that were modeled for this analysis were taken from the Lakes TSR4 data package that was available as of December 2008. This information package provides specific details on the modeling inputs and assumptions implemented in the Type 2 SIS Base Case Scenario and the sensitivities based on the Base Case Scenario as well as the Composite Scenario and Premium Log Scenario.

The Lakes TSA (Figure 1) has been substantially impacted by the MPB epidemic and the intent of this analysis is to assess the types of Silviculture investments that would provide additional timber supply in the mid-term as well as the long-term. Silviculture investments such as fertilization and stand rehabilitation will be assessed so that funding levels for these programs can be developed. Additionally, this analysis is intended to inform the Multiple Account Decision Analysis process.

Following a brief description of the modeling scenarios, the information package details the net down process, growth & yield and provides an examination of the integrated resource management regimes that are in place. The Lakes Type 2 Analysis Report is a separate document that shares some of the information in the information package, but also provides details on the outcomes of these scenarios and the enhanced silviculture sensitivities.

Figure 1. Operating Areas within the Lakes TSA



2.0 Scenarios & Sensitivities to be Modeled

There were a number of scenarios and sensitivities modeled for this analysis. They have been briefly summarized in subsequent sections with more details to follow where necessary for each element (i.e. growth & yield, land base reductions, management considerations, etc.)

2.1 Lakes Type 2 Base Case Scenario

The Lakes Base Case Scenario was prepared based on the information in the Lakes TSR4 Data Package since many of the assumptions within the package are based on current forest management practices. Modeling assumptions include:

Land base Info

- Old Growth Management Areas (OGMAs) were excluded from the Total Harvestable Land base (THLB);
- Wildlife connectivity corridors; and
- Updated land base and forest inventory data (e.g. used 2007 VRI for forest inventory, included mapped existing and proposed harvest activities, etc.).

Growth &Yield

- Volume matching to recovery curves for MPB depleted stands;
- Future managed stand site indices from new layer PEM and SIBEC;
- Increased spruce and decreased pine content on plantations in specific BEC zones that provided enhanced growing conditions;
- 2% increase in volume resulting from a 15cm reduction in stump height;
- Updated MPB reductions to include mature and immature stands;
- 1600 stems per hectare planting density; and
- Supplemented TSR3 OAF1 values with OAF1 values defined in IFPA studies. IFPA OAF1 studies provided values based on Biogeoclimatic Zones.

Management Considerations

- 'Best of the worst first' harvest priorities;
- Increased wildlife tree retention;
- Adjacency was not strictly modeled based on a height to reach green-up rule, rather adjacency was inferred within the model through setting patch size distribution targets. These targets would allow creation of blocks (patches) over time;
- Visually Sensitive Area disturbance adjustments; plan to perspective ratio; and
- No area reductions for future landings.

2.2 Lakes Type 2 Genetic Worth Sensitivity

Same as the Lakes Base Case Scenario but included genetic worth values for Pine and Spruce seedling stock based on the BC Forest Genetics Council stock plans. These plans provide estimates on availability and improved genetic worth of the seedlings. More details on this sensitivity can be found in Section 8 of this report.

2.3 Lakes Type 2 Fertilization Sensitivity

Same as the Lakes Base Case Scenario but this included estimates of fertilization treatment areas (based on discussions with stakeholders involved in this project). The fertilization program is to occur on natural

and managed stands within ages 20-60 (age class 2-4) and be prioritized based on a number of criteria. More details on this sensitivity can be found in Section 8 of this report.

2.4 Lakes Type 2 Rehabilitation Sensitivity

Same as the Lakes Base Case Scenario but included estimates of rehabilitation (rehab) treatment areas (based on discussions with stakeholders involved in this project). The rehab program is to occur on natural and managed stands within ages 20-60 (age class 2-4) and above a Site Index (SI) of 10. There were two types of rehab modeled, Basic Rehab and BioEnergy Rehab. Basic Rehab was prioritized over BioEnergy Rehab. Additionally, BioEnergy Rehab stands were prioritized by the projected sawlog volumes in the stands, the higher the stands sawlog volumes, the higher they were in the rehab queue. More details on this sensitivity can be found in Section 8 of this report.

2.5 Lakes Type 2 Future Species Sensitivity

Same as the Lakes Base Case Scenario but within the managed stands on certain ecosites, Spruce was regenerated as the dominant species rather than Pine. This sensitivity was generated since Spruce has a higher culmination volume than Pine. Other considerations that went into this decision were (a) Spruce genetically improved stock is more widely available; (b) Spruce has a higher genetic worth (i.e. increased growth/yield gain) than Pine; (c) reduce the amount of Pine forests in the TSA, to minimize potential for future MPB epidemics. More details on this sensitivity can be found in Section 8 of this report.

3.0 Inventory of Datasets

The data for this project was reviewed and updated in the summer/fall of 2008 by the IFPA member licensees to ensure that the layers were up to date. The datasets and the vintage of each dataset are provided in Table 1.

Table 1. Data Layers used for this Analysis

Data	Source	File Name & Description
Area-Based Tenures	LRDW (MoFR)	WHSE_FOREST_TENURE.FTEN_MANAGED_LICENCE_POLY. The area associated with woodlot tenures and with the community forest tenures (Burns Lake Community Forest and Cheslatta-Carrier Nation Community Forest) were left in the timber harvesting land base (THLB) so that activities in those areas could be reflected in the analysis. These areas were partitioned from the areas available to be cut by the licensees.
Biogeclimatic Zones	IFPA	Used Biogeoclimatic Zones within the new PEM mapping. In 2004, the Morice and Lakes Innovative Forest Practices Agreement (IFPA) undertook a predictive ecosystem mapping (PEM) project. The accuracy of the project was improved in 2007, and consequently, the Lakes TSA PEM meets accuracy requirements for timber supply analysis. The PEM will be used for growth and yield estimates, BEC zone mapping and setting objectives related to the Lakes North SRMP.
Chelaslie Caribou Migration Corridor	MoFR (Nadina)	Caribou_MigrationCorridor. The Lakes South Sustainable Resource Management Plan (SRMP) specifies seral stage distribution targets for the Cheslaslie Caribou Migration Corridor. This data file was created in the late 1990's.
Deer Winter Habitat	MoFR (Nadina)	LakesTSA_Deer. In the Lakes TSA, deer winter habitat – mapped in the early 1990's - is typically associated with steep south facing slopes which have shallow snow accumulations and which become snow-free in early spring. Specific forest cover requirements apply for deer winter habitat.
Environmentally Sensitive Areas	MoFR	From the previous forest inventory (FIP) files. Areas identified as being significantly valuable for wildlife were removed from the THLB.
Forest Cover Openings	LRDW (MoFR), NWDSN, Licensees	Used VRI from LRDW, Data provided by Licensees and NWDSN to develop forest cover opening layer and stand ages
Grizzly Habitat	MoFR (Nadina)	LakesTSA_Grizzly.
Lakes North Old Growth Management Areas	ILMB (Skeena)	lnsrmp_ogma8. Through the Lakes North SRMP process, old growth management areas (OGMA) were identified for the northern portion of the Lakes TSA. These OGMAs were removed from the THLB.
Lakes North Connectivity Corridors	ILMB (Skeena)	bensv2_lnsrmp. The Lakes North Sustainable Resource Management Plan (SRMP) includes an objective aimed at maintaining habitat connectivity.
Lakes South Connectivity Corridors	MoFR (Nadina)	LakesSouth_Corridors. The Lakes South SRMP, approved in 2003, includes a land use objective for habitat connectivity. The forest management requirements that apply to these corridors will be modelled as part of the base case.
Lakes South Old Growth Management Areas	LRDW (ILMB)	WHSE_LAND_USE_PLANNING.RMP_OGMA_LEGAL_CURRENT_SVW. Spatial old growth management areas (OGMAs) were legally established for the southern portion of the Lakes TSA in 2007. These areas were removed from the timber harvesting land base.
Landscape Units	LRDW (ILMB)	WHSE_LAND_USE_PLANNING.RMP_LANDSCAPE_UNIT_POLY
Mineral/Wildlife Management Resource Management Zone	MoFR (Nadina)	MWM_RMZ. As per the Order Establishing Resource Management Zones and Resource Management Zone Objectives for the Lakes District (2000), commercial timber harvesting is not permitted in this zone. This zone was removed from the THLB.

