Integrated Silviculture Strategy

Fraser Timber Supply Area

Data Package

V 2.9

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Prepared for:

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1 Introduction

The Resource Practices Branch (RPB) of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) is developing a new management unit planning framework; Integrated Silviculture Strategy (ISS). The ISS is a sustainable forest management planning framework with the objective to integrate all aspects of landscape-level and operational planning for each Timber Supply Area (TSA).

The ISS integrates Type 4 Silviculture Strategies with timber supply reviews (TSR) to reduce duplication and redundancies where possible by sharing inventories, management zones, analysis units, Timber Harvesting Land Base (THLB) definitions and management assumptions. It is expected that the ISS process will improve the linkages to landscape level fire management, the Cumulative Effects Framework, the Forest and Range Evaluation Program's (FREP) multiple resource values assessments (MRVA) and other regional, management unit level or landscape level plans and strategies.

Provincial Timber Management Goals and Objectives (FLNRO 2014) and the Chief Forester's Provincial Stewardship Optimization/Timber Harvesting Land Base (THLB) Stabilization Project (FLNRO 2015) provide guidance to the ISS.

The ISS consolidates all resource management related goals, objectives and strategies into one plan and then links these to a TSA-wide tactical plan. The process includes a framework for monitoring and auditing, and continuous improvement.

The ISS aims to improve resource planning in British Columbia by addressing specific issues such as:

- Species at risk management and reserve allocation. Are the reserves placed where they provide the conditions most needed by species at risk?
- Ability to investigate options to co-locate reserves to provide required habitat benefits while preserving or increasing harvest opportunities;
- Current and predicted harvest levels – are the assumptions regarding the transition from old growth stands to second growth and managed stands accurate and, if not, what are the possible impacts on timber harvest and habitat values?
- What options are available to address habitat and timber supply using silviculture treatments?
- Effective use of public funds for new and existing funding initiatives;
- A feedback loop for adaptive management; ability to assess decision outcomes and modify behaviour based on new and better information; and,
- First Nations consultation; better understanding of the expected impacts of planned activities.

The project has the following objectives:

- Understanding and geospatial representation of existing and proposed legislation, regulations, and policy that conserve stewardship values;

- Seek information on ongoing monitoring and cumulative effect work, and collaborate to identify additional work needed;
- Collaborate with the intent to comprehend common landscape values;
- Develop decision support products for comprehensive and durable decisions based on scientific and traditional knowledge;
- Manage natural resources to continue providing the values that support traditional and modern-day use;
- Work to identify the underlying issues and work towards solutions;
- Integration of the scenario-based silviculture strategy process (Type 4) with the most recent Timber Supply Review (TSR);
- Prioritization of activities and treatments necessary to help with achievement of timber supply and habitat needs;
- Create a tactical plan documenting the strategies, targets, activities and treatments to improve or benefit other resource values; the targets would be agreed upon by those on the planning team; and,
- Incorporate climate change as a consideration into the resource management planning process, including the identification of any associated risks (e.g. wildfire).

1.1 Context

This document is the second of six documents that make up an ISS. The documents are:

1 Situational Analysis – describes in general terms the current situation for the unit. The Situational Analysis forms the starting point for the initial planning group meeting to identify opportunities.

2 Data Package - describes the information that is material to the analysis including data inputs and assumptions.

3 Modeling and Analysis report –provides modeling outputs and rationale for choosing a preferred scenario.

4 Integrated Silviculture Strategy – represents the preferred management scenario which is the basis for the first iteration of the ISS. It includes an investment strategy and provides treatment options, associated targets, timeframes and expected benefits.

When the ISS is complete, a spatial operations schedule will provide direction for harvesting and a land base investment schedule will guide Forest for Tomorrow Annual Operating Plans.

1.2 Study Area

The Fraser TSA is in south-western BC, and includes Metro Vancouver as well as Abbotsford, Chilliwack, Mission, Hope, and a number of smaller communities. The TSA is bounded by Georgia Strait and Howe Sound on the west, the Soo and Lillooet TSAs to the north, the Merritt TSA to the east, and the Canada-USA border to the south (Figure 1). The TSA includes much the Fraser Canyon and the southern Coast and Cascade Mountains, as well as the entire Fraser Valley floodplain and delta. The total area of the TSA is 1,648,628 hectares.

The Fraser TSA is part of the FLNRORD Coast Region, and is administered by the FLNRORD, Chilliwack Natural Resource District in Chilliwack.

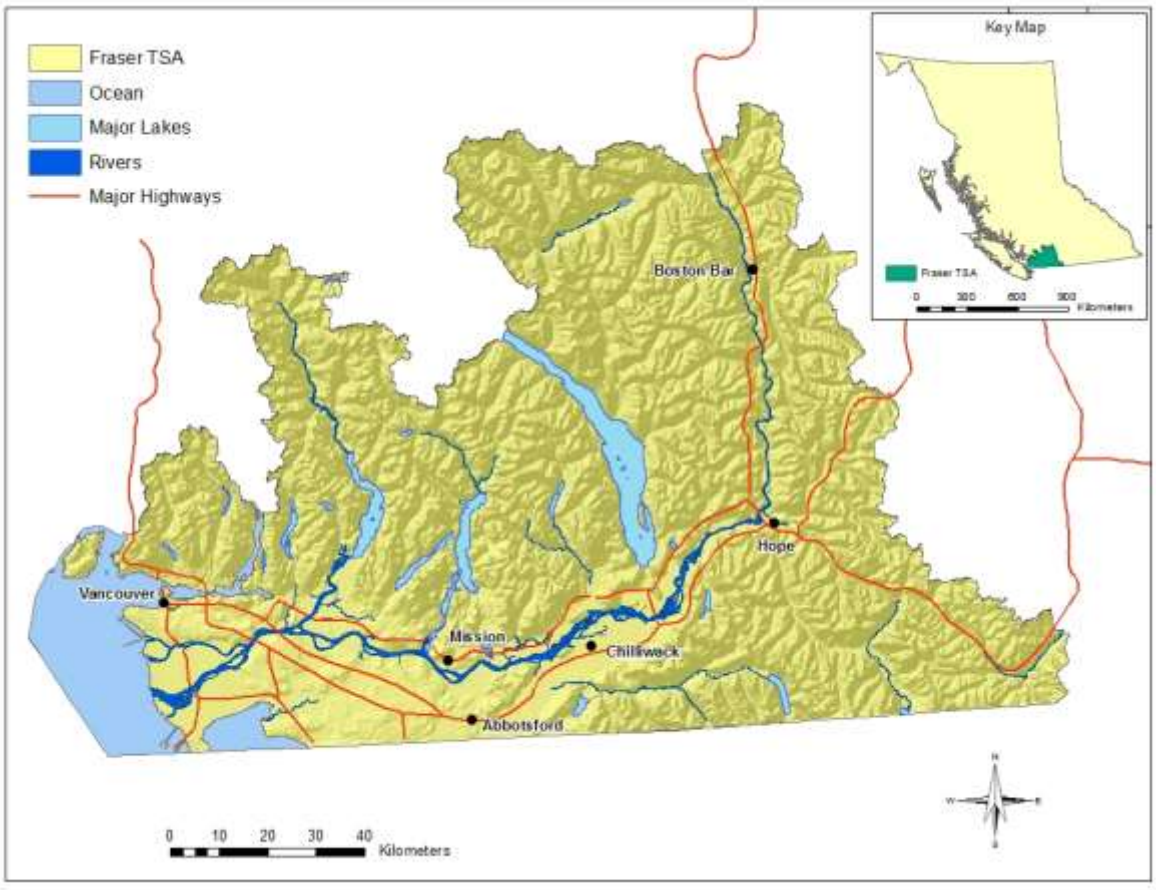

Figure 1: Fraser TSA location map

1.2.1 S'ólh Téméxw Use Plan

S'ólh Téméxw, the traditional territory of the Stó:lō First Nation, covers approximately 90 percent of the productive forest in the Fraser TSA and overlaps many other First Nations territories. The S'ólh Téméxw Use Plan (STUP) is a high-level strategic plan that expresses the land use interests of the Stó:lō, including economic development, cultural heritage, and environmental conservation and protection.

While the STUP has not been established through legislation, it is being considered in operational resource planning in the TSA. Cultural values recognized in the STUP are considered through various means such as co-location with existing reserve areas.

1.2.2 Landscape Unit Plans

While there is no existing land use plan in place, there are several landscape unit plans (LUP) in the Fraser TSA. Out of the total of 24 landscape units within the TSA, 21 are covered by 12 LUPs. The landscape units and their associated plans are listed in Table 1.

Table 1: Landscape Unit Plans in the Fraser TSA

Landscape Unit	Landscape Unit Plan Name	Date
Ainslie	Fraser Canyon LUPs Legal Order and Objectives	2004
Alouette	Lower Fraser SRMP Legal Order and Objectives	2013
Anderson	Fraser Canyon LUPs Legal Order and Objectives	2004
Big Silver	Big Silver LU – Legal Order and Objectives	2005
Chehalis	Chehalis LU – Legal Order and Objectives	2006
Chilliwack	Chilliwack LU – Legal Order and Objectives	2005
Coquihalla	Coquihalla LU Order and Objectives	2004
Coquitlam		
East Harrison	East Harrison LU – Legal Order and Objectives	2005
Fraser Valley South	Lower Fraser SRMP Legal Order and Objectives	2013
Hatzic	Lower Fraser SRMP Legal Order and Objectives	2013
Manning	Manning LU Order and Objectives	2004
Mehatl	Fraser Canyon LUPs Legal Order and Objectives	2004
Nahatlatch	Fraser Canyon LUPs Legal Order and Objectives	2004
Pitt	Lower Fraser SRMP Legal Order and Objectives	2013
Seymour-Capilano		
Silverhope	Silverhope LU Order and Objectives	2004
Similkameen		
Spuzzum	Fraser Canyon LUPs Legal Order and Objectives	2004
Stave	Lower Fraser SRMP Legal Order and Objectives	2013
Tretheway	Tretheway LU – Legal Order and Objectives	2005
West Harrison	West Harrison LU – Legal Order and Objectives	2005
Widgeon	Lower Fraser SRMP Legal Order and Objectives	2013
Yale	Yale LU Order and Objectives	2004

1.2.3 Spotted Owl Management Plan

The spotted owl management plan covers the Soo and Fraser TSAs and provides guidelines for the protection of spotted owl habitat. Some areas have been designated as Long-Term Owl Habitat (LTOH) while other areas are Managed Future Habitat Areas (MFHA). The LTOH areas are protected from harvesting, whereas harvesting is permitted in the MFHA with restrictions.

Harvesting in the LTOH may be permitted providing that replacement LTOH are designated within the MFHA.

1.2.4 Roosevelt Elk Management Plan

Roosevelt Elk are blue-listed in BC and a provincial management plan (FLNRO 2015) established population targets for portions of the TSA; however, there are no immediate land use implications (e.g., proposed Ungulate Winter Ranges).

1.2.5 Marbled Murrelet Recovery Implementation Plan

In respond to the federal Species-at-risk listing of the Marbled Murrelet, the Province has established a habitat retention threshold on the South Coast of 85% of suitable Marbled Murrelet habitat, based on a 2002 baseline (FLNRORD 2018). The precise distribution of this retention target is being developed and will be reflected in a future legal order.

1.2.6 Northern Goshawk Recovery Implementation Plan

Similarly, in response to the federal listing of the Northern Goshawk, *laingi* subspecies, the Province is implementing a strategy that will include protection of 30 new breeding area reserves on the South Coast (FLNRORD 2018). Implications of the strategy for the TSA have not been determined because the eastern portion of the TSA is in the "transition zone" with another subspecies of Northern Goshawk. Additionally, the Province has yet to respond to recent genetic analyses questioning the current classification of Northern Goshawks in the region as part of the *laingi* subspecies (Geraldes et al. 2018).

2 Timber Supply

2.1 Forest Inventory

The forest inventory for the Fraser TSA is a vegetation resource inventory (VRI). It was completed using 1996 aerial photography. Since then the inventory information has been updated for disturbance and forest cover attributes have been projected to 2016 in the most current inventory file.

VRI Phase 2 sampling was completed in the Chilliwack Natural Resource District (excluding private lands, parks and protected areas, TFLs, and woodlots). The data was compiled in 2014 for the TSR.

The overall volume adjustment ratio (net decay waste and breakage) was 0.98 indicating that the Phase 1 inventory slightly overestimates the overall per ha volume. Due to discrepancies in the sample data the latest TSR utilized unadjusted inventory volumes and natural stand yield tables.

2.2 Historical and Current Annual Allowable Cut (AAC)

The current AAC in the Fraser TSA is 1,235,700 m^3 per year (Table 2). This AAC was set in 2016 and will remain in effect until a new AAC is determined, which must occur in 2026 or before.

Table 2: Historical and current AAC (m^3 per year)

AAC (m^3)		1999	2004	2011	Current (2016)
		1,270,000	1,270,000	1,239,100	1,235,700
Partition	Conifer	1,237,500			
	Deciduous	32,500			

2.3 Apportionment of the AAC and TSA Licensees

Table 3 shows the current apportionment of the AAC to various license types within the Fraser TSA. Approximately 74% of the AAC has been committed to the licensees operating within the TSA. Note that the apportionment does not match the current AAC. This is because the current AAC has not yet been apportioned.

Table 3: Apportionment, Fraser TSA

Tenure	Total (m^3)
Forest Licenses Replaceable	650,119
Forest Licenses Non-Replaceable	290,116
Community Forest Agreement	44,300
BCTS Timber Sale License	246,745
TSL <=10,000 m^3 Replaceable	6,005
Woodlot License	12,600
Forest Service Reserve	20,115
Total	**1,270,000**

3 Modelling Approach

3.1 Model

Model Name: Forest Simulation and Optimization System (FSOS)

Model Developer: Dr. Guoliang Liu

Model Development: UBC, Hugh Hamilton Limited, Forest Ecosystem Solutions Ltd.

Model Type: Landscape Design Model

For this analysis Forest Simulation Optimization System (FSOS) is used for modelling. FSOS can operate as both a simulation and a heuristic optimization model using the same database. Simulation allows for sensitivity analysis and utilizes a hard constraint-based approach. Optimization is a target-oriented approach representing a shift in modeling approach from "what can we take from the forest" to "what can we create in the forest." Blocking and scheduling is conducted separately in simulation, and simultaneously in optimization. Scheduling in simulation progresses one period at a time, while optimization planning considers all periods at the same time. Data can be spatial and/or non-spatial. FSOS accommodates overlapping resource values and constraints and can account for multiple values such as timber, silvicultural treatments, carbon allocation, biodiversity, wildlife, and visual quality. Algorithms employed in FSOS include simulated annealing, Tabu search algorithms, and Hill Climbing.

3.2 Integrated Silviculture Strategy Base Case and Scenario Analysis

This analysis first built a dataset based on the assumptions of the latest Fraser TSA TSR. The dataset was updated for depletions and ownership changes. The TSR Base Case analysis assumptions were revised through stakeholder meetings to reflect current management in the Fraser TSA. Table 4 shows the TSR Base Case assumptions in a nutshell.

Scenario analysis will be used to test the impact of different management approaches on various indicators.

Table 4: ISS Base Case Assumptions

Objectives and overall assumptions	**Characterize current management to the extent practicable**
Land base assumptions	• Follow the latest TSR with updates to ownership etc. • Remove prospective FNWL outside of BCTS operating area from the THLB; • Remove known NOGO nests and nest buffers from the THLB; • Incorporate the STÓ:LŌ Plan in the analysis (netdowns); • Incorporate proposed Northern Goshawk (NOGO) WHAs and nests currently outside of WHAs in the analysis; • Use most TSR assumptions as they are; • Remove areas considered uneconomic from the THLB (in addition to TSR definition of uneconomic); • THLB 219,490 ha.
Harvest assumptions	• Incorporate available proposed harvest into the harvest forecast; • Use highest volume first harvest rule; • Incorporate the STÓ:LŌ Plan in the analysis (harvest constraints); • Set harvest priority based on distance from road and timber supply block; • Limit the harvest of stands older than 115 years to around 460,000 m^3 per year;

Objectives and overall assumptions	**Characterize current management to the extent practicable**
	• Maintain the harvest of HemBal around 50% of total harvest until natural HemBal stands are mostly harvested; • Limit alder harvest to 10,000 m^3 per year; • Include other deciduous in conifer leading stands in harvest and modelling (biodiversity values and silviculture implications).
Silviculture assumptions	• BEC based analysis units for managed stands; • Use the provincial site index layer as the site index source for managed stands; • Use TASS for modelling the growth and yield of managed stands; • Incorporate past treatments (fertilization); • Separate existing managed stands into eras to reflect different management.
Habitat assumptions	• Spotted Owl legal requirements as per TSR; • Report on nesting and foraging habitat in each LU as per the Spotted Owl model; • Report on Marbled Murrelet habitat; • Report on potential NOGO forage habitat.

3.3 Forest Inventory and Land Base Data

3.3.1 Data Sources

The data and assumptions for this project were provided by FLNRORD. Table 5 lists all the spatial data layers used in the analysis, with their source and vintage. Most of the data was downloaded from the BC Geographic Warehouse (BCGW), or provided by Jim Brown (FLNRORD) as used in the TSR. Zones of significance shapefiles were provided by the Stó:lō Research and Resource Management Centre (SRRMC).

Table 5: Spatial Data Sources

Layer Name	Description	Source	Vintage
tsa_bdy	Fraser TSA boundary	BCGW	2016
own	Generalized ownership complied by District	TSR	2013
f_own	Generalized ownership	BCGW	2016
fnt_treaty_ln	First Nation Treaty Lands	BCGW	2016
fnt_treaty_areas	First Nation Treaty Areas	BCGW	2016
fn_trt_rl	First Nation Treaty Related Lands	BCGW	2016
fadm_designated	Designated Areas (Yale Final Agreement)	BCGW	2016
ften_managed_licence	Community Forest, Woodlot	BCGW	2016
lu	Landscape units	BCGW	2016
tsb	Timber Supply Blocks	BCGW	2016
bowen	Bowen Island	TSR	2014
cws	Community Watersheds	BCGW	2016
bec	BEC version 10	BCGW	2016
oper	harvest method and inoperable areas	TSR	1996
esa	Environmentally Sensitive Areas	TSR	1978
terrain	Terrain Stability Mapping	FESL (MOE)	various
uwr	Ungulate Winter Range	BCGW	2016
deer_wr	Deer winter range partial netdowns	TSR	2013
wha	Wildlife Habitat Areas	BCGW	2017
vqo	Visual quality objectives	BCGW	2015
ogma	Old Growth Management Areas	BCGW	2016
kweh	Kweh Kwuch Hum Spiritual Areas	TSR	2013

Layer Name	Description	Source	Vintage
karst	Karst potential polygons	BCGW	2016
rec	Recreation Areas	TSR and BCGW	2016
psp	100m buffers around active permanent sample plot locations	FESL (BCGW)	2016
research	Research installations	TSR	2013
arch	Archeological sites	TSR	2013
fert	Fertilized areas from RESULTS	BCGW	2017
cons_cutblk_2015	Consolidated Cutblocks 2015 version	BCGW	2015
depl	Recent depletions from RESULTS	BCGW	2017
vri_2016	Vegetation Resource Inventory	BCGW	2016
rma	Riparian management areas	TSR	2013
hydro	Buffered powerlines	TSR	2013
road_15m	Buffered roads (15m wide)	TSR	2013
CulturalLandscape Feature	Sto:lo zones of significance	SRRMC	2017
CulturallySensHabitat	Sto:lo zones of significance	SRRMC	2017
HeritagePoly	Sto:lo zones of significance	SRRMC	2017
ProtectWatershed	Sto:lo zones of significance	SRRMC	2017
Sanctuary	Sto:lo zones of significance	SRRMC	2017
SensWater	Sto:lo zones of significance	SRRMC	2017
SubAlpine20	Sto:lo zones of significance	SRRMC	2017
PSTA_Public_Threat _Rating	Wildfire threat rating	FLNRORD	2015
Wildland_Urban_ Interface_Buffer_ Area	Wildland Urban Interface	FLNRORD	2015
site_productivity	Provincial site index layer: Raster site indices by species for entire province	FLNRORD	2017
licop	Licensee Operating Areas	FLNRORD	2017
sublu	Sub-Landscape Units	FLNRORD	2017
FNWL	Proposed First Nations Woodland Licenses	FLNRORD	2017
Slope_Aspect_Elev	Slope, aspect, and elevation classes	FESL (from TRIM)	2017
TEM	Hope IFPA and Dewdney TEM projects	BA Blackwell	2008
Wildlife	Wildlife Habitat data for Northern Goshawk and Marbled Murrelet	FLNRORD	2017

3.3.2 Forest Inventory and Depletions

The current forest inventory in the Fraser TSA is mainly new Vegetation Resource Inventory (VRI), based on 1996 aerial photographs, with a minor portion of rolled over FC1. The Forest Analysis and Inventory Branch (FAIB) updates and projects the VRI annually. The current version is updated with depletions up to April 2015, and projected to January 1, 2016.

FESL combined the VRI with the 2015 Consolidated Cutblocks layer and recent harvest from RESULTS openings. Consolidated Cutblocks includes harvest up to the end of 2014; RESULTS was used to identify logged blocks from 2015 and 2016.

The VRI projected age was updated based on depletions as follows:

- For depletions in 2011 or later, calculate age in 2016 as 2016 minus depletion year;
- For depletions between 1997 and 2010, the VRI may already be updated. An expected age was calculated as (2016 minus depletion year) and compared to the VRI projected

age. If the VRI projected age was greater than the expected age plus 1, or if the VRI age was null, we used expected age, otherwise the VRI age was used;

- For older depletions (before 1997), if the VRI age was null, we used the depletion year to calculate age, otherwise the VRI age was used;
- For all other stands, we used the VRI projected age;
- If a stand belongs to the FMLB with the VRI age null and no depletion date, we assumed that the stand is NSR and set age in 2016 to 0.

3.3.3 Ownership

After discussion with FLNRORD, it was determined that the ownership as used in the TSR analysis would be used for this project. The dataset was updated with the most recent woodlot data.

As the TSR dataset did not cover the entire TSA, the remaining area was filled in using the Provincial *f_own* and First Nations Treaty data. The Yale Final Agreement lands were added to the final ownership layer and some cleanup of sliver polygons within urban areas was completed.

4 Description of the Land Base

4.1 Timber Harvesting Land Base

Land base assumptions define the land base classification in the Fraser TSA. The different classes are a result of a land base netdown. The netdown is an exclusionary process. Once an area has been removed, it cannot be deducted further along in the process. For this reason, the gross area of netdown factors (e.g. inoperable) is often greater than the net area removed; a result of overlapping resource issues.

The TSA is classified in the following classes:

Excluded Land Base (EXLB) — private lands, non-forested areas and roads are excluded from the land base. These areas are excluded because they do not contain forest or are not managed by the Crown.

Crown Forested Land Base (CFLB) – the CFLB is identified as the broader land base that contains forest and can contribute towards meeting both timber and non-timber objectives (i.e. biodiversity).

Managed Forest Land Base (MFLB) – the MFLB is the portion of the CFLB excluding parks and protected areas.

Timber Harvesting Land Base (THLB) - the THLB is the portion of the CFLB considered to be physically, environmentally, economically and socially available for timber harvesting. It is productive forest land that is harvestable according to current forest practices and legislation.

