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Sunshine Coast Community Forest Timber Supply Analysis – Analysis Report

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OQM | Organizational Quality Management Program

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Version Control and Revision History

Version	Date	Prepared By	Reviewed By	Notes/Revisions
4	Oct 16th , 2015	Krysta Giles-Hansen	Kelly Sherman	Interim Analysis
5	Jan 1st ,2016	Krysta Giles-Hansen	Kelly Sherman	Netdown Update
6	April 14th, 2017	Stacey Boks	Jay Greenfield	Draft Final Analysis
7	May 18th, 2017	Stacey Boks	Jay Greenfield	Final Draft

Executive Summary

The Sunshine Coast Community Forest (SCCF) has prepared this timber supply analysis to support a new determination of the Annual Allowable Cut (AAC). This Timber Supply Analysis Report was prepared in order to provide the Ministry of Forest, Lands, and Natural Resource Operations (MFLNRO) District Manager with information to assist in the determination of an AAC for SCCF. This document describes the results of the recently completed timber supply analysis for the Sunshine Coast Community Forest (SCCF).

In 2015, the Sunshine Coast Community Forest (SCCF) undertook an interim timber supply analysis to support their management planning. This interim analysis was intended to determine whether the existing AAC of 20,000 m^3/year was achievable. The findings from the interim analysis, demonstrated that the area was sufficient to sustain the existing AAC of 20,000 m^3/year, and this enabled the SCCF to proceed with enhancing their dataset including a new Vegetation Resource Inventory (VRI).

This document describes the timber supply analysis for SCCF and considers existing inventories, silviculture practices, current management, forest health and non-timber resources. This analysis considers the most recent timber supply review (TSR) assumptions in the Sunshine Coast Timber Supply Area (TSA) (MFLNRO, 2011), with updates to include community-specific information or assumptions.

The steps involved in this analysis include:

1. Collate all the necessary data layers required for the analysis;
2. Run an initial netdown to determine the timber harvestable land base and review with the SCCF to include localized knowledge;
3. Assemble SCCF specific analysis unit groupings and growth and yield information;
4. Create an analysis database that incorporates all necessary netdown, inventory and resource information;
5. Create FPS-Atlas analysis files;
6. Run analysis scenarios to select an appropriate harvest level and assess sensitivities; and
7. Provide a combined data package and analysis report documenting the analysis assumptions and results.

Through a land base classification process, area is systematically removed from the gross land base area to establish both the productive forest land base (PFLB) and timber harvesting land base (THLB). The productive forest land base (PFLB) is 10,537 ha and timber harvesting land base (THLB) for the analysis is calculated at 6,289 ha.

The base case timber supply analysis includes:

- A timber harvesting land base of 6,289 ha;
- A harvest volume of 48,000 m^3/yr;
- Non-recoverable losses (NRLs) of 378 m^3/year as described in Section 5.6; and
- Land base constraints include community watersheds, integrated resource management zones, and visual quality objectives.

The base case harvest forecast is shown in Figure i and shows the harvest level across the planning horizon for SCCF.

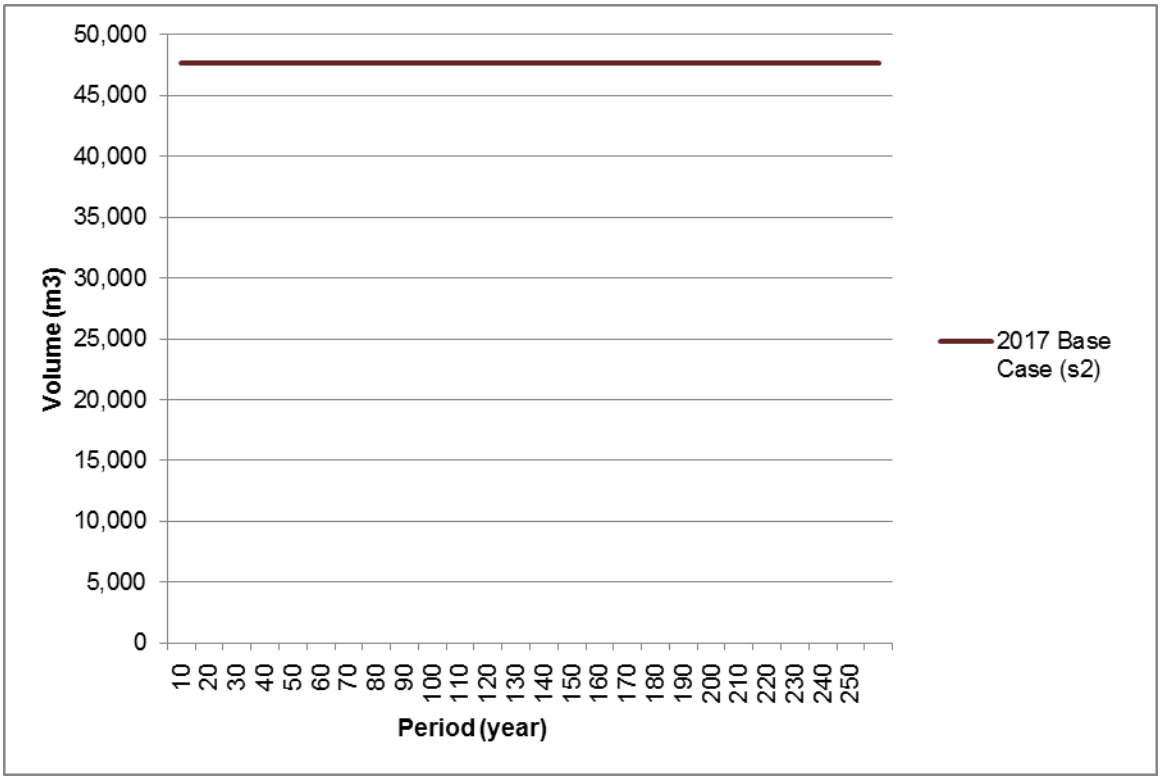

Figure i: Base Case – Harvest Forecast

Sensitivity analysis provides information on the degree to which uncertainty in the base case data and assumptions might affect the proposed harvest level for the land base. A summary of the average harvest level across the whole planning horizon for the base case and the sensitivity analysis results are shown in Table i. The sensitivities show that removing the Chapman watershed from the THLB results in a 10% reduction in the harvest volume and removing the Chapman and Gray watersheds from the THLB results in 32% reduction in the harvest volume. The individual sensitivities are discussed in Section 6.3.1 and Section 6.3.2.

Table i: Summary of Analysis Results

Scenario	Average Harvest Volume (m^3/yr)
Base Case (s2)	47,622
No Chapman Watershed (s3)	43,073
No Chapman and Gray Watersheds (s4)	32,421

Limitations of Report

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Acronyms and Abbreviations

AAC	Allowable Annual Cut
AU	Analysis Unit
BC	British Columbia
BCLCS	BC Land Classification System
BGC	Biogeoclimatic Zone
BEC	Biogeoclimatic Ecosystem Classification
CF	Community Forest
CFLB	Crown Forested Land Base
CWS	Community Watershed
DBH	Diameter At Breast Height
ESA	Environmentally Sensitive Area
FDU	Forest Development Unit
FPPR	Forest Planning and Practices Regulations
FPS	Forest Planning Studio
FRPA	Forest and Range Practices Act
FSP	Forest Stewardship Plan
GAR	Government Action Regulation
Ha	Hectares
IRM	Integrated Resource Management
LUP	Landscape Unit Plan
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
MHA	Minimum Harvest Age
MOE	Ministry of Environment
MOF	Ministry of Forests
NDT	Natural Disturbance Type
NRL	Non-Recoverable Losses
NROV	Natural Range of Variability
OAF	Operational Adjustment Factor
OGMA	Old Growth Management Area
PFLB	Productive Forest Land Base
REGEN	Regeneration
RESULTS	Reporting Silviculture Updates and Land status Tracking System
RMZ	Resource Management Zone
SCCF	Sunshine Coast Community Forest
THLB	Timber Harvestable Land Base
TIPSY	Table Interpolation Program for Stand Yields
TSA	Timber Supply Area
TSR	Timber Supply Review
VAC	Visual Absorption Capacity
VDYP	Variable Density Yield Prediction Model
VLI	Visual Landscape Inventory
VRI	Vegetation Resource Inventory
VQO	Visual Quality Objective
WHA	Wildlife Habitat Area
WTP	Wildlife Tree Patch

1. Introduction

The Sunshine Coast Community Forest (SCCF) has prepared this timber supply analysis to support a new determination of the Annual Allowable Cut (AAC). This Timber Supply Analysis Report was prepared in order to provide the Ministry of Forest, Lands, and Natural Resource Operations (MFLNRO) District Manager with information to assist in the determination of an AAC for SCCF. This document describes the results of the recently completed timber supply analysis along with a summary of the data and assumptions used in the analysis.

In 2015, the Sunshine Coast Community Forest (SCCF) undertook an interim timber supply analysis to support their management planning. This interim analysis was intended to determine whether the existing AAC of 20,000 m^3/year was achievable. The findings from the interim analysis, demonstrated that the area was sufficient to sustain the existing AAC of 20,000 m^3/year, and this enabled the SCCF to proceed with enhancing their dataset including a new Vegetation Resource Inventory (VRI).

This analysis considers the most recent timber supply review (TSR) assumptions in the Sunshine Coast Timber Supply Area (TSA) (MFLNRO, 2011), with updates to include SCCF- specific information or assumptions.

The updated analysis uses the 2016 VRI, updated information on logging, and other additional data sources, described in section 2.2.1.

This timber supply analysis report contains the data package and provides the results of the timber supply analysis. Section 6 of this report presents the results of the base case analysis and Section 6.3 summarizes the results of the sensitivity analysis that has been completed.

2. General Description of SCCF

The SCCF (K3F) lies in close vicinity to the community of Sechelt within the Sunshine Coast TSA as shown in Figure 2.1. The majority of the community forest is northeast of the community, however smaller parcels also lie to the east and northwest of Sechelt.

