Sunshine Coast Timber Supply Area
Timber Supply Review

Data Package

December 2021

Derek Lefler, District Manager
Sunshine Coast Resource District
Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Albert Nussbaum, Director
Forest Analysis and Inventory Branch
Ministry of Forests, Lands, Natural Resource Operations and Rural Development

BRITISH COLUMBIA
Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Table of Contents

List of Tables

List of Figures

1 INTRODUCTION

This *Data Package* summarizes the information and assumptions used to conduct the timber supply analysis for the Timber Supply Review (TSR) of the Sunshine Coast Timber Supply Area (TSA)[1]. Under Section 8 of the *Forest Act*, the chief forester must review the timber supply for each TSA at least once every 10 years and determine an appropriate allowable annual cut (AAC). The area to which this AAC decision is applied to is referred to throughout the document as the Section 8 Decision Area.

This *Data Package* contains inputs that represent the current legal requirements and performance for the TSA. For the purposes of this TSR, inputs are defined by:

- the current forest management regime — the productive forest land available for timber harvesting as well as the silviculture treatments, harvesting systems, and integrated resource management practices used in the area;
- fully implemented land-use plans;
- land-use plans approved by Cabinet; and,
- legal objectives established under the *Forest and Range Practices Act*, Government Actions Regulation, and the *Land Act* (e.g., visual quality objectives, community watersheds, stand- and landscape-level biodiversity, wildlife habitat etc.).

The primary purpose of the TSR is to gather and model information based on "what is" as opposed to "what if". Licensee operational practices drive the assumptions made in the TSR. The information in this data package represents the best available knowledge at the time of publication that is, however, subject to change. Future changes in forest management, data, and licensee practices, when and if they occur, will be captured in future timber supply analyses.

A First Nations consultation and public review period has been established to invite submission of comments and concerns to the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) for the consideration by the chief forester in determining the AAC for the Sunshine Coast TSA. Beyond this formal review period, FLNRORD has endeavored to engage and collaborate throughout the TSR period with First Nations and licensees in the TSA regarding the TSR process, forest management, and First Nations rights and interests. Input from the consultation and public reviews that have timber supply implications may be incorporated into the timber supply analysis or identified to the chief forester for consideration in the AAC determination. The chief forester's AAC determination will be documented through the public release of an *AAC Determination Rationale*.

As part of the public review and First Nations consultations, comments around the *Data Package* are being requested from First Nations and the public during a 60-day review period. Section 12 describes details around the review process and comment submissions. A further 60-day comment period will be available later, following the release of the *Discussion Paper* that details the timber supply analysis results based on the revised and up-to-date *Data Package*.

[1] For more information on the TSR process visit: https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut

1.1 Overview of the Sunshine Coast Timber Supply Area

The Sunshine Coast TSA comprises approximately 1.7 million hectares along the southwest coast of British Columbia (BC). It is located approximately 100 kilometers north of the City of Vancouver extending from Howe Sound in the south to the end of Bute Inlet in the north (Figure 1). The TSA is administered by the FLNRORD Sunshine Coast Natural Resource District with an office in Powell River, BC. The TSA is bordered by the Fraser TSA to the south, the Soo TSA to the east, the Arrowsmith, North Island and Great Bear Rainforest South TSAs to the west, and Williams Lake TSA to the north. The Sunshine Coast TSA contains Tree Farm Licences (TFLs) 39 and 43 but excludes the Pacific TSA adjacent to TFL 39. This analysis is focused on the Section 8 Decision Area.

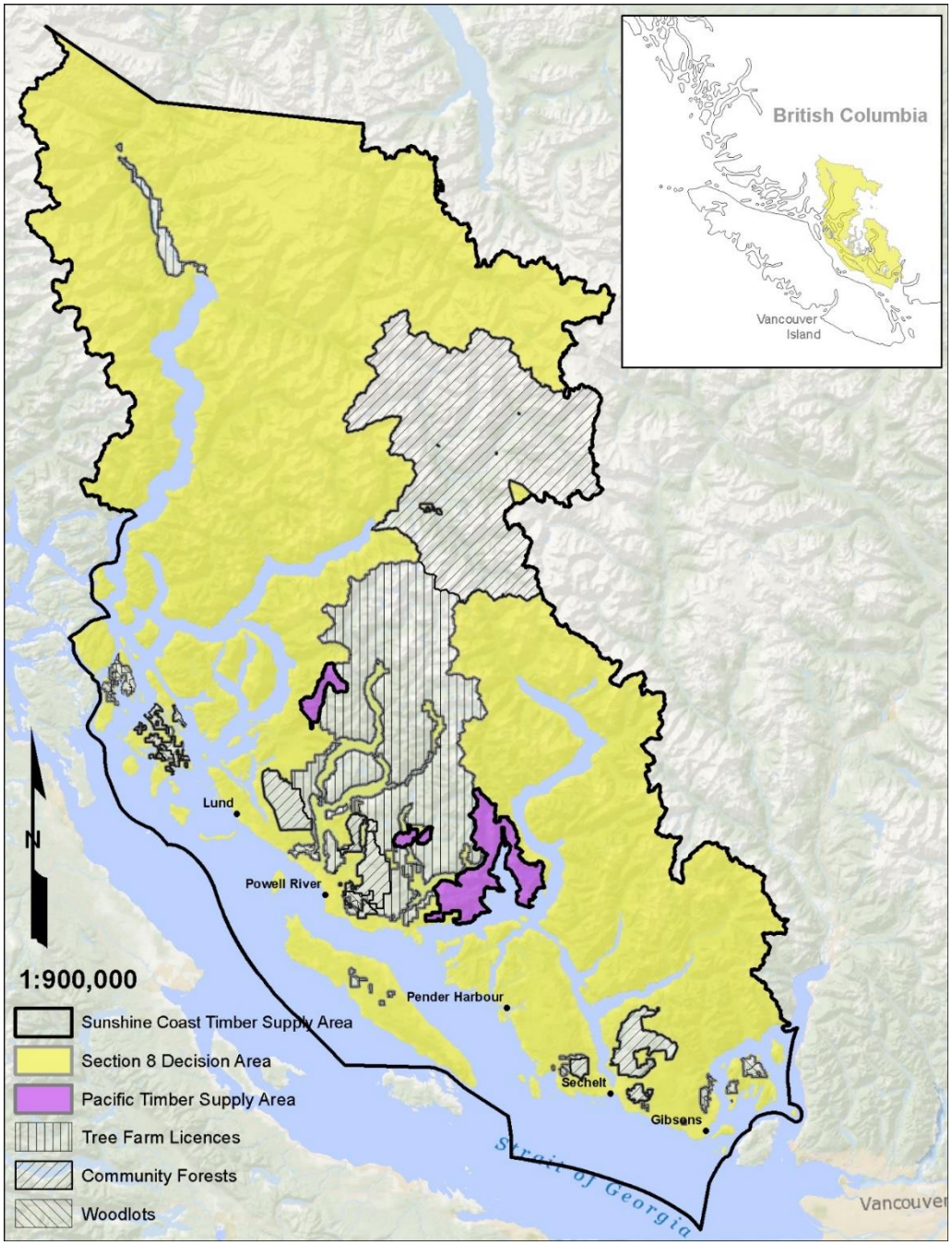

Figure 1. Sunshine Coast Timber Supply Area.

The landscape of the Sunshine Coast TSA is dominated by the Coast Mountains and several coastal

fjords, most notably the Bute, Toba and Jervis Inlets. The landscape ranges from nutrient rich, moist floodplains in the valley bottoms to alpine meadows at higher elevations. Approximately 25% of the land base of the TSA is considered to be productive forest managed land, of which approximately 38% is available for timber harvesting.

About half of the forests on the timber harvesting land base (THLB) are considered to have medium or good site productivity. Major tree species include Douglas-fir, hemlock, and amabilis fir (balsam), with lower proportions of western redcedar, spruce, pine, alder, and cottonwood. These forests have a long harvesting history and, as a result, rapidly maturing second-growth forests are located on the lower elevation, more accessible, and higher productivity growing sites. Nearly 60% of the stands on the THLB are between 21 and 100 years of age.