Data	Source	File Name & Description
Moose Winter Habitat	MOE (Skeena)	LakesTSA_Moose. In the Lakes TSA, moose habitat – mapped in the early 1990's – is typically associated with lowland riparian areas where forage is available even under severe winter conditions. Specific forest cover requirements apply for moose winter habitat.
Mountain Goat Draft Ungulate Winter Range	MOE (Skeena)	LakesTSA_Goats. Forest cover requirements associated with the general wildlife measures identified in the Proposed Order (Draft) for Ungulate Winter Range #U-006-017 Mountain Goat Winter Range within the Lakes TSA (2008) will be part of the base case analysis.
Ownership	MoFR (Nadina)	An updated ownership layer was provided by MoFR Land areas corresponding to private lands, Indian Reserves, federal reserves and such will be removed from the THLB.
Predictive Ecosystem Mapping	IFPA	In 2004, the Morice and Lakes Innovative Forest Practices Agreement (IFPA) undertook a predictive ecosystem mapping (PEM) project. The accuracy of the project was improved in 2007, and consequently, the Lakes TSA PEM meets accuracy requirements for timber supply analysis. The PEM will be used for growth and yield estimates, BEC zone mapping and setting objectives related to the Lakes North SRMP.
Protected Areas	MoFR (Nadina)	An updated protected areas layer was provided by MoFR Land areas corresponding to private lands, Indian Reserves, federal reserves and such will be removed from the THLB.
Riparian Reserves and Riparian Management Zones	IFPA	Comprehensive Riparian Layer derived by the IFPA was used as the basis for this information
Roads	IFPA	Due to road network issues (not being topologically correct for the existing and projected roads) the road layer developed in 2003/2004 was used.
Takla Caribou Draft Ungulate Winter Range	MOE (Skeena)	Lakes_Takla_Caribou. Forest cover requirements associated with the general wildlife measures identified in the Northern Caribou Ungulate Winter Range Proposal – Takla Herd (2008) will be modelled in the base case analysis.
Vegetation Resource Inventory	LRDW (MoFR)	WHSE_FOREST_VEGETATION. VEG. Based on a sampling project (VRI Phase II) conducted in 2006 and 2007, growth and yield inventory attributes for the Lakes TSA have been adjusted. This updated information will used in the timber supply analysis.
Visual landscape Inventory	IFPA	A Lakes Visual Resource Inventory has been completed for all scenic areas, and updated by the regional visual specialist in 2008. However, the updates were not available at the time of putting the GIS data together, so the previous VLI inventory (circa 2004) was used in this analysis. The VLI will be used to model the forest cover requirements associated with visual landscape management.

4.0 Land Base Description

4.1 Timber Harvesting Land base Determination

A detailed, ordered net-down analysis was performed for this analysis and will be the same for all scenarios/sensitivities modeled in this Type2 project and is listed in Table 2. Many of the categories have the criteria indicated, however those that require further explanation will be highlighted in additional sections of the report.

Table 2. Detailed Ordered Netdown

Netdown_Category	Identifying Criteria	Gross Ha	THLB Area Ha	NonTHLB Area Ha
3-Unclassified Lands	Np_Desc = NTA	14.2	0.0	14.2
4-NF Alpine	NP_Desc = A	72,057.0	0.0	72,057.0
5-NF Clay Bank	NP_Desc = CL	28.8	0.0	28.8
6-NF Gravel Bar	NP_Desc = G	3.4	0.0	3.4
7-NF Lake	NP_Desc = L	117,688.8	0.0	117,688.8
8-NF Meadow	NP_Desc = M	374.3	0.0	374.3
9-NF Non-Productive	NP_Desc = NP and Spec_Cd_1 = ""	7,694.3	0.0	7,694.3
10-NF NPBR	NP_Desc = NPBR	11,563.3	0.0	11,563.3
12-NF Rock	NP_Desc = R	1,466.9	0.0	1,466.9
13-NF River	NP_Desc = RIV	2,772.8	0.0	2,772.8
14-NF Swamp	NP_Desc = SWAMP	22,452.3	0.0	22,452.3
15-NF Non-Treed NDT5	Calc_NDT = 5 and Spec_Cd_1 = ""	856.8	0.0	856.8
16-Ice	NP_Desc = ICE	86.2	0.0	86.2
17-Ag_Settle Open Range	NP_Desc = OR	7,606.0	0.0	7,606.0
19-Ag_Settle Clearings	NP_Desc = C	16,925.4	0.0	16,925.4
21-Ag_Settle Urban	NP_Desc = U and NP_Code = 54	4,200.0	0.0	4,200.0
22-Ag_Settle Gravel Pit	NP_Desc = GR	5.0	0.0	5.0
23-Ag_Settle Highways	Highways = Yes	1,736.4	0.0	1,736.4
Built Roads (Aspatial Reduction) – see Section 4.1.1	MainlinesBuilt = Yes or OperationalBuilt = Yes or SpurBuilt = Yes	Not Available	0.0	5,304.9
Landings (Aspatial Reduction) – see Section 4.1.1	2.1% Aspatial Reduction	Not Available	0.0	1,598.7
24-Nat_TreedNP Alpine Forest	NP_Desc = AF	64,469.5	0.0	64,468.9

Netdown_Category	Identifying Criteria	Gross Ha	THLB Area Ha	NonTHLB Area Ha
25-Nat_TreedNP Treed NP	NP_Desc = NP and Spec_Cd_1 <> ""	10,102.1	0.0	10,073.0
26-Nat_TreedNP Treed NDT5	Calc_NDT = 5 and Spec_Cd_1 <> ""	5,099.1	0.0	5,099.1
30-Own Indian Reserves	Own1 = 52	1,236.7	0.0	1,232.6
31-Own Misc Leases	Own1 = 99	48.6	0.0	45.6
32-Own Private Land	Own1 = 40	43,252.9	0.0	42,946.5
33-Own Crown Lands NA	Own1 = 62 and Schedule1 = N	56.3	0.0	56.3
35-Own Misc Reserves	Own1 = 69 and Schedule1 = N	3,268.4	0.0	3,219.4
36-Own Prov Parks Current Status	Own1 = 63	356,552.1	0.0	356,546.6
37-Own UREPs	Own1 = 61 and Schedule1 = N	1,694.8	0.0	1,685.8
38-Own Prov Parks	Pa_Type = pk	275.5	0.0	275.3
40-OGMA	Lakes_OGMA <> ""	77,636.7	0.0	77,269.9
41-Wildlife Caribou	Taklacar = high	4,064.6	0.0	4,064.3
42-Wildlife Goat	Lakes_Goat = Goat_Winter	2,290.6	0.0	2,281.1
44-NCC NC	Nfor_Desc = NC	413.9	0.0	407.8
45-NCC NCBR	Nfor_Desc = NCBR	644.8	0.0	641.8
46-LowProd Douglas Fir	see coding	263.4	0.0	263.4
47-LowProd Balsam	see coding	1,434.3	0.0	1,422.1
48-LowProd Spruce	see coding	8,766.1	0.0	8,695.6
49-LowProd Pine	see coding	9,052.7	0.0	8,977.8
50-NonMerch Decid	see coding	23,837.3	0.0	23,686.9
51-NonMerch Balsam	see coding	529.8	0.0	522.6
52-ESA1 Wildlife	Esa_1 like W*	11,772.7	0.0	11,686.7
53-Terrain	CMP_TER = P or U	12,743.7	0.0	12,721.8
54-Recreation	Esa_1 like R*	1,610.0	0.0	1,599.4
55-Riparian	RRZ > 0	17,022.7	0.0	16,997.0
Riparian (Aspatial Reduction)	Ripclass = S1b, S2, S3, W1, W5, L1b	Not Available	0.0	2,213.8
Proposed Roads (Aspatial Reduction)		Not Available	0.0	7,792.5
Current THLB (Less Proposed Roads)		**1,571,084.6**	**637,562.2**	**933,522.5**

Netdown_Category	Identifying Criteria	Gross Ha	THLB Area Ha	NonTHLB Area Ha
Future THLB with Proposed Roads		1,571,084.6	629,769.7	941,315.0

4.1.1 Unclassified Lands

Table 3 lists the land that is unclassified in the Lakes TSA. Unclassified land is defined as non-typed area (NTA) within the forest inventory file.