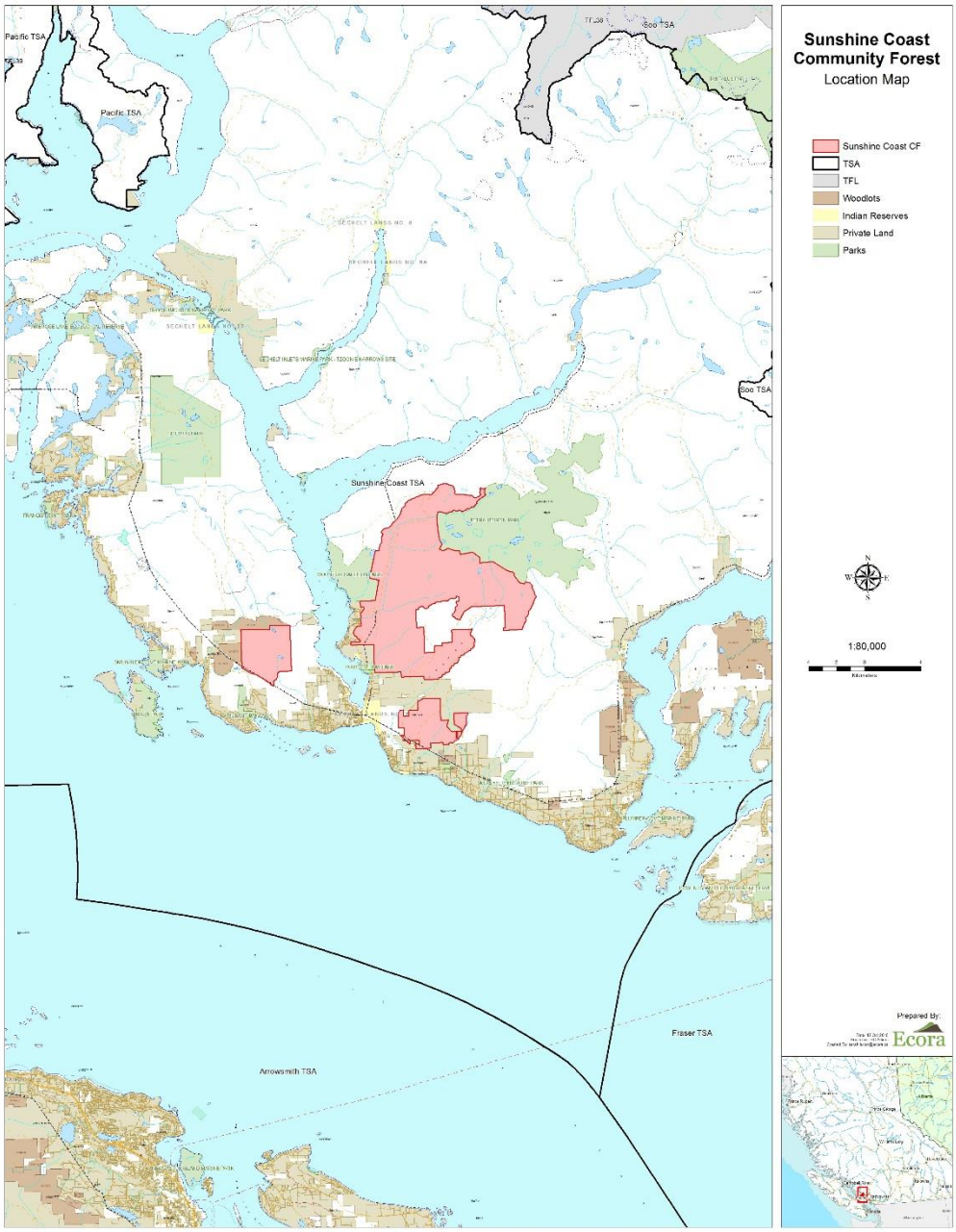

Figure 2.1: Location of SSCF

2.1 Inventory Information

Ecora completed a Vegetation Resources Inventory (VRI) for SCCF in 2016 using October 2015 imagery. The VRI project was carried out in accordance with the Provincial VRI standards and procedures in effect in 2015. Polygon delineation, field calibration planning, and polygon attribution were completed using DAT/EM Summit Evolution Lite v.7.1 softcopy software on an ESRI ArcMap 10.2 platform. LiDAR data was used to assist in both delineation and attribution. The VRI provides the SCCF with a more comprehensive, accurate and up-to-date understanding of the forest land base and natural resources with the community forest.

2.2 Data Sources

Table 2.1 provides a list of the relevant information about the input data for the interim timber supply analysis.

Table 2.1: Data Sources

Description	Input Data Layer	Source	Vintage
Community Forest (K3F) boundary	bccf	LRDW	2012
Ownership	FOREST_VEGETATION_F_OWN	LRDW	2015
Woodlots	FTEN_MANAGED_LICENCE_POLY_SVW	LRDW	2014
Archaeology Overview Assessment	RAAD_AOA_PROVINCIAL	LRDW	2012
Recreation Tenures	CM_REC_TEN	LRDW	2015
Recreation Areas	FTEN_RECREATION_POLY_SVW	LRDW	2015
Recreatoin Sites	FTEN_RECREATION_SITE_POINTS_SVW	LRDW	2015
Wildlife Habitat Areas	WHSE_WILDLIFE_MANAGEMENT_WCP_WILDLIFE_HABITAT_AREA_P	LRDW	2014
Ungulate Winter Range	WILDLIFE_MANAGEMENT_WCP_UNGULATE_WINTER_RANGE_S	LRDW	2014
Wildlife Habitat Features	WHSE_WILDLIFE_INVENTORY_SPI_RESULTS_BY_AREA_ALL_SP	LRDW	2014
Chapman Marbled Murrelet	ChapmanMAMU.shp	SCCF	2015
OGMA - Legal	OGMA_LEGAL_CURRENT_SVW	LRDW	2015
OGMA - Non-legal	OGMA_NON_LEGAL_CURRENT_SVW	LRDW	2015
Permanent Sample Plots	FOREST_VEGETATION_GRY_PSP_STATUS_ACTIVE	LRDW	2015
Landscape Units	LAND_USE_PLANNING_RMP_LANDSCAPE_UNIT_SVW	LRDW	2014
BEC v9	bec_v9	LRDW	2014
Community Watersheds	WATER_MANAGEMENT_WLS_COMMUNITY_WS_PUB_SVW	LRDW	2014
Visual Sensitivity Polygons	vqo	LRDW	2012
Wetlands	wetland	LRDW	2015
Lakes	BASEMAPPING_FWA_LAKES_POLY	LRDW	2014
Riparians Digitized	Riparian_digitized	Ecora	2015
Streams	FWA_STREAM_NETWORKS_SP	LRDW	2013
BC Fires	bc_fires	LRDW	2014
Digital Road Atlas	DRA_DGTL_ROAD_ATLAS_MPAR_SP	LRDW	2014
Roads, Trails and Landings	rd_buf10m	LRDW	2014
RESULTS - Cutblocks	FTEN_CB_PL	LRDW	2014
Forest Tenure Managed Licence	FTEN_MANAGED_LICENCE_POLY_SVW	LRDW	2014
RESULTS - Openings Polygons	RSLT_OPNGS_polygon	LRDW	2014
BCTS Management Areas	ADMIN_BOUNDARIES_FADM_BCTS_AREA_SP	LRDW	2014
VRI	VEG_COMP_LYR_R1_POLY	LRDW	2015
Environmentally Sensitive Areas	esa_coastal	LRDW	2013
Terrain Stability	terrain.shp	SCCF	2015
Site Index Tiles	si	MOF	2013

2.2.1 Additional Data Sources

Table 2.2 provides a list of the additional information about the input data incorporated into the final analysis. The changes from the previous analysis include additional harvest block, VRI and roads information.

Table 2.2: Additional Input Layers used in the analysis

Description	Input Data Layer	Source	Vintage
Community Forest Cut Blocks		SSCF	2017
Digital Road Atlas	DRA_DGTL_ROAD_ATLAS_MPAR_SP	LRDW	2017
Roads, Trails and Landings	rd_buf4m	Ecora	2017
FTEN – Cut blocks	FTEN_CB_PL	LRDW	2017
RESULTS - Openings Polygons	RSLT_OPNGS_polygon	LRDW	2017
Vegetation Resource Inventory	VRI_DELIN	Ecora	2016
Site Index Tiles	si	MOF	2017

2.3 Logging History

The logging history was defined from multiple Ministry sources and was based on the harvest end date :

- Forest tenure cutblocks disturbance completion date (DSTRBNCNDD)
- RESULTS openings and disturbance end date (DST_END_DT)
- Vegetation resource inventory (VRI) cutblocks (HARVEST_DATE)
- Any stand with a harvest history after 1900 was considered previously harvested. This logging history was also applied as an age update to the inventory in the analysis database if stand age >= 40 years old and the disturbance was recent (since the year 2000).

3. Land Base Description

The netdown process starts with the gross area of the land base and removes area in a step-wise fashion according to classification criteria detailed below. Through this process, area is systematically removed in order to establish both the productive forest land base (PFLB) and timber harvesting land base (THLB). The productive land base is the forested land that contributes towards meeting non-timber objectives. The land base classification process clarifies area into three broad categories:

- **Non-Productive:** areas that are non-crown, non-forested or non-productive and unable to grow viable timber;
- **Productive non-THLB:** productive land base that is unlikely to be harvested for reasons such as inoperability or special environmental protection; and
- **THLB:** productive land base that is expected to be available for harvest over the long-term.

Table 3.1 shows this step-wise classification of the land base. The THLB makes up 58% of the land base and the THLB was 6,289 ha.

Table 3.1: Final Netdown Classification

Land Classification	Area (ha)
Community Forest Gross Area	**10,790**
Non-forest	112
Land not managed by the Community Forest	13
Roads, trails, landings	129
Non-Productive Reductions	*253*
Productive Forest Land Base (PFLB)	**10,537**
Low sites and problem forest types	978
Established recreation reserves and sites	194
Wildlife Habitat Areas	214
Old growth management areas	393
Environmentally sensitive areas	247
Riparian reserve and management areas	757
Wildlife tree patches	344
Chapman Terrain Stability	677
Gray Creek Terrain Stability	444
Total Productive Reductions	*4,248*
Timber Harvesting Land Base (THLB)	**6,289**

For more details, refer to the description of each netdown step in sections 3.1.1 to 3.1.14. This analysis was benchmarked to the most recent Sunshine Coast timber supply area TSR (timber supply review) where possible based on the published Data Package and previous Analysis Reports. It also incorporated the SCCF Management Plans where applicable (i.e. Landscape Unit Plan objectives for wildlife tree patches).