Non-Harvestable Land Base (NHLB) — this is the portion of the CFLB where harvesting is not expected to occur according to current forest practices and legislation. The NHLB includes some areas that are currently not harvestable due to economic considerations. There is a possibility that some or all of these areas could become harvestable under different economic conditions.

The land base netdown is shown in Table 6 with each reduction described below.

Table 6: Fraser TSA netdown summary

Netdown Category	Net Area (ha)	Gross Area (ha)	MFLB Area (ha)
Total Area		**1,648,628**	
Ocean	98,728	98,728	0
Community Forest	26,075	26,075	0
Other Tenures and Leases	59,803	59,803	0
Private and Federal Land	297,688	297,688	0
TFL Lands	18,336	18,336	0
First Nations Treaty	2,225	2,225	0
First Nations Woodland License	6,758	6,778	0
Non-Forest	315,173	669,552	0
Hydro Lines	3,127	4,793	0
Roads	15,210	26,710	0
CFLB Area	**805,506**		
Parks	185,342	297,132	0
Inoperable Areas	259,931	1,086,686	259,931
Unmerchantable	10,406	61,844	12,755
Low Site	16,131	1,212,762	283,412
Old Growth Management Areas	20,949	81,618	52,962
Wildlife Habitat Areas	32,935	90,880	77,589
Ungulate Winter Range - Goat	1,807	35,487	24,129
Archeological Sites	442	2,506	791
Terrain and ESA	11,691	111,956	82,224
PSP and Research	492	1,027	672
Riparian Management Areas	12,824	71,994	23,458
Ungulate Winter Range - Deer	1,966	9,268	8,199
WHA Partial	494	950	732
Draft WHA – NOGO	136	400	261
Recreation Areas	279	621	446
S'ólh Téméxw Use Plan	9,408	91,175	38,821
Cultural Heritage Areas	148	315	308
Low Potential HemBal	11,067	12,773	12,553
Wildlife Tree Patches	8,421	10,526	9,927
Karst	3	4,117	1,580
Spotted Owl MFHA	1,141	1,143	1,089
NHLB Area	**586,016**		
THLB Area	**219,490**		

4.1.1 Ocean

The Fraser TSA includes Indian Arm, Burrard Inlet, English Bay, and parts of Howe Sound and Georgia Strait for a total of 98,728 ha. All these saltwater areas are removed from further analysis.

4.1.2 Community Forest

There is one community forest within the Fraser TSA, K3J, which is removed from the CFLB. The total area is 26,075 ha.

4.1.3 Other Tenures and Leases

Woodlots, watersheds, and miscellaneous lease ownership categories are removed from the CFLB. These areas are shown in Table 7.

Table 7: Other Tenures and Leases in the Fraser TSA

Category	Area (ha)
Watershed	50,767
Active Woodlot	8,929
Misc. Lease	107
Total	**59,803**

4.1.4 Private and Federal Lands

All private lands, federal reserves, military reserves, and Indian reserves are removed from the CFLB. The area in each category is shown in Table 8.

Table 8: Private and Federal Lands in the Fraser TSA

Category	Area (ha)
Private	284,983
Federal Reserve	765
Indian Reserve	11,925
Federal Military Reserve	15
Total	**297,688**

4.1.5 Tree Farm Licenses

There are two Tree Farm Licenses (TFLs) within the Fraser TSA, TFL26 and TFL43. The total area within these TFLs is 18,336 ha. This area is removed from the CFLB.

4.1.6 First Nations Treaty Lands

The Tsawwassen First Nation Treaty Lands and the Yale Final Agreement Lands are within the Fraser TSA. These areas are shown in Table 9 and are removed from the CFLB.

Table 9: First Nations Treaty Lands in the Fraser TSA

Category	Area (ha)
Tsawwassen First Nation Treaty Lands	663
Yale Final Agreement Lands	1,562
Total	**2,225**

4.1.7 First Nations Woodland License

There are two planned First Nations Woodland Licenses (FNWL) in the Fraser TSA that are removed from the CFLB. The total area removed is 6,778 ha, as shown in Table 10.

Table 10: First Nation Woodland License Areas in the Fraser TSA

FNWL	Area (ha)
Leqamel	3,214
Matsqui	3,564
Total	**6,778**

4.1.8 Non-Forest

Non-forest is defined based on the VRI fields Forest Management Land Base Indicator (FMLB), Land Cover Class 1 (LCC1), and logging history. Any areas where LCC1 is treed and FMLB = Y are considered forest, as are previously harvested areas where LCC1 is bryoid (BL, BY), exposed land (EL, ES), herb (HE, HF, HG), or shrub (SL, ST). Other areas are non-forest.

Using the FMLB field alone led to large urban areas being classified as forest, so the LCC1 criteria were added to ensure these urban areas were removed from the CFLB.

The total area of non-forest within the Fraser TSA is 669,552 ha.

4.1.9 Transmission Lines

Hydro transmission line right-of-way areas used in TSR were provided by FLNRORD. These areas were removed from the CFLB. Total area within hydro right-of-way is 4,793 ha.

4.1.10 Existing Roads

Buffered roads used in TSR were provided by FLNRORD. All roads were assumed to be 15m wide, and this area was removed from the CFLB. Total road area within the Fraser TSA is 26,710 ha.

4.1.11 Parks and Protected Areas

All provincial parks, protected areas, ecological reserves, and other park-equivalent areas were removed from the THLB. The area of each protected area category is shown in Table 11.

Table 11: Parks and Protected Areas in the Fraser TSA

Category	Area (ha)
Ecological Reserve	3,269
UREP	592
Provincial Park	283,787
Wildlife Management Area	1,164
Park Equivalent	7,935
Misc Reserves	385
Total	**297,132**

4.1.12 Inoperable Areas

Areas with no logging history and defined as physically inoperable were removed from the THLB. Total inoperable area is 1,087,686 ha.

4.1.13 Unmerchantable Species

Areas where the leading species is aspen, cottonwood, birch, maple, arbutus, yew, willow, or unknown were all removed from the THLB (Table 12).

Table 12: Unmerchantable Species in the Fraser TSA

Leading Species	Area (ha)
Aspen/Cottonwood	23,212
Birch	10,792
Maple	24,493
Arbutus	6
Willow	1,232
Unknown	2,109
Total	**61,844**

4.1.14 Low Site Areas

Areas with low growing potential will not be harvested and are removed from the THLB. This category is defined based on past harvest, leading species, harvest method, volume, and site index. (Species, site index and volume are all from VRI). These criteria are shown in Table 13. Both the volume and site index criteria must be below the threshold to remove the stand from the THLB. Table 14 shows the area in the low site category by species.

Table 13: Low Site Thresholds by Species and Harvest Method

Leading Species	Harvest Method	Site Index (m)	Volume (m^3/ha)
Hemlock/Balsam	Conventional	11	350
	Helicopter	13	400

Leading Species	Harvest Method	Site Index (m)	Volume (m^3/ha)
Cedar	Conventional	13	350
	Helicopter	15	400
Douglas Fir	Conventional	16	350
	Helicopter	18	400
Pine	Conventional	13	300
	Helicopter	all	all
Spruce	Conventional	11	300
	Helicopter	13	400
Alder	Conventional	n/a	150
	Helicopter	all	all

Table 14: Low Site Areas in the Fraser TSA

Leading Species	Conventional	Helicopter	Total
Hemlock/Balsam	7,837	850	8,686
Cedar	421	182	603
Douglas Fir	7,365	438	7,804
Pine	346	120	467
Spruce	294	17	311
Alder	8,165	89	8,253
Other/Inoperable			1,186,638
Total			**1,212,762**

4.1.15 Old Growth Management Areas (OGMA)

There are legally defined OGMAs in most of the landscape units in the Fraser TSA. These OGMAs are removed from the THLB, total area is 81,618 ha.

4.1.16 Wildlife Habitat Areas (WHA)

Wildlife habitat areas have been established in the Fraser TSA for Grizzly Bear, Spotted Owl (LTOHA), Mountain Beaver, Pacific Water Shrew, Coastal Giant Salamander, Pacific Tailed Frog, and Tall Bugbane. Some of these areas are no harvest zones, which are 100% removed from the THLB. Other areas allow some harvest under certain conditions, these are partially removed later on in the netdown (under Section 4.1.23 WHA Partial). The total area of no harvest WHA is 90,880 ha after accounting for overlaps (Table 15).

Table 15: No Harvest WHAs in the Fraser TSA

Species	Area (ha)
Tall Bugbane	339
Pacific Tailed Frog	36

Species	Area (ha)
Grizzly Bear	13,401
Mountain Beaver	78
Spotted Owl	75,687
Coastal Giant Salamander	1,135
Pacific Water Shrew	424
Total (with overlaps)	**91,099**

4.1.17 Goat Ungulate Winter Range (UWR)

Ungulate Winter Ranges have been established in the Fraser TSA for Mountain Goat, these areas are 100% removed from the THLB. The total area in goat UWR is 35,487 ha.

4.1.18 Archeological Sites

An archeological overview assessment was completed for the Chilliwack Forest District in 1999, and known locations were buffered by a minimum of one hectare. These buffers were used in TSR and provided to FESL by Jim Brown. The total area of archeological sites is 2,506 ha, this area is 100% removed from the THLB.

4.1.19 Terrain and ESA

For the TSR netdown, all Environmentally Sensitive Areas (ESA) classified as high for sensitive soils, regeneration difficulty, or avalanche that have not been previously harvested were removed from the THLB. For this analysis, terrain stability mapping was used in place of sensitive soils where it was available. Four terrain stability projects covering 97,737 ha were provided by the Ministry of Environment. Within these areas, terrain stability class V was used instead of ESA soils. No reduction was applied to terrain stability class IV or moderate ESAs. The total terrain and ESA area for the Fraser TSA is 111,956 ha (Table 16).

Table 16: Terrain and ESA Areas in the Fraser TSA

Category	Area (ha)
Terrain Class V	9,173
ESA soils	76,813
ESA regeneration	25,306
ESA avalanche	665
Total	**111,956**

4.1.20 Permanent Sample Plots and Research Installations

There are 172 active permanent sample plots (PSPs) in the Fraser TSA, each one was buffered 100m and that area removed from the THLB. There are also 101 research plots of various sizes. The total area of PSP and research plots is 1,027 ha.

4.1.21 Riparian Management Areas

As part of the TSR, lakes, rivers, wetlands, and streams were classified. These riparian classes were then buffered to make riparian management areas. The buffer width is determined by the width of the reserve zone, and the width and required retention in the management zone. These buffers were provided by Jim Brown and 100% removed from the THLB. Total area of riparian management areas is 71,994 ha.

4.1.22 Deer UWR

UWR #U-2-006 was established for mule and black-tailed deer. Harvesting is permitted with constraints on the age, species, and crown closure of stands. To facilitate modeling of these areas in TSR, MFLRNO calculated a percent netdown reduction for each UWR polygon based on the forest cover data and NHLB data. These reductions were applied as a surrogate for the harvest constraints. The total area of deer UWR removed from the THLB is 9,268 ha.

4.1.23 WHA Partial

Outside of the core habitat areas, there are WHA management area that allow conditional harvest. These are shown in Table 17. The total area removed from the THLB, after accounting for overlaps between species, is 950 ha. Note that there the netdown reduction for Spotted Owl managed forest habitat areas (MFHA) is applied separately at the end of the netdown (section 4.1.31).

Table 17: Partial WHA reductions in the Fraser TSA

Species	Area (ha)	Retention percent	Netdown Area (ha)
Tall Bugbane	881	60%	528
Pacific Tailed Frog	11	70%	8
Spotted Owl	29,139	0%	0
Coastal Giant Salamander - Upland	895	30%	269
Coastal Giant Salamander - Riparian	247	70%	173

4.1.24 Draft WHA – NOGO

Draft WHAs for Northern Goshawk (NOGO) have been delineated in the Fraser TSA. Although they are not yet approved, these areas were removed from the THLB in this analysis. The total area of draft WHA is 400 ha.

4.1.25 Recreation Areas

There are 16,588 ha in 125 different active recreation areas within the Fraser TSA, however, not all of these are excluded from harvesting. As part of the TSR, the District assigned a netdown reduction to each recreation area, resulting in 621 ha in 48 recreation areas being completely or partially removed from the THLB.

4.1.26 S'ólh Téméxw Use Plan

The People of the River Referrals Office (PRRO) provided the S'ólh Téméxw Use Plan (STUP) and spatial data for areas of cultural and spiritual significance to the Stó:lō people. The following areas were removed from the THLB (Table 18). After accounting for overlaps between features, the total area removed is 91,175 ha.

Table 18: S'ólh Téméxw Use Plan Areas Removed from THLB

Category	Area (ha)
Culturally Sensitive Habitat	200
Cultural Landscape Feature	12,280
Subalpine parkland plus 100m buffer zone	46,951
Sensitive Waterways plus 60m buffer	30,291
Canyon Heritage Area Corridor	2,065

4.1.27 Cultural Heritage Areas

The Kum-Kwuch-Hum (Mt Woodside) High Value Spiritual Areas are 100% removed from the THLB. The total area is 315 ha.

4.1.28 Low Harvest Potential Hemlock/Balsam Stands

The Chilliwack Natural Resource District Identified areas that are deemed to have low potential for harvest due to their species composition, age and location; location in this case also considered whether high harvest potential stands were adjacent or not (Table 19). A total of 12,773 ha of these stands were removed from the THLB.

Table 19: Low harvest potential HemBal stands

Profile	Composition	Road Buffer (m)	Slope (%)	Age (years)
> 50% HemBal	<=20% CW, FDC, YC	>200	>35	>115

4.1.29 Wildlife Tree Patches (WTP)

Wildlife tree patch requirements for the Fraser TSA are defined in the Landscape Unit Plans for most of the area. In 9 landscape units, the WTP retention percentage has not been defined, in these areas 7% retention will be used as per FRPA guidelines.

As per TSR, it was assumed that WTP requirements were already met in THLB areas within 200 m of NHLB. All THLB polygons more than 200 m from NHLB had the WTP reduction from Table 20 applied, with the WTP allowed to overlap with other partial reductions (e.g. if a polygon requires a 12% WTP reduction, but is already 5% RMA, the WTP reduction becomes 7%). This methodology resulted in 8,421 ha of WTP removed from the THLB.

Table 20: WTP requirements by landscape unit and BEC

Landscape Unit	BEC Variant	WTP Percent
Ainslie	CWHds1	12
	CWHms1	11
	ESSFdc2	9
	ESSFdcp	9
	ESSFmw	5
	IDFdk2	8
	IDFww	8
	IDFww1	8
Alouette	CWHdm	7
	CWHvm1	7
	CWHvm2	7
	CWHxm1	7
	MHmm1	7
Anderson	CWHds1	9
	CWHms1	9
	ESSFmw	6
	ESSFmwp	6
	IDFww	5
	MHmm2	7
Big Silver	CWHds1	9
	CWHms1	9
	ESSFmw	5
	MHmm2	5
Chehalis	CWHdm	10
	CWHvm1	10
	CWHvm2	10
	MHmm1	5
Chilliwack	CWHdm	13
	CWHds1	11
	CWHms1	11
	CWHvm2	9
	CWHxm1	10
	MHmm1	8
	MHmm2	8
Coquihalla	CWHds1	6
	CWHms1	7
	MHmm2	5
Coquitlam	CWHdm	7
	CWHvm1	7

Landscape Unit	BEC Variant	WTP Percent
Mehatl	CWHds1	6
	CWHms1	2
	ESSFmw	2
	IDFww	5
	MHmm2	1
Nahatlatch	CWHds1	3
	CWHms1	7
	ESSFmw	6
	ESSFmw2	6
	ESSFmwp	6
	ESSFmww	6
	IDFww	4
	IDFww1	4
	MHmm2	8
Pitt	CWHdm	7
	CWHvm1	7
	CWHvm2	7
	MHmm1	7
	MHmm2	7
Seymour-Capilano	CWHdm	7
	CWHvm1	7
	CWHvm2	7
	CWHxm1	7
	MHmm1	7
Silverhope	CWHds1	6
	CWHms1	6
	ESSFmw	3
	MHmm2	3
Similkameen	ESSFdc2	7
	ESSFmw	7
	IDFdk2	7
	MSdm2	7
Spuzzum	CWHds1	10
	CWHms1	10
	IDFww	6
	MHmm2	4
Stave	CWHvm1	7
	CWHvm2	7
	MHmm1	7

Landscape Unit	BEC Variant	WTP Percent
	CWHvm2	7
	MHmm1	7
East Harrison	CWHdm	9
	CWHds1	8
	CWHms1	8
	CWHvm1	12
	CWHvm2	12
	MHmm1	7
	MHmm2	7
Fraser Valley South	CDFmm	7
	CWHdm	7
	CWHds1	7
	CWHms1	7
	CWHvm2	7
	CWHxm1	7
	MHmm1	7
	MHmm2	7
Hatzic	CWHdm	7
	CWHvm1	7
	CWHvm2	7
	MHmm1	7
Manning	CWHds1	2
	CWHms1	4
	MHmm2	2

Landscape Unit	BEC Variant	WTP Percent
	MHmm2	7
Tretheway	CWHdm	10
	CWHds1	10
	CWHms1	6
	CWHvm2	6
	MHmm1	2
	MHmm2	2
West Harrison	CWHdm	14
	CWHds1	14
	CWHms1	14
	CWHvm1	14
	CWHvm2	14
	MHmm1	13
	MHmm2	13
Widgeon	CWHdm	7
	CWHvm1	7
	CWHvm2	7
	CWHxm1	7
	MHmm1	7
Yale	CWHds1	5
	CWHms1	8
	CWHvm2	8
	MHmm1	5
	MHmm2	5

4.1.30 Karst

There is no known karst in the Fraser TSA, however there are 51,468 ha where karst features are likely to be found. These areas are 8% removed from the THLB. This reduction can overlap with other partial netdowns, resulting in a final reduction of 3 ha.

4.1.31 Spotted Owl Managed Forest Habitat Areas

As stated in section 4.1.23, there are 29,139 ha of spotted owl MFHAs within the Fraser TSA. These areas allow partial harvesting, but require an additional 11% retention in drier ecosystems (CWHds1, CWHms1, CWHms2, MHmm2, and IDFww) and 5% in wetter ecosystems (CWHdm, CWHvm1, CWHvm2, and MHmm1). This additional retention cannot overlap with other reductions. The total reduction for Spotted Owl MFHA is 1,143 ha. Note that the Spotted Owl LTOHAs are removed from the THLB under WHA (Section 4.1.16).

4.2 Land Base Statistics

4.2.1 Climate

The climate in the TSA is mainly coastal, with the dominant biogeoclimatic zone being the coastal-western hemlock (CWH), with some mountain hemlock (MH), some Englemann spruce-subalpine fir (ESSF), some Coastal Douglas Fir (CDF) some Interior Douglas Fir (IDF), some Montane Spruce (MS) and alpine areas (CMA, IMA). Table 21 shows the areas of biogeoclimatic variants in the Fraser TSA.

Table 21: Biogeoclimatic variants in the Fraser TSA

BEC Variant	Area (ha)	Pct of Total
CDFmm	113,649	7%
CMAunp	171,605	10%
CWHdm	247,911	15%
CWHds1	91,632	6%
CWHms1	223,557	14%
CWHvm1	98,741	6%
CWHvm2	123,253	7%
CWHxm1	134,630	8%
ESSFdc2	6,216	0%
ESSFdcp	10	0%
ESSFmw	106,689	6%
ESSFmw2	3	0%
ESSFmwp	737	0%
ESSFmww	13	0%
IDFdk2	2,754	0%
IDFww	46,769	3%
IDFww1	40	0%
IMAunp	51,724	3%
MHmm1	93,611	6%
MHmm2	129,496	8%
MSdm2	5,588	0%
Total	**1,648,628**	**100%**

4.2.2 Species Profile

The CFLB in the Fraser TSA is dominated by western hemlock (Hw) mixed with balsam (Ba) and Douglas fir (Fd), with minor components of western redcedar (Cw), lodgepole pine (Pl), Sitka spruce (Ss), and alder (Dr). The hemlock/balsam (HemBal) leading stands constitute approximately 58% of the CFLB. The share of Fd-leading stands is 27% while Cw, Pl, Ss, Dr

and other species are each leading in 4% or less of the CFLB (Figure 2). "Other" species consist of deciduous and other unmerchantable species.

HemBal leading stands also dominate the THLB (53% of the area); however the share of Fd leading stands is substantially higher on the THLB at 34% of the area (Figure 3).

The same species ratio is reflected in the THLB inventory volume. Hemlock and Balsam stands constitute 56% of the standing timber inventory. The shares of Douglas-fir and Western redcedar are 29% and 12% correspondingly (Figure 4).