Table 3. Unclassified Lands

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Unclassified Lands (NP_Desc = NTA)	14.2	100	14.2

4.1.2 Non-Forest (Natural Non-Treed Non-Productive)

Table 4 lists the non-forest categories and their areas in the Lakes TSA.

Table 4. Non-Forest Area

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Alpine (NP_Desc = A)	72,057.0	100	72,057.0
Clay Bank (NP_Desc = CL)	28.7	100	28.7
Gravel Bar (NP_Desc = G)	3.4	100	3.4
Lake (NP_Desc = L)	117,665.8	100	117,665.8
Meadow (NP_Desc = M)	374.2	100	374.2
Non-Productive (NP_Desc = NP and SPEC_CD_1 is null)	7,694.3	100	7,694.3
Non-Productive Brush (NP_Desc = NPBR)	11,386.8	100	11,386.8
Non-Productive Burn (NP_Desc = NPBU)	0	100	0
Rock (NP_Desc = R)	1,455.9	100	1,455.9
River (NP_Desc = RIV)	2,772.8	100	2,772.8
Swamp (NP_Desc = SWAMP)	22,201.5	100	22,201.5
Non-Treed NDT 5 Ecosystems (NDT = 5 and SPEC_CD_1 is null)	856.8	100	856.8
Ice (NP_Desc = ICE)	86.2	100	86.2
TOTAL	**236,583.2**		**236,583.2**

4.1.3 Deforested Lands for Agriculture and Settlement

Table 5 lists the area that is a reduction from the total productive land base since it is deforested for agriculture and settlement purposes.

Table 5. Deforested Lands for Agriculture and Settlement

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Open Range (NP_Desc = OR)	7,585.8	100	7,585.8
Hayfields (NP_Desc = P)	0	100	0
Clearings (NP_Desc = C)	16,903.0	100	16,903.0
Urban Roads (NP_Desc = U and NP_CD = 50)	0	100	0
Urban (NP_Desc = U and NP_CD = 54)	4,139.5	100	4,139.5
Gravel Pit (NP_Desc = GR)	5.0	100	5.0
Highways (Highways = Yes)	1,683.4	100*	1,683.4
TOTAL	**30,316.7**		**30,316.7**

4.1.4 Reductions for Existing Roads and Landings

Reductions due to timber harvesting include polygons with roads. The actual existing mapped road length and road width associated with the different classes of roads are multiplied to calculate a roaded area, which is subtracted from the productive area of the polygon when the road is built. Existing landings were also removed from the THLB through an aspatial reduction.

Table 6 provides detail of the reductions from the total productive land base due to deforestation for timber harvesting and forest management activities.

Table 6. Reductions for Existing Roads and Landings

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Built Roads (MainlinesBuilt = Yes or OperationalBuilt = Yes or SpurBuilt = Yes)	NA	Aspatial, based on road lengths and widths	5,304.9
Landings[1]	NA	2.1% Aspatial	1,598.7
TOTAL	**NA**		**6,903.6**

[1] [1] Under TSR2, the existing area in landings was based on an ISIS report showing that about 4.2% of each cutblock is associated with roads and landings. It is estimated that, of the 4.2%, half is attributable to roads and half to landings therefore 2.1% was attributable to roads and excluded from the THLB. Landings within cutblocks are assumed to go back into production.

4.2 Reductions to Net Productive Land base

4.2.1 Lands to Which Volume Based Tenure Agreements cannot be Granted

Table 7 shows the areas to which volume based tenure agreements cannot be granted. These represent a reduction to the net productive land base.

Table 7. Lands to Which Volume Based Tenure Agreements Cannot Be Granted.

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Agricultural Leases (Own1 = 100)	0	100	0
Federal Reserves (Own1 = 50)	0	100	0
Grazing Leases (Own1 = 90)	0	100	0
Indian Reserves (Own1 = 52)	1,235.4	100	1,231.4
Miscellaneous Leases (Own1 = 99)	48.6	100	45.6
Private Land (Own1 = 40)	43,054.3	100	42,748.3
Crown Land Not Available for Timber Harvesting (Own1 = 62 and Schedule1 = N)	56.3	100	56.3
Ecological Reserves (Own1 = 60)	0	100	0
Miscellaneous Reserves (Own1 = 69 and Schedule1 = N)	3,220.0	100	3,171.2
Provincial Parks (& LRMP Proposed Parks) Own1 = 63 for Current Status and Pa_Type = pk for Current Status with Morice LRMP	356,741.8	100	356,736.4
UREPs (Use and Recreation Enjoyment for the Public) (Own1 = 61 and Schedule1 = N)	1,666.9	100	1,658.3
Mineral/Wildlife Reserves (Min_Zone is not null)	0	100	0
TOTAL	**406,023.2**		**405,647.5**

4.2.2 Old Growth Management Areas (OGMAs)

The Lakes North and South OGMAs were merged into one file and incorporated into the dataset. Table 8 lists the area reduction for the OGMA areas.

Table 8. Reductions for OGMAs

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
OGMA (Lakes_Ogma is not null)	74,441.8	100	74,131.3
TOTAL	**74,441.8**		**74,131.3**

4.2.3 Wildlife Habitat Reductions

Table 9 lists the reductions for 100% removal of certain wildlife habitat types from the THLB.

Table 9. Wildlife Habitat Reductions

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Takla Caribou (Taklacar = high)	4,015.8	100	4,015.8
Goat (M_Goat = Goat_Winter)	2,015.3	100	2,010.8
TOTAL	**6,031.1**		**6,026.6**

4.3 Reductions to Volume Based Tenure Agreement Lands

4.3.1 Non-Commercial Cover

Non-commercial cover is identified in the forest cover inventory where the non-forested descriptor indicates that an area is either non-commercial or covered with non-commercial brush (Table 10).

Table 10. Non-Commercial Cover

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Non-Commercial (Nfor_Desc = NC)	397.3	100	391.4
Non-Commercial Brush (Nfor_Desc = NCBR)	628.4	100	625.4
TOTAL	**1,025.7**		**1,016.8**

4.3.2 Low Productivity Sites

The low productivity sites identified in the Lakes TSA are shown in Table 11. The criteria for determining these low productive sites are indicated in Table 12. As in TSR4, low productivity site reductions apply only to stands with no harvest history.

Table 11. Low Productivity Sites

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Douglas Fir Leading Low Site Stands	263.4		263.4
Balsam Leading Low Site Stands	1,295.8	100	1,284.8
Spruce Leading Low Site Stands	8,528.9	100	8,461.7
Pine Leading Low Site Stands	8,908.7	100	8,835.4
TOTAL	**18,996.8**		**18,845.2**

Table 12. Description of Sites with Low Timber Growing Potential

Zone/Group	Inventory Type Group	Leading Species	Characteristics Age ≥ (years)	Characteristics Volume < (m^3/ha)	Reduction %
ESSF	1-8	Douglas Fir	250	140	100%
	18-20	Balsam	250	140	100%
	21-26	Spruce	250	140	100%
	28-31	Pine	250	140	100%
SBS	1-8	Douglas Fir	140	140	100%
	18-20	Balsam	140	140	100%
	21-26	Spruce	140	140	100%
	28-31	Pine	140	140	100%

4.3.3 Non-Merchantable Forest Types

The areas of non-merchantable forest types are shown in Table 13. These are stands that are accessible and otherwise available for harvesting but are assumed to be non-merchantable due to stand characteristics such as small piece size, incidence of decay, species composition and low stocking. In the Lakes TSA these are primarily deciduous leading stands.