The varied topography and forests of the Sunshine Coast TSA are home to many species of wildlife. Large mammals include grizzly and black bear, black-tailed deer, Roosevelt elk, mountain goat, cougar and wolf, as well as isolated populations of moose. Small mammals are diverse and abundant. The nutrient-rich, protected waters of the various estuaries in the TSA provide shelter and food for many waterfowl species, from ducks, Canada geese and gulls to eagles and ospreys. Large wintering congregations of harlequin duck, bald eagle, trumpeter swan, and Barrow‘s golden eye duck also occur in coastal waters throughout the TSA. Several species of raptor are found within the TSA, including pygmy owl, saw-whet owl, barred owl, western screech owl, Cooper‘s hawk, red-tailed hawk, sharp-shinned hawk, merlin, and kestrel, as well as golden eagle in remote valleys. The Sunshine Coast TSA is also home to several identified species at risk such as the Marbled Murrelet, Queen Charlotte northern goshawk, two Vananda Creek stickleback species, Coastal Tailed frog, and Great Blue heron.

According to BCStats[2], the population of the Sunshine Coast TSA in 2020 was 52,947, more than half live in the communities of Powell River, Sechelt and Gibsons. Other smaller communities include Halfmoon Bay, Pender Harbor and Lund, as well as communities on Texada and Cortes islands.

The AAC for the Sunshine Coast TSA was last determined by the chief forester on January 16, 2012, at 1 197 949 cubic metres per year (Table 1)[3]. This AAC included a partition of 95 000 cubic metres per year for red-alder leading stands, and a 3000 cubic metres per year partition for other deciduous-leading stands by order under Section 3(2) of the *Forest Revitalization Act*. Shortly after the 2012 AAC determination, the land base of the Sunshine Coast TSA changed; a small portion of TFL 39 was added and a Community Forest Agreement (CFA) area was removed from the Sunshine Coast TSA. Consequently, in August of 2013, the AAC was increased by 6869 cubic metres per year to 1 204 808 cubic metres per year.

Table 1. Historic and current AAC

Year	Coniferous (m^3/year)	Deciduous (m^3/year)	Total (m^3/year)	Year	Coniferous (m^3/year)	Deciduous (m^3/year)	Total (m^3/year)
1986			1,429,580	2002	1,045,000	98,000	1,143,000
1989	1,429,580	16,000	1,445,580	2007	1,099,000	98,000	1,197,949
1993			1,100,000	2012	1,099,000	98,000	1,197,949
1996	1,045,000	95,000	1,140,000	2013	1,106,800	98,000	1,204,808

[2] https://www2.gov.bc.ca/gov/content/data/statistics
[3] Information on TSA 39 (last visit on April 13, 2021): https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut/allowable-annual-cut-timber-supply-areas/sunshine-coast-tsa

1.2 Land use and landscape unit planning

Land use planning sets the strategic direction to guide sustainable resource stewardship and management of provincial public land and waters that meets economic, environmental, social, and cultural objectives. In other words, it sets high-level direction and helps define what can occur on the land base. Twenty-five landscape units have been delineated within the Sunshine Coast Natural Resource District. Plans for sustaining elements of biodiversity (e.g., old growth forest, wildlife tree retention areas) have been developed for 18 landscape units. Specific objectives and modelling approaches are discussed in Sections 5.10 and 5.22.

The shíshálh Nation Strategic Land Use Plan is a high-level strategic plan that expresses the land use interests of the shíshálh Nation. The plan provides general direction for management activities within several established land use zones across the shíshálh Nation traditional territory. This strategic plan was not legally established at the time of this analysis, however management guidance from the plan will be considered to inform the AAC determination. In October 2018, the shíshálh Nation and the BC government signed the shíshálh-BC Foundation Agreement that provides direction for the development of a Modernized Land Use Plan within shíshálh swiya. This plan aims to provide direction on biodiversity, watershed integrity, resources important to shíshálh culture, and sustainable economic development. The Modernized Land Use Plan was in progress at the time of this analysis but outcomes were unavailable.

1.3 Apportionment of the AAC

The current AAC is apportioned to Replaceable Forest Licences, Non-Replaceable Forest Licences, First Nations Non-Replaceable Forest Licence, BC Timber Sales (BCTS) Licences, and Forest Service Reserve (Table 2). Major forest licensees operating within the TSA include Interfor Corporation, BC Timber Sales, A&A Trading Ltd., and Tsain-Ko (Table 3).

Table 2. Current apportionment

Tenure	Conventional (m^3/year)	Alder (m^3/year)	Total (m^3/year)	Percentage
Replaceable Forest Licenses (RFL)	741,758		741,758	61.9%
Non-Replaceable Forest Licenses (NRFL)	61,411	98,000	159,411	13.3%
Non-Replaceable Forest License – First Nations	75,923		75,923	6.3%
BC Timber Sales License	209,316		209,316	17.5%
Forest Service Reserve	12,000		12,000	1.0%
Total	**1,100,408**	**98,000**	**1,198,408**	**100.0%**

Source: FLNRORD, TSA AAC, Apportionment and Commitments for Sunshine Coast TSA, Jan 11, 2021.

Table 3. Current commitments

Licensee	RFL (AAC)	NRFL (AAC)	NRFL (Deciduous)	NRFL (Lump)	Total (m^3/year)
Interfor Corporation	568,481				568,481
BC Timber Sales	209,316				209,316
A & A Trading Ltd.	152,666				152,666
1175401 BC - Thompson	17,675				17,675
Christensen	2,936				2,936
Tsain-Ko		127,540			127,540
Klahoose		8,571	10,000		18,571
Homalco				30,359	30,359
Total	**951,074**	**136,111**	**10,000**	**30,359**	**1,127,544**

Source: FLNRORD, TSA AAC, Apportionment and Commitments for Sunshine Coast TSA, Oct 19, 2021.

2 FIRST NATIONS CONSIDERATIONS

Fourteen First Nations have asserted traditional territory within the Sunshine Coast TSA (Table 4), while five First Nations have traditionally occupied communities within its boundaries. The TSA contains a diverse landscape including major river systems, islands, rich marine bays, alpine tundra, and forests. Consequently, there is a great variation in the Indigenous cultures with interests in the TSA. The earliest confirmed European presence in the area occurred in the summer of 1792 when English and Spanish ships explored the Strait of Georgia. Many of the earliest written accounts of Indigenous villages were documented on that voyage, as the Captains Vancouver, Valdez, and Galiano surveyed many of the mainland inlets in search of the fabled Northwest Passage. However, a permanent non-Indigenous population did not start to reside in the upper Strait until the mid-1800s.

Table 4. Indigenous peoples whose territories include portions of the Sunshine Coast TSA

First Nation	Reserve land	Traditional territory
The shíshálh First Nation	No (shíshálh First Nation Band Lands, fee simple)	Yes
The Tla'amin First Nation	No (Tla'amin Lands, fee simple)	Yes
The Xwémalhkwu (Homalco) First Nation	Yes	Yes
The Klahoose First Nation	Yes	Yes
The Squamish First Nation	Yes	Yes
The We Wai Kai First Nation	No	Yes
The Wei Wai Kum First Nation	No	Yes
The Kwiakah First Nation	No	Yes
The Snaw‘Naw‘As First Nation	No	Yes
The Qualicum First Nation	No	Yes
The Líl‘wat Nation	No	Yes
The Xeni Gwet‘in First Nations Government	No	Yes
Tsleil-Waututh First Nation	No	Yes
The Ulkatcho First Nation	No	Yes

Archaeological Overview Assessments (AOA) have been completed for portions of the Sunshine Coast TSA. These are the basis for determining areas and sites that may require further assessment through an Archaeological Impact Assessment (AIA), carried out as part of operational planning. Known archaeological sites and cultural heritage sites are considered in the timber supply analysis as described in Sections 5.11 and 5.13.

2.1 Agreements and tenures

2.1.1 Forest consultation and revenue sharing agreements

Most First Nations in the Sunshine Coast TSA have, or have had, Forest Consultation and Revenue Sharing agreements. These agreements help formalize how government to government engagement will take place for different decision types, and recognizes that licensee-led information sharing can be a beneficial form of engagement. Of critical importance is the fact that these agreements provide Indigenous communities with a portion of stumpage revenue based on a formula that accounts for the timber harvested from within their territories. Consequently, First Nations communities now receive direct economic benefits from forest operations that take place in their traditional territory.

2.1.2 shíshálh foundation agreement

In October 2018, BC and the shíshálh Nation signed a type of reconciliation agreement known as the shíshálh Foundation Agreement. A key part of this agreement included the establishment of a landmark government-to-government working relationship intended to create new decision-making structures between the Province and the shíshálh government. Other key components include land transfers, economic and socio-cultural investments, establishment of a land-use planning process, and joint aspirational long-term commitments.