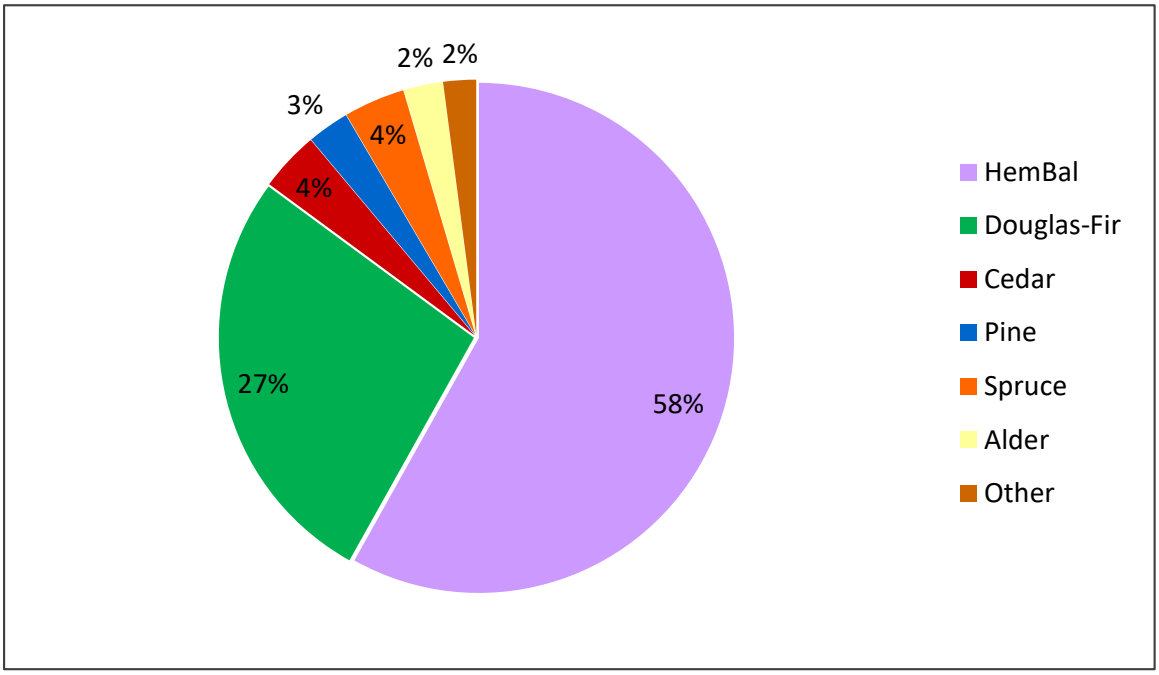

Figure 2: Leading species in the CFLB by area, Fraser TSA

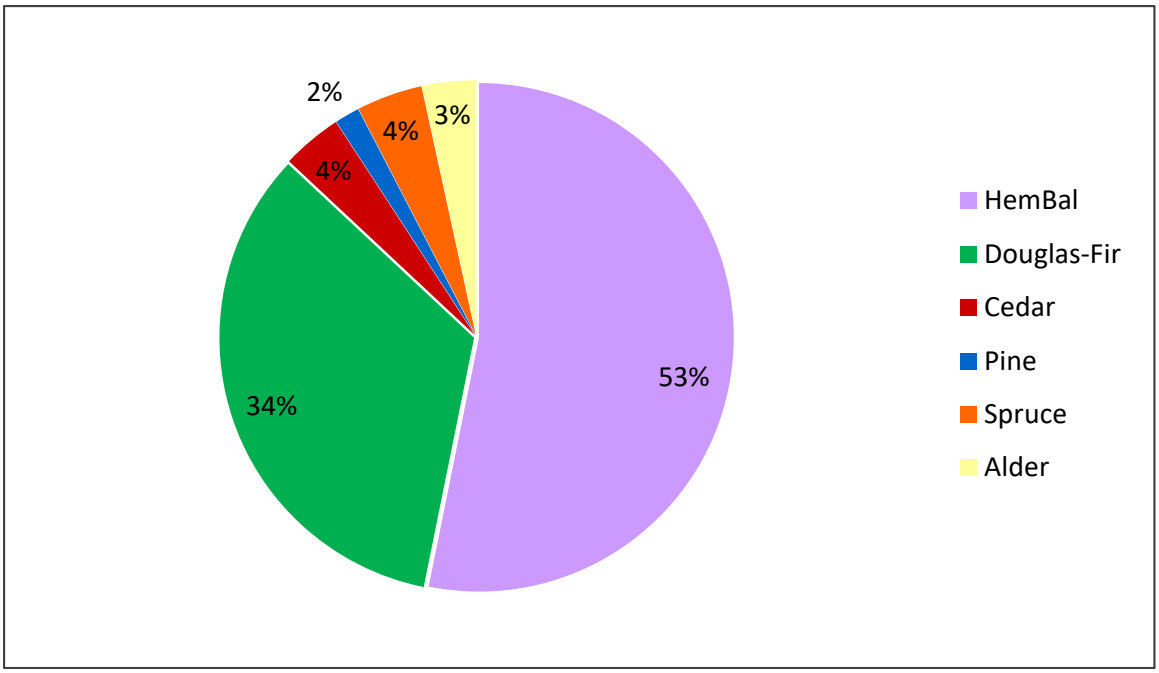

Figure 3: Leading species in the THLB by area, Fraser TSA

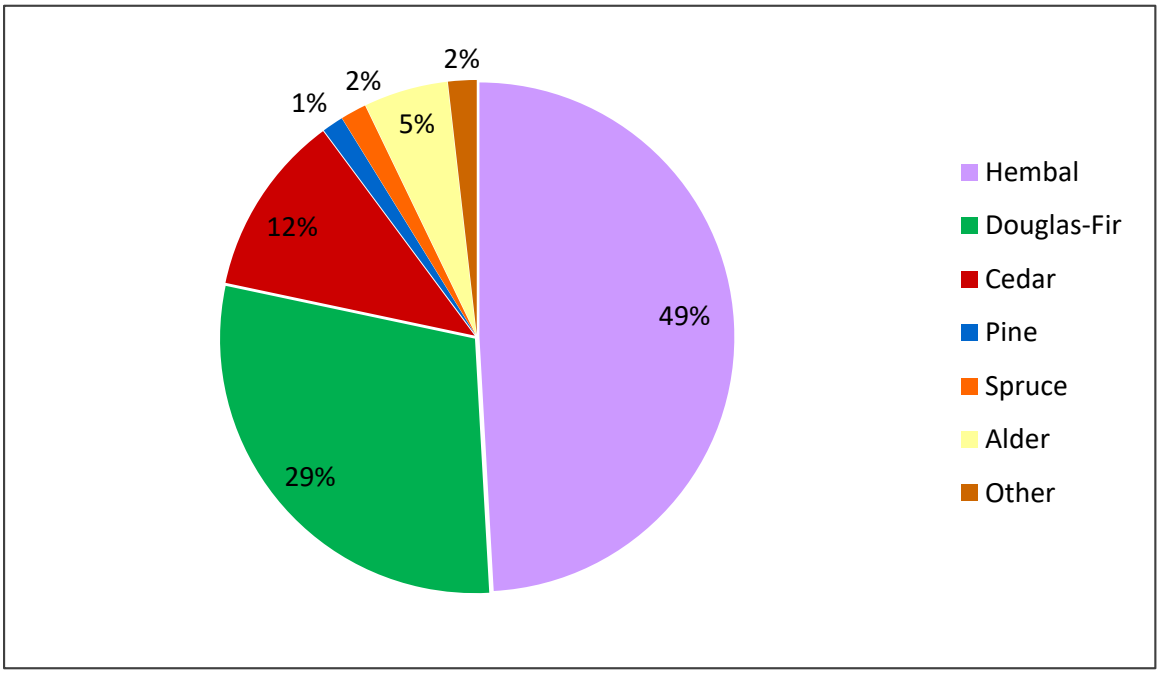

Figure 4: Inventory volume by species, Fraser TSA

4.2.3 Age Class Distribution

The TSA has a significant volume of second growth timber due to the long logging history extending back to the early 20th century. Approximately 60% of the THLB is younger than 60 years, while about 20% of the THLB is older than 140 (Figure 5). Age classes 5, 6 and 7 are not

well represented in the THLB. Approximately 75% of the old growth stands in the THLB are hemlock-balsam leading (Figure 6:).

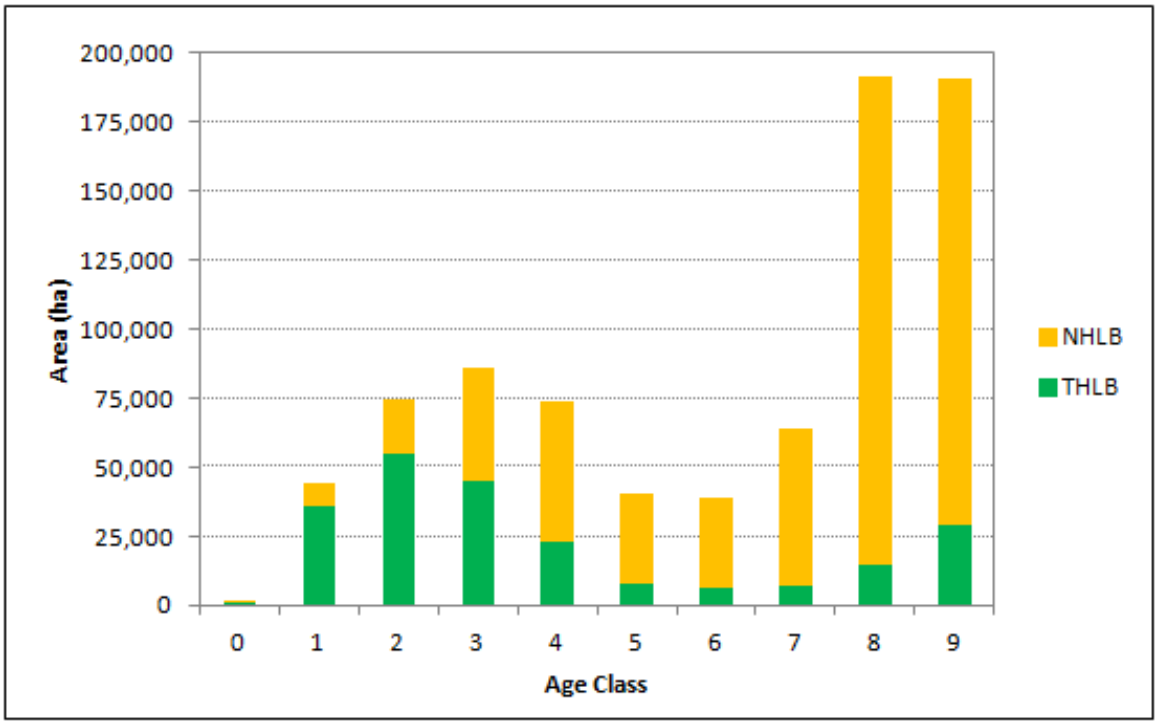

Figure 5: Age class distribution in the Fraser TSA

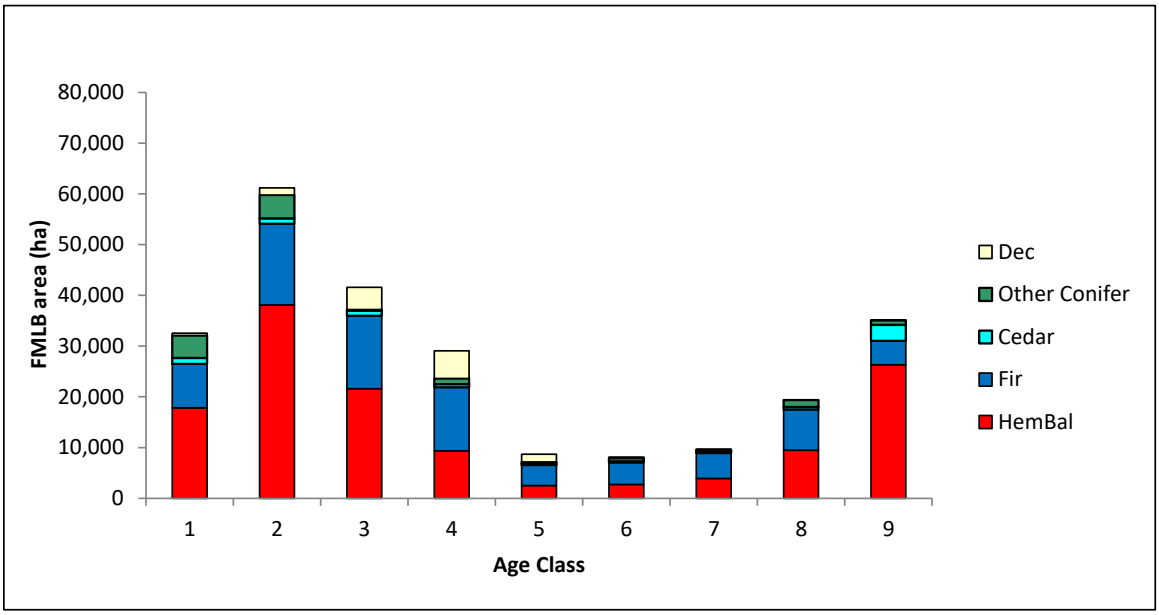

Figure 6: Age class distribution by leading species in the THLB, Fraser

5 Integrated Resource Management

This section provides details on how non-timber resource values are integrated with timber objectives in modeling.

5.1 Management Zones and Multi-Level Objectives

Management zones are geographically specific areas that require unique management considerations. Areas requiring the same management regime or the same forest cover requirements are grouped into management zones. Table 22 lists the management zones for the Fraser TSA and the rationale used to define these zones. Multiple resource issues may be present in the same forest area. For example, a management zone that requires a minimum area of mature and old seral forest may also have areas that are visually sensitive and require specific visual objectives. Forest estate models can accommodate multiple overlapping resource layers by establishing target levels for each layer. The models then schedule harvest units which best meet the target levels for all resource layers together.

Table 22: Management Zones –Base Case

Management Zone	Total Area (ha)	CFLB Area (ha)	Criteria Used to Delineate	Notes
Adjacent Cutblock Greenup				Applied by landscape unit to THLB areas outside VQO
Visual Quality Objectives: Retention (R) Partial Retention (PR) Modification (M)	 27,256 163,121 38,268	 20,894 115,503 30,757	GAR	Targets are applied to each VQO polygon separately, green-up height is 5m.
Biodiversity/Old Seral Stage				Targets met in OGMA
			LU/BEC	Track to understand current OGMAs and to facilitate testing aspatial old growth management.
Spotted Owl MFHA Wet Ecosystems Dry Ecosystems	 14,901 14,034	 12,812 12,713	WHA and BEC	Partial reduction applied in netdown
Spotted Owl Nesting and Forage Habitat			LU	As per the Spotted Owl Model (simplified)
Community Watersheds: 78 watersheds	 69,344	 25,328	Designated community watersheds.	Limit harvest to 1% percent of area annually.
S'ólh Téméxw Use Plan: Cultural Landscape Feature buffer Protected Watershed Sanctuary Canyon Heritage Upland	 29,303 68,078 57,370 11,770	 9,958 53,053 41,680 9,638	S'ólh Téméxw Use Plan	See Section 5.2.7
Marbled Murrelet Habitat	52,123	26,798		Old, undisturbed forest (second growth is not habitat)
Northern Goshawk Forage Habitat	3,928	2,190	Federal Recovery Strategy (Parks Canada 2017)	Based on age, height, species, BEC

5.2 Forest Cover Requirements

Modern natural resources management requires that multiple forest characteristics are retained across the landscape. These multiple characteristics are often referred to as forest cover objectives or requirements. It is important to identify how the THLB, and the productive forest which does not contribute to the THLB, are accounted for in the forest cover requirements. The most common way to express forest cover requirements is through maximum allowable disturbance or minimum area retention.

5.2.1 Landscape Green-up

As a surrogate for spatial cutblock adjacency constraint, a landscape green-up constraint will be applied in the base case, specifying that no more than 25% of the THLB area in each landscape unit outside of VQO may be below the green-up height of 3 m at any given time.

5.2.2 Visual Resources

Visual quality objectives are managed on 167,153 ha (21%) of the CFLB. Forest cover requirements for visual quality objectives are composed of two values:

- Visually Effective Greenup (VEG)—the stand height at which regeneration is perceived as a newly established forest, above which the stand is considered to have no visual impact; and
- Percent Planimetric Denudation—the maximum proportion of the productive area of a visual polygon that can be below the VEG height.

In the Fraser TSA, the VEG height is set at 5 m for all VQO areas.

The visual landscape inventory dataset field EVQO was used to determine the planimetric denudation limits. The limits are shown in Table 23. The targets are applied to the CFLB portion of each visual polygon separately. The allowable disturbance varies depending on the visual class and the visual absorption capability (VAC). The higher the VAC, the more disturbance is permitted. Polygons with no VAC provided are treated as moderate (VAC = M).

Table 23: Visual classes and maximum allowable disturbance

Visual Class	VAC	Maximum Allowable Disturbance	Number of Polygons	CFLB area (ha)
Retention (R)	L	1.1%	23	9,641
	M	3%	41	10,499
	H	5%	2	754
Partial Retention (PR)	L	5.1%	97	31,794
	M	10%	236	81,684
	H	15%	12	2,024
Modification (M)	L	15.1%	12	5,034
	M	20%	50	24,452
	H	25%	21	1,271

5.2.3 Community Watersheds

There are 78 community watersheds within the Fraser TSA, these are all constrained such that only 1% of the CFLB can be harvested each year. This will be modelled as a maximum of 5% every 5 years.

5.2.4 Biodiversity

In 21 of the 24 landscape units in the Fraser TSA, landscape-level biodiversity is managed through OGMAs, as discussed above in section 4.1.15. The landscape units that do not have legal OGMAs established consist mainly of parks and other NHLB areas; the provincial old growth order applies in these areas.

5.2.5 Spotted Owl Managed Forest Habitat Areas

Spotted Owl habitat areas have been established as WHAs in the Fraser TSA, with two habitat categories. Long Term Owl Habitat Areas (LTOH) are completely removed from the THLB (section 4.1.16) while Managed Forest Habitat Areas (MFHA) allow limited harvesting.

Within the spotted owl MFHA, a minimum of 10% of the area must be retained as wildlife tree retention, with a minimum of 40 large-diameter trees retained per hectare in drier ecosystems, and a minimum of 15 large-diameter trees per hectare in wetter ecosystems. No more than 40% of these retained trees can be in established WTP and other reserves.

Drier ecosystems are defined as BEC variants CWHds1, CWHms1, CWHms2, MHmm2, ESSFmw, and IDFww, while wetter ecosystems are defined as BEC variants CWHdm, CWHvm1, CWHvm2, and MHmm1.

Table 24 shows the Spotted Owl MFHA by BEC variant.

In the TSR, spotted owl MFHA targets were applied by adjusting the yield curves within MFHAs. In this analysis, MFHA retention was simulated by reducing the THLB (section 4.1.31).

Table 24: Spotted Owl MFHA in the Fraser TSA

Ecosystem	BEC Variant	CFLB (ha)
Drier	CWHds1	5,280
	CWHms1	6,205
	MHmm2	1,228
Wetter	CWHdm	2,292
	CWHvm1	5,207
	CWHvm2	3,613
	MHmm1	1,701
Total		**25,525**

A Spotted Owl habitat model was received from FLNRORD on November 2, 2017. This model defines suitable habitat for forage, nesting and dispersal based on BEC, leading species, and age. This model (forage and nesting only) will be used to track suitable owl habitat by landscape unit.

Suitable nesting habitat is defined as:

- Douglas Fir, Western Hemlock, or Cedar leading stands
- In BEC variants IDFdk2, IMA, and MSdm2
  - ✓ Age > 140
- In all other BEC variants
  - ✓ Age > 200

Suitable forage habitat is defined as:

- Douglas Fir, Western Hemlock, or Cedar leading stands
- Other stands with at least 30% Douglas Fir, Western Hemlock or Cedar component
- BEC variants IDFdk2, IMA, and MSdm2
  - ✓ Age > 80
- BEC variants CWHdm, CWHvm1, CWHvm2, CWHxm1
  - ✓ Age >120
- All other BEC variants
  - ✓ Age > 100

5.2.6 Old Seral Stage

Old growth in the Fraser TSA is managed through OGMAs. However, this analysis also tracks the achievement of old seral stage aspatially by LU and BEC variant to facilitate comparison with other scenarios that may test various alternatives to manage old growth (spatial vs. aspatial).

5.2.7 S'ólh Téméxw Use Plan

The People of the River Referrals Office (PRRO) provided the S'ólh Téméxw Use Plan (STUP) and spatial data for areas of cultural and spiritual significance to the Stó:lō people. The following constraints were applied in the forest estate model.

5.2.7.1 Cultural Landscape Features Buffer

Within a 1 km buffer around Cultural Landscape Features, no more than 5% of the CFLB can be under 5 m in height. The total CFLB area within the Cultural Landscape Feature buffers is 9,958 ha.

5.2.7.2 Protected Watersheds

Within each Protected Watershed, no more than 5% of the CFLB can be cut in a 5-year period. This was modeled in the same way as the community watersheds, such that no more than 5% can be under 5 years old. There are 12 Protected Watersheds within the Fraser TSA, covering a total of 53,053 ha of CFLB.

5.2.7.3 Sanctuary

Within each Sanctuary zone, no more than 5% of the CFLB can be cut in a 10-year period. There are 26 Sanctuary zones in the Fraser TSA, covering a total of 41,680 ha of CFLB.

5.2.7.4 Canyon Heritage Upland

Within the Canyon Heritage Upland zone, no more than 5% of the THLB can be cut in a 10-year period. There are 3,568 ha of THLB in this zone.

5.2.8 Northern Goshawk Forage Areas

Based on the Federal Northern Goshawk Recovery Strategy (Parks Canada 2018), a forage area buffer has been created around each of the draft WHAs. There are two WHAs, Bear Creek and Harrison Lake, and the total area of each forage buffer is 2,000 ha. Within these buffers, at least 40% of the CFLB must be maintained as suitable habitat. Suitable habitat is defined based on BEC, leading species, age, and height. The CFLB area is 1706 ha for Bear Creek, and 484 ha for Harrison Lake. The forage habitat targets were not enforced in the ISS Base Case.

5.2.8.1 Foraging Model

For this analysis it is assumed that all forested areas within the TSA are capable of becoming suitable NOGO foraging habitat. The NOGO foraging model allows for capable stands to become suitable as a function of age, height, BEC and leading species as per the following formula:

HSIf = mean(Ager, Heightr) * ITGr * BECvar

HSIf values greater than 0.5 indicate suitable goshawk habitat. The habitat index (HSIf) value was assigned to each yield curve in 5-year intervals in the analysis data set. Rather than using the ITG, a simpler rating scheme employing leading species was used with some exceptions. In using the leading species the following adjustments were made:

- ITG group value was used for hemlock and balsam stands only (0.95).
- Some of the analysis units are 50/50 cedar and hemlock. In these cases it was assumed that the predominant management of these stands would favor cedar and the forage rating was set accordingly at 0.7.

5.2.9 Marbled Murrelet Habitat

Suitable Marbled Murrelet (MAMU) habitat is composed largely of old, natural forest. A spatial file was received from Raychl Lukie of MFLRNO. These areas remain habitat until they are harvested. There is no target for MAMU habitat in the ISS Base Case, but the total amount of habitat is reported. There are 21,679 ha of suitable MAMU habitat within the CFLB of the Fraser TSA.

6 Timber Harvesting

6.1 Harvest Rule

Simulation models are rule-driven and require harvest scheduling rules to control the order in which stands are harvested. It is important that these rules are able to organize the harvest in a way that realizes the productive potential of the land base in a reasonable manner to understand the impacts of the timber supply assumptions and constraints.

In TSR, the harvest scheduling was based on volume, with stands of higher volume relative to the minimum harvest volume taken first. This is the harvest rule that will be used in the ISS Base Case as well.

6.2 Harvest Priority, Harvest Deferrals and Minimum Volume Requirements

6.2.1 Harvest Priority and Deferrals

Harvest priority and deferrals can be used to override the harvest rule. Harvest priority can be used in modelling to reflect situations when it is known that some areas will be targeted for harvesting. Such targeting may be required to address forest health issues as an example. Deferrals are used in cases where it is known that access to an area must be deferred for a period of time.

In TSR, stands were prioritized based on the distance to the nearest road, and the timber supply block. Areas close to roads and in supply blocks Harrison, Stave, and Chilliwack were given the highest priority, while areas in supply blocks Maple Ridge and Nahatlatch were given low priority. A similar set-up will be used in the ISS Base Case.

6.2.2 Minimum Volume Requirements

In some cases, such as where the THLB is fragmented into small parcels, the financial viability of harvest from certain areas may require a minimum volume harvest volume to reflect the operational reality associated with mobilization and demobilization. Minimum volume requirements can be set up in the model to ensure that harvest will only occur in the area if there is enough timber available to cover the costs.

There are no areas with minimum volume requirements in the Fraser TSA.

6.3 Utilization Levels

The utilization level defines the minimum top diameter (inside bark) and minimum diameter (dbh) of stems that must be removed from harvested areas. It also specifies the maximum height of stumps that may be left. These factors are used to determine the merchantable stand volume in the analysis.

The utilization levels used in this analysis are shown in Table 25.

Table 25: Utilization levels used in the analysis

Leading species	Utilization		
	Minimum DBH (cm)	Maximum stump height (cm)	Minimum top DIB (cm)
Pine and Spruce stands	12.5	30	10
All other stands <= 120 years of age	12.5	30	10
All other stands >120 years of age	17.5	30	15

6.4 Volume Exclusions

Deciduous-leading stands (apart from red alder) were removed from the THLB. Deciduous volume as secondary species is generally not merchantable in the Fraser TSA; however, deciduous volumes are included in the model as they are important for biodiversity.