Table 13. Non-Merchantable Forest Types

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Deciduous Leading Stands	23,222.5	100	23,084.8
Balsam Leading Stands	529.8	100	522.6
TOTAL	**23,752.3**		**23,607.4**

4.3.4 Environmentally Sensitive Areas & Terrain Stability Mapping

The following table (Table 14) lists the areas that are a reduction to the volume based tenure agreement lands since they are Environmentally Sensitive Areas (ESA's). These are areas with significant non-timber values, fragile or unstable soils, where there are impediments to establishing a new tree crop, or where timber harvesting may cause land slides.

The Type2 analysis used Terrain Stability Mapping to identify sensitive soils rather then using either Es1 or Es2 since it was deemed as better, higher resolution data than the ESA data within the forest inventory. The rest of the ESA reductions were used in this analysis.

Within the Terrain Stability Mapping, Unstable and Potentially Unstable Terrain was 100% netted out of the THLB.

Table 14. Environmentally Sensitive Areas & Terrain Stability Mapping

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Ew1 - Sensitive Wildlife Areas, High Rating (ESA_1 = W*)	10,776.4	100	10,708.9
Terrain Stability Mapping (CMP_TER = P or U)	11,485.4	100	11,469.2
TOTAL	**22,261.8**		**22,178.1**

4.3.5 Recreation Areas

Recreation areas are removed in the volume based tenure agreement lands.

Table 15. Recreation Areas

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Recreation ESA (ESA_1 like R*)	1,496.1	100	1,491.1

4.3.6 Riparian Management Areas

The process for creating the riparian layer for the IFPA was extensive, involving a number of data sources including Forest Cover, TRIM, PEM/TEM mapping and digital orthophotos. The intent of this process was to capture all lakes, rivers and wetlands that exist in the Lakes TSA so that they were adequately inventoried and accounted for in various IFPA projects. These riparian areas were then classified and buffered according to FRPA standards. Area reductions followed the criteria set forth in the Lakes TSR4 data package (Table 16). Table 17 provides the actual area reductions for the riparian management.

Table 16. Riparian Reserve Zones and Riparian Management Zones

Stream Class	Description	Riparian Reserve Zone (m)	Reduction %	Management Zone Width (m)	Reduction %
S1	Fish stream, width > 20m	50	100	20	25
S2	Fish stream, width > 5m	30	100	20	25
S3	Fish stream, with >1.5 m	20	100	20	25
L1B	Lake between 5 – 1000 ha	10	100	0	0
W1	Wetland >5 ha	10	100	40	20
W5	Complex of wetlands	10	100	40	20

THLB reductions were not be applied to riparian classes where a RRZ was not required (e.g. S4 streams) since current practices in these riparian areas consist of retaining non-merchantable conifer trees, deciduous trees, shrubs, and herbaceous vegetation within 10 metres of the channel or edge.

Approved Forest Stewardship Plans (FSP), indicate that a minimum of 25% of the RMZ will be retained along streams where a RRZ is required. For lakes and wetlands where a RRZ is required, these plans indicate that a minimum of 20% of the RMZ will be retained. The RMZ Retention percentages were applied using an aspatial reduction in the netdown process for the polygons within these zones.

Table 17. Riparian Management Areas

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Riparian RRZ (RRZBuff > 0)	16,568.3	100	16,544.4
Riparian Management Zones	NA	Aspatial, based on stream lengths and riparian widths	2,213.8

4.3.7 Future Roads, Trails, Landings (Deforested Lands for Timber Harvesting and Forest Management)

Table 18 summarizes the future reductions from the current THLB that will be deforested due to timber harvesting and forest management activities (i.e. roads). Tesera Systems Inc. used a Linear Feature Projection Model (LFPM) to develop the future road network required to access the entire Lakes TSA. LFPM is typically used to delineate road networks into currently unaccessed regions within a landbase through the use of an existing road network and identified flow control points (e.g. mill sites). Table 18 lists the road widths used to develop the area calculations. Table 19 provides the areas reduced due to roads.

Table 18. Road Classes and Associated Widths

Existing and Future Roads and Trails	Road Width (m)	Reduction%
Highways (Highway 16 + 35)	60	100
Secondary Highways (gravelled)	30	100
Forestry Mainlines	30	100
Operational Roads (e.g. branch)	18	100
In-block Roads	10	100

Table 19. Roads, Trails and Landings Area Reductions

Description	Gross Area (ha) including overlaps	Percent (%) Reduction	Area Removed (ha)
Future Roads (MainlinesProposed = Yes or OperationalProposed = Yes or SpurProposed = Yes)	NA	Aspatial, based on road widths and lengths	7,792.5

5.0 Inventory Analysis Units

The inventory analysis units were developed similar to the previous TSR2 assumptions as well as incorporating some additional resolution to allow for integrating the MPB reductions into the yield curves effectively, e.g. BEC Zones, Landscape Units, pine component, and stand age. Table 20 provides the main decision criteria for the analysis units, the other elements listed above were included just to track and apply the MPB reductions. All stands greater than or equal to 40-years of age were modeled using VDYP and were considered "natural" stands and all stands less than 40-years old were considered "managed" stands. The analysis units for managed stands are described in Section 6.2.1.4.

Table 20. Analysis Unit Classifications

Analysis Unit [2]	Leading Species	Inventory Type Group	Site Index Range
Balsam Good	Balsam	18-20	16.5 +
Balsam Medium			13-16.5
Balsam Poor			8-13
Balsam Low			Less than 8
Spruce Good	Spruce	21, 24-26	17+
Spruce Medium			12.7-17
Spruce Poor			7.5-12.5
Spruce Low			Less than 7.5
Pine Good	Pine	27-28, 30-31	18+
Pine Medium			13-18
Pine Poor			7.5-13
Pine Low			Less than 7.5
Hemlock Good	Hemlock	12-17	19.5+
Hemlock Medium			15-19.5
Hemlock Poor			9-15

[2] The analysis units provided represent all the combinations of natural stands that can occur on the land base, keeping in mind that deciduous volumes were removed from the yield tables and not included in timber supply modeling. The managed stand analysis units can be found in Section 6.2.1.4.

Analysis Unit [2]	Leading Species	Inventory Type Group	Site Index Range
Hemlock Low			Less than 9
Cottonwood Good	Cottonwood	35-36	22+
Cottonwood Medium			13.5-22
Cottonwood Poor			6-13.5
Cottonwood Low			Less than 6
Aspen Good	Aspen	41-42	23.5+
Aspen Medium			16.5-23.5
Aspen Poor			8-16.5
Aspen Low			Less than 8
Birch Good	Birch	40	23.5+
Birch Medium			16.5-23.5
Birch Poor			8-16.5
Birch Low			Less than 8
Fir Good	Fir	1-8	18.5+
Fir Medium			14.5-18.5
Fir Poor			8.5-14.5
Fir Low			Less than 8.5
Larch Good	Larch	33, 34	18+
Larch Medium			13-18
Larch Poor			6.5-13
Larch Low			Less than 6.5
Spruce/Fir Good	Spruce/Fir	10	17+
Spruce/Fir Medium			12.5-17
Spruce/Fir Poor			7.5-12.5
Spruce/Fir Low			Less than 7.5
Spruce/Hemlock Good	Spruce/Fir	10	17+
Spruce/Hemlock Medium			12.5-17
Spruce/Hemlock Poor			7.5-12.5
Spruce/Hemlock Low			Less than 7.5

6.0 Current Forest Management Assumptions

The underlying growth and yield assumptions used for this Timber Supply Analysis follow the standard BC Ministry of Forests (BC MoF) protocol. Growth and yield projections were obtained using two standard software programs, the Variable Density Yield Prediction (VDYP) version 6.6d and Table Interpolation Program for Standard Yields (TIPSY) version 4.1 mainly based on the TSR4 data inputs and assumptions for the Lakes TSA. There were a few deviations from the TSR4 analysis and these differences will be highlighted in the subsequent sections where necessary.

6.1 Harvesting

6.1.1 Utilization Levels

The utilization levels define the maximum stump height, minimum top diameter (inside bark) and minimum diameter at breast height by species and are used in the analysis to calculate merchantable volume and are listed in Table 21.