3.1 Netdown Item Descriptions

An interim analysis was completed in 2015, and the changes from that initial data package are described in section 3.2. The netdown was updated based on the VRI, updates on the logging history, a refinement of the

riparian areas, and a refinement of the road buffers. The sections 3.1.1 to 3.1.14 below describe the final netdown used in the analysis.

3.1.1 Gross Area

The SCCF boundary was identified using a provided community forest boundary layer. This area was confirmed with the Ministry community forest boundary layer (BCCF).

3.1.2 Non-Forest

Ecora completed a Vegetation Resources Inventory (VRI) product for the SCCF, in 2016, using October 2015 Imagery. The new VRI results were incorporated into the data used to build the netdown and analysis. These areas were identified using one of the following criteria from the VRI where there was no logging history:

- BCLCS 1 is non-vegetated ('N')
- BCLCS 1 is vegetated ('V') and BCLCS 2 is non-treed ('N')

3.1.3 Non-Crown

Non-crown land includes any private land, federal land, woodlots or other tenures overlapping the SCCF boundary, including parks and protected areas. These lands were identified using the Ministry's ownership layer (FOREST_VEGETATION_F_OWN) using the following codes to remove areas from the THLB (Table 3.2).

Table 3.2: Non-Crown Ownership Descriptions

Ownership Codes	
40	Private Land
50	Federal Reserve
52	First Nations Reserve
53	Military Reserve
54	Government Block
60	Crown Ecological Reserve
61	Crown UREP Reserves
63, 67	Crown Provincial Parks
69	Crown Miscellaneous Reserves
70	Crown Active Timber License
72	Crown and Private Schedule A and B Lands
74	Crown and Private Timber
75	Crown Christmas Tree Permit
77	Crown and Private Woodlot License
99	Crown Miscellaneous Lease

A small area in the southern parcel of the community forest that was previously included in the community forest that was removed from the gross area.

3.1.4 Roads, Trails, Landings

Existing roads are identified from the Ministry's digital road atlas (DRA) database (DRA_DIGITAL_ROAD_ATLAS_LINE_SP) and a provided road layer. After the completion of the first Iteration of the analysis, management assumptions were examined and refined which resulted in an updated netdown. The road buffers are 8m (4m of each side).

3.1.5 Inoperable

Inoperable areas include steep slopes, broken topography, difficult road access, soil instability, high elevation, timber quality, and a combination of these. In the TSA (timber supply area), these areas were identified using an operability inventory, however this inventory was not available for the SCCF and therefore this netdown item was not included in the land base classification.

3.1.6 Low Growing Potential and Problem Forest Types

Sites may have low growing potential due to inherent site factors such as nutrient and moisture availability, and therefore are unlikely to grow merchantable trees. Problem forest types are physically operable stands but are not currently utilized or have marginal merchantability. In the TSA, problem forest types have been identified for each analysis unit, as shown in Table 3.3. These areas are excluded from the THLB unless the stand has a logging history.

Table 3.3: Problem Forest Type Criteria

Leading Species	Age	Volume (m^3/ha)	Site Index (m)
Douglas-fir	> 150	< 300	-
	< 150	-	< 15.5
Cedar	> 150	< 300	-
	< 150	-	< 13.5
Hemlock, Balsam, Spruce	> 150	< 300	-
	< 150	-	< 12
Pine	> 150	Any	-
	< 150	-	Any
Red Alder	> 150	< 250	-
	< 150	-	< 12
Cottonwood, Maple	> 150	< 300	-
	< 150	-	< 12

3.1.7 Cultural Heritage

There were no identified archeological sites within the SCCF boundary and therefore this item was not included in the land base classification.

3.1.8 Unstable Terrain

A terrain stability layer was provided by SCCF that identified areas with terrain stability hazard based on sediment delivery potential to watershed intakes. Areas to be removed were identified individually for the Chapman and

Gray watersheds. In the Chapman watershed, area was removed where risk class was 1 (highest risk), 2 (moderately high) and 3 (moderate), whereas in the Gray watershed area was removed where risk class was 1 or 2.

3.1.9 Recreation Reserves and Sites

There are 14 identified recreation tenures within the TSA which have been established under the Government Action Regulation (GAR) order. Of these recreation sites, two are within the SCCF boundary: REC6516 Dakota Ridge and REC6206 Sechelt Heritage Forest. These were identified using the Ministry's forest tenure recreation polygon layer (FTEN_RECREATION_POLY_SVW) using Forest File ID. These areas were completely removed from the THLB.

3.1.10 Wildlife Habitat Areas

Wildlife habitat areas (WHA) were identified using the Ministry of Environment's (MOE) approved WHA layer (WCP_WILDLIFE_HABITAT_AREA_POLY). No approved WHAs were located within the SCCF boundary.

The SCCF provided additional WHA layers for Marbled Murrelet in the Chapman landscape unit (CHAPMAN_MAMU). No harvest areas were identified where the MAMU_RANK was 1, 2 or 3. These areas were excluded from the THLB.

3.1.11 Old Growth Management Areas

Permanent OGMAs were identified from the Ministry's legal OGMA layer (OGMA_LEG_C) and completely removed from the THLB.

3.1.12 Environmentally Sensitive Areas

Environmentally sensitive areas (ESA) are areas that are susceptible to disturbance. ESA mapping was available for the SCCF, however the classifications are dated. Where newer information was not available, areas with an ESA value of 'P' for difficult regeneration or 'S', 'SA', and 'SP' for sensitive soils were completely removed from the THLB.

3.1.13 Riparian Reserve Zones

Detailed riparian inventories were not available for the TSA. The TSR analysis proceeded without a spatial layer and removed 3% from the productive forest as stream riparian reserves. Where lakes and wetlands had defined feature classes (i.e. 'L1', 'W1'), buffers were applied according to the Riparian Management Guidebook.

In this analysis, all riparian features were identified spatially using the Ministry's streams, lakes and wetlands layers (FWA_STREAMS_NETWORKS_SP, FWA_LAKES_POLY, FWA_WETLANDS_POLY) and buffered by 20 m (10 m on each side of a stream, 20 m around lakes and wetlands). This was to account for riparian reserve zones and riparian management zones for all riparian features. These areas were completely removed from the THLB.

Additional riparian areas were identified and digitized based on local knowledge. These additional riparian areas were buffered by 20 m (10 m on each side of a stream, 20 m around lakes and wetlands) and removed from the THLB.

3.1.14 Wildlife Tree Patches

Wildlife tree patches (WTP) are modelled by reducing the land base available for harvesting to account for trees that must be left standing in these areas. Where Landscape Unit Plans exist, WTP reductions have been specified by BEC zone. For all other areas the Forest Range and Practices Act specifies a default of 7% reduction to the THLB.

In the SCCF, Landscape Unit Plans exist for the Chapman and Sechelt landscape units, as shown in Table 3.4. In the TSR, an area weighted average wildlife tree reduction percentage was first determined for each BEC zone, then was reduced by 75% following the assumption that some WTP requirements will already be achieved by riparian reserves, non-merchantable stands, inoperable areas, steep slopes, and unstable soils.

Since the LUP objectives were greater than those listed in the TSR, the WTP applied in this analysis was the difference between the LUP objective (column 3) and the TSR area weighted average (column 4) plus the TSR residual amount (column 5).

Table 3.4: Wildlife Tree Patch Retention

Landscape Unit	BEC Subzone	LUP Objective (%)	2011 TSR (%)	2011 TSR Residual (%)	% Reduction
Sechelt	CDF mm	4	6.67	1.67	0
	CWH dm	10	7.9	1.98	4.08
	CWH vm	11	7.24	1.81	5.57
	CWH xm	10	7.79	1.95	4.16
	MH mm	7	6.62	1.66	2.04
Chapman	CWH xm	7	7.79	1.95	1.16
	CWH dm	10	7.9	1.98	4.08
	CWH vm	12	7.24	1.81	6.57
	MH mm	6	6.62	1.66	1.04

3.1.15 Other Factors

The following factors were considered in the netdown but do not require specific netdown assumptions.

Growth and Yield Plots

There are a number of growth and yield plots installed within the Community Forest. Plots that are no longer active may be harvested. Any active plots will have a small buffer placed around them and will form part of normal block retention. Therefore, no timber harvesting land base reductions are required.

Robert's Creek Study Forest

The Robert's Creek Study Forest partially overlap with the Community Forest. This study forest is managed by the Ministry of Forests, Lands and Natural Resource Operations in cooperation with the Community Forest. Active harvesting occurs within the study forest and therefore, no timber harvesting land base reduction is required.

3.2 Changes to the 2015 Netdown

There have been a number of key changes from the interim analysis in 2015. These changes were built through an iterative process whereby various management assumptions were examined and refined and additional data

was retrieved. The sections 3.2.1 to 3.2.5 below describe the netdown items that were used in the interim analysis that differ from the final netdown classification as shown above.

3.2.1 Non-Productive and Non-Forest

In the interim analysis, in 2015, areas were identified using one of the following criteria from the TSA VRI where there was no logging history:

- Non-productive descriptor code (NON_PRODUCTIVE_DESCRIPTOR_CD) where it is not blank
- BCLCS 1 is non-vegetated ('N')
- BCLCS 1 is vegetated ('V') and BCLCS 2 is non-treed ('N')

This differs from the final netdown because Ecora completed a Vegetation Resources Inventory (VRI) product for the SCCF in 2016, using October 2015 imagery. Non-forest was described using BCLCS level 1 and BCLCS level 2. Non-productive descriptor code is no longer identified in the VRI process because BCLCS is used.

3.2.2 Non-Crown

Non-crown land was identified using the MFLNRO ownership layer using the following codes to remove area from the THLB as shown by Table 3.5

Table 3.5: Non-Crown-Ownership Descriptions

Ownership Codes	
40	Private Land
50	Federal Reserve
52	First Nations Reserve
53	Military Reserve
54	Government Block
60	Crown Ecological Reserve
61	Crown UREP Reserves
63, 67	Crown Provincial Parks
69	Crown Miscellaneous Reserves
70	Crown Active Timber License
72	Crown and Private Schedule A and B Lands
74	Crown and Private Timber
75	Crown Christmas Tree Permit
77	Crown and Private Woodlot License
99	Crown Miscellaneous Lease

This differs from the final netdown because in the final netdown an additional area in the southern parcel of the community forest that was previously included was removed from the gross area.

3.2.3 Roads, Trails and Landings

In the interim 2015 analysis, existing roads are identified from the Ministry's digital road atlas (DRA) database (DRA_DIGITAL_ROAD_ATLAS_LINE_SP) and a provided road layer. These lines were buffered by 10m total (5m on each side) and removed from the THLB.