6.5 Minimum Harvest Criteria

Minimum harvest criteria is the earliest age, volume per ha or other criterion such as DBH at which stands become eligible for harvest within the timber supply model. Minimum harvest criteria can have a profound effect on modeled harvest levels by creating acute timber supply shortages, or "pinch points", that constrain the rest of the planning horizon.

The minimum harvestable age was defined as:

- The estimated age at which the stand is predicted to reach a required minimum volume; and
- The age at which the stand's mean annual increment (MAI) achieves a value of 95 percent of the maximum (culmination).

For most species in the Fraser TSA, the minimum harvest volume is defined as 350 m^3/ha in conventional areas, and 400 m^3/ha in helicopter harvest areas. The exceptions to this are pine-leading stands with a minimum volume of 300 m^3/ha, and alder-leading stands which require a minimum volume of 150 m^3/ha.

The minimum harvest age will be set as the age at which both the minimum volume criteria and the 95% MAI culmination are met.

6.6 Harvest Profile

As per the latest TSR, this analysis also attempts to model current practise and harvest trends. The harvest of stands older than 140 years is limited to about 40% of the total harvest in the first 70 years. Also, a maximum target for harvest of natural hemlock and balsam leading stands will be applied. The target will be set at around 50% of total harvest until natural hemlock and balsam stands are mostly harvested. The harvest of alder will be limited to 10,000 m^3 per year.

7 Growth and Yield

Growth and yield assumptions define the net volumes that are realized when natural and managed stands are harvested. They also describe various tree and stand attributes over time (i.e., volume, height, diameter, presence of dead trees, etc.).

7.1 Site Index

The provincial site productivity data layer will be used as in the TSR to model the growth and yield of managed stands. Where there is no data in the provincial layer, the inventory site index will be used.

The growth and yield of natural stands will be modeled using the inventory site index.

7.2 Analysis Units

An analysis unit is a grouping of similar forest area with the objective of simplifying the analysis and the interpretation of analysis results.

7.2.1 Natural Stands

Douglas-Fir stands established prior to 1968 (> 48 years old in 2016), all other stands established prior to 1978 (> 38 years old in 2016) are considered natural stands in this analysis. Their growth and yield will be modeled using the Variable Density Yield Prediction (VDYP7) yield model. Default Decay, Waste, and Breakage adjustments for VDYP7 will be incorporated. Inventory site index estimates are considered to be the most appropriate in modelling these stands.

The stands have been aggregated into analysis units based on species, site index, and volume to reduce the number of yield curves in the model. The first factor in defining analysis units is species composition. The species classes are shown in Table 26. Species combinations that had significant area were kept as separate classes (e.g. B/Ss), while the smaller classes were grouped as “other”. Each species class is further split based on the percentage of the leading species into 3 groups, >70%, 50-70%, and <50%.

Table 26: Natural Analysis Units Species Classes

Leading Species	Species Class
Balsam	Ba
	Ba/Hw
	Ba/Ss
	Ba/Other
Cedar	Cw/Hw
	Cw/Other
Deciduous (maple, birch, aspen), NHLB only	Deciduous
Alder	Dr
Douglas Fir	Fd
	Fd/Hw

Leading Species	Species Class
	Fd/Pl
	Fd/Other
Hemlock	Hw/Ba
	Hw/Cw
	Hw/Fd
	Hw/Other
Pine	Pl/Fd
	Pl/Other
Spruce	Ss/Ba
	Ss/Other
Other	Other

Once the forested stands were classified by species, they were split based on inventory site index into 3 classes: Low, Medium, and High. The class breaks were defined based on K-means clustering.

The same clustering process was done on the THLB stands to split by volume (NHLB stands were not included in this process). Using K-means clustering, each species/site index group was split into 5 volume classes.

An example analysis unit name is: NAT_BA_SS_50-70_M_4. This example is a natural curve, balsam-leading with spruce secondary. The percent of balsam is between 50% and 70%. The site index class is Medium, and the volume class is 4. There are a total of 712 analysis units in the THLB.

7.2.2 Managed Stands

Stands established in 1968 or later for Douglas fir, and 1978 or later for other species are considered managed stands in this analysis. Their growth and yield were modeled using the Tree and Stand Simulator (TASS). Provincial site productivity layer estimates of site index are considered to be the best estimates of site productivity for modelling managed stands.

Managed stands were divided into old managed stands, contemporary managed stands and future managed stands. Contemporary managed stands include all stands established since 1996 (<= 20 years old in 2016). Old Managed stands are those older than 20 years old in 2016. Future managed stands consist of all stands established after 2016. Contemporary and future managed stands have genetic worth applied.

Analysis units for managed stands are based on BEC, slope, aspect, elevation, site index and stand age. Table 27, Table 28, and Table 29 show the classification of future, contemporary, and old managed analysis units respectively.

Table 27: Future Managed Stands; Analysis Units

BEC Variant	Slope/Aspect	Elevation	Site Class	AU
CWHds1	Warm	All	Good	200
			Medium Poor	201
	Gentle Cool	All	Good	202
			Medium Poor	203

BEC Variant	Slope/Aspect	Elevation	Site Class	AU
CWHdm	Warm	All	Good	204
			Medium Poor	205
	Gentle Cool	All	Good	206
			Medium Poor	207
MHmm1	Warm	All	All	208
	Gentle Cool	All	All	209
MHmm2	Warm	All	All	210
	Gentle Cool	All	All	211
CWHms1	Warm	Submontane	Good	212
			Medium Poor	213
		Montane	All	214
	Gentle Cool	Submontane	Good	215
			Medium Poor	216
		Montane	All	217
CWHvm1	Warm	All	Good	218
			Medium Poor	219
	Gentle Cool	All	Good	220
			Medium Poor	221
CWHvm2	Warm	All	Good	222
			Medium Poor	223
	Gentle Cool	All	Good	224
			Medium Poor	225
IDFww	Warm	All	All	226
	Gentle Cool	All	All	227
ESSFmw	Warm	All	All	228
	Gentle Cool	All	All	229

Table 28: Contemporary Managed Stands (<=20 years old); Analysis Units

BEC Variant	Slope/Aspect	Elevation	AU
CWHds1	Warm	All	100
	Gentle Cool	All	101
CWHdm	Warm	All	102
	Gentle Cool	All	103
MHmm1	Warm	All	105
	Gentle Cool	All	104
MHmm2	Warm	All	106
	Gentle Cool	All	107
CWHms1	Warm	Submontane	108
		Montane	109
	Gentle Cool	Submontane	110
		Montane	111
CWHvm1	Warm	All	112

BEC Variant	Slope/Aspect	Elevation	AU
	Gentle Cool	All	113
CWHvm2	Warm	All	114
	Gentle Cool	All	115
IDFww	Warm	All	116
	Gentle Cool	All	117
ESSFmw	Warm	All	118
	Gentle Cool	All	119

Table 29: Old Managed Stands; Analysis Units

BEC Variant	Slope/Aspect	Elevation	Age Group	AU
CWHds1	Warm	All	21 -30	1
			31+	21
	Gentle Cool	All	20-30	2
			31+	22
CWHdm	Warm	All	21-30	3
			31+	23
	Gentle Cool	All	21-30	4
			31+	24
MHmm1	Warm	All	All	6
	Gentle Cool	All	All	5
MHmm2	Warm	All	All	7
	Gentle Cool	All	All	8
CWHms1	Warm	Submontane	21-30	9
			31+	29
		Montane	All	11
	Gentle Cool	Submontane	21-30	10
			31+	30
		Montane	All	12
CWHvm1	Warm	All	21-30	13
			31+	33
	Gentle Cool	All	All	14
CWHvm2	Warm	All	All	15
	Gentle Cool	All	All	16
IDFww	Warm	All	All	17
	Gentle Cool	All	All	18
ESSFmw	Warm	All	All	19
	Gentle Cool	All	All	20

Some of the old managed stands were further split to account for juvenile spacing and fertilization (Table 30). Juvenile spacing was modeled to occur at age 20, and to a density of 500 stems (except for AU 34, with a density of 600) favoring larger trees. Fertilization was modeled at age 25.

Table 30: Juvenile Spacing and Fertilization of Old Managed Stands

BEC Variant	Slope/Aspect	Elevation	Age Group	Treatment	AU
CWHds1	Warm	All	21-30	Spacing	41
	Gentle Cool	All	21-30	Spacing	42
	Warm	All	31+	Spacing/Fert	81
	Gentle Cool	All	31+	Spacing/Fert	82
CWHdm	Gentle Cool	All	21-30	Spacing	44
	Warm	All	31+	Spacing/Fert	83
	Gentle Cool	All	31+	Spacing/Fert	84
CWHms1	Warm	Submontane	21-30	Spacing	49
	Gentle Cool	Submontane	21-30	Spacing	50
	Warm	Submontane	31+	Spacing/Fert	89
	Gentle Cool	Submontane	31+	Spacing/Fert	90
CWHvm1	Gentle cool	All	All	Spacing	34
	Warm	All	31+	Spacing/Fert	93

Yield curve specifications for managed stands are provided in Appendix 1: Managed Stand Yield Curve Specifications

7.2.3 Operational Adjustment Factors in Managed Stand Yields

The yield tables generated by TASS are based on the data observed and collected in research plots established by FLNRORD and industry. Historically, this research has been carried out in fully stocked, even aged stands with no significant incidences of pests and diseases.

Operational adjustment factors (OAF) are usually applied to the TASS generated yields to reflect average operational growing conditions.

OAF 1 allows for yield reductions associated with non-productive areas in the stand, uneven spacing of crop trees (clumping), and endemic and random loss. The standard OAF1 of 15 % is considered a province-wide approximation of the difference between research plots and actual yields, and is composed of the following estimates:

- Espacement 4%
- Non-productive 4%
- Random risk 3%
- Endemic losses 4%

The standard OAF 1 of 15% will be applied to all yield curves generated by TASS.

OAF 2 allows for increasing volume losses towards maturity, attributable to decay, waste and breakage, disease and pest factors. The standard OAF2 of 5% is also a province-wide approximation of the difference between research plot yields and actual yields. As this difference increases with age, the impact of OAF 2 also accelerates with age.

7.3 Natural Disturbance Assumptions

7.3.1 Non-Harvestable Land Base

This analysis assumes no natural disturbance within the NHLB.

7.3.2 Timber Harvesting Land Base, Non-Recoverable Losses

Non-recoverable losses (NRL) provide an estimate of the average annual volume of timber damaged or killed within the THLB and not salvaged or accounted for by other factors. These losses result from natural events such as insects, diseases, wind, wildfires, etc.

The TSR estimated non-recoverable losses in the TSA to be 26,940 m^3/yr (Table 31). These numbers are based on the TSR THLB of 250,405 ha. Pro-rating this to the base case THLB of 219,490 ha gives an NRL of 23,614.

Table 31: Non-recoverable losses in the Fraser TSA

Cause of Loss	Annual Loss within THLB (m^3/yr)	Salvage rate	Annual Unsalvaged Loss within the THLB (m^3/yr)
Wind	3,120	25%	2,340
Fire	16,500	0%	16,500
Mountain Pine Beetle	400	0%	400
Douglas-fir Bark Beetle	8,800	50%	4,400
Spruce Beetle	200	0%	200
Western Balsam Bark Beetle	3,100	0%	3,100
Total	**32,120**		**26,940**

7.4 Silviculture

7.4.1 Silviculture Systems and Harvesting Systems

Clear cut with reserves is the most common silvicultural system in the Fraser TSA. Reductions to account for retention are applied through land base netdowns as described in Section4.1.29.

7.4.2 Regeneration activities in managed stands

The Silviculture Working Group composed of government and licensee foresters with extensive knowledge of the Fraser TSA used RESULTS data and professional experience to formulate the ISS Base Case assumptions. The assumptions used in the analysis are provided in Appendix 1: Managed Stand Yield Curve Specifications.

7.4.3 Not satisfactorily restocked (NSR) areas

In this analysis all NSR is considered current. It is assumed to regenerate within the regeneration delay detailed in Appendix 1: Managed Stand Yield Curve Specifications.

7.4.4 Stand Level Modelling Using TASS

TASS II is used as the growth and yield model for the ISS Base Case and all further scenarios for the following reasons:

1. Stands with both planted and ingress trees can be modeled in TASS II.
2. Mixed species stands can be simulated in TASS II with the caveat that calibration of the model for mixtures is ongoing with the development of the latest version of TASS (TASS III).
3. TASS has a custom bucking routine which allowed us to use generic industrial log sorts and pricing for second growth timber.

7.4.5 Juvenile Spacing and Fertilization

7.4.5.1 Juvenile Spacing

According to RESULTS tabular data, approximately 25,670 ha were juvenile spaced in the Fraser TSA between 1973 and 2013. Most of these treatments (25,500 ha) occurred between 1973 and 1999.,

Juvenile spacing that that occurred before 1983 (approximately 8,000 ha) is assumed to be reflected by the VRI and associated VDYP yield curves. The remaining 17,500 ha (up to 1999) of juvenile spacing targeted stands were classified as old managed stands in this analysis. A GIS review revealed that many of the juvenile spaced old managed stands had been harvested; only 7,270 ha still exist in the THLB.

This analysis accounted for past juvenile spacing. The 7,270 ha spaced stands were assumed have been spaced to 500 stems per ha (sph) at age 20 (one analysis unit was spaced to 600 sph) as shown in Appendix 1: Managed Stand Yield Curve Specifications. Note that 4,730 ha of these spaced stands were also assumed to have been fertilized as detailed below.

Based on post treatment assessments and observations, the silviculture and timber working group determined that Fd stands spaced to 500 sph on sites with a Fd site index >32m, were of poor quality and would likely command low log prices (as per section 7.4.8).

7.4.5.2 Fertilization

According to RESULTS, approximately 25,350 ha were fertilized in the Fraser TSA between 1999 and 2015. Local foresters believe that more fertilization has occurred in the TSA; however, no records exist to verify this.

Once the harvested areas are accounted for, approximately 8,000 ha fertilized stands still exist in the TSA. Fertilization of these stands was considered in this analysis as follows:

- All the spaced old managed stands (see above) were assumed to have been fertilized once at 25 years of age (Appendix 1: Managed Stand Yield Curve Specifications). This accounts for approximately 4,730 ha of fertilization. The fertilization treatment response will come from the TASS.

- The remaining fertilization (3,270 ha) was assumed to have occurred on natural Fd leading stands currently aged 41 to 80 years old, with 2,457 ha of these stands fertilized once and 813 ha twice. A spatial coverage for these stands was provided by FLNRORD. An additional 20 m^3/ha per treatment will be added to the Douglas fir volume to account for fertilization of these stands.

7.4.6 Industrial Recoverable Volume

Industrial recoverable volume estimates are based on the logs that are expected to be marketed maximizing the financial benefit to the licensee (when operating on crown land in BC). Industrial preferred log lengths for sawlog and gang are 13 m, 11 m and 8 m. Chip & Saw and pulp sorts also include log lengths of 6.3 and 5 m. Industrial sorts use a top diameter inside bark (DIB) of 12.5cm.

Government's net volume estimates are used to calculate appraisal stumpage rates. They are also used in harvest forecasting for determining Annual Allowable Cuts (AAC) and use different top DIB, minimum log length and log length. Table 32 compares the key differences between these volume compilation methods.

Table 32: Government and industry compilation methods

Compilation Attribute	Government	Industry
Top DIB	10.0 cm	12.5 cm
Min. Log length	2.6 m	5 m
Log Lengths	10 m	13, 11, 8 m
Recoverable Volume	no	yes

Industrial recoverable volumes were used for this project to compare the impacts of different silvicultural regimes on timber yield and value.

7.4.7 Industrial Sorts and Values

The majority of the coastal industry uses generic log sorts (sawlog, gang, chip & saw) for coniferous logs. Based on advice from a coastal log quality expert[1], the generic sort matrix for Douglas fir gang was customized to split the gang sort into a small and large gang sort. This was done to better reflect the influence of top diameter on price within the gang sort (the predominant sort when harvesting managed stands at less than 100 years of age).

The average industrial selling prices used for this project are based on data from the Forest Industry Trader, an industrial newsletter, for 2014 and 2015. Sorts and values for intensively managed red alder are from Coast Mountain Hardwoods[2] Sets of "Low" and "High" prices were used in an attempt to differentiate values based on quality. High prices are surrogates for logs with better quality which are suitable to export to Japan (using delivered net prices to Japan). Low prices are surrogates for "fast grown" trees with poor taper, low rate of growth (ROG) and big branches (using prices for a "utility" sort[3]). For this project average values will be used for

[1] Orr-Ewing, A., March 2012
[2] Brian Kyle, November, 2016
[3] Orr-Ewing, A., January 2016

the base case and most of the analysis scenarios. High prices may be used in some scenarios where species selection and silviculture treatments are expected increase the value of logs.

The government system assigns alpha log grades (e.g., for immature timber; H, I, J, U, X, Y) based on an algorithm. The government selling price is based on recent transactions using the alpha log grades as summarized in the Coast Marketing Pricing System Log Values for Second Growth Timber Reports (published with monthly and quarterly averages).

Industrial sorts and values were used for this project to compare the impacts of different silvicultural regimes on timber yield and value.

7.4.8 Bucking Simulation

Sort specifications and values used for this project for Douglas fir (Fd), Hemlock/Balsam/Spruce/Pine (HB), Western red cedar/yellow cedar (Cw) and intensively managed Red Alder[4] (Dr) are summarized in Table 33, Table 34, Table 35 and Table 36.

Table 33: Fd industrial log sorts and values

Sort	Min Top (cm)	Length (m)	Base Value	Low Value	High Value
Sawlog/ Peeler	38	13	$120.00	$60.00	$150.00
Sawlog/ Peeler	38	11	$120.00	$60.00	$150.00
Sawlog/ Peeler	38	8	$120.00	$60.00	$130.00
Large Gang	30	13	$90.00	$80.00	$130.00
Large Gang	30	11	$90.00	$80.00	$130.00
Large Gang	30	8	$90.00	$80.00	$100.00
Small Gang	20	13	$70.00	$60.00	$110.00
Small Gang	20	11	$70.00	$60.00	$110.00
Small Gang	20	8	$70.00	$60.00	$80.00
Chip'n'Saw	12.5	13	$55.00	$55.00	$80.00
Chip'n'Saw	12.5	11	$55.00	$55.00	$80.00
Chip'n'Saw	12.5	8	$55.00	$55.00	$80.00
Chip'n'Saw	12.5	6.3	$55.00	$55.00	$80.00
Chip'n'Saw	12.5	5.1	$55.00	$55.00	$80.00
Pulp	12.5	5	$35.00	$35.00	$35.00

Table 34: HemBal/Spruce/Dr (unmanaged)/Pine sorts

Sort	Min Top (cm)	Length (m)	Base Value	Low Value	High Value
Sawlog	38	13	$70.00	$60.00	$110.00
Sawlog	38	11	$70.00	$60.00	$110.00
Sawlog	38	8	$70.00	$60.00	$80.00
Gang	20	13	$60.00	$50.00	$90.00
Gang	20	11	$60.00	$50.00	$90.00
Gang	20	8	$60.00	$50.00	$70.00
Chip'n'Saw	12.5	13	$50.00	$50.00	$75.00
Chip'n'Saw	12.5	11	$50.00	$50.00	$75.00
Chip'n'Saw	12.5	8	$50.00	$50.00	$75.00
Chip'n'Saw	12.5	6.3	$50.00	$50.00	$75.00
Chip'n'Saw	12.5	5.1	$50.00	$50.00	$75.00
Pulp	12.5	5	$40.00	$40.00	$40.00

[4] Dr from the base case runs used the HB sorts and values.

Table 35: Cw industrial log sorts and values

Sort	Min Top (cm)	Length (m)	Base Value	Low Value	High Value
Sawlog	38	13	$200.00	$190.00	$210.00
Sawlog	38	11	$200.00	$190.00	$210.00
Sawlog	38	8	$200.00	$190.00	$210.00
Gang	20	13	$185.00	$175.00	$195.00
Gang	20	11	$185.00	$175.00	$195.00
Gang	20	8	$185.00	$175.00	$195.00
Chip'n'Saw	12.5	13	$100.00	$100.00	$110.00
Chip'n'Saw	12.5	11	$100.00	$100.00	$110.00
Chip'n'Saw	12.5	8	$100.00	$100.00	$110.00
Chip'n'Saw	12.5	6.3	$100.00	$100.00	$110.00
Chip'n'Saw	12.5	5.1	$100.00	$100.00	$110.00
Pulp	12.5	5	$20.00	$20.00	$20.00

Table 36: Intensively managed Dr Industrial log sorts and values

Sort	Min Top (cm)	Length (m)	Base Value	Flat Value
Sawlog1	30.5	8.3, 7.6, 6.3, 5.7, 5.1	$125.00	$85.00
Sawlog2	25.4	8.3, 7.6, 6.3, 5.7, 5.1	$70.00	$75.00
Sawlog3	20.3	8.3, 7.6, 6.3, 5.7, 5.1	$70.00	$70.00
Sawlog4	17.8	8.3, 7.6, 6.3, 5.7, 5.1	$70.00	$65.00
Pulp	15.2	8.3, 7.6, 6.3, 5.7, 5.1	$40.00	$35.00

8 Objectives for the Fraser TSA

Coarse objectives were developed for the Fraser TSA through several stakeholder meetings. The objectives were developed for broad values considered important to the stakeholder group: economic values, environmental values and social values.

The objectives are expressed as statements of what ideally is desired on the land base; however, not all objectives might be realized as stated when attempting to achieve them simultaneously. The objectives are not ranked or constrained by targets; this provides maximum flexibility and learnings from scenario analysis.

Each objective contains a performance measure or indicator to facilitate meaningful quantitative and qualitative comparisons between different scenarios and ultimately management options. Note that the objectives and performance measures are focused on addressing critical issues that have been raised by stakeholders; however, there are other non-listed objectives that will be captured as current management as driven by legislation and policies. These will be fixed in the ISS Base Case and across all scenarios. Strategies to achieve objectives are collated into logical scenarios for comparison against the ISS Base Case.

The matrix in Table 37 illustrates agreed upon management objectives.

Table 37: Management objectives for the Fraser TSA

Value	Objective	Performance measure/indicator	Notes
First Nations / cultural	Improve local employment	Person-years of employment in communities	Requires training, capacity building. Not modeled or tracked.
	Sustain non-timber values	Availability of monumental cedar	Spatial distribution important – need to be near communities. Not modeled, managed operationally.
		Availability of trees for bark-stripping	Need to be proactive with referrals to better understand context and interactions rather than just reacting to individual proposals. Not modeled, managed operationally.
		Managed access to preferred areas	Not modeled, managed operationally.
		Distribution and abundance of suitable moose, deer and elk habitat	Assume that UWR and elk recovery plan will provide adequate habitat. Additional habitat through S'ólh Téméxw Use Plan, which is modeled.
		Protection of spiritual sites.	Provided through S'ólh Téméxw Use Plan, which is modeled.
		Protection of resource harvesting areas.	Locations must be known. Not modeled, managed operationally.
		Maintain and enhance culturally sensitive waterways	Provided through S'ólh Téméxw Use Plan, which is modeled.