Table 21. Utilization Levels in the Lakes TSA

Analysis unit	Minimum diameter at DBH (cm)	Maximum Stump Height (cm)	Minimum Top dib (cm)
Lodgepole Pine	12.5	15.0 [3]	10.0
Balsam	17.5	15.0 [4]	10.0
Spruce	15	15.0 [5]	10.0

6.1.2 Volume Exclusions for Mixed Species Stands

In practice within the Lakes TSA, deciduous leading stands or deciduous volume within conifers leading stands are not harvested as a rule. Therefore deciduous volume will be excluded from the analysis; leading deciduous stands were netted out of the THLB and within mixed coniferous/deciduous stands the deciduous volumes will be excluded from the yield tables.

Table 22. Volume Exclusions in the Lakes TSA

Inventory Type Group	Species	Volume Exclusion (%)
All coniferous leading	Deciduous	100

[3] The growth and yield models can not model a 15cm stump height, so the IFPA performed a study to determine the volume gain in harvesting to a lower stump height. The volume gain was determined as an additional 2% on existing growth & yield projections from the models. This additional volume was incorporated into the yield tables as a 2% increase on the merchantable yield.

[4] Same as Footnote 2

[5] Same as Footnote 2

6.1.3 Minimum Harvestable Volume/Age Derivation

The minimum harvestable volume is the amount required for a stand to grow to a harvestable size. While harvesting may occur in stands at the minimum volume to meet forest level objectives (e.g. maintaining overall harvest levels for a short period of time or avoiding large changes in harvest levels), most stands will not be harvested until past the minimum volume because of management objectives for other resource values. Table 23 shows the criterion to be used in deriving minimum harvestable volume.

Table 23. Volume Exclusions in the Lakes TSA

Species	Minimum Volume Criteria (m^3/ha)
All species	140

Note that these are simply minimum criteria that the Timber Supply Model uses to assess when a stand can be harvested. Stands are often harvested well after MHA is attained depending on forest cover constraints and target harvest levels. Stands may also be harvested prior to MHA when the scheduling model must build new roads to access harvest blocks.

6.1.4 Modeling the MPB Epidemic

This section will outline how the MPB epidemic in the Lakes TSA is being modeled, within young stands (less than 60 years) as well as older stands (greater than 60 years). At the time of the last AAC determination for the Lakes TSA (2004), very little beetle attack in young pine stands had been observed. This situation began to change in late 2005, with the biggest hits on young pine incurring with the late flights of 2006. This also corresponds to the time the mountain pine beetle infestation reached its peak. The mountain pine beetle population within the Lakes TSA is now in the declining phase due to host depletion.

6.1.4.1 Young Pine Mortality

This section summarizes recent Ministry of Forests and Range efforts to assess MPB mortality in young stands in the Lakes TSA, as per the Lakes TSR4 data package. From the spring of 2006 through to September 2008, 21,019 ha of surveys have been completed on pine leading stands, through the Forest For Tomorrow or the Forest Investment Account programs. All measurements and findings have been recorded in the RESULTS database, and the impacts of MPB within the pine plantations are shown in Table 24.

Table 24. Impact of MPB within Pine leading Plantations (surveyed from 2006-2008)

Age Class	Total Area (ha)	Total Area With MPB (ha)	MPB %	NSR % MPB
1	6140	270	0.04%	0%
2	10874	3144	29%	1%
3	1699	819	48%	24%

Additionally the attack happened from the south to the north part of the TSA so a Landscape Unit approach was developed to grow the epidemic. Since 0% of the stands in age class 1 were impacted enough to convert a plantation to an NSR stand, reductions were not performed for age class 1 stands. Table 25, lists the age class 2 stands where attack was assumed to occur due to the landscape units'

position (i.e. south to north) in the TSA. The assumption was that the MPB attack happened in an orderly, step-wise south to north sequence and that conversion of plantations to NSR stands happened randomly in each landscape unit to equal the % area in NSR stands listed in Table 24. The same approach was followed for age class 3 (Table 26).

Table 25. MPB Reductions for Stands 21-40 Years of Age (Lakes)

LU_Name	ID_Attacked_Stands	ID_Killed_Stands	Hectares
			53.78
BABINE EAST			273.90
BABINE WEST			1,221.98
BULKLEY			6,282.79
BURNS LAKE EAST			2,307.36
BURNS LAKE WEST			3,371.54
CHELASLIE	MPB_Attacked		67.81
CHELASLIE	MPB_Attacked		1,885.03
CHESLATTA	MPB_Attacked		54.31
CHESLATTA	MPB_Attacked		1,987.83
CHESLATTA	MPB_Attacked	MPB_Killed	86.24
FLEMING			293.76
FRANCOIS EAST			2,848.58
FRANCOIS EAST	MPB_Attacked		179.82
FRANCOIS EAST	MPB_Attacked		872.80
FRANCOIS EAST	MPB_Attacked	MPB_Killed	26.94
FRANCOIS WEST			3,435.88
INTATA	MPB_Attacked		77.67
INTATA	MPB_Attacked		4,461.47
OOTSA	MPB_Attacked		661.27
TALTAPIN			5,300.57
TETACHUK ENTIAKO	MPB_Attacked		2.47

Of the 10,353 ha that was attacked within stands aged 21-40, only ~112 ha were killed or set to NSR.

Table 26. MPB Reductions for Stands 41-60 Years of Age (Lakes)

LU_Name	ID_Attacked_Stands	ID_Killed_Stands	Hectares
			1,628.63
BABINE EAST			892.88
BABINE WEST			252.26

LU_Name	ID_Attacked_Stands	ID_Killed_Stands	Hectares
BULKLEY			1,724.93
BURNS LAKE EAST			3,585.78
BURNS LAKE EAST	MPB_Attacked		2,108.21
BURNS LAKE EAST	MPB_Attacked		1,045.55
BURNS LAKE EAST	MPB_Attacked	MPB_Killed	824.41
BURNS LAKE WEST			679.56
CHELASLIE	MPB_Attacked		117.03
CHELASLIE	MPB_Attacked		144.36
CHELASLIE	MPB_Attacked	MPB_Killed	36.88
CHESLATTA	MPB_Attacked		435.68
CHESLATTA	MPB_Attacked		318.56
CHESLATTA	MPB_Attacked	MPB_Killed	382.52
FLEMING			217.50
FRANCOIS EAST	MPB_Attacked		513.89
FRANCOIS EAST	MPB_Attacked		99.65
FRANCOIS EAST	MPB_Attacked	MPB_Killed	65.30
FRANCOIS WEST	MPB_Attacked		431.93
FRANCOIS WEST	MPB_Attacked		119.22
FRANCOIS WEST	MPB_Attacked	MPB_Killed	176.13
INTATA	MPB_Attacked		18.64560254
INTATA	MPB_Attacked		29.49347207
INTATA	MPB_Attacked	MPB_Killed	7.229779102
OOTSA	MPB_Attacked		287.6215162
OOTSA	MPB_Attacked		107.0931119
OOTSA	MPB_Attacked	MPB_Killed	297.301058
TALTAPIN			877.8406025
TETACHUK ENTIAKO	MPB_Attacked		24.19852266
TETACHUK ENTIAKO	MPB_Attacked		16.10743516

Of the 7,602 ha that was attacked within stands aged 41-60, only ~1,787 ha were killed or set to NSR.

The reductions for young pine mortality were incorporated into the yield tables used for the Timber Supply model, whereby the curves were developed using TIPSY 4.1 and then adjusted to account for the MPB mortality.

6.1.4.2 Mature Pine Mortality

For stands greater than 60 years of age, projected reductions from the MPBPBv5 model were used to reduce the merchantable yields generated from VDYP 6.6d. These reductions were performed in the similar manner as previously approved by the MoF in past IFPA analysis.

6.1.5 Harvest Priorities

The approach to harvest priorities used in the analysis can be described as "best of the worst first". Stands with the largest projected beetle related volume losses are high priority and within the subset the higher the site index the higher the harvest priority (Table 27). The intention is to salvage as much of the beetle killed wood as possible before the shelf life has expired. Within this salvage priority, there is another priority intended to preferentially convert higher productivity sites to managed stands first as these have the potential to provide available timber the soonest. Also, spruce and balsam leading Inventory Type Groups (ITG) are not being ignored since this priorities scheme is based on total pine volume killed within each stand, regardless of its' leading species or ITG classification.