2.1.3 Forest tenure opportunity agreements

Many First Nations hold forest tenures within the Sunshine Coast TSA that were direct-awarded through Forest Tenure Opportunity Agreements (FTOA). In accordance with the *Forest Act*, First Nations may be awarded forest tenures without competition as part of an interim measures agreement, treaty related measures agreement, or economic measures agreement, which are met through FTOAs. The FTOAs include language acknowledging that the direct award of the tenure supports the reconciliation of Indigenous rights and title, and assists to help First Nations meet the goals and objectives of the Transformative Change Accord.

2.1.4 Strategic engagement agreements

Two First Nations within the Sunshine Coast TSA are signatories to the Nanwakolas Strategic Engagement Agreement which establishes mutually agreed upon procedures for consultation and accommodation. These agreements with First Nations are intended to encourage positive and respectful government-to-government relationships and to strengthen BC's investment climate. They are also used by the provincial government to support objectives established through the New Relationship Accord and the Transformative Change Accord.

For First Nations in the treaty process, Strategic Engagement Agreements can help build mechanisms to support decision making in a post-treaty environment. The Strategic Engagement Agreements provide an opportunity for First Nations not in the treaty process to take a more active role in the decision making process and develop a stronger government-to-government relationship with the province.

2.2 Treaties and treaty negotiations

Certainty, as it relates to treaty making, refers to the need for all parties – each First Nation, Canada and BC – to have clearly defined land ownership and jurisdiction. A fundamental goal of a modern treaty is to achieve certainty and facilitate strong and workable relationships between First Nations and other governments including federal, provincial and local. Treaties bring certainty with respect to a First Nation's rights to use, own and manage lands and resources throughout their traditional territory, as well as provide the treaty First Nation with modern governance tools to develop sustainable, healthy and resilient communities. When ownership and use of lands and resources is clear, there is increased predictability for continued development and growth in the province.

In the Sunshine Coast TSA, the Tla'amin Final Agreement is currently the only treaty agreement in place, which came into effect on April 5, 2016.

Data source and comments:

Information was provided by Mark Sloan, Stewardship Officer with the Sunshine Coast Natural Resource District. Additional information was sourced from the previous TSR for the Sunshine Coast TSA and updated accordingly.

3 FOREST MANAGEMENT CONSIDERATIONS AND ISSUES

3.1 Established management assumptions

The assumptions described in this *Data Package* reflect current performance and knowledge with respect to the status of forest land, forest management practices, and timber growth and yield. These assumptions will be used to model the timber supply forecast called the established scenario. The forecast of the established scenario is one component of the information presented to the chief forester for a Section 8 AAC determination. While there may be uncertainty associated with the assumptions used to develop the established scenario, these uncertainties are examined by conducting a current practice scenario which includes additional management practices that are often not legally required, as well as a suite of sensitivity analyses to understand the implications of these uncertainties (Section 8).

3.2 Climate change

There is substantial scientific agreement that climate is changing and that the changes will affect forest ecosystems. Forest management practices will need to be adapted to these changes and can contribute to climate change mitigation by promoting carbon uptake and storage. Deciding on the preferred management approach will involve consideration of established climate change strategies and available adaptation and mitigation options together with social, economic, cultural, and environmental objectives.

It is difficult to quantify impacts on timber supply by climate change given both the uncertainty of the rate and specific characteristics of climate change and the uncertainty around the impact to the forest and how management will respond. However, current changes (e.g., recent natural disturbances, silvicultural practices, forest growth monitoring) that may relate to climate change are captured as part of existing data collection processes and incorporated into this analysis. In addition, species portfolios of future managed stands were adjusted with some consideration for climate change and forest health risk.

The Climate Change Strategy for BC indicates that increasing future temperatures may cause:

- More extreme weather patterns, and increase the likelihood of disasters including wildfire, flooding, and drought
- Shifting rainfall and snowfall patterns will change the timing and magnitude of spring freshet and summer low flows
- Higher summer temperatures will increase hot and dry conditions which could decrease water supply, stress aquatic ecosystems, and increase wildfire risk
- Higher winter temperatures will continue to contribute to a greater proportion of precipitation falling as rain instead of snow, increasing the possibility of winter flooding
- Decreasing winter snow pack will cause some watersheds to shift towards rainfall dominant regimes, causing an increased need for water conservation and storage
- By 2050, B.C. will experience an average of 16-24 more frost free days each year
- Forest health is at risk due to climate change, with increasing prevalence of damaging agents such as beetles, pests, and pathogens

Increased natural disturbances can be estimated by adjusting the information on non-recoverable losses (Section 6.4.2) along with the disturbance on the non-harvestable land base (Section 6.4.3). Because the potential increases due to climate change are difficult to quantify, specific sensitivities on these have not been added.

In addition to the natural disturbance, forest health may also be affected by climate change. Experts indicate that for the Sunshine Coast TSA, the most likely short-term risk would be dieback of western redcedar (Cw) and increase in Hemlock Looper. The Cw dieback affects very dry to fresh sites. A sensitivity analysis will be incorporated to assess the potential impact of this dieback, with more detail in Section 6.4.1. Hemlock Looper is estimated to become more extensive and spread to drier areas in the

TSA. The extent of this change cannot be estimated based on current data, but the effect would be an unknown increase in non-recoverable losses.

3.3 Cumulative effects

The need to measure the effects of all natural resource activities on the values important to British Columbians led to the provincial government establishing a Cumulative Effects Framework (CEF) to guide the assessment of cumulative effects across natural resource sectors. The CEF and TSR both provide landscape-level assessments that report on the state of values to support decision making. Currently, the CEF has developed assessment protocols for aquatic ecosystems, grizzly bear, moose and old growth forests that are approved by the natural resource sector for implementation. Indicators under these protocols relevant to the Sunshine Coast TSA that have been completed prior to the AAC determination will be presented to the chief forester.

3.4 Major issues and changes in forest management

Major forest management issues reflected in this analysis and changes since the previous TSR are listed below (Table 5). Issues that are considered to be current management will be modelled, as best possible, within the established and current practice scenarios. Other issues with uncertain influence on current management will be assessed through sensitivity analyses as outlined in Section 8.4.

Table 5. Major forest management issues

Consideration/issue	Description
TSA boundary changes	In December 2018, Lasqueti Island and the smaller islands around it were transferred to the Arrowsmith TSA. Four new community forests and four new woodlots have been established in the Sunshine Coast TSA since last TSR. In addition, TFL 10 was eliminated and part of it was included into the Sunshine Coast TSA (offset the area lost to woodlots and community forests with little change to the THLB).
Land use plans	No new legal land use plans have come into effect since the last TSR. However, the shíshálh Nation Strategic Land Use Plan will be considered in this analysis as a separate management scenario and results made available for the AAC determination.
Landscape-level biodiversity	The landscape unit (LU) boundaries and biodiversity emphasis objectives (BEO) were established under the Order Establishing Provincial Non-Spatial Old Growth Objectives, which came into effect June 30, 2004. These will be applied in five LUs (Bishop, Brem, Deserted, Narrows, and Toba) where legal old growth management areas (OGMA) have not yet been established.
OGMAs	OGMAs were established for 20 (out of 24) LUs within the TSA. The non-legal OGMAs established in Haslam and Texada LUs are currently being monitored in forest operations.
Stand-level biodiversity	In areas covered by approved LU plans (18 LUs), wildlife tree patch retention percentages are specified (4-15%). For the remaining LUs, 7% of harvested areas is retained in wildlife tree patches as per the *Forest and Range Practices Act*.
Riparian management	Lakes and wetlands are classified as per the Forest Practices and Planning Regulation (Sections 48-49) with appropriate reserve areas identified. Streams are classified using a fish passage model dataset developed by the Forest Analysis and Inventory Branch (FAIB) in 2019, including appropriate reserve areas.
Conservation of ungulate winter range	Mountain Goat ungulate winter range habitat has been approved under a Government Action Regulation (GAR) Order, with established management actions as either a no-harvest or conditional-harvest zones. There are 399 approved ungulate winter range (UWR) units in the TSA that conserve 48 065 hectares, including 25 233 hectares of Crown forest management land base (CFMLB).