This differs from the final in that the road, trails and landing were re-examined and the buffer size was reduced to 8m.

3.2.4 Riparian Reserve Zone

In the interim analysis, all riparian features were identified spatially using the Ministry's streams, lakes and wetlands layers (FWA_STREAMS_NETWORKS_SP, FWA_LAKES_POLY, FWA_WETLANDS_POLY) and buffered by 20 m (10 m on each side of a stream, 20 m around lakes and wetlands). This was to account for riparian reserve zones and riparian management zones for all riparian features. These areas were completely removed from the THLB.

This differs from the final analysis because it did not include additional riparian areas that were identified and digitized based on local knowledge.

3.2.5 Harvest History

In the interim analysis harvest history was based on harvest start date; however, in the final analysis harvest end date was use

3.3 Forest Characteristics

This section summarizes important forest characteristics of the community forest. The following land base characteristics are summarized:

1. Biogeoclimatic zone (BGC),
2. Leading species,
3. Site index, and
4. Age distribution.

3.3.1 Biogeoclimatic Zone

Figure 3.1 shows the THLB and non-THLB productive area in each BEC zone in the community. The most common BEC zones with 46% and 30% of the THLB are CWHdm and CWHvm2 respectively.

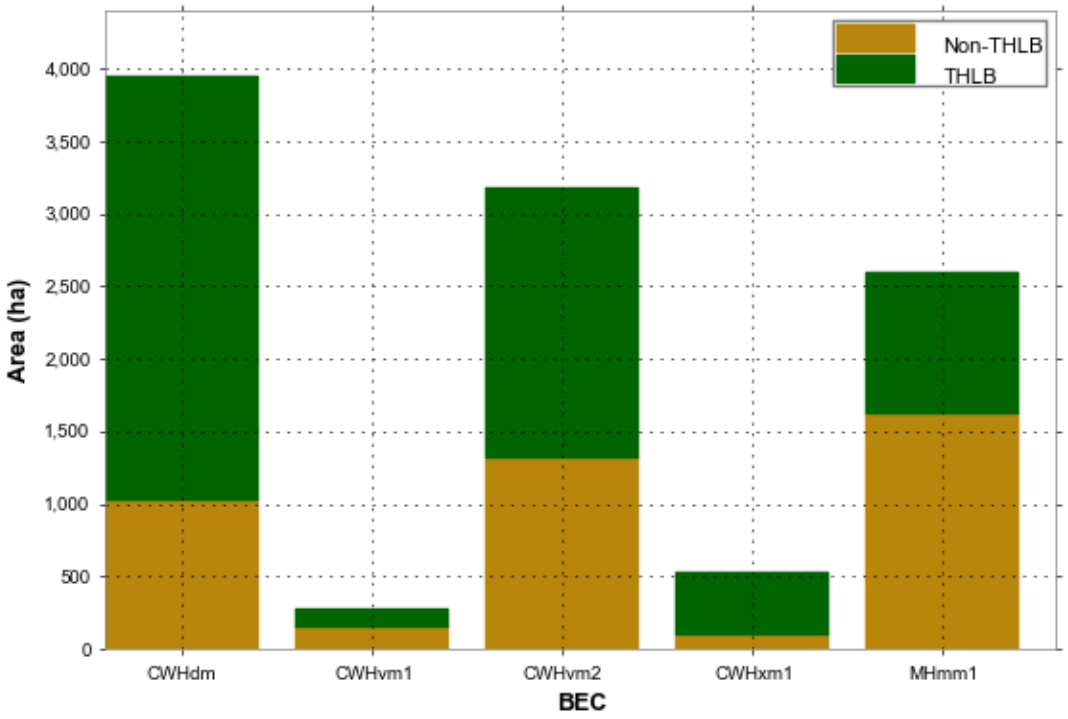

Figure 3.1: BGC Summary

3.3.2 Leading Species

Figure 3.2 shows the area by leading species in the community forest. The THLB is approximately 42% hemlock leading (HW and HM), 35% Douglas-fir leading (FD),19% balsam leading (B), 3% cedar leading (CW) and 1% maple leading (DR). The 'none' category with no leading species contains areas with recent harvest history.

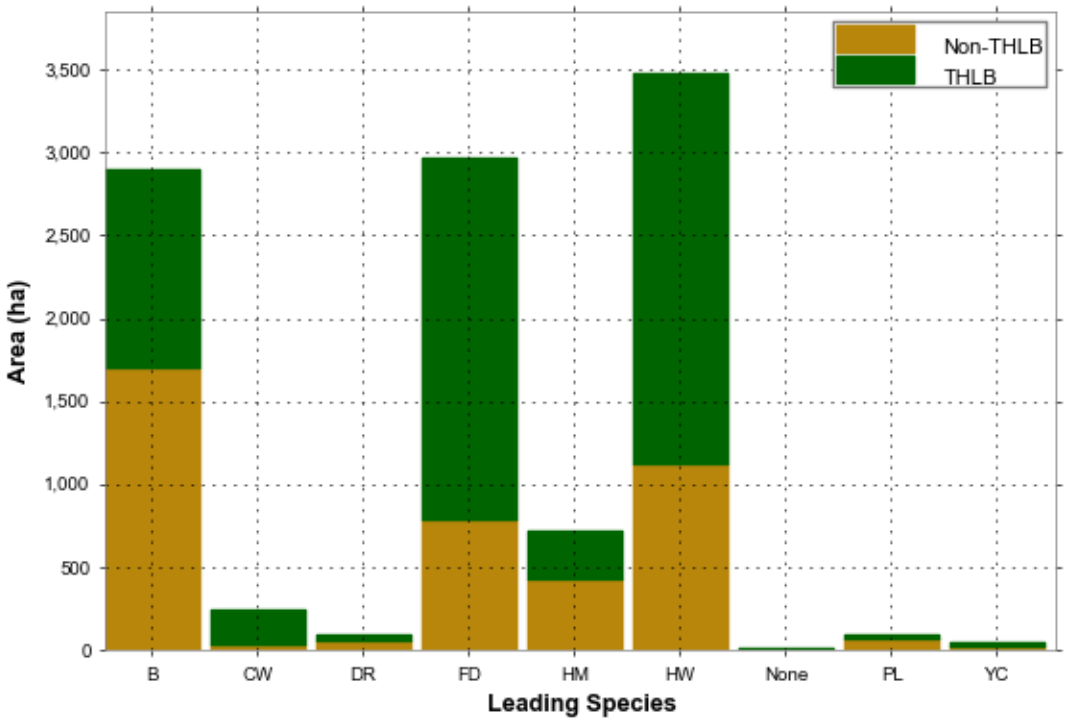

Figure 3.2: Leading Species Summary

3.3.3 Site Index

Figure 3.3 shows the area by site index class (inventory site index rounded to the nearest 3m) in the community forest.

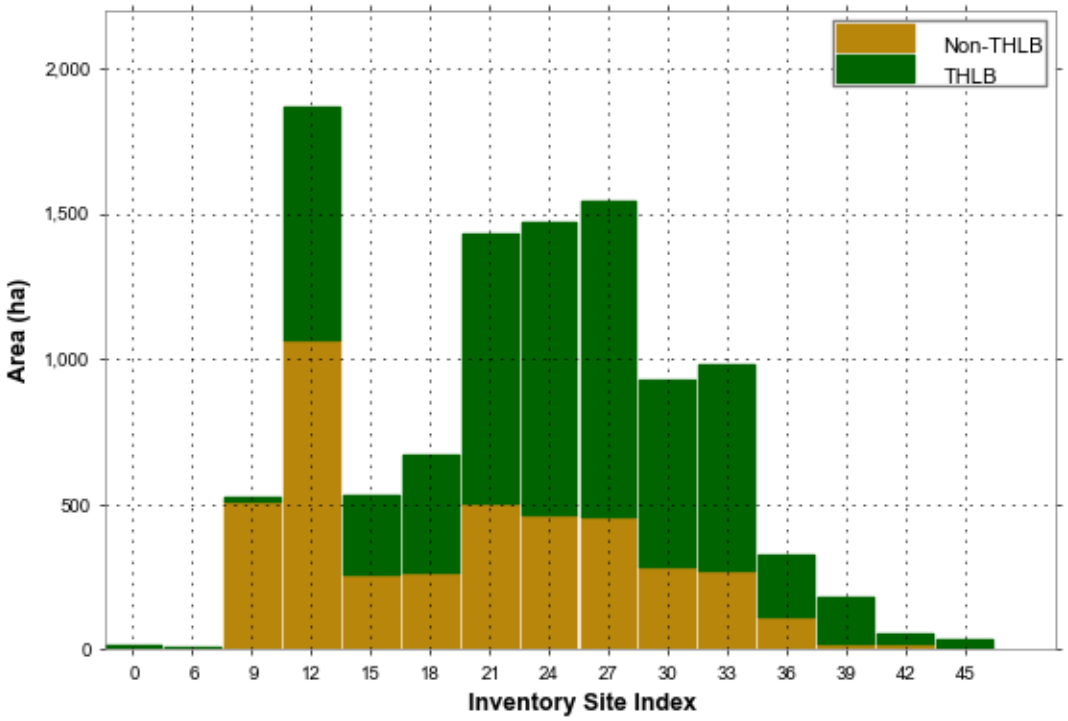

Figure 3.3: Site Index Summary

3.3.4 Age Distribution

Figure 3.4 shows the area by age class in the community forest. The majority of the THLB (81%) is less than 100 years (age class 5) and 19% of the land base is greater than 100 years old.