Table 27. Beetle Mitigation Harvest Priorities

Harvest Priority		Site Productivity		
		High (SI>18)	Med (12<SI<18)	Low (SI<12)
High	>185 m^3/ha lost	1	2	7
Medium	>90 and <185 m^3/ha lost	3	4	8
Low	<90 m^3/ha lost	5	6	9

The Timber Supply Model will also apply an Oldest First harvest rule. This is a further rule applied to the above priorities, so within the priority, the stands will be ranked by the oldest stands to get them back into production.

6.1.6 Shelf Life

TSR4 has updated the shelf-life values from the previous 5-year shelf-life values used in past IFPA and TSR analysis work. These new shelf-life values shown in Table 28 have been incorporated into this analysis via adjustments to yield tables.

Table 28. Revised Shelf-Life values for the Lakes TSA

Years Since Attack	Sawlog % Available	Other Wood Product % Available
1 to 5 yrs	85	15
6 to 10 yrs	70	30
11 to 15 yrs	50	50
16 to 20 yrs	30	70
> 20 yrs	0	100

An assumption that stands were regenerated on natural VDYP stands 20 years after the epidemic has been used for this analysis.

6.1.7 Unsalvaged Losses

Table 29 shows the estimate of average annual unsalvaged volume loss to epidemics caused by insects or diseases, fires, wind damage or other agents on the timber harvesting land base. The unsalvaged loss column reflects only areas where the volume is not expected to be recovered or salvaged. These unsalvaged loss estimates were taken directly from the TSR4 information package and exclude MPB losses.

Table 29. Unsalvaged Losses

Cause of Loss	Total Loss (m^3 for the 2003-2007 period)	Annual Unsalvaged Loss (m^3/yr)
Blowdown	0	0
Spruce Bark Beetle	25,929	5,186
Balsam Bark Beetle	51,736	10,347
Spruce Budworm	1,587	317
Fire	51,292	7,418
Total	**130,544**	**23,268**

Existing and future losses associated with the mountain pine beetle have been accounted for in adjustments to yield curves.

6.1.8 Succession/Recovery/Volume Matching

For this project, stands depleted by MPB to a level below the merchantable threshold of 140 m^3/ha were assigned to start recovery 20 years after harvest on natural stand yield tables. Recovery begins at an age when the volume of the recovery curve "matches" that of the depleted curve being left behind. The two curves were assumed to have matching volumes if the volume difference was less than 20 m^3/ha. Succession begins on average 45 years into the planning horizon, and the average age of stands after succession has occurred is 60 years.

This "volume-matching" approach allowed stands to retain some older seral characteristics and all their residual live volume. This approach avoids widespread binding of early seral constraints and also, over time, advanced the recovery of depleted stands.

6.1.9 Logging Method

The purpose of this section is to describe the logging methods used in the TSA. There is no timber supply modeling assumptions related to Table 30.

Table 30. Logging Method

Zone or analysis unit	Logging Method	Volume of wood (m^3) OR Percent of Annual Harvest (* Rounded to the nearest percentage)
All	Conventional	100%*

6.1.10 Harvest Flow Policy & Rates

The harvest flow policy used in the analysis was to match the current AAC uplift for the first five years of the planning horizon (2009-2013), then minimize the depth and duration of the MPB epidemic induced harvest trough before returning to a maximum LTHL that is sustainable as evidenced by non-declining THLB growing stock.

The initial harvest rate was based on the allowable annual cut of 3.13 million cubic metres set in the expedited timber supply review in June of 2004. The first 20 periods (starting in 2009) were each 5 years long, followed by 15 periods of 10 years for a total planning horizon of 250 years.

6.1.11 Silvicultural systems

Clearcut with reserves is the predominant silvicultural system in use in the Lakes TSA. Under this system, a range of patch sizes (1 ha to several hundreds of ha) of even-aged forest is being produced. Cutting of adjacent blocks is restricted until green-up conditions are met. A characteristic of this system is the maintenance of older forest remnants within harvest blocks. These remnants are intended to function as wildlife tree patches, riparian reserves and management zones, and island remnants to conserve old growth characteristics.

6.2 Silviculture

6.2.1 Regeneration activities in managed stands

Recent plantations and future stands were grown on managed stand yield tables (MSYTs) produced using the MoFR TIPSY growth and yield model. The assumptions for building the yield tables were based on those found in the TSR4 Lakes Data Package, however there was some deviations and they will be noted in the subsequent sections.

6.2.1.1 Regeneration Delay

In TSR4, the regeneration delay of two years was applied to all analysis units. Consistent with previous IFPA analyses a 1-year regeneration delay was used for this analysis.

6.2.1.2 Operational Adjustment Factors

Operational adjustment factors (OAFs) are used to adjust timber yield estimates to account for operational conditions. OAF 1 is a constant percentage reduction to account for small unproductive areas within stands, uneven stem distribution, endemic losses and other random risk factors such as snow press. The OAF1 values used in this analysis differed from TSR4, where the OAF1 values developed in previous studies were used (Table 31). The IFPA has committed to collecting, monitoring and reporting actual OAF1 values achieved as part of the free growing survey information. The report, *Collecting Data on Operational Adjustment Factor Values in Conjunction with Silviculture Surveys* outlines how the OAF1 values will be integrated into free-growing surveys and can be found on the IFPA website; http://www.moricelakes-ifpa.com/publications/index.html.

Table 31. OAF 1 Values by BEC Classification within the Morice TSA

BEC Zone	Morice IFPA OAF1 Value
SBSdk 01/05/06	5
SBSmc2 01.01c/05/06/09/10	5
ESSFmc 01/04/05/06	5
ESSFwv 01	5
SBSdk 07	10
ESSFmc 09/10	10
All others	15

OAF 2 accounts for decay, waste and breakage, in this case 5% was used for all analysis units and was consistent with TSR4.

6.2.1.3 Density

TSR4 indicates that a density of 1500 stems/ha will be planted, however during discussions with the IFPA members and Carolyn Stevens in particular this analysis had assumed a different density: 1600 stems/ha.

6.2.1.4 Species Compositions

The Lakes TSR4 Data Package had indicated multiple species compositions for each managed analysis unit. This allows for a range of species compositions on the land base, based on the percentage of occurrence on the land base. A managed stand yield table (MSYT) may be built from a number of tables if more than one regeneration method is used within an analysis unit. In this case, the inputs into the TIPSY were blended based on the occurrence with the results listed in Table 32. Additionally, when developing the analysis units, criteria to correctly apply yield curve adjustments to account for the MPB epidemic were incorporated (age of the stand, Landscape Unit, etc).

Table 32. Species Composition Regeneration Assumptions

Composition	Method		Species Code/Percent Occurrence		Blended Species Comp. for MSYTs
	Type	%			
Balsam Leading	Plant	100	P60,S40	80	
Balsam Leading	Plant	100	S70,P30	15	P54.5,S44.5,B1
Balsam Leading	Plant	100	S40,P40, B20	5	
Spruce Leading	Plant	100	P60,S40	80	
Spruce Leading	Plant	100	S100	10	P51,S49
Spruce Leading	Plant	100	S70,P30	10	
Pine Leading	Plant	100	P60,S40	95	P62,S38

Composition	Method		Species Code/Percent Occurrence		Blended Species Comp. for MSYTs
	Type	%			
Pine Leading	Plant	100	P100	5	

6.2.1.5 Site Index Adjustments

Managed stand site indices are principally taken from PEM/SIBEC, where once a natural stand was harvested, the regenerating stand was grown on the site index based on the PEM/SIBEC relationships. The latest SIBEC values, "2008 Approximation" were used for this analysis. For more details on SIBEC refer to the website; http://www.for.gov.bc.ca/hre/sibec/.

7.0 Integrated Resource Management

A number of non-forest resource management objectives have been expressed as a need to maintain specified forest cover structures. These forest cover requirements will be used to model various issues including:

- Landscape level biodiversity;
- Species specific habitat requirements;
- Visual Resources;
- Recreation Resources;
- Green up requirements; and
- Patch size distribution.

7.1 Landscape Level Biodiversity

The following section outlines the forest management assumptions with respect to the forest cover constraints.