Value	Objective	Performance measure/indicator	Notes
Biodiversity	Protect Northern Goshawk nesting areas and foraging habitat	Protect nest sites (breeding habitat) with a 200 m buffer.	Remove from THBL in all scenarios.
		Forage habitat: maintain 40% within each foraging territory.	Report in in the ISS Base Case and test the impact of enforcing the target. The TSA contains only two foraging areas.
	Protect Norther Spotted Owl Habitat	Nesting and foraging habitat in LTOHA and MFHA.	Protected through legislation. Track nesting and foraging habitat in LTOHA and MFHA.
	Maintain/improve tree species diversity	Predicted harvest by species and predicted growing stock by species.	Reforestation regimes follow climate change species portfolios to reduce risk. Objective is to achieve species diversity at the landscape level, rather than stand level.
	Protect Species at Risk	Enforced though legislation.	Review existing reserves; can incremental protections be rationalized to maintain/improve current situation?
Timber/economic	Increase utilization and future value of high-elevation HemBal sites	Area converted to higher value stands Carbon sequestration	Explore stand conversion opportunities. Not modeled or tracked.
	Increase value of deciduous stands	Area converted to higher-value stands	Explore stand conversion opportunities. Explore opportunities to intensively managed Dr on appropriate sites. Not modeled or tracked.
	Maximize species/product value	$/ha	Silviculture strategies will test in modelling.
	Minimize impacts of forest health issues	Proportion of forest with forest health issues and/or cost-effectiveness of responses	Modified species selection and reduced planting investments in elk areas. Limit the amount of Fd in SNC hazard zones. Stumping and species selection in areas susceptible to root rot. Will be modeled.
	Maximize volume	Vol/ha and annual harvest	Use high genetic gain seed, fertilize where feasible. Fertilization and genetic gain accounted for in modelling.
	Increase harvest in highly constrained areas	Proportion of harvest that is partial harvesting.	Permitting challenges Small volume but takes pressure off young stands. Final or next harvest pass may be challenging. Not modeled.
	Improve marketability of wood products	Revenue captured above present cost	FN mark or certification for marketing? Not modeled or tracked.
	Manage even flow of revenue	Even flow of revenue.	Variation is expected in revenue flow due to markets. Value of future stands tracked in the model.

Value	Objective	Performance measure/indicator	Notes
	Promote product diversity		Some concern of managing for poles, peelers Difficult to predict future markets Not modeled or tracked.
	Continued access to timber	Access maintained	Not modeled or tracked.
	Improved understanding of growth and yield of managed stands.		Work with FAIB to promote more YSM plots and mid-rotation timber cruise. Not modeled or tracked.
Recreation/visuals	Maintain visual quality objectives	Disturbance in visual quality areas.	Protected through legislation. Modeled as per legislation.
	Minimize fire risk in interface areas	Area of fuel treatments in high risk interface areas	Not modeled or tracked. Strategy will contain recommendations.
Water	Maintain community watershed function	Water quality Water quantity	Modeled as per legislation.

8.1 Modeled Indicators

The objectives presented in Table 37 contain performance measures or indicators to facilitate meaningful quantitative and qualitative comparisons between different scenarios and management options. The following indicators are used in this analysis (Table 38):

Table 38: Indicators used in the analysis

Value	Indicator
Timber/Economic	Annual harvest volume
	Predicted value per ha of managed stands
Biodiversity	NOGO forage habitat within the two existing territories in the TSA
	Spotted owl forage and nesting habitat within each LTOHA and MFHA. Also tracked by LU
	MAMU habitat
	Late seral by BEC and LU

9 Strategies for Exploration

The strategies that could be employed to meet some of the ISS management objectives were discussed at the stakeholder meetings. The following strategies will be explored in this analysis:

9.1 Remove OGMAs and use the S'ólh Téméxw Use Plan as the vehicle for managing old growth

This scenario removed all OGMAs and reclassified the land base within them as THLB, where appropriate. The THLB in this scenario is 230,128ha, 5 % larger than in the ISS Base Case of 219,490 ha.

The intent of this scenario is to investigate whether the S'ólh Téméxw Use Plan and other existing constraints in the land base provide adequate retention for old growth. The achievement of old growth is tracked by landscape unit (LU) and BEC as per the Old Growth Order; however, the old growth targets are not enforced. The harvest limits for old stands and HemBal volume were maintained as in the ISS Base Case.

9.2 Swiss Needle Cast, Root Rot and Elk Impacts

A Silviculture/Timber Working Group (WG) was formed at the beginning of this project to help develop managed stand yield curves for the ISS Base Case. The ISS Base case inputs were finalized, and the yield curves developed in early 2018.

In the summer of 2018, the WG had meetings and field tours and became concerned about Swiss Needle Cast (SNC), root rot (RR) and elk impacts on some growing sites. As a result, these forest health agents were incorporated in the analysis as a scenario.

9.2.1 Swiss Needle Cast (SNC)

According to the regional forest health expert, SNC is reducing growth and killing some Fd in the Fraser TSA[5]. Most of the damage is occurring in contemporary era (stands <20 years old) in the CWHdm and CWHvm1. There is limited research on the spread and impact of SNC. No modules exist in the growth and yield model TASS for estimating the SNC impacts.

The silviculture and timber working group agreed that the most significant observed damage was growth loss and there was no need to assume mortality in the modeling. The SNC impacts were also assumed to occur in future Fd stands. Based on the advice from the Forest Analysis and Inventory Branch (FAIB), potential growth impacts were tested using reductions in site indices. The reductions varied from 10% to 50%.

As most of the affected stands are of mixed species (via planting and/or natural infill), the growth losses on the Fd due to SNC primarily lead to species substitution (Figure 7). A decrease in the Fd SI from 30.9m (ISS Base Case) to 25m leads to a decrease in the total volume of the stand; the Fd volume decreases and the Hw volume increases. The combined impact is a reduction in total log value.

[5] Stefan Zeglen, FLNRORD

Interestingly, decreasing the Fd SI from 25 to 16 m leads to a slight rebound in total volume due to substitution of Fd with Hw and Cw, which have higher site indices. A higher volume of Cw also increases the total value (Figure 7).

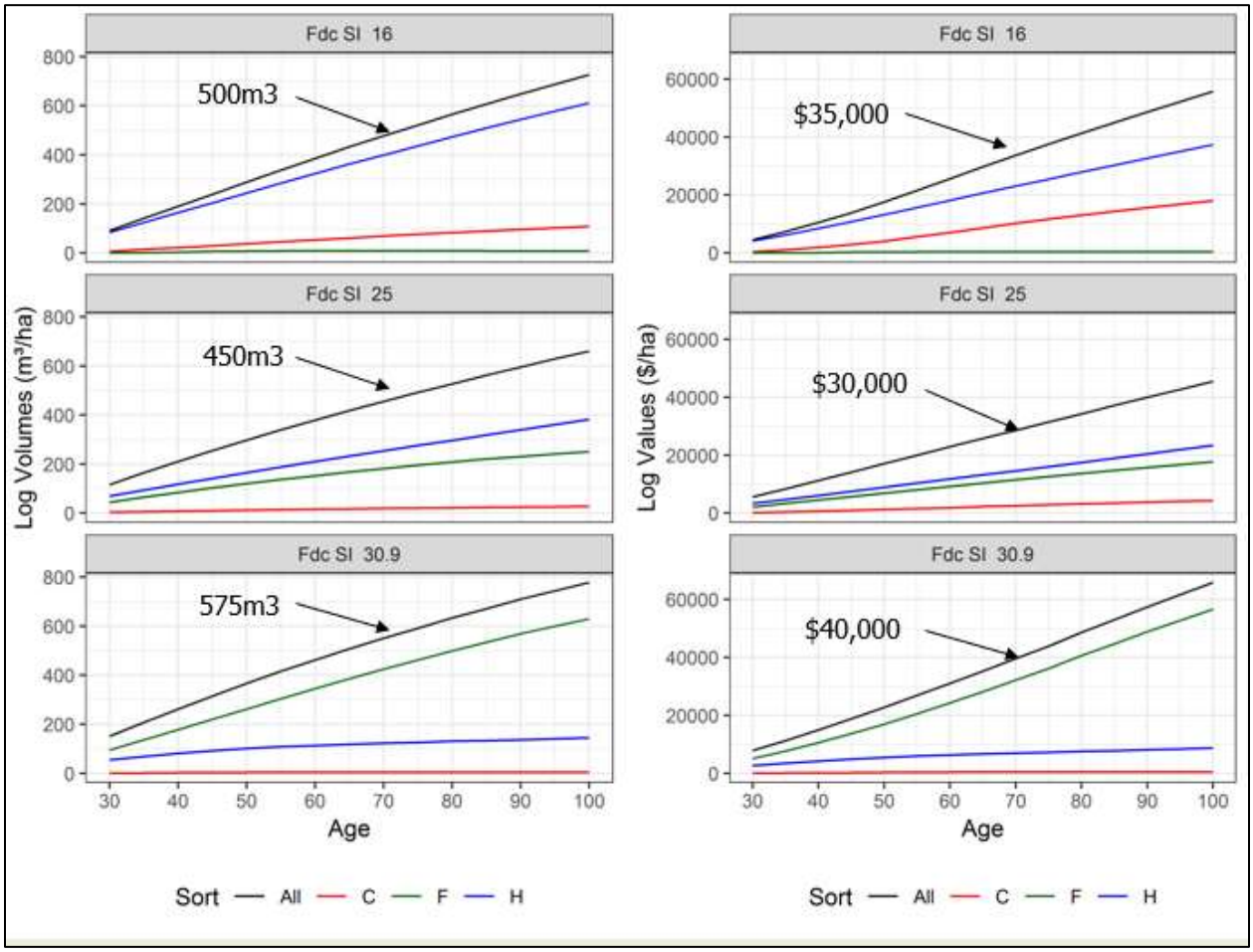

Figure 7: Comparison of volume and value impacts of different levels of Fd SI reductions due to SNC in future stands in CWHdm Gentle Cool

After a review of the above analysis results, the silviculture and timber working group decided to use a reduction of 20% in Fd site index for all yield curves assumed to be affected by the SNC in the forest health scenario.

9.2.2 Elk

Elk have been re-introduced to portions of the Fraser TSA. Their presence has negatively impacted contemporary era (<20 years old) stands in the Upper Pitt, Upper Stave and Upper Chehalis River areas and along the west side of Harrison Lake. Based on the current government elk management strategy, elk populations in the Fraser TSA are expected to increase in some areas and expand to others. For this reason the timber and silviculture working group recommended that elk impacts should be assessed as part of the forest health scenario.

Elk cause physical damage to trees, which leads to reduced stocking, patchy distributions and species shifts of the crop trees (Figure 8). As re-planting is often required, the regeneration delay is increased along with the reforestation costs. For this project, data and observations on past damage come primarily from Teal Jones Ltd., one of the major licensees with operations in the affected areas (Elske von Hardenberg, RFT).

Figure 8: Example of patchy distribution of stocking associated with elk damage in the Upper Pitt River

Two damage severities were applied in existing elk damage areas. In the Upper Pitt and Upper Stave elk zones, damage was assumed to be high and occur on all contemporary future era stands within the CWHdm and vm1. In the Upper Chehalis and West Harrison Lake elk zone, the damage was assumed to be moderate and occur on contemporary stands less than 10 years old and future stands within the CWHdm and vm1. Table 39 summarizes the distribution of contemporary era elk hazard stands within the current elk zones.

Table 39: Contemporary Managed Stands with moderate to high elk hazard within current elk zones

Elk Zone Unit	Contemporary Era Stands with Moderate to High Hazard (ha)
Upper Stave R	**470**
Upper Chehalis R	**85**
Upper Pitt R	**490**
West Harrison	**1,440**
Totals	**2,485**

The assessment of future elk impacts in areas currently without significant elk damage was based on the government's planned enhanced population targets and range expansions (Table 40) and a biophysical habitat model developed by Steven F. Wilson, Ph.D., R. P. Bio for this project.

Table 40: Elk population forecasts

Elk Management Unit	THLB with moderate to high hazard (ha)	2018 Pop Estimate	Target Pop
Alouette	4,680	0	0
Cap-Seymour	310	0	0
Chehalis	17,440	86	211
Coquitlam	1,975	0	0
Pitt	4,890	65	168
Stave	4,565	52	54
Total	**33,860**	**203**	**433**

The predicted risk of elk damage by BEC, slope and aspect are depicted in Table 41.

Table 41: Predicted risk of elk damage by BEC, slope and aspect

BEC	Elevation (m)	Slope/Aspect[6]	Risk of damage from wintering elk
CDFmm		gentle slope or warm aspect	High
CWHvh1		gentle slope or warm aspect	High
CWHvm1	<250	gentle slope or warm aspect	High
CWHvm1	251-500	gentle slope	Moderate
CWHvm2	400-550	gentle slope	Moderate
CWHxm1	<250	gentle slope or warm aspect	High
CWHxm1	251-450	gentle slope	Moderate
CWHxm2	<250	gentle slope or warm aspect	High

[6] Warm aspect = 35-100% slope on aspects 135 to 285 degrees

BEC	Elevation (m)	Slope/Aspect[6]	Risk of damage from wintering elk
CWHxm2	251-550	gentle slope	Moderate
CWHdm	<250	gentle slope or warm aspect	High
CWHdm	251-550	gentle slope	Moderate
CWHmm1	400-550	gentle slope	Moderate
MHwh	400-550	gentle slope	Moderate
Other	All	All	Low

Elk management units and damage hazard classes are illustrated in Figure 9. As elk populations increase, the area of damage is expected to expand into additional moderate to high hazard areas west of Harrison Lake and north of the Fraser Valley.

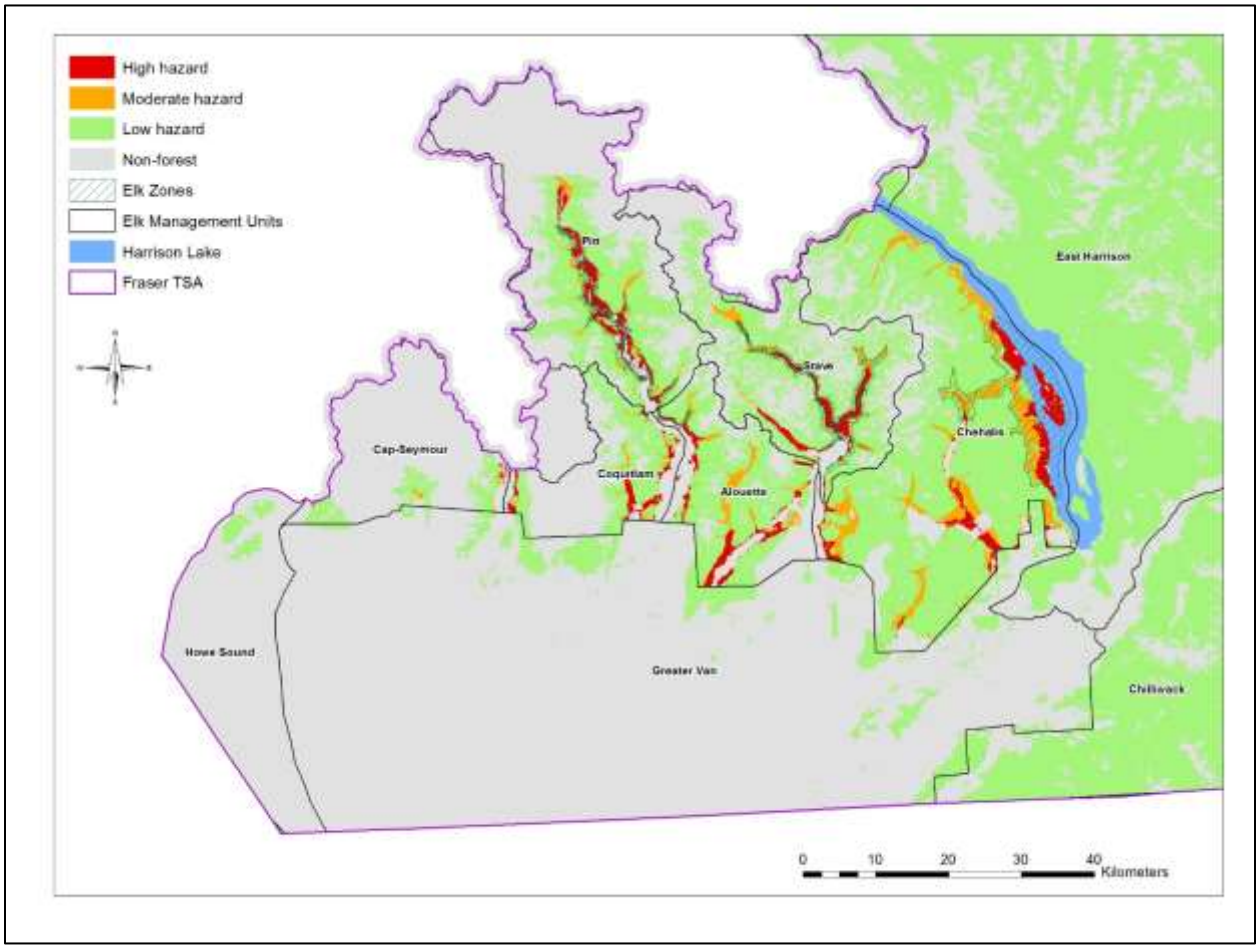

Figure 9: Elk management units, elk zones and damage hazard classes

Damage was modeled in TASS using randomly applied, planted species-specific mortality factors, longer regeneration delays for plantations and reduced natural infills. These factors were developed for each BEC unit based on free growing data in the Upper Pitt River provided by Teal Jones Ltd.

Figure 10 compares the volume forecasts of non-impacted elk stands (top graphs) with two different levels of natural infill in CWHvm1. The stand is a contemporary era CWHvm1 gentle cool in the Pitt River elk zone site planted with 1,200 sph of Fd, Ss, Hw and Dr. The left side graphs depict an infill density of 800 sph of Hw with Dr and Ss, while the right side graphs depict an infill density of 1600 sph of Hw with Ss, Fd and Dr.

Elk damage is predicted to leave only 600 sph (bottom left) or 400sph (bottom right) depending on the natural infill assumptions. The analysis further showed that elk damage potentially reduced the merchantable volume by 13 to 21% at 75 years. Furthermore, the volume reduction was not significantly impacted by the assumptions about natural infill. The timber and silviculture working group agreed that elk damage be modeled by reducing the sph to 400 as per the bottom right graph for this analysis unit. The open, fast growing trees are also expected have a negative impact on the quality of timber. This will be accounted for by using low log values in the analysis.

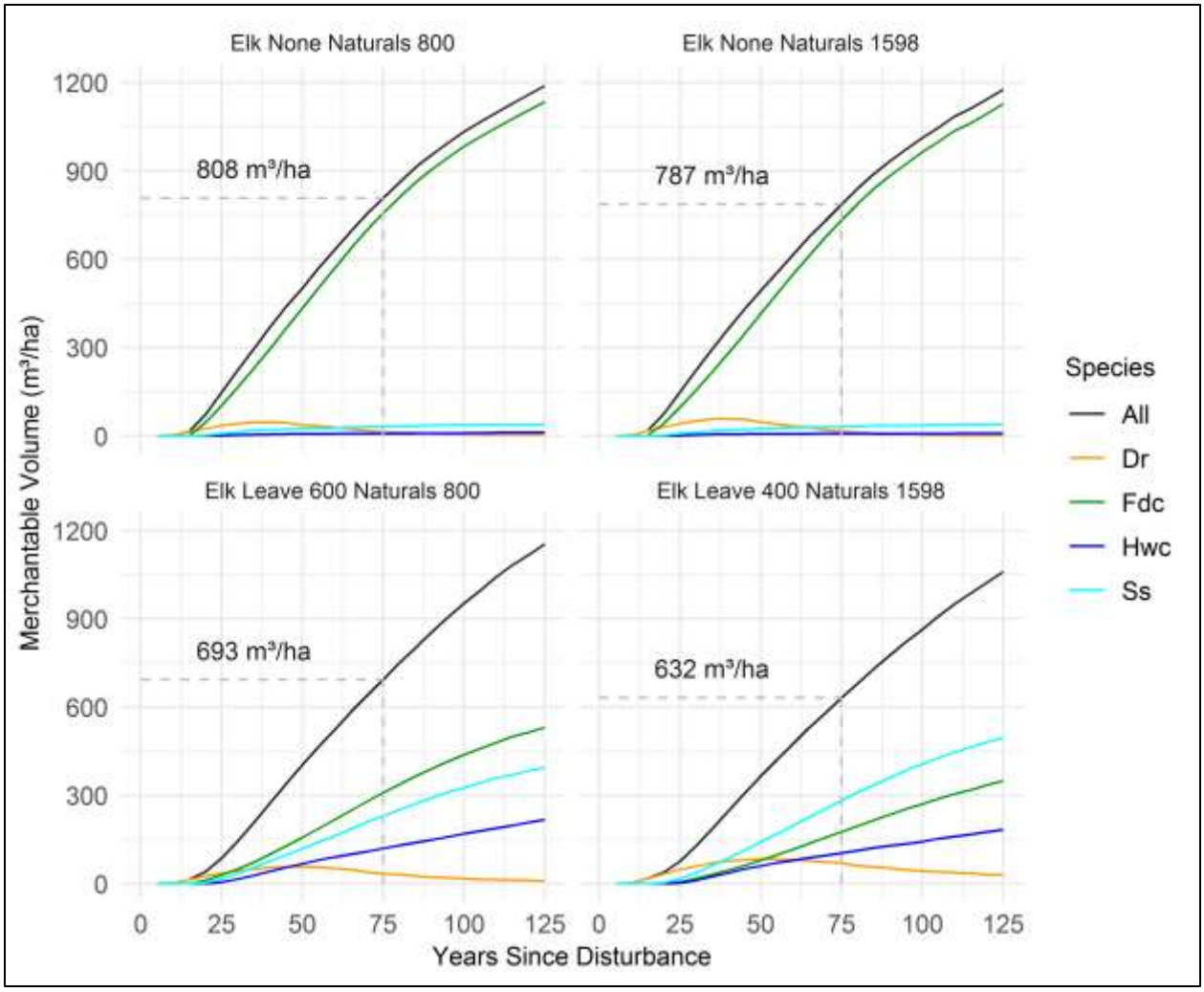

Figure 10: Volume impacts of different elk damage assumptions for contemporary era stands with a high elk hazard in the CWHvm1 Cool in the Upper Pitt River Elk Zone (black lines=total vol, green=Fd, dark blue=Hw, light blue=Ss and orange=Dr)

Figure 11 compares the volume forecasts of non-impacted elk stands (top graphs) with two different levels of natural infill (left and right graphs) and two levels on elk impact (middle and bottom graphs). The stand is a contemporary era CWHvm1 gentle cool site in the West Harrison elk zone planted with 1,200 sph of Fd and Cw. The left side graphs depict an infill density of 350 sph of Hw with Dr, while the right side graphs are depict an infill density of 850 sph of Hw with Dr.

Elk damage is predicted to leave either 750 sph in moderate damage areas (middle graphs) or 500 sph in severe damage areas (bottom graphs) depending on the natural infill assumptions. Given the expectation of moderate damage in this area, the timber and silviculture working group chose the 750 sph as appropriate to model the elk damage level. Furthermore, the group agreed that the 350 sph of natural infill would be suitable for this site. The overall volume reduction due to elk damage in this case is approximately 4% at 75 years. It is further assumed that average log values would apply on these sites.