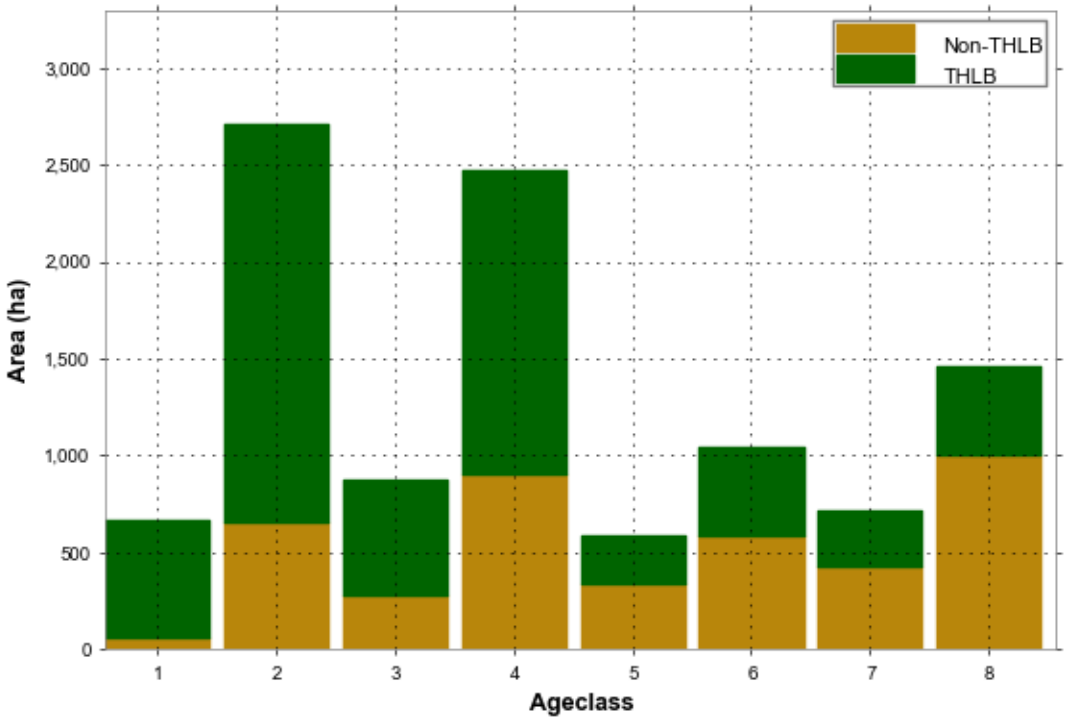

Figure 3.4: Age Class Distribution

4. Resource Management Zones

Resource management zones (RMZs) are grouped areas that support non-timber resource requirements. Each RMZ has forest cover objectives (either retention or disturbance requirements) which are applied to sub-sets of the land base. They are often overlapping and therefore not additive in area. For detailed modelling information on the RMZs, see section 4.1 to 4.3. The following RMZs occur in the community forest:

- Community watersheds
- Integrated resource management areas
- Visually sensitive areas

Direction on resource management zones (RMZ) comes from a variety of sources including:

- Under the Forest and Range Practices Act, objectives that are grand-parented from the Forest Practices Code – such as community watershed objectives;
- The Ministry of Forest and Range's 1998 Procedures for Factoring Visual Resources into Timber Supply Analyses;
- The 2006 Sechelt Community Forest Stewardship Plan;
- The 2002 Sunshine Coast Landscape Unit Planning Chapman Landscape Unit Plan; and
- The 2004 Sustainable Resource Management Plan Biodiversity Chapter for the Sechelt Landscape Unit.

The sources of information and modelling assumptions for each RMZ are documented in the sections below. RMZs that exist in the Sunshine Coast TSA but not within SCCF include the community interface zone and landscape level biodiversity requirements through the application of seral constraints where there is no legally approved old growth management areas. SCCF has legally established OGMAs that were removed during the netdown classification and therefore require no further modelling considerations.

4.1 Integrated Resource Management

The maximum opening size for a harvested area is 40 ha. To meet the patch size distribution objective, the THLB area is grouped into integrated resource management (IRM) zones by landscape unit outside of community watersheds, and visually sensitive areas. A maximum of 35% may be less than 3 m height in each IRM zone. Harvesting of adjacent blocks will not be allowed until openings have reached a 3 m green-up height.

4.2 Visually Sensitive Areas

The visual landscape inventory (VLI) delineates areas of visual sensitivity near communities or adjacent to travel corridors. Restrictions on the acceptable limits of visual change are applied by visual polygon and modelled by a combination of visual quality objective (VQO) and visual absorption capability (VAC). VQOs include retention, partial retention, and modification, and VACs include low, medium, and high.

Visual resource management will be modelled according to the Procedures for Factoring Visual Resources into Timber Supply Analyses (MOFR 1998). The VAC % denudation range was used to apply the maximum disturbance requirement in the timber supply analysis based on the upper % denudation. Visual requirements are

consistent with the established VQO and applied by visual polygon by the maximum percent denudation for a medium VAC, as shown in Table 4.1. Visual requirements are applied by visual polygon.

Table 4.1: Maximum Allowable Disturbance Percent (%) by VQO

Visual Quality Objective	Maximum Allowable Disturbance Percent (%)			Green-up Height	Applicable Area
	VAC Low	VAC Medium	VAC High		
Preservation (P)			1	3.5 m	Productive forested land base for each visual unit
Retention (R)			3	3.5 m	
Partial Retention (PR)	15	10	6	3.5 m	
Modification (M)			20	3.5 m	

4.3 Community Watersheds

There are 3 community watersheds within the SCCF boundary: Chapman Creek, Gray Creek, and Milne Creek. Forest cover constraints are modelled based on recommendations in the Community Watershed Guidebook where no more than 5% of an area can be less than 5 m in height. This is equivalent to 1% harvest per year.

A sensitivity analysis was conducted to test the impact on timber supply if the Chapman Creek and Gray Creek community watersheds was removed from the THLB.

5. Growth and Yield

A stand's growth in terms of height and volume is predicted over time and the assumptions, inputs and outputs used in this analysis are documented in this section. Stands are either classified as natural or managed, with the age break being determined from the harvest history on the land base. In this case, those stands harvested since 1975 or are less than 40 years are classified as managed, and stands that are older than 40 years are classified as natural.

5.1 Analysis Unit Aggregation

Analysis units (AU) are aggregation of stands with similar species composition and growing potential, and are important in an analysis to reduce complexity without obscuring information. This analysis assumes that stands with an age < 40 years are managed and stands >= 40 years are natural.

Stands are grouped into AUs (Table 5.1) based on criteria from the most recent TSR data package (MFLNRO, 2011), specifically leading species and productivity. AU groupings are assigned to stands that are currently managed and also to natural stands for modelling their growth after harvesting.

Table 5.1: Analysis Unit Definition

Natural AU	Description	Leading Species	SI Range	Managed AU
1	Fir - good	F (Fd, Fdc, Fdi)	> 27	101
2	Fir - medium	F (Fd, Fdc, Fdi)	19 to 27	102
3	Fir - poor	F (Fd, Fdc, Fdi)	< 19	103
4	Cedar - good, medium	C, Y (Cw, Yc)	>= 17	104
5	Cedar - poor	C, Y (Cw, Yc)	< 17	105
6	H/B/S - good	H, B, S (Hm, Hw, Ba, Bg, Bl, Se, Ss)	> 23	106
7	H/B/S - medium	H, B, S (Hm, Hw, Ba, Bg, Bl, Se, Ss)	15 to 23	107
8	H/B/S - poor	H, B, S (Hm, Hw, Ba, Bg, Bl, Se, Ss)	< 15	108
9	Pine - all	P, L, A (except Act), E, M (except Mb), W, U	All	109
10	Alder - all	D (Dr)	All	110
11	Cottonwood/ Maple - all	Act, Mb	All	111

5.2 Yields

Yield projections for natural stands are produced using the MFLNRO's Variable Density Yield Prediction model version 7 (VDYP7). Productivity estimates for natural stands are sourced directly from the VRI via VDYP using age, height and species. A yield curve is generated for each stand and then these yield curves are area-weighted to produce one yield curve for each AU.

Table Interpolation Program for Stand Yields Version 4.3 (TIPSY4.3) is used to model the growth and yield for managed stand AUs. Productivity estimates for managed stand yields are sourced from the MFLNRO's provincial site productivity layer version 2.

Management practices such as species and planting densities are assigned using a combination of past practice and a review of current practice. Class A seeds are used for cedar and Douglas-fir stands and the genetic gains are incorporated into the managed stand yields. Table 5.2 shows the interim managed stand assumptions by AU.

Table 5.2: Analysis Managed Stand Input Assumptions

AU	Description	SI	Sp1	Sp1 %	Sp1 GG	Sp2	Sp2 %	Sp3	Sp3 %	Planted/ Natural	Prop	Density	Regen Delay
101	Fir - good	35.0	Fd	90	11.1	Cw	10			P	100	1,200	0.5
102	Fir - medium	25.3	Fd	80	11.1	Cw	20			P	100	1,200	0.5
103	Fir - poor	15.7	Fd	80	11.1	Cw	20			P	100	1,200	0.5
104	Cedar - good, medium	22.1	Cw	60	4.5	Fd	40			P	100	1,200	0.5
105	Cedar - poor	14.4	Cw	50	4.5	Fd	50			P	60	1,200	0.5
106	H/B/S - good	27.4	Ba	50	1.0	Yc	50			P	50	1,200	0.5
107	H/B/S - medium	19.9	Ba	50	1.0	Yc	50			P	50	1,200	0.5
108	H/B/S - poor	11.8	Ba	50	1.0	Yc	50			P	50	1,200	0.5
109	Pine - all	19.0	Pl	100						N	100	1,200	0.5
110	Alder - all	24.0	Dr	90		Fd	5	Cw	5	P	100	1,600	0.5
111	Cottonwood/ Maple - all	25.9	Dr	50		Fd	25	Cw	25	P	100	1,200	0.5

5.3 Changes to the Managed Stand Input Assumptions

In the interim analysis a regeneration (regen) delay of a year and half was used. In the final analysis, the regeneration delay was refined to half a year.

5.4 Operational Adjustment Factors

Operational adjustment factors (OAFs) were applied to all managed stands in TIPSY and are shown in Table 5.3 for both the interim analysis scenario (TSR scenario), the base case (s2), and sensitivities.

Table 5.3: Operational Adjustment Factors

AU	OAF1	OAF2
101	15	12
102	15	12
103	15	5
104	15	5
105	15	5
106	15	5
107	15	5
108	15	5
109	15	5
110	15	5
111	15	5

5.5 Utilization Level

Utilization levels define the minimum diameter at breast height (DBH) for a stand to be selected for harvesting. In TSR, utilization levels are based on leading species:

- Pine: minimum DBH of 12.5 cm
- All other species: minimum DBH of 17.5 cm

5.6 Non-Recoverable Losses

The calculation of non-recoverable losses (NRLs) used the TSR TSA-level estimates and pro-rated them for land base area. The SCCF is approximately 3% of the TSA THLB. The NRL estimate used is shown below in Table 5.4.