Consideration/issue	Description
Conservation of Grizzly Bear Habitat	Grizzly Bears are a blue-listed species in BC and designated as a species of *Special Concern* in Canada (COSEWIC 2018). There are currently 152 (103 more compared to previous TSR) approved wildlife habitat areas (WHA) in the TSA which conserve 27 856 hectares, including 4629 hectares of CFMLB, of seasonally important Grizzly Bear habitat (22 875 hectares and 2456 hectares of CFMLB more compared to previous TSR).
Conservation of Marbled Murrelet Habitat	The Marbled Murrelet is a blue-listed species in BC and designated as *Threatened* in Canada (COSEWIC 2012). Currently, there are 85 approved WHAs (53 more compared to previous TSR) which conserve 6208 hectares of CFMLB as Marbled Murrelet nesting habitat (3539 hectares more compared to previous TSR). With the minimum area of 10 270 hectares set for the Sunshine Coast district[4], another 4062 hectares of suitable Marbled Murrelet habitat is expected to be established as future WHAs.
Conservation of Stickleback Habitat	The Vananda Creek Limnetic and Benthic Sticklebacks occur only on Texada Island in BC. Both species are red-listed in BC and designated as *Endangered* in Canada (COSEWIC 2010). Since the previous TSR, one WHA was legally established to manage 636 hectares for Stickleback habitat. Out of the 636 hectares, 242 are conserved (no harvesting), while harvesting can occur on the remaining WHA subject to no road construction and no erosion or sediment delivery into the water features.
Conservation of Northern Goshawk	The Northern Goshawk is a red-listed species in BC and designated as *Threatened* in Canada (COSEWIC 2013). Previous TSR had no WHAs established for Northern Goshawk. To date, there are five approved and seven proposed WHAs to conserve core habitat for Northern Goshawk.
Conservation of Coastal Tailed Frog	The Coastal Tailed Frog is a blue-listed species in BC and designated as a species of *Special Concern* in Canada (COSEWIC 2011). Section 7 Notice for Species at Risk identify up to 30 hectares, not exceeding an impact to the mature THLB of 20 hectares, may be conserved for Coastal Tailed Frog. No Tailed Frog WHAs have been established to date.
Protection of archaeological sites	Archaeological Overview Assessments (AOA) and Archaeological Impact Assessments (AIA) are used to identify potential archaeological sites which include cultural, habitat and historic sites. Additional areas may be excluded from harvesting for unknown archaeological sites following field verifications.
Protection of water quality within community watersheds	Community watersheds established under GAR Orders that specify forest cover requirements intended to protect water quality. There are 23 designated community watersheds in the Sunshine Coast TSA.
Visual landscape management	Visual quality objectives are established throughout the TSA to manage the visual impact of forestry activities on the land base. Recently, there were proposed changes to the visual quality objectives which will be considered in a sensitivity analysis.
Currency of the Vegetation Resource Inventory (VRI)	The Sunshine Coast TSA inventories consist of VRI standard inventories (21%), older Forest Inventory and Planning inventories (76%) and a smaller amount of area attributed with RESULTS data. Approximately 38% of the VRI was initially completed in the 1960's and 70's, 37% was completed between 1980 and 1999 and 25% completed after 2000.Updates for wildfire and recent disturbances have been incorporated to 2020 for the entire TSA.
Operability	Operability consists of two distinct zones; conventional and helicopter logging. The criteria to develop the operability mapping was defined in the previous TSR (with inputs from licensee) and will not be changed for this TSR. The operability layer for the former TFL 10 will be added to consolidate a complete operability layer for the entire TSA.
Deciduous forest types	The allowable annual cut contains 98 000 cubic metres for deciduous volume, all apportioned to non-replaceable forest licences.

[4] Source: FLNRORD Proposed Land Use and Wildlife Objectives – Relating to the recovery of Marbled Murrelet, September 18, 2020.

Consideration/issue	Description
Independent power projects (IPP)	Currently, within the Sunshine Coast TSA there are approximately 521 kilometers of transmission line built on right-of-way varying between 20 metres and 200 metres in width depending on the capacity of the specific transmission line. There are two types of impacts from IPP: 1) the IPP footprint (transmission line, penstock, power house, and access roads), and 2) the impact on harvesting (i.e., isolation of timber, working around transmission lines, and visual constraints).
Treaty settlement lands	To date, the Tla'amin Final Agreement is the only treaty in effect (April 5, 2016); this area is removed from the Crown land.
Priority old growth deferral areas	FLNRORD recently announced that it is working in partnership with Indigenous Nations to defer logging activities within 2.6 million hectares of BC's most at-risk old growth forests. Approved short-term deferrals will help protect and support these ecosystems while First Nations, the Province, and other partners develop a new approach for old growth forest management. Data to support this initiative was provided by the Old Growth Technical Advisory Panel. Excluding these priority deferral areas will be considered in a sensitivity analysis.

4 INVENTORIES

4.1 Vegetation resource inventory

The Sunshine Coast TSA forest inventory is a combination of the older forest cover inventory converted to the current vegetation resource inventory (VRI) standard (completed between 1991 and 1993) and the recently completed VRI for the old TFL 10 inventory covering the parcels of land transferred to the TSA. The provincial VRI is developed and managed by the Forest Analysis and Inventory Branch (FAIB). The version used for this analysis was projected to January 2017 and published in February 2018. The inventory data for the portion of the TSA that was previously included in TFL 10 (approximately 12.5% of the TSA and 2.7% of the THLB) will be translated to the VRI standard by FAIB. Finally, all known harvest events to December 31, 2020 (from the RESULTS database and the BC Consolidated Cutblocks data layer) will be accounted for (if not already present in the VRI) and stand ages current to calendar year 2020 will be updated as follows:

- Harvest events in year 2015 and later: 2020 minus harvest year;
- Harvest events in year 2000 and earlier than year 2015:
    - 2020 minus harvest year if VRI projected age (to calendar year 2020) is absent or older than 2021 minus harvest year, otherwise,
    - VRI projected age (to calendar year 2020).
- Harvest events before year 2000:
    - 2020 minus harvest year if VRI projected age (to calendar year 2020) is absent, otherwise,
    - VRI projected age (to calendar year 2020).
- All other stands:
    - Zero if VRI projected age (to calendar year 2020) is absent (three hectares assumed to be not-sufficiently restocked areas if indicated as forest management land base), otherwise,
    - VRI projected age (to calendar year 2020).

4.2 Ecosystem mapping

BC has developed a robust biogeoclimatic ecosystem classification (BEC) system. In the Sunshine Coast TSA, mapping and classification of climatic zonal and subzonal lands is available. In addition to this layer, some terrestrial ecosystem mapping (TEM) is also available for portions of the TSA.

Data source and comments:

BEC layer from the BCGW file: WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY. The TEM dataset was accessed from the Ministry of Environment and Climate Change Strategy (MOE).

4.3 Site productivity

Site index is a measure of site productivity based on the top height (metres) of a stand at breast-height age 50 years. Three sources of information on site productivity will be used for deriving managed stand volume tables with growth and yield models:

- For older stands regenerated naturally, VRI site index-based estimates of height and age from aerial photography.
- For younger plantations, a provincial site productivity layer developed by FLNRORD (led by FAIB) based on Site Index Estimates by Biogeoclimatic Ecosystem Classification (SIBEC) relationships for site series either mapped through TEM or PEM or defined through a biophysical model. The SIBEC approach assigns a potential site index to the site series identified from ecosystem mapping. The potential site index assigned to site series estimates are derived from an extensive standardized field base sampling and compilation process.

Data source and comments:

Information and data associated with the site productivity layer can be found here[5].

4.4 Data sources

Various data sources will be used to determine the CFMLB and THLB used to forecast forest management activities (Table 6).

Table 6. Data sources

Name	Description	Source	Vintage
WHSE_WILDLIFE_MANAGEMENT. WCP_WILDLIFE_HABITAT_AREA_POLY WCP_WHA_PROPOSED	Wildlife Habitat Areas (approved and proposed)	BCGW	2021
WHSE_WILDLIFE_MANAGEMENT. WCP_UNGULATE_WINTER_RANGE	Ungulate Winter Range	BCGW	2021
WHSE_WATER_MANAGEMENT. WLS_COMMUNITY_WS_PUB_SVW	Community Watersheds	BCGW	2021
WHSE_TERRESTRIAL_ECOLOGY. STE_TER_STABILITY_POLYS_SVW	Terrain Stability Mapping	BCGW	various
WHSE_TANTALIS. TA_CROWN_RIGHTS_OF_WAY_SVW	Utility Right-of-Way	BCGW	2019
WHSE_TANTALIS. TA_PARK_ECORES_PA_SVW	Provincial parks and protected areas	BCGW	2021
WHSE_LAND_USE_PLANNING. RMP_OGMA_LEGAL_CURRENT_SVW RMP_OGMA_NON_LEGAL_CURRENT	Old Growth Management Areas, legal and non-legal	BCGW	2021
WHSE_LAND_USE_PLANNING. RMP_LANDSCAPE_UNIT_SVW	Landscape Unit boundaries	BCGW	2021
WHSE_LAND_USE_PLANNING. RKPM_KARST_POTENTIAL_AREA_SP	Known and potential karst inventory	BCGW	2019
WHSE_LAND_AND_NATURAL_RESOURCE. PROT_WUI_RISK_CLASS_SP	Wildland Urban Interface	BCGW	2017
WHSE_FOREST_VEGETATION. VEG_CONSOLIDATED_CUT_BLOCKS_SP	Consolidated Cutblocks	BCGW	2021
WHSE_FOREST_VEGETATION. VEG_COMP_LYR_R1_POLY	Vegetation Resource Inventory	BCGW, FAIB	2021
WHSE_FOREST_VEGETATION. RSLT_OPENING_SVW	RESULTS openings	BCGW	2021
WHSE_FOREST_VEGETATION. REC_VISUAL_LANDSCAPE_INVENTORY	Visual Landscape Inventory	BCGW	2021
WHSE_FOREST_VEGETATION. GRY_PSP_STATUS_ACTIVE	Permanent Sample Plots	BCGW	2021
WHSE_FOREST_VEGETATION. F_OWN	Provincial ownership dataset (modified)	BCGW and DSC	2021