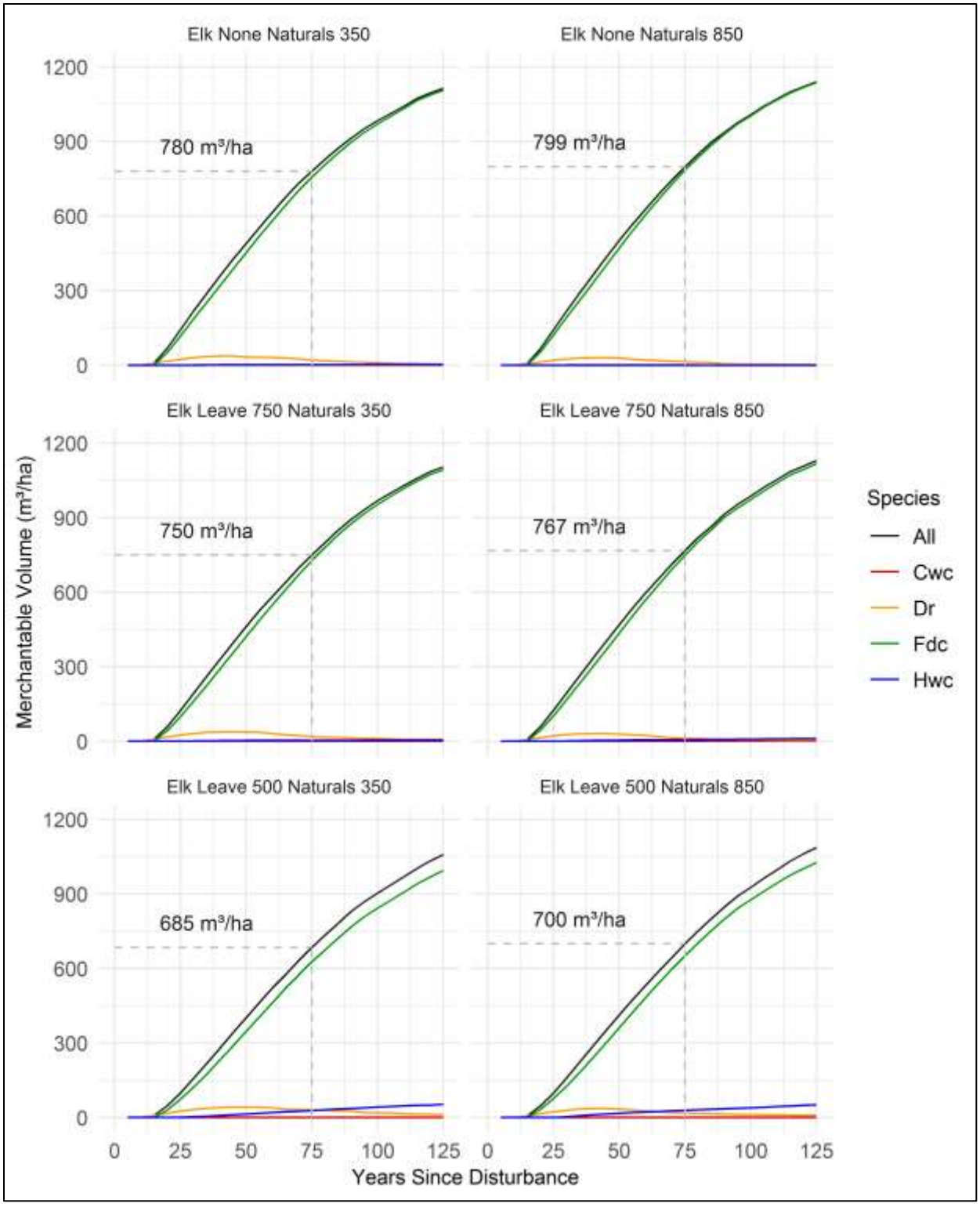

Figure 11: Volume impacts of different elk damage assumptions for contemporary era stands with a moderate elk hazard in the CWHdm Cool in the West Harrison Elk Zone (black lines=total vol, green=Fd, blue=Hw, and orange=Dr)

9.2.3 Root Rot

Based on feedback from Stefan Zeglen, Regional Forest Health Specialist, Fdc leading existing and future managed stands in high root rot hazard zones (CWHdm, ds1 and IDFww) were requested to have an OAF2 of 12.5% applied (vs 5%).

The standard OAF2 of 5% was used for future Fdc or Hw reforestation regimes, where stumping treatments were assumed.

9.3 Zoning

The THLB in the Fraser TSA was zoned based on suitability for investment in silviculture treatments. Three zones were developed: green, yellow and red. Green depicts areas where management actions and investments are generally recommended due to higher site productivity, lower harvest costs and reduced anticipated risks from constraints and other risks to future harvest. In the yellow zone caution is recommended, while the red zones denote areas where management actions and investments in forest management should be avoided due to costs and risks. The THLB areas for green and yellow zones are presented in Table 42 and Table 43, while Table 44 details the zoning criteria. The silviculture zones for the TSA are illustrated in Figure 12.

Table 42: Silviculture zone areas by ERA

Silviculture Zone	Description	THLB (ha)
Green	EM contemporary	1,765 ha
Green	EM Old	2,587 ha
Green	Natural	4,764 ha
Yellow	EM contemporary	14,477 ha
Yellow	EM Old	20,656 ha
Yellow	Natural	51,258 ha
Total		**95,508 ha**

Table 43: Silviculture zone areas

Silviculture Zone	THLB (ha)
Green	9,117 ha
Yellow	86,392 ha
Red	123,982 ha
Total	**219,490 ha**

Table 44: THLB zoning, Fraser TSA

Category	Data Source	Green (good)	Yellow (caution)	Red (stop)
Site Productivity	Managed Stands (AU)	CWH ds1/all; dm/all; CWH vm1/all; CWH vm2/warm/all; CWH ms1s/warm, cool/G	CWH vm2/cool/G; CWH ms1s/warm, cool/M-P; CWH ms1m/warm; IDF/cool	CWH ms1m/cool; CWH vm2/cool/M-P IDF/warm; ESSF/all; MH/all;
Costs	Operability	Ground	Cable	Heli
	Areas eligible for Isolated allowance in appraisal manual	Regular truck	Upper Pitt and Upper Stave	N/A
Constraints to Harvest	Potential land use issues (First Nations interest areas, non-forestry development, public interest, etc.)	No	Hemlock Resort Area; Slesse Creek FN interest area; Bowen Island; Hatzic drainage public interest area	N/A
	VQO	Modification or none	Partial Retention	Preservation, Retention
	Community Watersheds	No	Yes	N/A
	Legal WHAs	No	Constrained harvest zone	
	Draft WHAs; Northern Goshawk	No	Forage areas	Nesting areas
	First Nations values; Stó:lō Plan	No	Other Stó:lō constrained areas (watersheds, cultural buffers etc.)	Within Sanctuaries
Forest Health	Elk hazard to reforestation. Based on v.3 of Steve Wilson's Roosevelt Elk Winter Range Model and mapped Elk Zones	Low Hazard or not located within units that are managed for elk	Moderate to high hazard to reforestation, and outside of Pitt, Stave, Chehalis and West Harrison Elk Zones.	Moderate to high ranking and within Pitt, Stave, Chehalis and West Harrison Elk Zones
Fire Hazard	Fire Hazard; High to extreme within 2km buffer (WUI)	Outside WUI	Within WUI and outside of high to extreme fire hazard	Within WUI and within high to extreme fire hazard

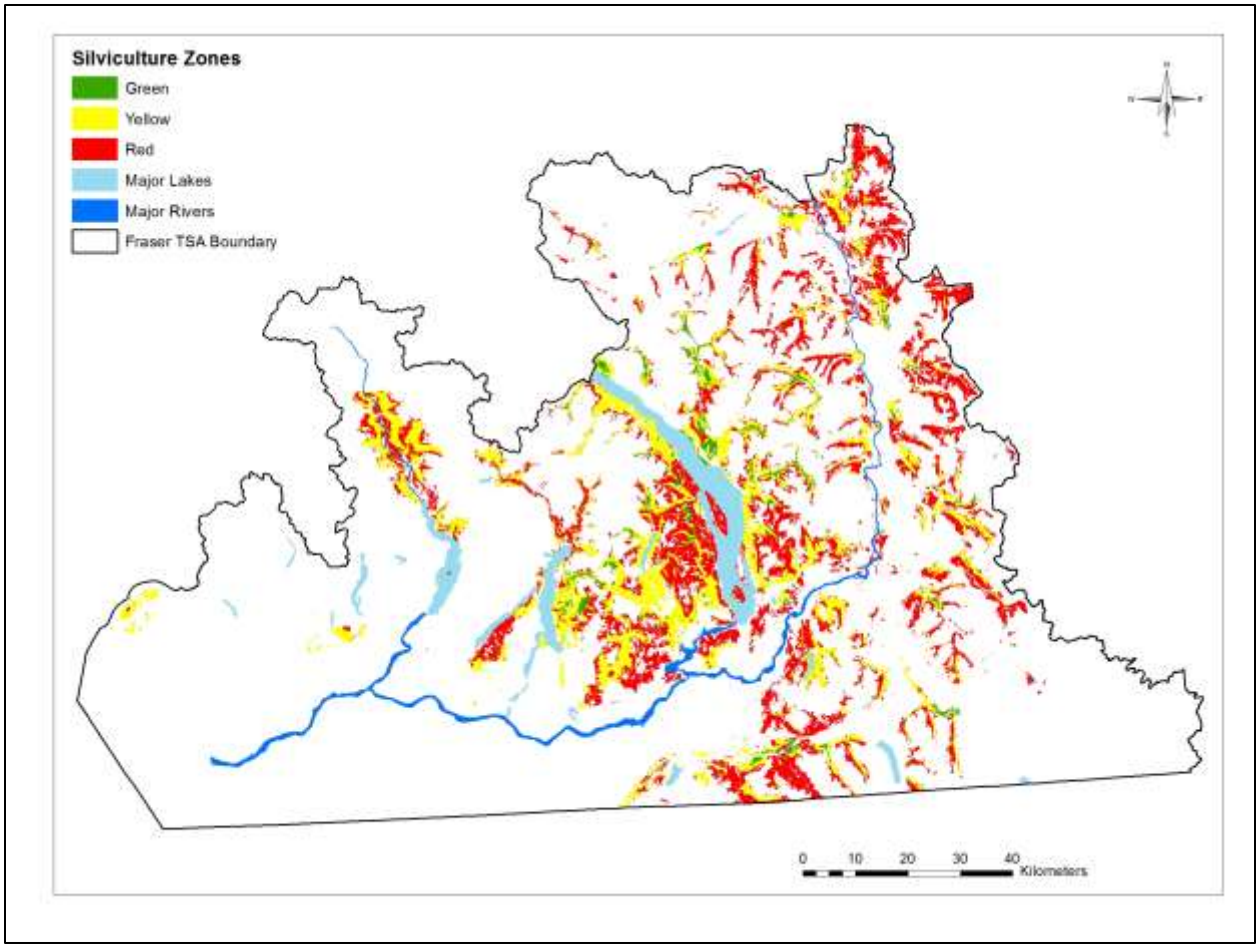

Figure 12: Fraser TSA silviculture zones

9.4 Volume and Value Strategies

Two volume strategies and one value strategy are tested. In the first volume strategy (Volume Strategy 1) portions of the existing and future Fd leading managed stands[7] were fertilized on green to yellow silviculture zones every 10 years from 30 to 70 years.

The second volume strategy (Volume Strategy 2) involved revised reforestation regimes for future stands and assumed the following:

- For medium to good sites which are expected to be managed primarily for timber, a mosaic of ecologically suitable single species stands with enhanced densities specifically designed to optimize the production and value of each species were established ("unmix the mixes"). The species portfolio for each BEC unit was developed with consideration for climate change through the use of Climate Change Informed Species Selection (CCISS) tool and forest health risks;

[7] Based on recent experience in identifying fertilization candidates from queries of VRI and ecological data, opportunity areas were netted down to more realistic estimates on a BEC and yield curve basis.

- Average expected genetic worth for each species from seed available under the Climate Based Seed Transfer (CBST) rules was used (see Table 45 for a comparison of the genetic worth of available seed from CBST versus what was used for the ISS Base Case and previous scenarios)
- On operable sites where root rot is a hazard, stumping was assumed with Fd and Hw regimes;
- On SNC hazard sites, the Fd percent was reduced in the species portfolios;
- Reduced stocking was assumed on sites with high or moderate elk hazard;
- High future log prices were assumed for all enhanced regimes;
- Fd stands on green and yellow zones were fertilized every 10 years from 30 to 70 years.

Table 45: Comparison of CBST and the ISS Base Case genetic worth for future stands for the primary BEC/species combinations

BEC Var	Fdc		Fdi		Hw		Cw		Ss	
	Base Case	CBST	Base Case	CBST	Base Case	CBST	Base Case	CBST	Base Case	CBST
CWH dm	11	16-20			N/A	2-16	9	20-24		
CWH ds1	1.3	16-20					0	0		
CWH vm1	11	16-20			N/A	14-17	8	20-24	0	2
CWH vm2	11	2-16			N/A	9-14	3.7	20-24	0	2
CWH ms1	2	2-16					0	0		
IDF ww			2	26-27						

The Value Strategy is like Volume Strategy 2 with the following exceptions:

- Cw with average genetic worth was introduced, where ecologically appropriate. Juvenile spacing was assumed to reduce competition from Hw. High log prices were assumed for all harvested Cw.

Yield curve inputs for the volume and value strategies are presented in Appendix 1: Managed Stand Yield Curve Specifications.

9.4.1 Treatment Costs

The treatment costs are assumed to be $500 per ha for fertilization and $2,500 per ha for juvenile spacing. Stumping costs are assumed at $1,250 per ha; however, in this analysis it is assumed that only 60% of root rot sites require stumping. This reduces the average stumping costs for BEC units with a root rot hazard to approximately $750 per ha.

Increased planting densities are assumed in Volume Strategy 2 and the Value Strategy. Table 46 shows the assumed increased planting costs due to enhanced densities and stumping.

Table 46: Planting cost increases due to enhanced planting densities and stumping

BEC	Treatment	Density Difference vs. Base Case (sph)	Cost Difference per ha vs. Base Case ($1/tree, no stumping)	Cost Difference per ha vs. Base Case ($1/tree, $750 for stumping)
CWHds1 cool all	Fd; stump/no stump; fert	350	$350	$1,100
CWHdm cool all	Hw; stump/no stump	50	$50	$800
	Cw; JS	250	$250	
CWHms1s all	Fd; fert	800	$800	
	Hw	400	$400	
	Cw; JS	600	$600	
CWHms1m warm	Fd; fert	650	$650	
	Cw JS	450	$450	
	Hw	250	$250	
CWHvm1 cool all	Hw	300	$300	
	Cw; JS	500	$500	
CWHvm2 warm all	Hw	500	$500	
	Fd; Fert	900	$900	
	Cw; JS	700	$700	

In elk zones lower establishment densities are proposed. Table 47 shows the estimated planting cost savings using lower densities. The cost reduction is based on the cost of $1 per tree; in CWHdm and CWHvm1, one less replant is assumed reducing the planting cost by $700 per ha.

The silviculture costs listed in this section were also used for the stand-level financial analysis summarized in the Analysis Report.

Table 47: Planting cost decreases due to low density planting in elk zones

BEC	Treatment	Density Difference vs. Base Case (sph)	Cost Difference per ha vs. Base Case ($1/tree)1 less replant ($700 per ha) in dm and vm1
CWHds1 cool all	Fd	(350)	($350)
CWHdm cool all	Hw	(550)	($1,250)
	Dr	(250)	($950)
CWHvm1 cool all	Hw	(550)	($1,250)
	Dr	(250)	($950)

9.5 Selected Scenario

The analysis results were presented to the Fraser ISS implementation group in February 2018. The group agreed that no additional scenarios were required; the value scenario as presented is to serve as the basis for the Fraser TSA Integrated Silviculture Strategy.

10 List of Acronyms

Acronym	Description
AAC	Annual Allowable Cut
AU	Analysis Unit
BCGW	BC Geographic Warehouse
BCTS	BC Timber Sales
BEC	Biogeoclimatic Ecosystem Classification
CBST	Climate Based Seed Transfer
CCISS	Climate Change Informed Species Selection
CFLB	Crown Forested Land Base
DBH	Diameter at Breast Height
DIB	Diameter Inside Bark
EM	Existing Managed
ESA	Environmentally Sensitive Areas
EVQO	Established Visual Quality Objective
EXLB	Excluded Land Base
FAIB	Forest Analysis and Inventory Branch
FC1	Former Forest Cover Inventory Standard
FESL	Forest Ecosystem Solutions Ltd
FLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
FMLB	Forest Management Land Base (from VRI)
FNWL	First Nations Woodland License
FREP	Forest and Range Evaluation Program
FSOS	Forest Simulation and Optimization System
GAR	Government Action Regulation
GIS	Geographic Information System
ISS	Integrated Silviculture Strategy
ITG	Inventory Type Group
LCC1	Land Cover Class 1
LTOH	Long Term Owl Habitat
LUP	Landscape Unit Plan
MAI	Mean Annual Increment
MFHA	Managed Forest Habitat Area (Spotted Owl)
MFLB	Managed Forest Land Base (Netdown)
MOE	Ministry of Environment
MRVA	Multiple Resource Values Assessment
NHLB	Non-Harvestable Land Base
NOGO	Northern Goshawk
NRL	Non-Recoverable Losses
NSR	Not Sufficiently Restocked
OAF	Operational Adjustment Factor
OGMA	Old Growth Management Area
PSP	Permanent Sample Plot
RMA	Riparian Management Area

Acronym	Description
RPB	Resource Practices Branch
ROG	Rate of Growth
SNC	Swiss Needle Cast
SRMP	Sustainable Resource Management Plan
SRRMC	Stó:lō Research and Resource Management Centre
STUP	S'ólh Téméxw Use Plan
TASS	Tree and Stand Simulator
TEM	Terrestrial Ecosystem Mapping
TFL	Tree Farm License
TIPSY	Table Interpolation Program for Stand Yields
THLB	Timber Harvesting Land Base
TSA	Timber Supply Area
TSL	Timber Sale License
TSR	Timber Supply Review
UWR	Ungulate Winter Range
VAC	Visual Absorption Capacity
VDYP	Variable Density Yield Prediction
VEG	Visually Effective Greenup
VRI	Vegetation Resource Inventory
VQO	Visual Quality Objective
WG	Working Group
WHA	Wildlife Habitat Area
WTP	Wildlife Tree Patch
WUI	Wildland Urban Interface
YSM	Young Stand Monitoring

11 References

Brown, Jim. 2015. Fraser TSA Timber Supply Analysis, File Report

Chilliwack Forest District, 2008. Order to Identify a Cultural Heritage Resource, Resource Feature on Mt. Woodside (Kweh-Kwuch-Hum) for the Chilliwack Forest District.

Cortex Consultants Inc. 2002. Fraser TSA Silviculture Strategy (Type 2)

Parks Canada Agency. 2018. Recovery Strategy for the Northern Goshawk laingi subspecies (*Accipiter gentilis laingi*) in Canada. Species at Risk Act Recovery Strategy Series. Parks Canada Agency, Ottawa, ON.

Geraldes A., K.K. Askelson, E. Nikelski, F.I. Doyle, W.L. Harrower, K. Winker, and D.E. Irwin. Population genomic analyses reveal a highly differentiated and endangered genetic cluster of northern goshawks (*Accipiter gentilis laingi*) in Haida Gwaii. Evolutionary applications 12:757-772.

Ministry of Environment, 2009. Order – Ungulate Winter Range U-2-006.

Ministry of Environment, 2010. Order – Wildlife Habitat Areas 2-097, 2-098, 2-105 to 2-107, 2-111, 2-113, 2-116, 2-372 to 2-380, Grizzly Bear – Chilliwack Forest District.

Ministry of Environment and Ministry of Forests and Range, 2009. Best Management Practices for Managing Spotted Owl Habitat.

Ministry of Environment, Lands, and Parks and Ministry of Forests, 1999. General Wildlife Measures – Order No. 1.

Ministry of Forests, Lands and Natural Resource Operations, 2013.Fraser Timber Supply Area Timber Supply Review, Data Package.

Ministry of Forests, Lands and Natural Resource Operations, 2015. A management plan for Roosevelt Elk in British Columbia.

Ministry of Forests, Lands and Natural Resource Operations, 2016. Fraser Timber Supply Area Rationale for Annual Allowable Cut.

Ministry of Forests, Lands, and Natural Resource Operations, 2011. Order – Amendment to Ungulate Winter Range U-2-006 Units BS 26 and CH 9-11, Mule Deer and Columbian Black-tailed Deer – Fraser TSA.

Ministry of Forests, Lands, and Natural Resource Operations, 2014. Order – Wildlife Habitat Areas 2-511 to 2-513.

Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2018. Implementation Plan for the Recovery of Marbled Murrelet (*Brachyramphus marmoratus*) in British Columbia.

Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2018. Implementation Plan for the Recovery of Northern Goshawk, laingi Subspecies (Accipiter gentilis laingi) in British Columbia.

Ministry of Natural Resource Operations, 2011. Order – Wildlife Habitat Areas 2-494 to 2-510.