Table 5.4: Non-Recoverable Losses Estimate

Land Base	THLB Area	% of TSA	Volume (m^3/year)							
			Wind	Fire	Forest Health Agent			Mammal/ Abiotic Damage	Other Abiotic Damage	Total
					Beetles	Sawfly, Looper	Balsam Wooly Adelgid			
Sunshine Coast TSA	222,894	100%	6,900	500	250	1,000	200	300	3,500	12,650
Sunshine Coast CF	6,655[1]	3%	206	15	7	30	6	9	105	378

[1] NRL was calculated using the interim netdown total

5.7 Minimum Harvest Age

Minimum harvest age (MHA) is an estimation of the lowest age at which a stand can be harvested economically. MHA is determined for each stand using the criteria of minimum volume per hectare by analysis unit as shown in Table 5.5.

Table 5.5: Minimum Harvest Age by Analysis Unit

Analysis Unit		Minimum Volume per Hectare (m^3/ha)
1	Fir – good	300
2	Fir – medium	
3	Fire - poor	
4	Cedar – good, medium	
5	Cedar – poor	
6	Hemlock, Balsam, Spruce – good	
7	Hemlock, Balsam, Spruce – medium	
8	Hemlock, Balsam, Spruce – poor	
9	Pine – good, medium, poor	250
10	Red Alder – good, medium, poor	
11	Cottonwood, Maple – good, medium, poor	300

5.8 Forest Estate Model

The timber supply model *Forest Planning Studio* (FPS) is used in this analysis. FPS is the most recent version of the timber supply model previously known as ATLAS (A Tactical Landscape Analysis Software). FPS was developed at the University of British Columbia by a team headed by Dr. John Nelson. FPS is a commonly used and accepted forest simulation model in BC. It is a spatially explicit harvest simulation model that is designed to schedule timber harvesting while considering a wide variety of spatial and temporal objectives.

5.8.1 Planning Horizon

A 250 year planning horizon is used in this analysis to ensure the long-term sustainability of the harvest level and allow the analysis to reach a stable and non-declining growing stock.

5.8.2 Harvest Systems

A harvest system characterizes the type of harvesting expected to occur on a stand. In the SCCF, the predominant harvesting system utilized is clear-cut. Some areas are candidates for alternative systems such as partial cutting, however these systems are not used widely enough in the TSA to warrant additional modelling.

5.8.3 Harvest Priority

The order of harvest will be determined by using the default oldest first harvest priority rule.

5.9 Disturbing the Non-THLB

In the timber supply model, the productive area that is not part of the THLB (non-THLB) will continuously age throughout the planning horizon because harvesting is traditionally the only form of disturbance modelled. This causes concern because eventually, in the model, all the non-THLB becomes old whereas in reality, there will be some level of natural disturbance within the non-THLB. This is addressed by modelling disturbances in the non-THLB.

This section describes the process of disturbing the non-THLB used for this analysis. The intentions are to achieve the early, mature and old seral percentages for each BGC zone in accordance with the natural range of variation (NROV) defined in the Biodiversity Guidebook (MOF, 1995). The method used for this analysis is for each BGC zone to:

1. Impose an annual disturbance to the non-THLB of each BGC zone. The size of the disturbance will be determined from the disturbance frequency in the Biodiversity Guidebook.
2. A retention requirement on the non-THLB of each BGC variant is applied, which will force the non-THLB to achieve a seral zone distribution similar to the NROV from the Biodiversity Guidebook.

The area in each BGC zone is summarized and the natural disturbance type (NDT) and disturbance return interval are found from the Biodiversity Guidebook (MOF 1995). This information allows the annual disturbance to be calculated by BGC. The annual disturbance is 1%of the disturbance interval, and the annual disturbance area is this percentage times the non-THLB area (as shown in Table 5.6).

Table 5.6: Non-THLB Annual Disturbance

BGC Label	NDT	Disturbance Interval	% Disturbed Annually	Total Non-THLB Area (ha)	Annual Disturbance (ha)
CWHvm1	1	250	0.40%	231	1
CWHvm2	1	250	0.40%	1,175	5
MHmm1	1	350	0.29%	1,355	4
CWHdm	2	200	0.50%	622	3

The seral stage distribution is estimated using the negative exponential equation from Appendix 4 of the Biodiversity Guidebook (MOF 1995). The negative exponential equation uses the disturbance return interval and gives the percent older than the input age from the equation:

Percent older then specified age = exp (-[age/return interval])

Table 5.7 shows the retention requirements placed on each BGC zone in order to achieve the desired NROV.

Table 5.7: Retention Requirements for the Non-THLB

BGC Label	NDT	Mature Requirements		Old Requirements	
		Minimum Age (years)	Minimum %	Minimum Age (years)	Minimum %
CWHvm1	1	80	73	250	37
MHmm1	1	120	71	250	49
CWHvm2	1	80	73	250	37
CWHdm	2	80	67	250	29

6. Timber Supply Analysis

The timber supply analysis results for the interim timber supply analysis completed in 2015 are described below in section 6.1. The base case analysis results are discussed in section 6.2.

6.1 Interim Timber Supply Analysis

The changes to the netdown were built through an iterative process whereby various management assumptions were examined and refined. An interim analysis scenario (TSR 2015 scenario) was run based on the most recent timber supply analysis for the Sunshine Coast Timber Supply Area (TSA) (MFLNRO, 2011) and was completed in 2015. This section presents the results of this initial timber supply scenario. Harvest levels were found to the nearest 500 m^3/year and are shown net of NRLs. A harvest level of 50,000 m^3/year was achieved. This interim analysis scenario was then used to test and refine SCCF management assumptions discussed in section 3.2 including incorporation of the 2015 VRI, refinement of the roads, riparian, and block information. The harvest level is shown in Figure 6.1.

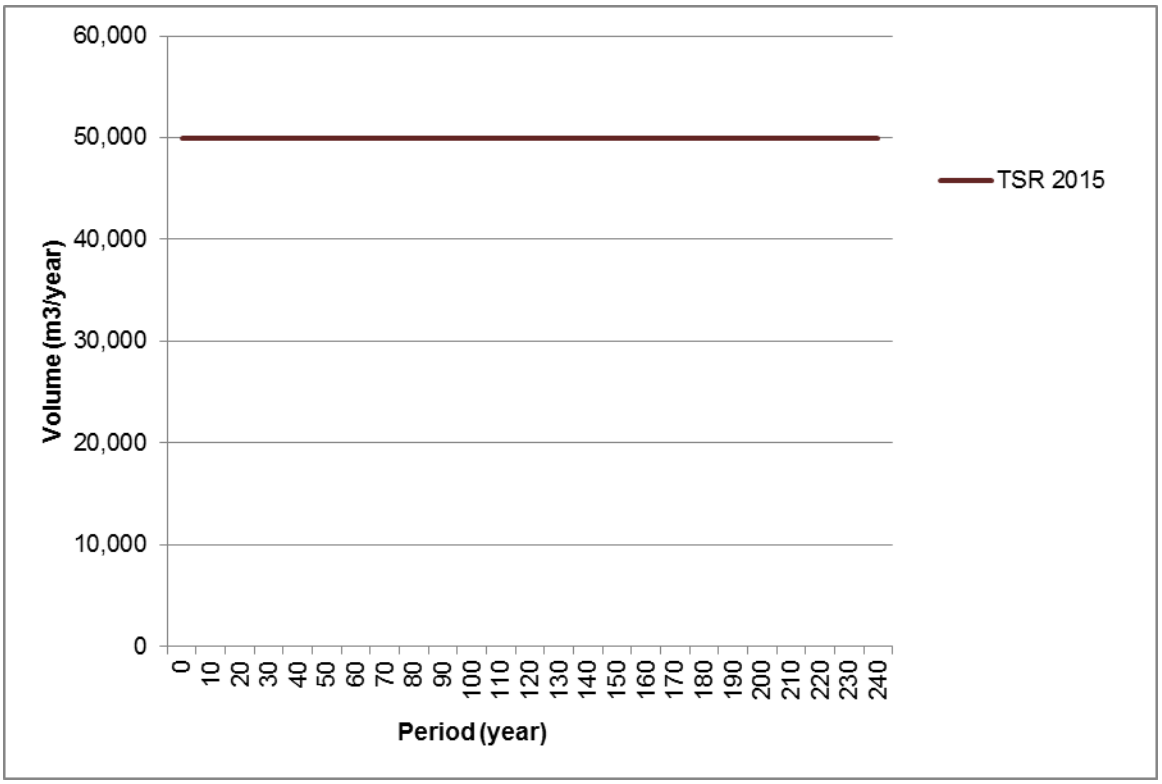

Figure 6.1: 2015 Interim Analysis Results

Using a TSR like THLB an analysis scenario was run and this includes:

- A THLB of 6,655 ha THLB.
- Non-recoverable losses (NRLs) of 378 m^3/year as described in Section 5.6
- RMZs including community watersheds, integrated resource management zones, and visual quality objectives

- Standard yield curves using TIPSY for managed stands and VDYP for natural stands
- A non-declining harvest flow

6.2 Base Case Timber Supply Analysis

The purpose of the base case scenario is to understand the harvest level that can be achieved under the set of data and assumptions that best reflect current management of the land base. This scenario is based on current performance and our best understanding of how this data and assumptions might change in the future. The base case scenario also provides a reference against which timber supply implications of different management assumptions may be measured and tested. The base case scenario is used as the baseline to assess risk associated with any of the assumptions in the sensitivity analysis.

The following sections present the results of the base case scenario and provide background information on different aspects of the timber supply. The base case and all sensitivity analyses have been carried out using the forest estate model *Forest Planning Studio (FPS)* and all harvest levels are reported net of non-recoverable losses.

The base case scenario includes the changes described above in section 2.2 to better represent SCCF management objectives and new VRI:

- A THLB of 6,289 ha;
- Non-recoverable losses (NRLs) of 378 m^3/year as described in Section 5.6;
- RMZs including community watersheds, integrated resource management zones, and visual quality objectives;
- Standard yield curves using TIPSY for managed stands and VDYP for natural stands; and
- A non-declining harvest flow.

6.2.1 Harvest Forecast

Figure 6.2 shows the base case harvest forecast over the 250-year planning horizon. It was modelled with 10 year periods. The average annual harvest volume across the planning horizon was 47,622 m^3. This section presents the results of the base case scenario (s2).