[5] Site Productivity (last visit on April 14, 2021): https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/site-productivity

Name	Description	Source	Vintage
WHSE_FOREST_VEGETATION. BEC_BIOGEOCLIMATIC_POLY	Provincial Biogeoclimatic Variants	BCGW	2021
WHSE_FOREST_VEGETATION. VEG_COMP_VDYP_INPUT_POLY VEG_COMP_VDYP_INPUT_LAYER	VDYP input tables	BCGW	2021
WHSE_FOREST_TENURE. TIMBER_LICENCE_POLY_SVW TL_ELIMINATION_POLY_SVW	Timber Licences	BCGW	2021
WHSE_FOREST_TENURE. FTEN_ROAD_SECTION_LINES	Forest Tenure Roads	BCGW	2021
WHSE_FOREST_TENURE. FTEN_RECREATION_POLY_SVW FTEN_REC_SITE_POINTS_SVW	Forest Tenures Recreation polygons and points	BCGW	2020
WHSE_FOREST_TENURE. FTEN_RECREATION_LINES_SVW	Forest Tenures Recreation Trails	BCGW	2020
WHSE_FOREST_TENURE. FTEN_MANAGED_LICENCE_POLY_SVW	Community Forests and Woodlots	BCGW	2021
WHSE_BASEMAPPING. FWA_LAKES_POLY FWA_RIVERS_POLY FWA_WETLANDS_POLY TRIM_EBM_OCEAN	Freshwater Atlas Streams, Lakes, Rivers, Wetlands, and Ocean	BCGW	2020
WHSE_BASEMAPPING. DRA_DGTL_ROAD_ATLAS	Digital Road Atlas	BCGW	2020
WHSE_ADMIN_BOUNDARIES. FADM_TSA	TSA boundaries	BCGW	2020
WHSE_ADMIN_BOUNDARIES. FADM_TFL	TFL boundaries	BCGW	2020
BEC12_VRI_PriorityDeferral	Priority Old Growth Deferral Areas	FAIB	2021
Integrated Stewardship Strategy – TEM	Terrestrial Ecosystem Mapping	MECCS	various
Integrated Stewardship Strategy – SSLUP	shíshálh land use plan	DSC	2018
Integrated Stewardship Strategy – sprod_39.gdb	Provincial Site Productivity layer	BCGW	2014
Integrated Stewardship Strategy – Oper and TSR_Oper	Physical operability	DSC	2010
Integrated Stewardship Strategy – MAMU	Suitable habitat for Marbled Murrelet	FLNRORD	2019
Integrated Stewardship Strategy – Fut_blk	Planned future harvest blocks	BCTS, Interfor	2019
Integrated Stewardship Strategy – ESA	Environmentally Sensitive Areas	DSC	unknown
Integrated Stewardship Strategy – EPU	Elk Population Units	S. Wilson	2015
Integrated Stewardship Strategy – DSC VLI 2019	Updated version of proposed new VLI	DSC	2019
Integrated Stewardship Strategy – DEM	Digital Elevation model for slope, aspect, and elevation	TRIM	2005
Integrated Stewardship Strategy – CIZ	Community Interface Zone	DSC	2010
Integrated Stewardship Strategy – BCTS inop	BCTS inoperable areas	BCTS	2019
Integrated Stewardship Strategy – Arch	Archeological Sites	Archeology Branch	2019

5 LAND BASE DEFINITION

This section outlines the steps used to identify the Crown Forest Management Land Base (CFMLB) and the timber harvesting land base (THLB) for the TSA. This simplified land base classification is intended for analysis purposes and does not confer or imply additional management restrictions. The CFMLB consists of provincial Crown land with forest cover that is managed by FLNRORD for timber supply and/or other forest management objectives that impact timber supply within the Section 8 Decision Area. The CFMLB excludes:

- Non-provincial lands that are not within the decision land base, such as:
  - private lands; and,
  - lands under federal jurisdiction (e.g., National Parks and Indian Reserves).
- Provincial lands managed under another Section 8 Decision Area, such as:
  - Pacific TSA lands;
  - community forests (CFs);
  - tree farm licences (TFLs);
  - controlled recreation areas;
  - woodlot licences (WLs);
  - Land Claim Settlement Areas; and,
  - First Nations woodland licences (FNWLs).
- Non-forested and unproductive lands with no impact on forest management objectives.

The THLB is that portion of the CFMLB that is identified and modelled as available for timber harvesting. Any area that might be harvested is included in the THLB (modelled), even if the area is subject to other management objectives such as wildlife habitat that limits timber harvesting. The THLB excludes:

- parks and protected areas;
- areas that are estimated as being not suitable for timber production; and,
- areas where timber harvesting is fully incompatible with management objectives for other resource values.

The above definition for THLB and its complement, non-harvestable land base (NHLB), are strictly model constructs. Operationally, areas classified as NHLB are sometimes harvested, while some areas classified as THLB may never be harvested.

The table below, commonly called the netdown table (Table 7), summarizes the classification of each factor excluded from the CFMLB and THLB. The netdown process is exclusionary (i.e., the area of a polygon can only be excluded once), which begins with the total Section 8 Decision Area and gradually accounts for each netdown factor in a hierarchical order. However, polygons may overlap with multiple netdown factors (e.g., same polygon could be riparian and wildlife reserve at the same time). Consequently, gross area is always equal to or greater than the netdown area, while the difference from previous netdowns is accounted for each factor as the effective area.

This netdown table is a draft and is subject to change based on input received during the public and First Nations review period for the draft *Data Package*. Each factor in this table is further described in subsections below.

Table 7. Netdown table to identify the CFMLB and THLB

Factor	Total area (ha)	Effective area (ha)	% of total TSA	% of CFMLB
Total area	1,906,100			
less:				
Pacific TSA	26,018	26,022		
TFLs	145,611	145,613		
Total Sunshine Coast TSA		1,734,471	100.0%	
Managed licence	199,571	199,571	11.5%	
Non-Crown from F_OWN	792,094	449,746	25.9%	
Non-FMLB from VRI	1,221,330	635,249	36.6%	
Non-VRI FWA water	401,519	754	0.0%	
No species information	1,110,955	2,509	0.1%	
Roads and utilities	16,326	6,229	0.4%	
Total CFMLB		440,414	25.4%	100.0%
Less spatial:	within CFMLB			
Parks	30,115	30,115	1.7%	6.8%
WHA	12,470	12,470	0.7%	2.8%
UWR	25,226	24,642	1.4%	5.6%
OGMA	46,734	27,920	1.6%	6.3%
Arch buffer	261	156	0.0%	0.0%
Recreation sites and trails	789	226	0.0%	0.1%
Permanent sample plots	194	186	0.0%	0.0%
Potentially unstable terrain V/ES1	83,454	54,544	3.1%	12.4%
Environmentally Sensitive Areas	28,703	7,152	0.4%	1.6%
Inoperable	156,688	57,960	3.3%	13.2%
Low volume	21,790	11,009	0.6%	2.5%
Riparian buffers	14,793	8,646	0.5%	2.0%
Less aspatial:				
THLB aspatial factor <30%	1	1	0.0%	0.0%
Terrain IV + ES2 (30%)		4,293	0.2%	1.0%
Slope >60% outside TSM (>32.3%)		4,897	0.3%	1.1%
Wildlife Tree Retention		7,199	0.4%	1.6%
Effective THLB		**188,998**	**10.9%**	**42.9%**

Data source and comments:

Section 8 Decision Area includes timber licence areas that will revert to TSA once harvested.