7.1.1 Seral Stage Constraints

7.1.1.1 Areas Outside the Chelaslie Migration Corridor

Landscape units and their associated Biodiversity Emphasis Options were modeled as outlined in the TSR4 Draft Information Package (Table 33). The assessment area for the indicators was the Crown Forested Area

Table 33. Seral Stage Assessment Units and Targets

Landscape Unit	Biodiversity Emphasis Option and BEC Zone	Early Seral		Mature plus Old Seral		Old Seral	
		Maximum Allowable Disturbance (%)	Age for Retention (years)	Minimum Retained Area (%)	Age for Retention (years)	Minimum Retained Area (%)	Age for Retention (years)
Babine East	Intermediate - SBS	54	<40	23	>100	11	>140
	Intermediate - ESSF	36	<40	28	>120	9	>250
Babine West	Low – SBS	N/A	<40	11	>100	11	>140
	Low - ESSF	N/A	<40	14	>120	9	>250
Bulkley	Intermediate - SBS	54	<40	23	>100	11	>140

Landscape Unit	Biodiversity Emphasis Option and BEC Zone	Early Seral		Mature plus Old Seral		Old Seral	
		Maximum Allowable Disturbance (%)	Age for Retention (years)	Minimum Retained Area (%)	Age for Retention (years)	Minimum Retained Area (%)	Age for Retention (years)
	Intermediate - ESSF	36	<40	28	>120	9	>250
Burns Lake East	Low – SBS	N/A	<40	11	>100	11	>140
	Low - ESSF	N/A	<40	14	>120	9	>250
Buns Lake West	Low – SBS	N/A	<40	11	>100	11	>140
	Low - ESSF	N/A	<40	14	>120	9	>250
Cheslatta	Intermediate - SBS	54	<40	23	>100	11	>140
	Intermediate - ESSF	36	<40	28	>120	9	>250
Fleming	Intermediate - SBS	54	<40	23	>100	11	>140
	Intermediate - ESSF	36	<40	28	>120	9	>250
Francois East	Low – SBS	N/A	<40	11	>100	11	>140
	Low - ESSF	N/A	<40	14	>120	9	>250
Francois West	Intermediate - SBS	54	<40	23	>100	11	>140
	Intermediate - ESSF	36	<40	28	>120	9	>250
Intata	Intermediate - SBS	54	<40	23	>100	11	>140
	Intermediate - ESSF	36	<40	28	>120	9	>250
Ootsa	Intermediate - SBS	54	40	23	>100	11	>140
	Intermediate - ESSF	36	40	28	>120	9	>250
Taltapin	Low – SBS	N/A	40	11	>100	11	>140
	Low - ESSF	N/A	40	14	>120	9	>250

7.1.1.2 Caribou Migration Corridors

Consistent with TSR4, seral stage requirements within the Caribou Migration Corridors were applied as forest cover constraints (Table 34).

Table 34. Seral Stage Requirements in Caribou Migration Corridor

Caribou Migration Zones	Seral Stages		
	< 40 years	> 80 Years	> 140 years
High Use	< 25%	> 60%	> 40%
Moderate Use	< 32%	> 45%	> 30%
Low Use	< 54%	> 30%	> 20%

7.1.1.3 Lakes South SRMP Landscape Corridors

The landscape corridors identified in the Lakes South SRMP were incorporated as constraints within the model (Table 35). The assessment area is the crown forested area.

Table 35. Lakes South SRMP Landscape Corridor Constraints

BEC Zone	Analysis Units	Minimum Area Retained (%)	Minimum Height Retained (m)	Minimum Crown Closure (%)	Age for Retention (years)
SBS	Conifer leading	70	-	-	≥ 70
ESSF	Conifer leading	70	-	-	≥ 100
SBS	All	70	15	25	≥ 100
ESSF	All	70	15	25	≥ 120
All	Deciduous leading	70	-	-	≥ 40

At least one of these criteria must be met in the Landscape Corridors. The timber supply analysis will model the minimum area and age requirements.

7.1.1.4 Lakes North SRMP Landscape Corridors

The Lakes North SRMP Landscape Corridors were incorporated in the dataset and modeled. These corridors were created as part of landscape-level habitat connectivity strategies. They are meant to maintain and enhance habitat connectivity at the landscape level across the Lakes District planning area to provide opportunities for the distribution of species, populations and genetic material. Their geographic extent and associated seral targets were in place for all scenarios/sensitivities. The constraint criteria are outlined in Table 36. The assessment areas for these constraints were the Crown Forested Area.

Table 36. Lakes North SRMP Landscape Corridor Constraints

Zone	Analysis Unit	Ecosystem	Minimum retained area (%)	Retention Period
Vegetative cover important for biodiversity	Balsam and spruce-leading > 140 years of age	All	100	Until 2015
	Balsam and spruce-leading > 140 years of age	All	70	From 2016 on
Hydro-riparian ecosystems	All	SBS dk 07, 08, 09, 10	100	Until 2015
		SBS mc 07, 09, 10, 12	100	Until 2015
		ESSF mc 07, 08, 09, 10	100	Until 2015
		SBS dk 07, 08, 09, 10	70	From 2016 on
		SBS mc 07, 09, 10, 12	70	From 2016 on
		ESSF mc 07, 08, 09, 10	70	From 2016 on
Rare ecosystems	All	TBA	100	All times

7.1.1.5 Specified Wildlife

Table 37 illustrates the habitat preservation requirements for specified wildlife. These requirements are designed to preserve and enhance winter range habitat for these species. These requirements are consistent with the TSR4 Draft Information Package.

Table 37. Habitat Preservation for Specified Wildlife

Habitat For:	Maximum Allowable Disturbance (% area)	Minimum Green-up Height (metres) / Age (years)	Minimum Retained Area (%)	Maximum Age for Retention (years)	Minimum Age for Retention (years)	Land base to Which Constraint Applies
Deer	33	3 m / 17 yrs				THLB
			50		101	Crown Forest
Moose	33	3 m / 17 yrs				THLB
			30		101	Crown Forest
Grizzly	50			121		Crown Forest
	33	5 m / 28 yrs				THLB

7.2 Visual Resources

A visual landscape inventory was completed for the Lakes TSA. Constraint targets were developed for the visually sensitive units and incorporated slope based based on methods outlined in a Forest Service Bulletin from December 12th, 2003 entitled 'Modelling Visuals in TSR III'. To perform this adjustment, there must be an ability to relate slope to the modeling dataset. In this case, slope classes were derived from the DEM generated for the Lakes TSA which allowed development of the constraint criteria listed in Table 38 and Table 39.

Denudation targets specify the maximum area permitted to be below the visually effective green-up height (VEG) at any time for each VSU. The VEG height represents the average[6] height trees must achieve so that alterations to forest cover due to disturbances are no longer visible from selected viewpoints.

Table 38. Percent Denudation Targets for Visually Sensitive Units.

Visually Sensitive Unit	Scenic Area	Recommended Visual Quality Class	Maximum Forested Area Allowed Below Visually Effective Green-up Height	Minimum VEG Height
Partial Retention Visually Sensitive Area	No	PR	9.1	Variable depending on slope (see Table 39, below)
Retention Visually Sensitive Area	No	R	45.3	
Partial Retention Scenic Area	Yes	PR	13.3	
Retention Scenic Area	Yes	R	49.6	

Table 39 was used as a lookup to derive the required VEG height for each VSU.

[6] TIPSY and VDYP only report the top height of the stand at a particular age and not the average height which is recommend for assessing VEG. Since top height reflects the average height of the 100 trees within a stand of largest diameter at breast height, use of this measure may result in more rapid achievement of VEG than if average height was used.

Table 39. Visually Effective Green-up for Scenic Areas

VQO: Retention									
slope (%)	0	10	20	30	40	50	60	70	80+
tree ht (m)	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0+
VQO: Partial Retention in Scenic Areas									
slope (%)	0	10	20	30	40	50	60	70	80+
tree ht (m)	3.0	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5+
VQO: Partial Retention in Visually Sensitive Areas									
slope (%)	0	10	20	30	40	50	60	70	80+
tree ht (m)	3.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0+

Denudation percent was calculated and tracked for each of the 733 VSU polygons delineated under the VLI. The assessment area in each VSU was based on the crown forested area in each VSU.