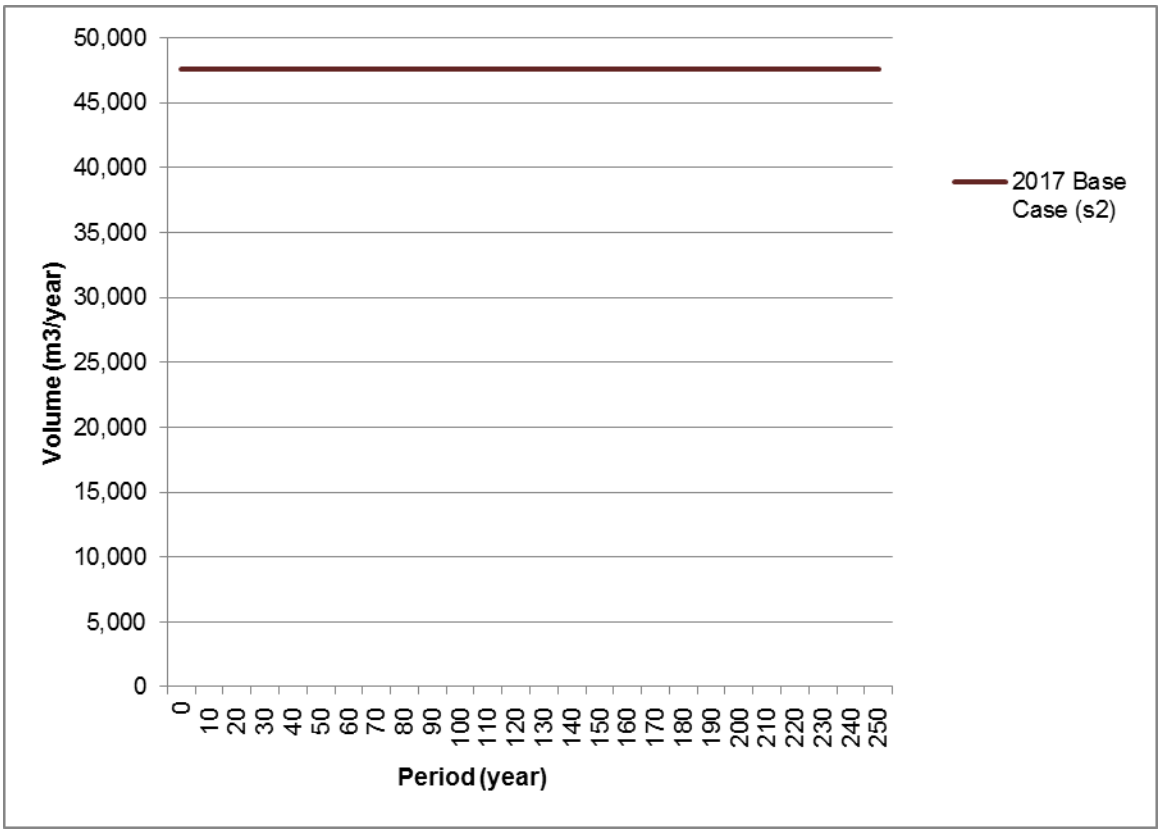

Figure 6.2: Base Case - Harvest Forecast

The total growing stock represents the standing inventory of total forest volume over the 250-year planning horizon and is shown in Figure 6.3. The total growing stock starts at approximately 1.8 million m^3 and decreases through the planning horizon to its lowest point at 60 years in which it is 1.6 million m^3, and stabilizes there for the remainder of the planning horizon.

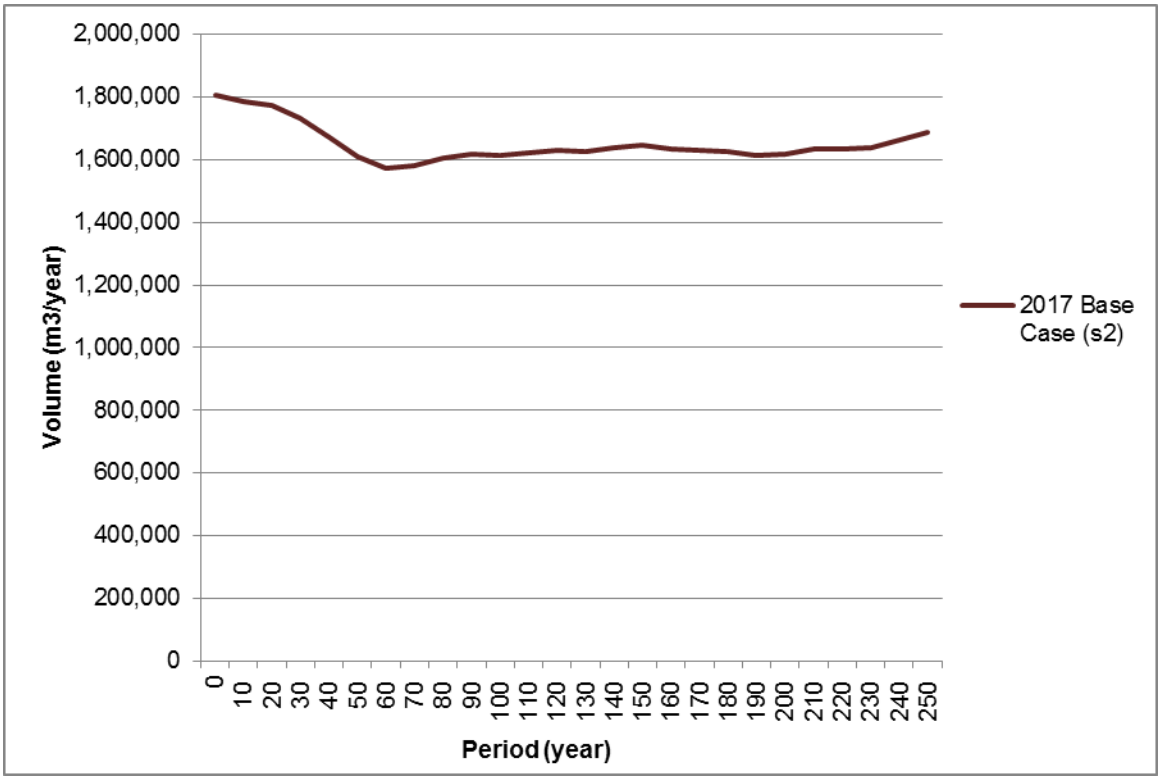

Figure 6.3: Base Case – Total Growing Stock

6.2.2 Base Case Harvest Characteristics

Figure 6.4 shows the distribution and transition of the harvest volume between natural and managed stands. For the first 20 years, harvesting is almost exclusively in natural stands. Harvesting then transitions to managed stands over the next 60 years.

Figure 6.4: Base Case – Harvest Transition from Natural to Managed

As shown in Figure 6.5 , average volume per hectare varies between 600 m^3/ha and 800 m^3/ha for the planning horizon.

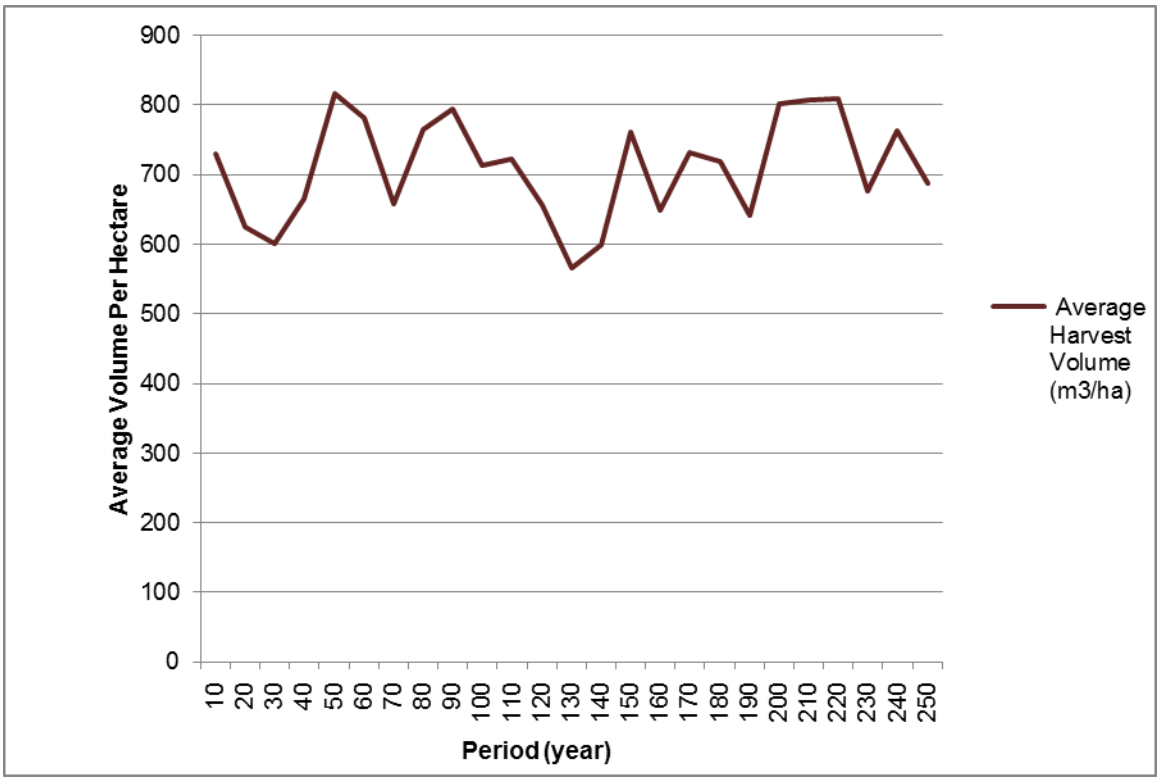

Figure 6.5: Base Case – Average Volume Per Hectare Harvested

Figure 6.6 shows the average annual harvest area for each period in the base case.