Ungulate winter range (u-2-004), terrain stability, and wildlife tree retention area (WTRA) have aspatial reductions. The aspatial reductions are not cummulative within each polygon. Rather, the highest THLB reduction accounts for all other CFMLB reductions while the road and utility right-of-way reductions take precedence over CFMLB reduction (i.e., roads + CFMLB always equals 100% while CFMLB is the remnant of the polygon after road reductions).

In the netdown table, estimates of aspatial wildlife tree retention are based on an assumption that 50% of the targets are already met through overlaping spatial requirements. These figures will be updated later, according to the procedure described in Section 5.22.

Polygons where the THLB aspatial factor is < 30% (i.e., retention of 70% or more) will be considered non-harvestable CFMLB.

5.1 Timber supply area boundary

The total area of the Sunshine Coast TSA is 1.734 million hectares after excluding the Pacific TSA blocks 21-23 and non-provincial Crown lands (e.g., TFLs, woodlots) that do not contribute to the AAC as determined for timber supply areas under the *Forest Act* Section 8.

Data source and comments:

BCGW file: WHSE_ADMIN_BOUNDARIES.FADM_TSA

Forest tenures were assigned based on the spatial layer provided by district staff (f_own_updated). Ocean was identified where ownership IS NULL.

5.2 Non-provincial Crown lands

Land not administered by the FLNRORD for timber supply includes area identified as non-provincial Crown land, such as private land, municipal land, federal land, and Indian Reserves. Table 8 shows the contribution of each ownership category to the CFMLB and the THLB.

Table 8. Non-provincial Crown lands

Ownership code – description	Within CFMLB	Within THLB
40N: Private	No	No
41N: Land Claim Settlement Area	No	No
50N: Federal Reserve	No	No
52N: Indian Reserve	No	No
53N: Federal – Military Reserve	No	No
54N: Federal – Dominion Government Block	No	No
91U: Unknown Ownership/Exceptions	No	No
99N: Crown Misc. Lease (Fairground, R&G Club site, recreation cottage site)	No	No
99U: Crown Misc. Lease	No	No

Data source and comments:

Land ownership was assigned based on the spatial layer from the Crown land registry and the Integrated Cadastral Information Society as provided by district staff. Non-provincial Crown lands includes ownership codes that occur in the TSA as described Table 8. Areas previously classified as '91U' (unknown) were updated to the appropriate code by district staff.

5.3 Forest tenures

A variety of area-based tenures exist within the Sunshine Coast Natural Resource District but are not considered within the Section 8 Decision Area: tree farm licences, community forest agreements, woodlot licences, and First Nations woodland licences. As these tenures have separate AAC determination processes, they were excluded from the CFMLB and THLB (Table 9), compared to other forest tenures for the Section 8 Decision Area.

Table 9. Forest tenures

	Ownership code - description	Within CFMLB	Within THLB
Excluded	70U: Crown Tenure – Timber Licence in TFL	No	No
	72A&B: Crown Tenure – Tree Farm Licence	No	No
	75N: Crown Tenure – Christmas Tree Licence	No	No
	77A&B: Crown Tenure – Woodlot Licence	No	No
	78B: Crown Tenure – First Nations Woodland Licence	No	No
	79A&B: Crown Tenure – Community Forest Agreement	No	No
	80N: Crown – Municipal Parcels	No	No
	Controlled Recreation Areas	No	No
Included	60N: Crown – Conservancy Area, Ecological Reserve, Protected Area, Provincial Park	Yes	No
	61C: Crown – UREP (Use, Recreation and Enjoyment of the Public Reserve)	Yes	Yes
	62C: Crown – Forest Management Unit	Yes	Yes
	68U: Crown – Forest Recreation Reserves	Yes	Yes
	69C: Crown – Community Watershed	Yes	Yes
	69U: Crown – Watershed Reserve	Yes	Yes
	70U: Crown – Active Timber Licence in TSA*	Yes	Yes
	81U: Crown – Local/Regional Park	Yes	No

** Timber licences will be included in the THLB layer but will not contribute to the THLB until the expiry of the TL.*

Data source and comments:

The spatial layer f_own_updated was improved by district staff in April 2017.

5.4 Timber licence reversions

Timber licences (TL) are a form of area-based timber tenure originally granted in the early 1900s that gave holders the exclusive right to harvest merchantable timber, defined in the *Forest Act* as older than 75 years in 1975, from a defined area of Crown land. Once the forest is re-established, the licensee will request the area to be removed from the TL where it reverts to the Section 8 Decision Area. There are currently 19 active TLs within the Sunshine Coast TSA (Table 10).

Assuming the remaining TL reversion into the Section 8 Decision Area will be completed over the next 20 years, the model will be configured accordingly:

- Initially, stands classified as THLB will not be available for harvest but stands classified as CFMLB will contribute towards non-timber objectives.
- Stands currently older than 120 years will be scheduled for harvest at the end of the second decade but the timber harvested will be excluded from the harvest forecast.
- At the end of the second decade, all THLB within TLs will be added into the Section 8 Decision Area.

Table 10. Timber licences

Timber licence	Non-CFMLB (ha)	CFMLB (ha)	Effective THLB (ha)
T0033	3	19	7
T0041	4	98	24
T0048	0	8	0
T0147	0	318	45
T0162	1	12	7
T0383	42	179	106
T0392	0	154	20
T0395	17	48	29
T0404	4	109	79
T0656	132	702	273
T0661	0	161	42
T0666	17	500	408
T0669	11	54	28
T0704	1	55	48
T0707	12	482	388
T0712	3	160	117
T0780	5	251	170
T0788	2	252	162
T0790	8	234	137
Total	**262**	**3,795**	**2,089**

Data source and comments:

BCGW file: WHSE_FOREST_TENURE.FTEN_TIMBER_LICENCE_POLY_SVW (for expiration) and Tenures Branch (for list of active TLs).

5.5 Non-forest

Generally, non-forested lands do not contribute to or impact timber supply. Consequently, these lands are excluded from the CFMLB.

Areas classified in the VRI as non-forest, very low productivity, and non-commercial will be excluded from the forested land base used to assess non-timber objectives (Table 11). Except where stands have been previously logged, areas classified as ‘non-treed’, with a site index less than five metres, or ocean, alpine, wetland, lakes, rocks, shrubs, etc., are excluded from the CFMLB. In addition, areas that were misclassified as non-forested in the VRI (e.g., lakes, wetlands, rivers) or areas with no logging history and no species information (typically transmission lines, wetlands, and avalanche tracks) will also be excluded from the CFMLB.

Table 11. Description of non-forest, very low productivity and non-commercial areas

Description	Total area (ha)	Effective area (ha)
FMLB = N (no logging history)	1,221,330	635,249
Water body where FMLB = Y	401,519	754
No species information (no logging history)	1,110,955	2,509
Roads and utilities	16,326	6,229
Total	**2,750,129**	**644,741**

Data source and comments:

BCGW files: WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY (2020 projection), WHSE_BASEMAPPING. FWA_WETLANDS_POLY, WHSE_BASEMAPPING. FWA_LAKES_POLY, and WHSE_BASEMAPPING. FWA_RIVERS_POLY.

5.6 Roads and utility lines

Included in the non-forest areas described above (Table 11), the CFMLB is decreased as new permanent roads, trails and landings, and utility right-of-ways are constructed. Because these will change as new blocks are harvested, this analysis accounts for existing and future reductions differently, as described below.

Existing roads and utility lines

Several provincial sources of information on roads and utility lines are available for the Sunshine Coast TSA. The Provincial Consolidated Roads layer created for use in provincial cumulative effects projects is a composite of multiple spatial data sources (Digital Road Atlas, Forest Tenures, Terrain Resource Information Management (TRIM), Oil and Gas Commission, and RESULTS). The Forest Tenure Road Section Lines (FTEN) layer provides additional road coverage for recently harvested cutblocks. The two road layers will be consolidated (i.e., FTEN layer buffered by seven metres to remove duplicates with the DRA, then merged with the DRA), and a road class assigned to each segment using existing information from the two road layers. Finally, road buffers will be applied (Table 12) to account for disturbed areas that are no longer considered forested. Other features such as transmission lines, railways and pipelines have been sourced from the Tantalis right-of-way polygon dataset.