People of the River Referrals Office. 2014. S'ólh Téméxw Use Plan Policy version 1.0

Appendix 1: Managed Stand Yield Curve Specifications

Table 48: Old Managed Stand Specifications; Base Case

	Planted																Natural											
AU#	Planted Stems	Regen Delay	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	Sp5	Pct5	SI5	Natural Stems	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3	Sp4	Pct4	SI4
1	1255	3	Fdc	40	31.5	Cw	14	24.0	Pli	13	24.0	Hw	30	26.1	Ba	4	25.2	45	At	100	26.8									
2	1295	3	Fdc	37	31.3	Cw	16	24.2	Hw	44	25.7	Ba	3	25.2				45	At	100	26.8									
3	1380	2	Fdc	43	32.2	Cw	11	21.9	Hw	46	26.1							120	Dr	100	26.5									
4	1820	2	Fdc	26	32.7	Cw	18	22.5	Hw	45	26.4	Ba	11	26.4				80	Dr	100	26.5									
5	0																	3100	Cw	3	12.3	Ba	77	12.0	Hm	19	16.0			
6	0																	3100	Sx	3	12.0	Ba	77	12.0	Hm	19	16.0			
7	0																	2300	Sx	12	16.0	Cw	1	16.2	Ba	70	16.0	Hm	17	16.0
8	0																	3200	Sx	6	16.0	Cw	1	16.2	Ba	75	16.0	Hm	19	16.0
9	1170	3	Fdc	26	28.0	Cw	10	21.8	Hw	38	23.2	Ba	23	21.1	Sx	3	21.1	50	At	100	21.7									
10	1450	3	Fdc	17	28.9	Cw	10	22.5	Hw	41	23.8	Ba	28	22.5	Sx	3	22.5	50	At	100	23.4									
11	230	3	Fdc	22	25.8	Sx	52	18.6	Cw	26	20.7							2170	Ba	71	18.6	Hw	29	21.5						
12	200	3	Sx	75	20.0	Fdc	25	26.9										2700	Ba	67	20.0	Hw	33	22.0						
13	1480	3	Fdc	10	32.6	Cw	17	23.0	Hw	57	26.5	Ba	16	25.8				120	Dr	100	26.5									
14	2020	3	Fdc	4	33.1	Cw	16	22.7	Hw	53	26.7	Ba	27	26.5				180	Dr	100	26.5									
15	2200	3	Fdc	2	30.2	Cw	11	20.0	Hw	45	24.0	Ba	41	22.4				50	Dr	100	26.5									
16	140	2	Cw	100	19.6													3090	Fdc	2	30.0	Ba	67	22.7	Hw	31	23.8			
17	600	3	Fdi	83	24.4	Pli	17	22.5										500	Cw	45	15.0	Hw	55	22.4						
18	850	3	Fdi	61	24.6	Pli	8	22.5	Cw	31	16.0							480	Hw	100	22.6									
19	310	2	Sx	81	18.0	Fdi	10	15.0	Pli	10	20.0							2000	Ba	95	15.0	At	5	17.8						
20	210	2	Sx	90	17.8	Pli	10	20.1										3325	Ba	100	15.0									
21	1255	3	Fdc	40	31.5	Cw	14	24.0	Pli	13	24.0	Hw	30	26.1	Ba	4	25.2	45	At	100	26.8									
22	1295	3	Fdc	37	31.3	Cw	16	24.2	Hw	44	25.7	Ba	3	25.2				45	At	100	26.8									
23	1380	2	Fdc	43	32.2	Cw	11	21.9	Hw	46	26.1							120	Dr	100	26.5									
24	1820	2	Fdc	26	32.7	Cw	18	22.5	Hw	45	26.4	Ba	11	26.4				80	Dr	100	26.5									
29	1170	3	Fdc	26	28.0	Cw	10	21.8	Hw	38	23.2	Ba	23	21.1	Sx	3	21.1	50	At	100	21.7									
30	1450	3	Fdc	17	28.9	Cw	10	22.5	Hw	41	23.8	Ba	28	22.5	Sx	3	22.5	50	At	100	23.4									
33	1480	3	Fdc	10	32.6	Cw	17	23.0	Hw	57	26.5	Ba	16	25.8				120	Dr	100	26.5									

Table 49: Old Managed Stands with Treatment Specifications; Base Case

	Planted																Natural				Treatments			
AU#	Planted Stems	Regen Delay	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	Sp5	Pct5	SI5	Natural Stems	Sp1	Pct1	SI1	JS_Age	JS_Density	JS_Type	Fert_Age1
34	2020	3	Fdc	4	33.1	Cw	16	22.7	Hw	53	26.7	Ba	27	26.5				180	Dr	100	26.5	20	600	Well-spaced favoring larger trees	
41	1255	3	Fdc	40	31.5	Cw	14	24.0	Pli	13	24.0	Hw	30	26.1	Ba	4	25.2	45	At	100	26.8	20	500	Well-spaced favoring larger trees	
42	1295	3	Fdc	37	31.3	Cw	16	24.2	Hw	44	25.7	Ba	3	25.2				45	At	100	26.8	20	500	Well-spaced favoring larger trees	
44	1820	2	Fdc	26	32.7	Cw	18	22.5	Hw	45	26.4	Ba	11	26.4				80	Dr	100	26.5	20	500	Well-spaced favoring larger trees	
49	1170	3	Fdc	26	28.0	Cw	10	21.8	Hw	38	23.2	Ba	23	21.1	Sx	3	21.1	50	At	100	21.7	20	500	Well-spaced favoring larger trees	
50	1450	3	Fdc	17	28.9	Cw	10	22.5	Hw	41	23.8	Ba	28	22.5	Sx	3	22.5	50	At	100	23.4	20	500	Well-spaced favoring larger trees	
81	1255	3	Fdc	40	31.5	Cw	14	24.0	Pli	13	24.0	Hw	30	26.1	Ba	4	25.2	45	At	100	26.8	20	500	Well-spaced favoring larger trees	25
82	1295	3	Fdc	37	31.3	Cw	16	24.2	Hw	44	25.7	Ba	3	25.2				45	At	100	26.8	20	500	Well-spaced favoring larger trees	25
83	1380	2	Fdc	43	32.2	Cw	11	21.9	Hw	46	26.1							120	Dr	100	26.5	20	500	Well-spaced favoring larger trees	25
84	1820	2	Fdc	26	32.7	Cw	18	22.5	Hw	45	26.4	Ba	11	26.4				80	Dr	100	26.5	20	500	Well-spaced favoring larger trees	25
89	1170	3	Fdc	26	28.0	Cw	10	21.8	Hw	38	23.2	Ba	23	21.1	Sx	3	21.1	50	At	100	21.7	20	500	Well-spaced favoring larger trees	25
90	1450	3	Fdc	17	28.9	Cw	10	22.5	Hw	41	23.8	Ba	28	22.5	Sx	3	22.5	50	At	100	23.4	20	500	Well-spaced favoring larger trees	25
93	1480	3	Fdc	10	32.6	Cw	17	23.0	Hw	57	26.5	Ba	16	25.8				120	Dr	100	26.5	20	500	Well-spaced favoring larger trees	25

Table 50: Young Managed Stand Specifications; Base Case

	Planted																	Natural									
AU#	Planted Stems	Regen Delay	Sp1	Pct1	SI1	GW1	SA1	Sp2	Pct2	SI2	GW2	SA2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	Natural Stems	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3
100	1350	2	Fdc	59	31.2	1.1	12	Cw	19	22.7			Hw	22	26.0				150	At	100	26.6						
101	1800	2	Fdc	49	32.1	1.1	12	Cw	20	23.4			Hw	31	25.9				100	At	100	26.6						
102	1790	2	Fdc	49	32.4	7	12	Cw	11	22.4	5.6	10	Pw	3	22.4	Hw	38	26.4	100	Dr	100	26.5						
103	2200	2	Fdc	35	32.8	7	12	Cw	15	22.7	5.6	10	Bg	3	32.8	Hw	47	26.6	100	Dr	100	26.5						
104	900	2	Ba	78	12.0			Cw	11	13.4			Yc	11	13.4				2380	Hm	42	16.0	Ba	58	12.0			
105	900	2	Ba	78	12.0			Cw	11	13.4			Yc	11	13.4				2380	Hm	42	16.0	Ba	58	12.0			
106	560	2	Sx	100	16.0	0.3	15												2140	Ba	90	16.0	Hm	5	16.0	Yc	5	17.6
107	220	2	Sx	91	16.0	0.3	15	Yc	9	17.6									3180	Ba	95	16.0	Hm	5	16.0			
108	1600	2	Fdc	25	27.5	1.9	12	Cw	22	21.1			Hw	44	22.8	Ba	9	20.4	0									
109	2000	2	Fdc	15	28.8	1.9	12	Cw	23	21.8			Ba	33	21.8	Hw	30	23.4	0									
110	950	1	Fdc	21	26.1	1.9	12	Sx	37	18.8	1.3	15	Cw	37	20.5	Yc	5	20.5	2150	Hw	65	21.4	Ba	35	18.8			
111	530	2	Sx	91	20.2	1.3	15	Yc	9	21.0									2670	Ba	56	20.2	Hw	44	22.0			
112	2140	2	Fdc	14	32.7	7.2	12	Cw	26	22.9	5.5	10	Hw	54	26.7	Ba	6	25.8	60	Dr	100	26.5						
113	2710	2	Fdc	7	33.7	7.2	12	Cw	25	23.4	5.5	10	Hw	54	27.3	Ba	13	27.3	90	Dr	100	26.5						
114	700	1	Fdc	14	30.5	6.5	12	Cw	74	20.8	2.2	10	Yc	11	20.8				1860	Hw	65	24.2	Ba	32	22.8	Dr	3	26.5
115	500	1	Cw	80	20.3	2.2	10	Yc	20	20.3									3200	Hw	78	23.9	Ba	20	23.0	Dr	2	26.5
116	800	1	Fdi	63	23.8	1.6	15	Pli	12	22.2			Cw	25	15.0				500	Cw	45	15.0	Hw	55	19.9			
117	885	1	Fdi	62	24.1	1.6	15	Cw	32	15.0			Pli	6	22.5				725	Hw	69	22.0	Cw	31	15.0			
118	1645	3	Sx	36	16.9	1.7	15	Fdi	3	15.0	2	15	Ba	61	15.0				100	At	100	16.4						
119	2000	3	Sx	25	16.9	1.7	15	Ba	75	15.0									100	At	100	16.4						

Note: GW = genetic worth, SA = selection age (for genetic worth)

Table 51: Future Managed Stand Specifications: Base Case

	Planted																	Natural											
AU#	Planted Stems	Regen Delay	Sp1	Pct1	SI1	GW1	SA1	Sp2	Pct2	SI2	GW2	SA2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	Natural Stems	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3	Sp4	Pct4	SI4
200	1400	1	Fdc	50	33.3	1.3	12	Cw	29	24.4			Hw	21	27.7				150	At	100	29.2									
201	1400	1	Fdc	50	29.5	1.3	12	Cw	29	22.6			Hw	21	25.3				150	At	100	25.4									
202	1800	2	Fdc	40	33.5	1.3	12	Cw	29	24.5			Hw	31	27.2				100	At	100	26.6									
203	1800	2	Fdc	40	30.0	1.3	12	Cw	29	23.1			Hw	31	25.1				100	At	100	26.6									
204	1790	2	Fdc	49	33.4	11.1	12	Cw	11	23.2	9.2	10	Pw	3	23.2	Hw	38	27.5	100	Dr	100	26.5									
205	1790	2	Fdc	49	30.9	11.1	12	Cw	11	21.2	9.2	10	Pw	3	21.2	Hw	38	25.2	100	Dr	100	26.5									
206	2200	2	Fdc	35	33.7	11.1	12	Cw	15	23.1	9.2	10	Bg	3	32.8	Hw	47	27.4	100	Dr	100	26.5									
207	2200	2	Fdc	35	30.9	11.1	12	Cw	15	21.2	9.2	10	Bg	3	32.8	Hw	47	25.0	100	Dr	100	26.5									
208	900	2	Ba	78	12.0			Cw	11	12.3			Yc	11	12.3				2380	Hm	42	16.0	Ba	58	12.0						
209	900	2	Ba	78	12.0			Cw	11	12.3			Yc	11	12.3				2380	Hm	42	16.0	Ba	58	12.0						
210	560	2	Sx	100	16.0	0.5	15												2140	Ba	91	16.0	Hm	5	16.0	Yc	5	17.6			
211	220	2	Sx	91	16.0	0.5	15	Yc	9	17.6									3180	Ba	95	16.0	Hm	5	16.0						
212	1600	2	Fdc	25	31.7	2	12	Cw	22	23.3			Hw	44	25.4	Ba	9	24.4	0												
213	1600	2	Fdc	25	26.8	2	12	Cw	22	21.2			Hw	44	22.6	Ba	9	20.1	0												
214	2000	2	Fdc	15	31.9	2	12	Cw	23	23.0			Ba	33	25.0	Hw	30	25.4	0												
215	2000	2	Fdc	15	27.3	2	12	Cw	23	21.8			Ba	33	21.1	Hw	30	23.0	0												
216	950	1	Fdc	21	25.6	2	12	Sx	37	18.5	0.3	15	Cw	37	20.7	Yc	5	20.7	2150	Hw	65	21.4	Ba	35	18.5						
217	530	2	Sx	91	20.0	0.3	15	Yc	9	20.0									2670	Ba	56	21.9	Hw	44	21.0						
218	2140	2	Fdc	14	33.4	11	12	Cw	26	23.8	7.9	10	Hw	54	27.5	Ba	6	26.9	60	Dr	100	26.5									
219	2140	2	Fdc	14	31.2	11	12	Cw	26	21.6	7.9	10	Hw	54	25.3	Ba	6	24.1	60	Dr	100	26.5									
220	2710	2	Fdc	7	33.9	11	12	Cw	25	23.6	7.9	10	Hw	54	27.4	Ba	13	27.5	90	Dr	100	26.5									
221	2710	2	Fdc	7	31.2	11	12	Cw	25	21.1	7.9	10	Hw	54	25.3	Ba	13	24.6	90	Dr	100	26.5									
222	700	1	Fdc	14	31.8	10.9	12	Cw	74	21.3	3.7	10	Yc	11	21.3				1860	Hw	65	25.6	Ba	32	24.4	Dr	3	26.5			
223	700	1	Fdc	14	29.6	10.9	12	Cw	74	19.7	3.7	10	Yc	11	19.7				1860	Hw	65	23.6	Ba	32	21.9	Dr	3	26.5			
224	500	1	Cw	80	21.4	3.7	10	Yc	20	21.4									3200	Hw	78	25.7	Ba	19	24.9	Dr	2	26.5	Fdc	2	31.7
225	500	1	Cw	80	19.4	3.7	10	Yc	20	19.4									3200	Hw	78	23.4	Ba	19	22.3	Dr	2	26.5	Fdc	2	29.6
226	800	1	Fdi	63	23.9	1.6	15	Pli	13	22.2			Cw	25	15.0				500	Cw	45	15.0	Hw	55	19.9						
227	885	1	Fdi	62	24.4	0.5	15	Cw	32	15.0			Pli	6	22.5				725	Hw	69	22.4	Cw	31	15.0						
228	1645	3	Sx	36	17.4	0.6	15	Fdi	3	15.0	2	15	Ba	61	18.2				100	At	100	17.1									
229	2000	3	Sx	25	17.2	0.6	15	Ba	75	15.0									100	At	100	16.7									

Note: GW = genetic worth, SA = selection age (for genetic worth)

Table 52: Treated Old Managed Stand Specifications; Volume and Value Scenarios

AU#	Planted Stems	Regen Delay	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	Sp5	Pct5	SI5	Natural Stems	Regen Delay	Sp1	Pct1	SI1	JS Age	JS Density	Fert Age1	Fert Age2	Fert Age3	Fert Age4	Fert Age5
753	1255	3	Fdc	40	31.5	Cwc	14	24.0	Pli	13	24.0	Hwc	30	26.1	Ba	4	25.2	45		At	100	26.8			50	60	70		
754	1255	3	Fdc	40	31.5	Cwc	14	24.0	Pli	13	24.0	Hwc	30	26.1	Ba	4	25.2	45		At	100	26.8	20	500	25	50	60	70	
755	1295	3	Fdc	37	31.3	Cwc	16	24.2	Hwc	44	25.7	Ba	3	25.2		0		45		At	100	26.8			50	60	70		
756	1295	3	Fdc	37	31.3	Cwc	16	24.2	Hwc	44	25.7	Ba	3	25.2		0		45		At	100	26.8	20	500	25	50	60	70	
757	1380	2	Fdc	43	32.2	Cwc	11	21.9	Hwc	46	26.1		0			0		120		Dr	100	26.5			50	60	70		
758	1380	2	Fdc	43	32.2	Cwc	11	21.9	Hwc	46	26.1		0			0		120		Dr	100	26.5	20	500	25	50	60	70	
759	1820	2	Fdc	26	32.7	Cwc	18	22.5	Hwc	45	26.4	Ba	11	26.4		0		80		Dr	100	26.5			50	60	70		
760	1820	2	Fdc	26	32.7	Cwc	18	22.5	Hwc	45	26.4	Ba	11	26.4		0		80		Dr	100	26.5	20	500	25	50	60	70	
761	1480	3	Fdc	10	32.6	Cwc	17	23.0	Hwc	57	26.5	Ba	16	25.8		0		120		Dr	100	26.5			50	60	70		
762	1480	3	Fdc	10	32.6	Cwc	17	23.0	Hwc	57	26.5	Ba	16	25.8		0		120		Dr	100	26.5	20	500	25	50	60	70	
763	1170	3	Fdc	26	28.0	Cwc	10	21.8	Hwc	38	23.2	Ba	23	21.1	Ss	3	21.1	50		At	100	21.7			50	60	70		
764	1170	3	Fdc	26	28.0	Cwc	10	21.8	Hwc	38	23.2	Ba	23	21.1	Ss	3	21.1	50		At	100	21.7	20	500	25	50	60	70	
765	1450	3	Fdc	17	28.9	Cwc	10	22.5	Hwc	41	23.8	Ba	28	22.5	Ss	3	22.5	50		At	100	23.4			50	60	70		
766	1450	3	Fdc	17	28.9	Cwc	10	22.5	Hwc	41	23.8	Ba	28	22.5	Ss	3	22.5	50		At	100	23.4	20	500	25	50	60	70	
767	1255	3	Fdc	40	31.5	Cwc	14	24.0	Pli	13	24.0	Hwc	30	26.1	Ba	4	25.2	45		At	100	26.8			30	40	50	60	70
768	1255	3	Fdc	40	31.5	Cwc	14	24.0	Pli	13	24.0	Hwc	30	26.1	Ba	4	25.2	45		At	100	26.8	20	500	30	40	50	60	70
769	1295	3	Fdc	37	31.3	Cwc	16	24.2	Hwc	44	25.7	Ba	3	25.2		0		45		At	100	26.8			30	40	50	60	70
770	1295	3	Fdc	37	31.3	Cwc	16	24.2	Hwc	44	25.7	Ba	3	25.2		0		45		At	100	26.8	20	500	30	40	50	60	70
771	1380	2	Fdc	43	32.2	Cwc	11	21.9	Hwc	46	26.1		0			0		120		Dr	100	26.5			30	40	50	60	70
772	1820	2	Fdc	26	32.7	Cwc	18	22.5	Hwc	45	26.4	Ba	11	26.4		0		80		Dr	100	26.5			30	40	50	60	70
773	1820	2	Fdc	26	32.7	Cwc	18	22.5	Hwc	45	26.4	Ba	11	26.4		0		80		Dr	100	26.5	20	500	30	40	50	60	70
774	1480	3	Fdc	10	32.6	Cwc	17	23.0	Hwc	57	26.5	Ba	16	25.8		0		120		Dr	100	26.5			30	40	50	60	70
775	1170	3	Fdc	26	28.0	Cwc	10	21.8	Hwc	38	23.2	Ba	23	21.1	Ss	3	21.1	50		At	100	21.7			30	40	50	60	70
776	1170	3	Fdc	26	28.0	Cwc	10	21.8	Hwc	38	23.2	Ba	23	21.1	Ss	3	21.1	50		At	100	21.7	20	500	30	40	50	60	70
777	1450	3	Fdc	17	28.9	Cwc	10	22.5	Hwc	41	23.8	Ba	28	22.5	Ss	3	22.5	50		At	100	23.4			30	40	50	60	70
778	1450	3	Fdc	17	28.9	Cwc	10	22.5	Hwc	41	23.8	Ba	28	22.5	Ss	3	22.5	50		At	100	23.4	20	500	30	40	50	60	70
779	850	3	Fdi	61	24.6	Pli	8	22.5	Cwc	31	16.0		0			0		480		Hwc	100	22.6			30	40	50	60	70

Table 53: Treated Young Managed Stand Specifications; Volume and Value Scenarios, Planting Inputs

AU#	Planted Stems	Regen Delay	Sp1	Pct1	SI1	GW1	SA1	PK1	Sp2	Pct2	SI2	GW2	SA2	PK2	Sp3	Pct3	SI3	Sp4	Pct4	SI4
780	1350	2	Fdc	59	31.2	1.1	12	0	Cwc	19	22.7			0	Hwc	22	26.0		0	
781	1800	2	Fdc	49	32.1	1.1	12	0	Cwc	20	23.4			0	Hwc	31	25.9		0	
782	1790	2	Fdc	49	25.9	7	12	0	Cwc	11	22.4	5.6	10	0	Pw	3	22.4	Hwc	38	26.4
783	2200	2	Fdc	35	26.2	7	12	0	Cwc	15	22.7	5.6	10	0	Bg	3	32.8	Hwc	47	26.6
784	2140	2	Fdc	14	26.2	7.2	12	0	Cwc	26	22.9	5.5	10	0	Hwc	54	26.7	Ba	6	25.8
785	2710	2	Fdc	7	26.9	7.2	12	0	Cwc	25	23.4	5.5	10	0	Hwc	54	27.3	Ba	13	27.3
786	1600	2	Fdc	25	27.5	1.9	12	0	Cwc	22	21.1			0	Hwc	44	22.8	Ba	9	20.4
787	2000	2	Fdc	15	28.8	1.9	12	0	Cwc	23	21.8			0	Ba	33	21.8	Hwc	30	23.4
788	950	1	Fdc	21	26.1	1.9	12	0	Ss	37	18.8	1.3	15	0	Cwc	37	20.5	Yc	5	20.5
789	885	1	Fdi	62	24.1	1.6	15	0	Cwc	32	15.0			0	Pli	6	22.5		0	
850	1790	2	Fdc	49	25.9	7	12	0	Cwc	11	22.4	5.6	10	0	Pw	3	22.4	Hwc	38	26.4
851	2200	2	Fdc	35	26.3	7	12	0	Cwc	15	22.7	5.6	10	0	Bg	3	32.8	Hwc	47	26.6
852	2140	2	Fdc	14	26.1	7.2	12	0	Cwc	26	22.9	5.5	10	0	Hwc	54	26.7	Ba	6	25.8
853	2710	2	Fdc	7	26.9	7.2	12	0	Cwc	25	23.4	5.5	10	0	Hwc	54	27.3	Ba	13	27.3
862	1200	4	Fdc	80	25.9	7	12	22	Cwc	20	22.4	5.6	10	100		0			0	
863	1200	4	Fdc	80	26.3	7	12	22	Cwc	20	22.7	5.6	10	100		0			0	
864	1200	4	Fdc	80	25.9	7	12	48	Cwc	20	22.4	5.6	10	100		0			0	
865	1200	4	Fdc	80	26.3	7	12	48	Cwc	20	22.7	5.6	10	100		0			0	
866	1200	4	Fdc	60	26.1	7.2	12	95	Hwc	10	26.7			95	Dr	10	26.5	Ss	20	28.4
867	1200	4	Fdc	60	26.1	7.2	12	80	Hwc	10	26.7			20	Dr	10	26.5	Ss	20	28.4
868	1200	4	Fdc	60	26.9	7.2	12	80	Hwc	10	27.3			20	Dr	10	26.5	Ss	20	29.2
869	1200	4	Fdc	60	26.9	7.2	12	95	Hwc	10	27.3			95	Dr	10	26.5	Ss	20	29.2

Note: GW = genetic worth, SA = selection age (for genetic worth), PK – percent killed

Table 54: Treated Young Managed Stand Specifications; Volume and Value Scenarios, Ingress and Treatment Inputs

AU#	Natural Stems	Regen Delay	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	Fert Age1	Fert Age2	Fert Age3	Fert Age4	Fert Age5
780	150	0	At	100	26.6		0			0			0		30	40	50	60	70
781	100	0	At	100	26.6		0			0			0		30	40	50	60	70
782	100	0	Dr	100	26.5		0			0			0		30	40	50	60	70
783	100	0	Dr	100	26.5		0			0			0		30	40	50	60	70
784	60	0	Dr	100	26.5		0			0			0		30	40	50	60	70
785	90	0	Dr	100	26.5		0			0			0		30	40	50	60	70
786	0	0		0			0			0			0		30	40	50	60	70
787	0	0		0			0			0			0		30	40	50	60	70
788	2150	0	Hwc	65	21.4	Ba	35	18.8		0			0		30	40	50	60	70
789	725	0	Hwc	69	22.0	At	0	21.3	Cwc	31	15		0		30	40	50	60	70
850	100	0	Dr	100	26.5		0			0			0						
851	100	0	Dr	100	26.5		0			0			0						
852	60	0	Dr	100	26.5		0			0			0						
853	90	0	Dr	100	26.5		0			0			0						
862	350	2	Dr	29	26.5	Hwc	71	26.4		0			0						
863	350	2	Dr	29	26.5	Hwc	71	26.6		0			0						
864	850	2	Dr	29	26.5	Hwc	71	26.4		0			0						
865	850	2	Dr	29	26.5	Hwc	71	26.6		0			0						
866	1600	2	Dr	5	26.5	Hwc	75	26.7	Fdc	10	26.1	Ss	10	28.4					
867	800	2	Dr	3	26.5	Hwc	93	26.7	Ss	5	28.4		0						
868	800	2	Dr	3	26.5	Hwc	93	27.3	Ss	5	29.2		0						
869	1600	2	Dr	5	26.5	Hwc	75	27.3	Fdc	10	26.9	Ss	10	29.2					