7.3 Cutblock Adjacency & Patch Size Distribution

The draft TSR4 information package states that adjacency will be modeled in an aspatial manner using the characteristics in Table 40. However, specifically modeling cutblock adjacency is not current practice within the Lakes TSA. The licensees have moved to using seral and patch size targets to create an acceptable patch size distribution on the THLB, reducing the level of fragmentation on the landscape. The licensees monitor and assess patch size distribution as part of their certification and/or Sustainable Forest Plan (SFMP) requirements every year.

Table 40. Cutblock Adjacency Constraint

Zone or Group	Maximum allowable disturbance (% area)	Green-up height (metres)	Land base to which constraints apply
Cutblock Adjacency	33%	3	THLB

The patch size distributions used for this project are listed in Table 41. The patch size distribution criteria were taken from the Lakes South SRMP.

Table 41. Desired Patch Distribution from Lakes South SRMP

Natural Disturbance Type	BEC Subzone	Small Patch	Medium Patch	Large Patch
2	ESSF mc	<40 ha	40 – 80 ha	>80 ha
		30 – 40%	30 – 40%	20 – 40%
3	SBS dk SBSmc	<40 ha	40 – 250 ha	>250 ha
		10 – 30%	10 – 30%	40 – 80%

The seral stage definitions used for assessing patches are provided in Table 42.

Table 42. Seral Classes for Patch Definition

BEC zone	Early	Immature	Mid	Mature + Old
ESSF	<=20	>20 and <=40	>40 and <=120	>120
SBS	<=20	>20 and <=40	>40 and <=100	>100

7.4 Reductions to Reflect Volume Retention in Cutblocks

7.4.1 Wildlife Tree Retention

The Biodiversity Guidebook describes two methods for providing the maintenance of stand structure over time. One method is wildlife trees while the other is wildlife tree patches. The Guidebook also indicates that wildlife tree patches (group reserves) larger than 2 ha in size within a cutblock boundary can contribute to old-seral stage forest requirements at the landscape level. The targets consistent with TSR4 and used for this analysis have been listed in Table 43 and Table 44.

Table 43. Wildlife Tree Retention Targets from the Lakes South SRMP

BEC Zone	% Cutblock to be Retained as WTP by Landscape Units					
	Chelaslie	Ootsa	Intata	Cheslatta	François West	François East
SBS	>12	>12	>16	>12	>13	>14
ESSF	>9	>9	>9	>9	>12	>9

Table 44. Wildlife Tree Retention Targets from the Lakes North SRMP

Landscape Unit	Analysis Unit	Persistence	% Retention
Babine East Babine West Bulkley Burns Lake East Burns Lake West Fleming Taltapin	All	Long term	10

In the Lakes North SRMP planning area, the management practice is to retain a minimum of 5% of the gross area of each cutblock for WTR, and to retain a minimum of 10% of the total area of cutblocks harvested on an annual basis.

All wildlife tree retention targets were applied to the THLB. The reductions were applied as percent area reduction of each cutblock harvested, through the “partial cut” functionality of the timber supply model.

8.0 Sensitivities

8.1 Genetic Worth Sensitivity

The IFPA genetic worth % increases and availability windows were duplicated for this dataset. The Forest Genetics Council Species Plan numbers for seedling availability and volume gains shown in Table 45 was applied to the Type 2 dataset's managed stand yield tables.

Table 45. Lakes Genetic Worth Factors for Future Managed Stands by Seed Planning Unit (SPU)

	Seedling Availability / Volume Gain	
SPU code	2008	2018
Pl BV low	54% / 10%	100% / 13%
Sx BV low	80% / 16%	100% / 23%
Sx PG high / Sx BVP high	100% / 19%	100% / 20%
Sx PG low / Sx BVP	87% / 28%	100% / 31%

8.2 Fertilization Sensitivity

MPB mapping was used to further sequence fertilization based on the levels of MPB Attack Severity mapping. Fertilization of candidate stands was performed annually during a 10-year window. In calculating the amount of fertilization to be performed annually, the total candidate stands available were determined and treated at a rate of 10% per year. The fertilization program was started in the model in 2010 and continued to 2020.

The criteria for stand selection for the fertilization program include:

- medium sites, having an SI between 12 and 18.
- Within Age Classes 2 (21-40 yrs), 3 (41-60yrs) and 4 (61-80 yrs).
- Fertilization Program to exclude stands within the following areas:
  - NonTHLB
  - VQO areas (Preservation, Retention)
  - Goat Habitat, Grizzly Habitat, Caribou habitat, Wildlife Corridors and BENs.
- Fertilization priorities were set within CMC and VQOs. Treatment Priorities within CMC areas would be low to high, and within VQOs, stands falling within Modification VQOs would be treated before Partial Retention. Partial Retention stands would be last in the Ranking.

The fertilization curves were developed in TIPSY version 4.1 and were derived so that each yield curve maintained its initial age and then fertilization and harvest deferrals occurred as per the specifications above. The default growth response in BatchTipsy was used (can not customize responses in Tipsy).

8.3 Rehab Sensitivity

Harvesting was used as a rehab measure within the model – essentially this was a treatment that reset the stands age and status. Stands were identified stands that did not achieve Minimum Harvest Criteria (140 m^3/ha for all species) after the MPB epidemic. These stands were forced to be harvested to simulate rehab. If any sawlog volumes exist in these stands it will contribute to the AAC since shelf life reductions already reduce the pine sawlog volumes appropriately.

The criteria for the rehab of eligible stands are listed below:

- Basic Rehab: SI >10 within age classes 2 & 3 and within stands that do not recover from MPB.
- BioEnergy Rehab: Age classes 4+ with an SI >10.
- Rehab costs will come from the Type 1 SIS.
- Rehab targets are from the amount of projected NSR in the Lakes due to MPB (Table 5)

8.4 Composite Scenario

This was developed based on input from the above sensitivities.

8.5 Premium Log Scenario

This was developed based on the Composite Scenario, where the harvest level is adjusted to allow for 10% of the resulting harvest to be in premium logs. The definition of premium logs is outlined in Table 46.

Table 46. Definition of Premium, Standard and Merchantable Sawlogs

Quality Class	Products	Species	Min Stand DBH
Premium Sawlog	Peelers, poles, house-logs and high grade sawlogs	All except deciduous	>32.5
Standard Sawlog	Sawlogs		27.5-32.5
Merchantable			>12.5 ,15 or 17.5 (depending on initial DBH utilization spec.)

9.0 Financial Assessment

The product values and harvest costs were provided by licensees in a planning meeting in December of 2008. Some of this information was taken from the previous Type I Silviculture Investment Strategy and some numbers, such as harvest costs were updated since harvest costs were not provided in the Type I analysis. The product values are listed in Table 47.

Table 47. Product Values

	Premium ($/m^3)	Sawlog ($/m^3)	Pulp ($/m^3)
Base	70	45	28

Table 48. Costs of Silvculture Treatments

Silviculture Treatments	Cost ($/ha)	Jobs (ha/day)	Application & Timing
Site Prep (Mounding & Disc Trenching)	550	1.7	Apply to all harvest blocks in same period of harvest
Planting Non-GW seedlings	864	1.5	Apply to all harvest blocks in same period of harvest, for Basecase/Fert and rehab runs
Planting GW seedlings	896	1.5	Apply to all harvest blocks in same period of harvest, for GW run
Rehabilitation	1200	3.2	Apply to all rehab blocks in same period of harvest, for GW run
Aeral Fertilization	395	10	Apply to Fertilized Blocks in Fert run

The harvesting costs used was an average harvest cost for the TSA of $37.73/m3 and came from the BC bioenergy website[7].

[7] B.C. Ministry of Forests and Range. 2008. Bioenergy Opportunities Using Wood Resources: Cost Estimates Based on July 1, 2007 Average Market Price Dataset (Forest Industry Averages). http://www.for.gov.bc.ca/hts/bioenergy/estimates/cost%20estimates.pdf. 2 pp