Table 12. Roads and utility lines

Class	Length (km)	Buffer width* (m)	Total area (ha)
Highway	272	18	680
Primary main	637	13	839
Secondary main	2,669	11	2,903
Tertiary road	8,442	9	7,139
Communication			6
Pipe line	218		303
Power line	505		7,143
Transportation			16
Water power			782
Other			204
Total area			20,015

** Total buffer width applied to both sides of the feature centreline.*

Future roads, trails, and landings

Where existing road sections are not maintained or re-constructed, much of the area currently classified as rough roads and removed from the productive forest will eventually become overgrown by the forest. District staff are satisfied that as the land base approaches a normal age class distribution, this increase in productive forest is roughly offset by permanent access structures needed to develop future harvest areas, and the overall disturbance is expected to remain fairly stable over time. Thus, no future reductions for roads, trails, and landings will be applied in this analysis.

Data source and comments:

The previous TSR used an average 10-metre buffer width for all rough road segments. Licensee data sampled over seven years showed average widths of disturbed area for rough roads to be closer to nine metres. Average widths for highway, main, and secondary roads were estimated throughout the TSA using available imagery.

Digital Road Atlas: WHSE_BASEMAPPING.DRA_DGTL_ROAD_ATLAS_MPAR_SP

Forest Tenure Road Section Lines:
WHSE_FOREST_TENURE.FTEN_ROAD_SECTION_LINES_SVW

Transmission Lines (other right-of-way): WHSE_TANTALIS.TA_CROWN_RIGHTS_OF_WAY_SVW

5.7 Parks and ecological reserves

The total land base in the Sunshine Coast TSA includes 3.6% (62 287 hectares) that is provincially designated for the protection of its natural environment. Such protection is afforded under various designations including Crown Ecological Reserve, Crown Provincial Park Class A, Crown Provincial Protected Areas, and Regional Parks.

Provincial Class A Parks preserve the natural environment and provide public use and enjoyment. There are 45 Class A parks in the Sunshine Coast TSA, ranging in size from 0.5 hectares (Sechelt Inlets Marine Park) to 19 758 hectares (Bishop River Park).

Protected areas generally have one or more existing or proposed activities that are not usually allowed in a park (e.g., industrial roads). The two protected areas in the Sunshine Coast TSA are Duck Lake (768 hectares) and Homathko River-Tatlayoko (18 449 hectares).

Ecological reserves preserve representative and special natural ecosystems, plant and animal species, features and phenomena. The two ecological reserves in the Sunshine Coast TSA are Ambrose Lake (295 hectares) and East Redonda Island (6184 hectares).

Local and regional parks are municipal or regional district lands designated by local government agencies and managed for public enjoyment, ecosystem or wildlife values. A total of 55 (3804 hectares) in local and regional parks range in size from 0.1 hectares (Oyster Point) to 932 hectares (Dakota Ridge Winter Recreation Area).

While they contribute to the CFMLB, Parks, Protected Areas, Ecological Reserves, and Regional Parks are completely removed from the THLB (Table 13).

Table 13. Protected areas

Park category	Non-CFMLB (ha)	CFMLB (ha)
Ecological Reserve	980	5,514
Protected Area	174	595
Provincial Park	30,491	22,154
Regional Park	527	1,852
Total	**32,172**	**30,115**

Data source and comments:

Protected areas were sourced from BCGW file WHSE_TANTALIS.TA_PARK_ECORES_PA_SVW, while Local and Regional Parks were provided by district staff (f_own_updated (81U)).

5.8 Wildlife habitat areas

Wildlife habitat areas (WHA) are mapped areas that meet the critical habitat requirements and establish where activities are managed to limit their impact on an Identified Wildlife element. The purpose of WHAs is to conserve those habitats considered most limiting to a given Identified Wildlife element. The impact to timber supply varies among WHAs due to the associated general wildlife measures and the forest composition. While the majority of WHAs require no harvest activities, the Stickleback WHA allows conditional harvesting using operational practices that cannot be explicitly modelled in this analysis. Approved WHAs have been established in the Sunshine Coast TSA for grizzly bear, Marbled Murrelet, Vananda Creek Stickleback, and Northern Goshawk (Table 14). Additional WHAs are also proposed for Northern Goshawk.

Table 14. Wildlife habitat areas

Species	Status	# WHAs	Non-CFMLB (ha)	CFMLB (ha)	Effective THLB (ha)	Management activity
Grizzly Bear	Approved	152	23,227	4,629	0	No harvest or road construction
Marbled Murrelet	Approved	85	3,008	6,208	0	No harvest or road construction
Northern Goshawk	Approved	5	255	770	0	No harvest or road construction
Northern Goshawk	Proposed	7	438	1,029	0	No harvest or road construction
Stickleback	Approved	1	52	580	417	Avoid road construction; harvest and silviculture activities must not cause any erosion or sediment delivery into water features.
Stickleback	Approved	1	40	200	0	No harvest or road construction
Total*		**251**	**27,020**	**13,416**	**417**	

**Does not consider overlaps between various WHAs that are adjusted in the netdown table (Table 7).*

Generally, when a WHA is established, the outstanding amount is reduced by the applicable amount designated in the Section 7 Notice for Species at Risk (FPPR) for an Identified Wildlife element. A Section 7 Notice for Coastal Tailed Frog establishes a target of 30 hectares of suitable habitat with a maximum impact of 20 hectares mature timber from the THLB. However, there are no immediate plans to establish a WHA for this species. Given the relatively small area impacted by the Coastal Tailed Frog Section 7 Notice (20hectares mature THLB), no management activity will be modelled in this analysis because it is expected to achieve the target from riparian and wildlife tree patch retention.

In February 2018, the Province announced a plan for further protection of Marbled Murrelet and Northern Goshawk nest/breeding areas through the release of implementation plans for each species. The implementation plans commit to increasing protected areas for both species over the next 5-7 years. The distribution of these new protected areas has yet to be determined, but the existing proposed WHAs in the TSA would be considered likely candidates to help meet the additional objectives. Only the approved WHAs will be removed in the established and current scenarios and the proposed WHAs will be removed in a sensitivity analysis.

Data source and comments:

BCGW files: WHSE_WILDLIFE_MANAGEMENT.WCP_WILDLIFE_HABITAT_AREA_POLY, WHSE_WILDLIFE_MANAGEMENT.WCP_WHA_PROPOSED_SP. Individual wildlife habitat area information (spatial data set, approved order and general wildlife measures) is available from: https://www.env.gov.bc.ca/wld/frpa/iwms/wha.html.

Both approved and proposed WHAs are included in this analysis.

Section 7 Notices for Species at Risk: http://www.env.gov.bc.ca/wld/frpa/notices/sar.html

5.9 Ungulate winter range

An ungulate winter range (UWR) is an identified area that contains habitat necessary for the winter survival of various ungulate species. There are three applicable Government Action Regulation Orders for mountain goat (Table 15) that fulfill the target established for in the Section 7 Notice for the winter survival of ungulate species in the Sunshine Coast TSA. The remaining timber supply impact budget from the Section 7 Notice will be used in developing a deer winter range plan.

Table 15. Ungulate winter ranges

Species	UWR	Status	# units	Non-CFMLB (ha)	CFMLB (ha)	Effective THLB (ha)	Management activity
Mountain Goat	u-2-003	Approved	280	21,708	25,226	0	No harvest
	u-2-004*	Approved	62	13,031	8	0	50-95% retention
	u-2-015	Approved	57	13,327	0	0	No harvest
Total			**399**	**48,065**	**25,233**	**0**	

**u-2-004 is initially assigned to THLB, yet THLB polygons with retention >70% are re-assigned to NHLB later in the netdown process. U-2-004 area overlap with CFMLB has an 80% retention requirement.*

Since candidate areas for black-tailed deer winter range were first drafted in 2014, significant changes have been made to reduce impacts, align with 2021 deer suitability model outputs, include feedback from First Nations, accommodate licensee interest areas (where significant investments have been made), co-locate with established designations for other wildlife values and land use, and improve boundaries. Since no management activities have been developed for the draft black-tailed deer winter ranges (228 units), no modelling assumptions for will be included with this TSR.

There are no immediate plans to develop Government Action Regulation Orders for Roosevelt Elk.

Data source and comments:

BCGW files: WHSE_WILDLIFE_MANAGEMENT.WCP_UNGULATE_WINTER_RANGE_SP, WHSE_WILDLIFE_MANAGEMENT.WCP_UNG_WNTR_RNG_PROPOSED_SP.