Table 55: Future Managed Stand Specifications; Volume and Value Scenarios, Planting Inputs

AU#	Planted Stems	Regen Delay	Sp1	Pct1	SI1	GW1	SA1	PK1	Sp2	Pct2	SI2	GW2	SA2	PK2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	Sp5	Pct5	SI5	SI3	Sp4	Pct4	SI4
700	1600	2	Fdc	100	33.5	18	12	0		0						0			0			0				0	
701	1400	2	Cwc	100	24.5			0		0						0			0			0				0	
702	1600	2	Fdc	100	30	18	12	0		0						0			0			0				0	
703	1400	2	Cwc	100	23.1			0		0						0			0			0				0	
704	1600	2	Fdc	100	33.7	18	12	0		0						0			0			0				0	
705	1200	2	Hwc	100	27.4	9	15	0		0						0			0			0				0	
706	1400	2	Cwc	100	23.1	22	10	0		0						0			0			0				0	
707	600	2	Hwc	50	27.4			25	Ss	50	29.3			0		0			0			0				0	
708	900	2	Dr	100	26.5			0		0						0			0			0				0	
709	1600	2	Fdc	100	30.9	18	12	0		0						0			0			0				0	
710	1200	2	Hwc	100	25	9	15	0		0						0			0			0				0	
711	1400	2	Cwc	100	21.2	22	10	0		0						0			0			0				0	
712	600	2	Hwc	50	25			25	Ss	50	26.3			0		0			0			0				0	
713	900	2	Dr	100	26.5			0		0						0			0			0				0	
714	1600	2	Fdc	100	31.7	9	12	0		0						0			0			0				0	
715	1200	2	Hwc	100	25.4			0		0						0			0			0				0	
716	1400	2	Cwc	100	23.3			0		0						0			0			0				0	
717	1600	2	Fdc	100	26.8	9	12	0		0						0			0			0				0	
718	1200	2	Hwc	100	22.6			0		0						0			0			0				0	
719	1400	2	Cwc	100	21.2			0		0						0			0			0				0	
720	1600	2	Fdc	100	31.9	9	12	0		0						0			0			0				0	
721	1200	2	Hwc	100	25.4			0		0						0			0			0				0	
722	1800	2	Se	100	22.4			0		0						0			0			0				0	
723	1400	2	Cwc	100	23			0		0						0			0			0				0	
724	1600	2	Fdc	100	27.3	9	12	0		0						0			0			0				0	
725	1200	2	Hwc	100	23			0		0						0			0			0				0	
726	1800	2	Se	100	20			0		0						0			0			0				0	
727	1400	2	Cwc	100	21.8			0		0						0			0			0				0	
728	1200	2	Hwc	100	21.4			0		0						0			0			0				0	
729	1800	2	Se	100	18.5			0		0						0			0			0				0	
730	1800	2	Ba	100	18.5			0		0						0			0			0				0	
731	1600	2	Fdc	100	25.6			0		0						0			0			0				0	
732	1400	2	Cwc	100	20.7			0		0						0			0			0				0	
733	1600	2	Fdc	100	27.1	18	12	0		0						0			0			0		26.5		0	
734	1200	2	Hwc	100	27.4	15	15	0		0						0			0			0		26.5		0	
735	1200	2	Hwc	50	27.4	15	15	0	Ss	50	29.3			0		0			0			0		26.5		0	
736	1400	2	Cwc	100	23.6	22	10	0		0						0			0			0		26.5		0	
737	600	2	Hwc	50	27.4			25	Ss	50	29.3			0		0			0			0				0	
738	900	2	Dr	100	26.5			0		0						0			0			0				0	
739	1600	2	Fdc	100	25	18	12	0		0						0			0			0		26.5		0	
740	1200	2	Hwc	100	25.3	15	15	0		0						0			0			0		26.5		0	

AU#	Planted Stems	Regen Delay	Sp1	Pct1	SI1	GW1	SA1	PK1	Sp2	Pct2	SI2	GW2	SA2	PK2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	Sp5	Pct5	SI5	SI3	Sp4	Pct4	SI4
741	1200	2	Hwc	50	25.3	15	15	0	Ss	50	26.6			0		0			0			0		26.5		0	
742	1400	2	Cwc	100	21.2	22	10	0		0						0			0			0		26.5		0	
743	600	2	Hwc	50	25.3			25	Ss	50	26.6			0		0			0			0				0	
744	900	2	Dr	100	26.5			0		0						0			0			0				0	
745	1600	2	Fdc	100	31.8	6	12	0		0						0			0			0		26.5		0	
746	1200	2	Hwc	100	25.6	12	15	0		0						0			0			0		26.5		0	
747	1200	2	Hwc	50	25.6	12	15	0	Ss	50	27			0		0			0			0		26.5		0	
748	1400	2	Cwc	100	21.3	22	10	0		0						0			0			0		26.5		0	
749	1600	2	Fdc	100	29.6	6	12	0		0						0			0			0		26.5		0	
750	1200	2	Hwc	100	23.6	12	15	0		0						0			0			0		26.5		0	
751	1200	2	Hwc	50	23.6	12	15	0	Ss	50	24.5			0		0			0			0		26.5		0	
752	1400	2	Cwc	100	19.7	22	10	0		0						0			0			0		26.5		0	
790	1400	1	Fdc	50	33.3	1.3	12	0	Cwc	29	24.4			0	Hwc	21	27.7		0			0				0	
791	1400	1	Fdc	50	29.5	1.3	12	0	Cwc	29	22.6			0	Hwc	21	25.3		0			0				0	
792	1800	2	Fdc	40	33.5	1.3	12	0	Cwc	29	24.5			0	Hwc	31	27.2		0			0				0	
793	1800	2	Fdc	40	30.0	1.3	12	0	Cwc	29	23.1			0	Hwc	31	25.1		0			0				0	
794	1790	2	Fdc	49	26.7	11.1	12	0	Cwc	11	23.2	9.2	10	0	Pw	3	23.2	Hwc	38	27.5		0				0	
795	1790	2	Fdc	49	24.7	11.1	12	0	Cwc	11	21.2	9.2	10	0	Pw	3	21.2	Hwc	38	25.2		0				0	
796	2200	2	Fdc	35	27.0	11.1	12	0	Cwc	15	23.1	9.2	10	0	Bg	3	32.8	Hwc	47	27.4		0				0	
797	2200	2	Fdc	35	24.7	11.1	12	0	Cwc	15	21.2	9.2	10	0	Bg	3	32.8	Hwc	47	25.0		0				0	
798	2140	2	Fdc	14	26.7	11	12	0	Cwc	26	23.8	7.9	10	0	Hwc	54	27.5	Ba	6	26.9		0				0	
799	2140	2	Fdc	14	25.0	11	12	0	Cwc	26	21.6	7.9	10	0	Hwc	54	25.3	Ba	6	24.1		0				0	
800	2710	2	Fdc	7	27.1	11	12	0	Cwc	25	23.6	7.9	10	0	Hwc	54	27.4	Ba	13	27.5		0				0	
801	2710	2	Fdc	7	25.0	11	12	0	Cwc	25	21.1	7.9	10	0	Hwc	54	25.3	Ba	13	24.6		0				0	
802	1600	2	Fdc	25	31.7	2	12	0	Cwc	22	23.3			0	Hwc	44	25.4	Ba	9	24.4		0				0	
803	1600	2	Fdc	25	26.8	2	12	0	Cwc	22	21.2			0	Hwc	44	22.6	Ba	9	20.1		0				0	
804	2000	2	Fdc	15	31.9	2	12	0	Cwc	23	23.0			0	Ba	33	25.0	Hwc	30	25.4		0				0	
805	2000	2	Fdc	15	27.3	2	12	0	Cwc	23	21.8			0	Ba	33	21.1	Hwc	30	23.0		0				0	
806	950	1	Fdc	21	25.6	2	12	0	Ss	37	18.5	0.3	15	0	Cwc	37	20.7	Yc	5	20.7		0				0	
807	885	1	Fdi	62	24.4	0.5	15	0	Cwc	32	15.0			0	Pli	6	22.5		0			0		15		0	
854	1790	2	Fdc	49	26.7	11.1	12	0	Cwc	11	23.2	9.2	10	0	Pw	3	23.2	Hwc	38	27.5		0				0	
855	1790	2	Fdc	49	24.7	11.1	12	0	Cwc	11	21.2	9.2	10	0	Pw	3	21.2	Hwc	38	25.2		0				0	
856	2200	2	Fdc	35	27.0	11.1	12	0	Cwc	15	23.1	9.2	10	0	Bg	3	32.8	Hwc	47	27.4		0				0	
857	2200	2	Fdc	35	24.7	11.1	12	0	Cwc	15	21.2	9.2	10	0	Bg	3	32.8	Hwc	47	25.0		0				0	
858	2140	2	Fdc	14	26.8	11	12	0	Cwc	26	23.8	7.9	10	0	Hwc	54	27.5	Ba	6	26.9		0				0	
859	2140	2	Fdc	14	25.0	11	12	0	Cwc	26	21.6	7.9	10	0	Hwc	54	25.3	Ba	6	24.1		0				0	
860	2710	2	Fdc	7	27.1	11	12	0	Cwc	25	23.6	7.9	10	0	Hwc	54	27.4	Ba	13	27.5		0				0	
861	2710	2	Fdc	7	25.0	11	12	0	Cwc	25	21.1	7.9	10	0	Hwc	54	25.3	Ba	13	24.6		0				0	
870	1200	4	Fdc	60	26.8	11	12	95	Hwc	10	27.5			95	Dr	10	26.5	Ss	20	29.4		0		26.8	Ss	4	29.4
871	1200	4	Fdc	60	25.0	11	12	95	Hwc	10	27.5			95	Dr	10	26.5	Ss	20	29.4		0		25.0	Ss	4	29.4
872	1200	4	Fdc	60	27.1	11	12	95	Hwc	10	27.4			95	Dr	10	26.5	Ss	20	29.3		0		27.1	Ss	4	29.3
873	1200	4	Fdc	60	25.0	11	12	95	Hwc	10	25.3			95	Dr	10	26.5	Ss	20	26.7		0		25.0	Ss	4	26.7
874	1200	4	Fdc	80	26.7	11.1	12	48	Cwc	20	23.2	9.2	10	100		0			0			0				0	
875	1200	4	Fdc	80	24.7	11.1	12	48	Cwc	20	21.2	9.2	10	100		0			0			0				0	
876	1200	4	Fdc	80	27.0	11.1	12	48	Cwc	20	23.1	9.2	10	100		0			0			0				0	

AU#	Planted Stems	Regen Delay	Sp1	Pct1	SI1	GW1	SA1	PK1	Sp2	Pct2	SI2	GW2	SA2	PK2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	Sp5	Pct5	SI5	SI3	Sp4	Pct4	SI4
877	1200	4	Fdc	80	24.7	11.1	12	48	Cwc	20	21.2	9.2	10	100		0			0			0				0	
878	1200	4	Fdc	80	33.3	1.3	12	22	Cwc	20	24.2	9.2	10	100		0			0			0				0	
879	1200	4	Fdc	80	29.5	1.3	12	22	Cwc	20	22.6			100		0			0			0				0	
880	1200	4	Fdc	80	33.5	1.3	12	22	Cwc	20	24.5			100		0			0			0				0	
881	1200	4	Fdc	80	30.0	1.3	12	22	Cwc	20	23.1			100		0			0			0				0	
882	1200	4	Fdc	80	26.7	11.1	12	22	Cwc	20	23.2	9.2	10	100		0			0			0				0	
883	1200	4	Fdc	80	24.7	11.1	12	22	Cwc	20	21.2	9.2	10	100		0			0			0				0	
884	1200	4	Fdc	80	27.0	11.1	12	22	Cwc	20	23.1	9.2	10	100		0			0			0				0	
885	1200	4	Fdc	80	24.7	11.1	12	22	Cwc	20	21.2	9.2	10	100		0			0			0				0	
886	1200	4	Fdc	60	26.8	11	12	80	Hwc	10	27.5			20	Dr	10	26.5	Ss	20	29.4		0		26.8	Ss	8	29.4
887	1200	4	Fdc	60	25.0	11	12	80	Hwc	10	25.3			20	Dr	10	26.5	Ss	20	26.7		0		25.0	Ss	8	26.7
888	1200	4	Fdc	60	27.1	11	12	80	Hwc	10	27.4			20	Dr	10	26.5	Ss	20	29.3		0		27.1	Ss	8	29.3
889	1200	4	Fdc	60	25.0	11	12	80	Hwc	10	25.3			20	Dr	10	26.5	Ss	20	26.7		0		25.0	Ss	8	26.7
890	900	2	Fdc	80	33.5	1.3	12	50	Hwc	20	27.2			0		0			0			0				0	
891	900	2	Fdc	80	30.0	1.3	12	50	Hwc	20	25.1			0		0			0			0				0	

Note: GW = genetic worth, SA = selection age (for genetic worth), PK – percent killed

Table 56: Future Managed Stand Specifications; Volume and Value Scenarios, Ingress and Treatment Inputs

AU#	Natural Stems	Regen Delay	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	JS Age	JS Density	JS Type	Fert Age1	Fert Age2	Fert Age3	Fert Age4	Fert Age5
700	660	1	Hwc	85	27.2	At	15	26.6		0			0					30	40	50	60	70
701	660	1	Hwc	85	27.2	At	15	26.6		0			0		15	900	favour Cw	30	40	50	60	70
702	660	1	Hwc	85	25.1	At	15	26.6		0			0					30	40	50	60	70
703	660	1	Hwc	85	25.1	At	15	26.6		0			0		15	900	favour Cw	30	40	50	60	70
704	1140	1	Hwc	90	27.4	Dr	10	26.5		0			0					30	40	50	60	70
705	1140	1	Hwc	90	27.4	Dr	10	26.5		0			0									
706	1140	1	Hwc	90	27.4	Dr	10	26.5		0			0		15	900	favour Cw	30	40	50	60	70
707	500	2	Hwc	90	27.4	Dr	10	26.5		0			0									
708	500	2	Hwc	90	27.4	Dr	10	26.5		0			0									
709	1140	1	Hwc	90	25	Dr	10	26.5		0			0					30	40	50	60	70
710	1140	1	Hwc	90	25	Dr	10	26.5		0			0									
711	1140	1	Hwc	90	25	Dr	10	26.5		0			0		15	900	favour Cw	30	40	50	60	70
712	500	2	Hwc	90	25	Dr	10	26.5		0			0									
713	500	2	Hwc	90	25	Dr	10	26.5		0			0									
714	850	1	Hwc	80	25.4	Ba	20	24.4		0			0					30	40	50	60	70
715	850	1	Hwc	80	25.4	Ba	20	24.4		0			0									
716	850	1	Hwc	80	25.4	Ba	20	24.4		0			0		15	900	favour Cw	30	40	50	60	70
717	850	1	Hwc	80	22.6	Ba	20	20.1		0			0					30	40	50	60	70
718	850	1	Hwc	80	22.6	Ba	20	20.1		0			0									
719	850	1	Hwc	80	22.6	Ba	20	20.1		0			0		15	900	favour Cw	30	40	50	60	70
720	1250	1	Hwc	50	25.4	Ba	50	25		0			0					30	40	50	60	70
721	1250	1	Hwc	50	25.4	Ba	50	25		0			0									
722	1250	1	Hwc	50	25.4	Ba	50	25		0			0					30	40	50	60	70
723	1250	1	Hwc	50	25.4	Ba	50	25		0			0		15	900	favour Cw	30	40	50	60	70
724	1250	1	Hwc	50	23	Ba	50	21.1		0			0					30	40	50	60	70
725	1250	1	Hwc	50	23	Ba	50	21.1		0			0									
726	1250	1	Hwc	50	23	Ba	50	21.1		0			0					30	40	50	60	70
727	1250	1	Hwc	50	23	Ba	50	21.1		0			0		15	900	favour Cw	30	40	50	60	70
728	2150	1	Hwc	65	21.4	Ba	35	18.5		0			0									
729	2150	1	Hwc	65	21.4	Ba	35	18.5		0			0					30	40	50	60	70
730	2150	1	Hwc	65	21.4	Ba	35	18.5		0			0									
731	2150	1	Hwc	65	21.4	Ba	35	18.5		0			0					30	40	50	60	70
732	2150	1	Hwc	65	21.4	Ba	35	18.5		0			0		15	900	favour Cw	30	40	50	60	70
733	1910	1	Hwc	75	27.4	Ba	20	27.5	Dr	5	26.5		0					30		50		70
734	1910	1	Hwc	75	27.4	Ba	20	27.5	Dr	5	26.5		0									
735	1910	1	Hwc	75	27.4	Ba	20	27.5	Dr	5	26.5		0									
736	1910	1	Hwc	75	27.4	Ba	20	27.5	Dr	5	26.5		0		15	900	favour Cw	30	40	50	60	70
737	500	2	Hwc	90	27.4	Dr	10	26.5		0			0									
738	500	2	Hwc	90	27.4	Dr	10	26.5		0			0									
739	1910	1	Hwc	75	25.3	Ba	20	24.6	Dr	5	26.5		0					30		50		70
740	1910	1	Hwc	75	25.3	Ba	20	24.6	Dr	5	26.5		0									
741	1910	1	Hwc	75	25.3	Ba	20	24.6	Dr	5	26.5		0									

AU#	Natural Stems	Regen Delay	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	JS Age	JS Density	JS Type	Fert Age1	Fert Age2	Fert Age3	Fert Age4	Fert Age5
742	1910	1	Hwc	75	25.3	Ba	20	24.6	Dr	5	26.5		0		15	900	favour Cw	30	40	50	60	70
743	500	2	Hwc	90	25.3	Dr	10	26.5		0			0									
744	500	2	Hwc	90	25.3	Dr	10	26.5		0			0									
745	1860	1	Hwc	65	25.6	Ba	32	24.4	Dr	3	26.5		0					30		50		70
746	1860	1	Hwc	65	25.6	Ba	32	24.4	Dr	3	26.5		0									
747	1860	1	Hwc	65	25.6	Ba	32	24.4	Dr	3	26.5		0									
748	1860	1	Hwc	65	25.6	Ba	32	24.4	Dr	3	26.5		0		15	900	favour Cw	30	40	50	60	70
749	1860	1	Hwc	65	23.6	Ba	32	21.9	Dr	3	26.5		0					30		50		70
750	1860	1	Hwc	65	23.6	Ba	32	21.9	Dr	3	26.5		0									
751	1860	1	Hwc	65	23.6	Ba	32	21.9	Dr	3	26.5		0									
752	1860	1	Hwc	65	23.6	Ba	32	21.9	Dr	3	26.5		0		15	900	favour Cw	30	40	50	60	70
790	150	0	At	100	29.2		0			0			0					30	40	50	60	70
791	150	0	At	100	25.4		0			0			0					30	40	50	60	70
792	100	0	At	100	26.6		0			0			0					30	40	50	60	70
793	100	0	At	100	26.6		0			0			0					30	40	50	60	70
794	100	0	Dr	100	26.5		0			0			0					30	40	50	60	70
795	100	0	Dr	100	26.5		0			0			0					30	40	50	60	70
796	100	0	Dr	100	26.5		0			0			0					30	40	50	60	70
797	100	0	Dr	100	26.5		0			0			0					30	40	50	60	70
798	60	0	Dr	100	26.5		0			0			0					30	40	50	60	70
799	60	0	Dr	100	26.5		0			0			0					30	40	50	60	70
800	90	0	Dr	100	26.5		0			0			0					30	40	50	60	70
801	90	0	Dr	100	26.5		0			0			0					30	40	50	60	70
802	0	0		0			0			0			0					30	40	50	60	70
803	0	0		0			0			0			0					30	40	50	60	70
804	0	0		0			0			0			0					30	40	50	60	70
805	0	0		0			0			0			0					30	40	50	60	70
806	2150	0	Hwc	65	21.4	Ba	35	18.5		0			0					30	40	50	60	70
807	725	0	Hwc	69	22.4	At	0	21.4	Cwc	31	15		0					30	40	50	60	70
854	100	0	Dr	100	26.5		0			0			0									
855	100	0	Dr	100	26.5		0			0			0									
856	100	0	Dr	100	26.5		0			0			0									
857	100	0	Dr	100	26.5		0			0			0									
858	60	0	Dr	100	26.5		0			0			0									
859	60	0	Dr	100	26.5		0			0			0									
860	90	0	Dr	100	26.5		0			0			0									
861	90	0	Dr	100	26.5		0			0			0									
870	1000	2	Dr	2	26.5	Hwc	84	27.5	Fdc	10	26.8	Ss	4	29.4								
871	1000	2	Dr	2	26.5	Hwc	84	27.5	Fdc	10	25.0	Ss	4	29.4								
872	1000	2	Dr	2	26.5	Hwc	84	27.4	Fdc	10	27.1	Ss	4	29.3								
873	1000	2	Dr	2	26.5	Hwc	84	25.3	Fdc	10	25.0	Ss	4	26.7								
874	350	2	Dr	29	26.5	Hwc	71	27.5		0			0									
875	350	2	Dr	29	26.5	Hwc	71	25.2		0			0									
876	350	2	Dr	29	26.5	Hwc	71	27.4		0			0									
877	350	2	Dr	29	26.5	Hwc	71	25.0		0			0									

AU#	Natural Stems	Regen Delay	Sp1	Pct1	SI1	Sp2	Pct2	SI2	Sp3	Pct3	SI3	Sp4	Pct4	SI4	JS Age	JS Density	JS Type	Fert Age1	Fert Age2	Fert Age3	Fert Age4	Fert Age5
878	350	2	Dr	29	25.4	Hwc	71	27.7		0			0									
879	350	2	Dr	29	25.4	Hwc	71	25.3		0			0									
880	350	2	Dr	29	26.6	Hwc	71	27.2		0			0									
881	350	2	Dr	29	26.6	Hwc	71	25.1		0			0									
882	350	2	Dr	29	26.5	Hwc	71	27.5		0			0									
883	350	2	Dr	29	26.5	Hwc	71	25.2		0			0									
884	350	2	Dr	29	26.5	Hwc	71	27.4		0			0									
885	350	2	Dr	29	26.5	Hwc	71	25.0		0			0									
886	1000	2	Dr	4	26.5	Hwc	86	27.5	Fdc	2	26.8	Ss	8	29.4								
887	1000	2	Dr	4	26.5	Hwc	86	25.3	Fdc	2	25.0	Ss	8	26.7								
888	1000	2	Dr	4	26.5	Hwc	86	27.4	Fdc	2	27.1	Ss	8	29.3								
889	1000	2	Dr	4	26.5	Hwc	86	25.3	Fdc	2	25.0	Ss	8	26.7								
890	500	2	At	20	26.6	Hwc	80	27.2		0			0									
891	500	2	At	20	26.6	Hwc	80	25.1		0			0									