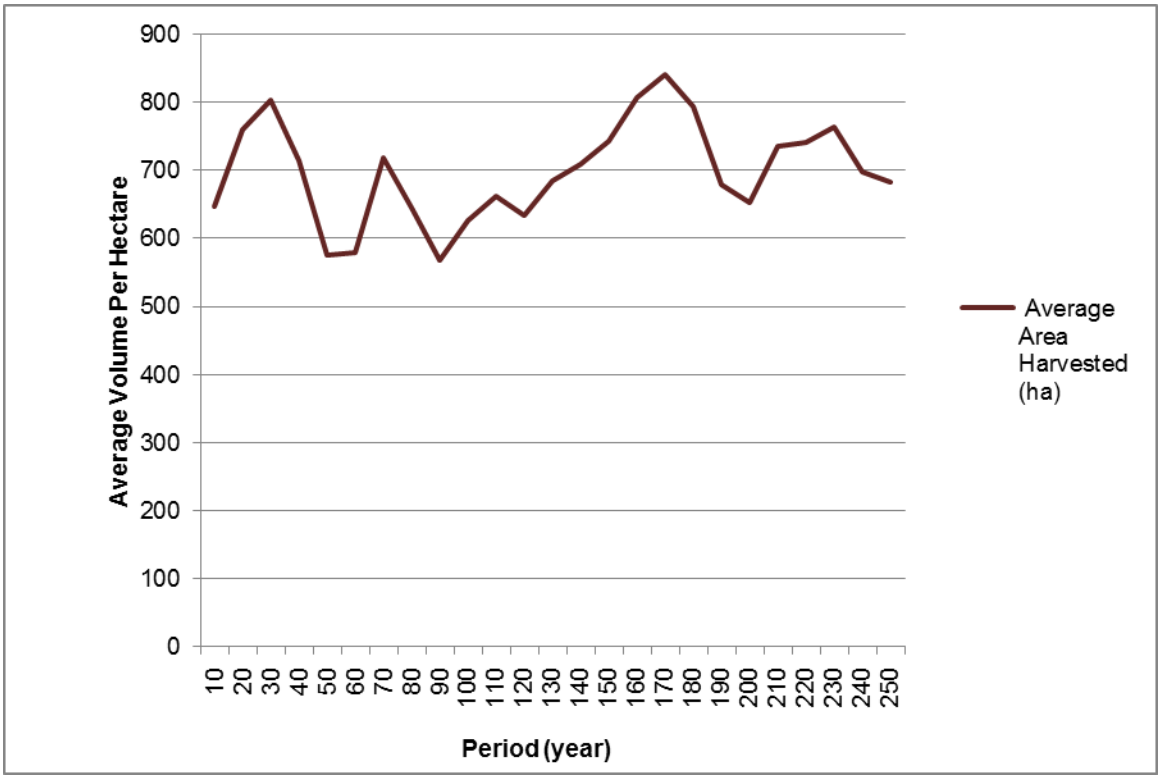

Figure 6.6: Base Case – Harvest Area by Year

6.3 Sensitivity Analysis

Sensitivity analysis provides information on the degree to which uncertainty in the base case data and assumptions might affect the proposed harvest level for the land base. The magnitude of the change in the sensitivity variable(s) reflects the degree of risk associated with a particular uncertainty – a very uncertain variable that has minimal impact on the harvest forecast represents a low risk. By developing and testing a number of sensitivity issues, it is possible to determine which variables most affect results and provide information to guide management decisions in consideration of uncertainty.

Sensitivity analyses included are listed in Table 6.1. The inputs and results of these sensitivity analyses are outlined in the sections below.

Table 6.1: List of Sensitivity Analyses

Section	Sensitivities
6.3.1	No harvest in the Chapman Watershed
6.3.2	No harvest in the Chapman Watershed and Gray Watersheds

6.3.1 No Harvest Chapman Watershed

The netdown classification process removed area in the Chapman watershed where unstable terrain risk class was high, moderately high, and moderate. This sensitivity was developed to assess the timber supply impact of completely removing the Chapman watershed from the THLB.

This scenario (s3) can sustain a long-term harvest level of approximately 43,000 m^3/year as shown in Figure 6.7. This is a 10% decrease from the base case scenario harvest level.

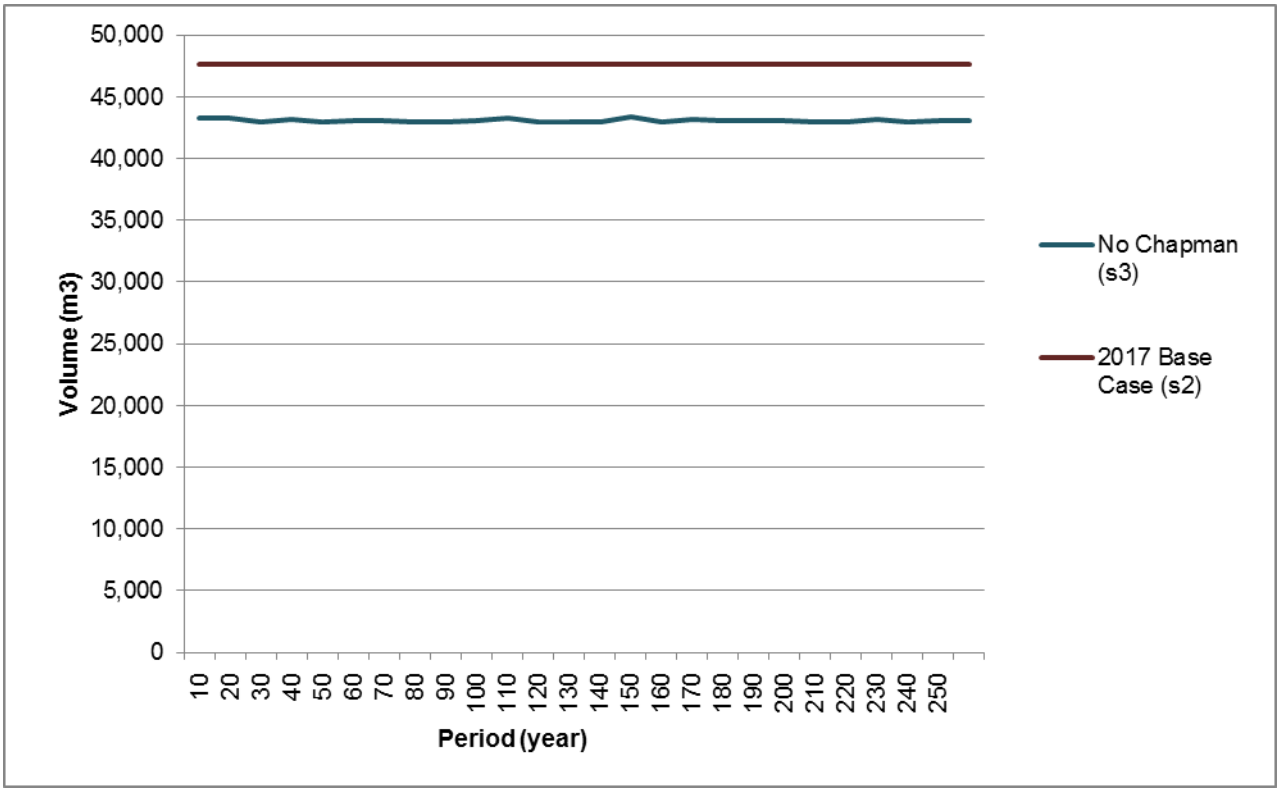

Figure 6.7: No Chapman Watershed – Harvest Forecast

6.3.2 No Chapman and No Gray Watersheds

The netdown classification process removed area in the Chapman watershed where unstable terrain risk was high, moderately high, and moderate. The netdown classification process also removed area in the Gray watershed where unstable terrain risk was high or moderately high. This sensitivity was developed to assess the timber supply impact of completely removing both the Chapman watershed and the Gray watershed from the THLB.

This scenario (s4) can sustain a long-term harvest level of 32,000 m^3/year as shown in Figure 6.7. This is a 32% decrease from the base case scenario harvest level.

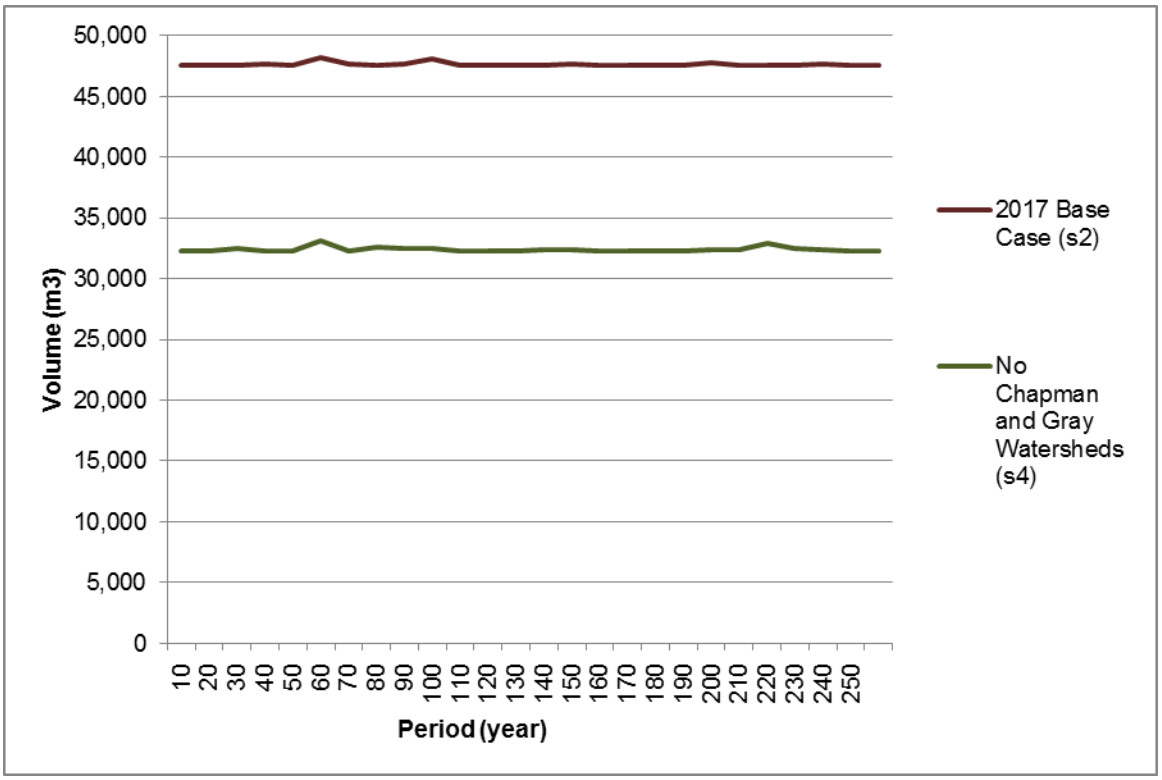

Figure 6.8: No Chapman and Gray Watersheds – Harvest Forecast

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