5.10 Old growth management areas

Old growth forests are considered a key biodiversity component and a coarse filter for maintaining ecological diversity at the landscape level over time. It is recognized that old growth management areas (OGMA) are only one tool in maintaining biodiversity. Old growth attributes are also managed across the landscape at a stand level and may be included via other fine filter tools such as wildlife tree patches, wildlife habitat areas, or other tools used to capture specific features important to old growth and biodiversity goals. OGMAs are usually comprised of 'old forests' but may also capture younger forests or unusual/rare features that have importance to the landscape as a whole.

Landscape-level biodiversity objectives for old-seral forest types originate from the Order Establishing Provincial Non-Spatial Old Growth Objectives (NSOGO). Following NSOGO, spatial OGMAs were established through Ministerial Orders for Land Use Objectives. Some LUs have legal OGMAs, some have non-legal OGMAs (meeting the intent of the NSOGO), and others continue to follow the NSOGO either aspatially according to Biodiversity Emphasis Option (BEO) and Natural Disturbance Type (NDT) or spatially through licensee developed draft OGMAs that meet the NSOGO (Table 16).

Table 16. Direction for old growth management areas by landscape unit

Legal order	Legal order	Non-Legal	NSOGO (BEO)
Brittain	Jervis	Bunster*	Bishop (Intermediate)
Bunster	Lois	Chapman*	Brem (Intermediate)**
Bute East	Quatam	Cortes*	Deserted (High)**
Bute West	Salmon Inlet	Haslam	Narrows (Intermediate)**
Chapman	Sechelt	Homfray*	Toba (High)**
Cortes	Skwawka	Howe*	
Homathko	Southgate	Jervis*	
Homfray		Salmon Inlet*	
Howe		Sechelt*	
		Texada	

**LUs with both legal and non-legal OGMAS.*
***Licensee draft OGMAs will be included in a sensitivity analysis*

Within the legal and non-legal OGMAs, certain operational activities are generally permissible if necessary, however incursions must be replaced. The same approach applies for the licensee draft OGMAs.

For this analysis, all legal and non-legal OGMAs will be removed from the THLB, while aspatial targets established under the NSOGO will be applied to LUs as described in Section 6.3.1. A sensitivity analysis will also be done to replace the NSOGO targets by removing licensee draft OGMAs from the THLB, where available.

Data source and comments:

BCGW file: WHSE_LAND_USE_PLANNING.RMP_OGMA_NON_LEGAL_CURRENT_SVW, WHSE_LAND_USE_PLANNING.RMP_OGMA_LEGAL_CURRENT_SVW.

Powell Lake LU OGMAs are entirely out of the CFMLB for the Section 8 Decision Area.

5.11 Strategic land use plan for the shíshálh Nation

The shíshálh Nation Strategic Land Use Plan is a high-level strategic plan developed in 2007 that expresses the land use interests of the shíshálh Nation. The plan was not legally established at the time of this analysis, but it provides general direction for management activities within several established land use zones.

The plan includes eight conservation areas that cover approximately 70 491 hectares and 14 cultural emphasis areas that cover approximately 140 212 hectares (Table 17) distributed across the TSA. The current practice scenario will exclude the conservation areas. Less than 5% of the THLB was harvested from these conservation areas over the past decade. To better understand how these areas contribute to the harvest flow, the sensitivity analysis removing avoidance areas will also exclude these conservation areas. It is assumed the cultural emphasis areas will be managed operationally, with any excluded areas incorporated into existing netdowns (i.e., riparian, WTRA). These will remain in the THLB.

Table 17. Conservation and cultural emphasis areas for the shíshálh Nation

Type	Name	Non-CFMLB (ha)	CFMLB (ha)	Effective THLB (ha)
Cultural Emphasis Area	No Name	196	23	0
	?iy ch'ach'tl-am CEA	3,531	8,927	5,329
	ayl'-khain CEA	3,368	7,529	3,675
	kalpilin-stsexwena CEA	5,903	7,821	4,529
	kelkalaxay-stenput CEA	3,968	10,382	3,558
	lhawtikan CEA	715	6,137	3,702
	s-tikiw-shen tselalh CEA	712	0	0
	s-xweit-ay CEA	1,550	1,056	566
	skwakwiyam CEA	6,128	10,296	3,950
	slhilhem CEA	3,167	8,911	1,881
	stl'ikwu CEA	1,996	375	301
	stl'ixwim-kekaw CEA	8,895	16 382	7,928
	swiwelat CEA	4,987	1,411	310
	ts'ukw'um stulu CEA	939	130	64
	ts'unay CEA	7,768	7,212	3,047
Conservation Area	No Name	11	12	0
	kelkalaxay-stenput CA	3,210	863	171
	selkant kwatamus CA	0	86	4
	skw'akw'u-xenichen CA	27,186	11,464	3,657
	spipiyus swiya CA	703	13,896	9,101
	sta'als CA	0	151	119
	tikin CA	0	9	2
	ts'ukw'um stulu CA	8,097	4,800	1,062
Total		**93,032**	**117,875**	**53,003**

Data source and comments:

https://shishalh.com/wp-content/uploads/2018/10/SLUP.pdf

5.12 Archaeological sites

Archaeological sites are locations where there is physical evidence of how and where people lived in the past. Once identified, these sites are protected under the *Heritage Conservation Act.* A permit issued by the FLNRORD Archaeology Branch is required to conduct activities within the boundaries of an archaeological site. Examples of these sites include, but are not limited to, those containing physical evidence of human use or activity predating 1846, burial places, and Indigenous rock carvings or paintings. These sites, along with the Archaeological Overview Assessments, are recorded in the Province of BC's Remote Access to Archaeological Data.

A total of 451 archaeological sites have been recorded throughout the Sunshine Coast TSA. In all modelling scenarios, these sites and a 50-metre buffer around them will be excluded from the THLB.

In most cases where a new potential archaeological site is identified, the licensee, along with an archaeologist, operationally assess the identified area(s), follow-up with the First Nations who assert traditional territory in the identified area and FLNRORD, and where required, apply for an alteration permit under the *Heritage Conservation Act*.

While potential archaeological sites are not modelled directly in the current analysis, they are expected to be operationally captured under other modelling considerations. For example, a newly discovered archaeological site may be incorporated into a wildlife tree retention area or, if adjacent to a stream, be included in a stream reserve area. Licensees, when placing a wildlife tree retention area, have flexibility on location and generally choose to anchor the reserve on key features (i.e., unique ecosystems, key wildlife trees, archaeological sites). This TSR accounts for future WTRAs (aspatially) and riparian reserves on the stream network on the land base, so if an archaeological feature coincides with those future reserves it is addressed. All archaeological sites are recorded in BC's Remote Access to Archaeological Data, and would then be captured spatially in future TSRs.

Data source and comments:

BCGW file: WHSE_ARCHAEOLOGY.RAAD_TFM_SITES_SVW.

5.13 Cultural heritage sites

The *Forest and Range Practices Act* defines a cultural heritage resource as an object, site or location of a traditional societal practice that is of historical, cultural, societal or archaeological significance to the province, community or an Aboriginal People. These sites can include, but are not limited to, archaeological sites, structural features, linear features such as trails, heritage landscape features, guide outfitter and trapline interests, and traditional use sites, polygons and lines.

First Nations access cultural cedar on both the THLB and CFMLB. There is continued demand for cultural cedar and an expectation that a sustainable supply is maintained into the future. This analysis will provide statistics on cedar by age class on the land base over time.

For this analysis, the protection of cultural heritage resources will be considered to be addressed through other modelling assumptions (e.g., archaeological sites, wildlife tree retention, and riparian).

5.14 Recreation sites and trails

Recreation areas are associated with special features on the land base that are important for public and commercial recreation activities, such as wildlife viewing areas, camp sites, and sheltered moorage areas, can result in the exclusion of harvest activities.

Recreation tenures established under Government Action Regulation and identified spatially in the FTEN recreation polygon coverage will be removed from the THLB (Table 18). In addition, active recreation sites and trails spatially identified in the FTEN recreation inventory will be removed from the THLB. Harvesting within recreation areas is sometimes possible under an authorization issued through Section 16 of the *Forest Recreation Regulation*. Finally, to account for the reduced harvest opportunities, a more restrictive forest cover requirement will be applied to operable stands within the community interface zone (Section 6.3.5).

Areas designated as Crown Use, Recreation and Enjoyment of the Public (UREPs) fall under *Land Act* reserves but without further designation under other legislation they are not reserved from harvest. These areas are considered in Section 5.3.

Table 18. Considerations for recreation areas

Category	Within CFMLB	Within THLB	Non-CFMLB (ha)	CFMLB (ha)
FTEN Recreation Reserves and Active Recreation Sites	Yes	No	896	681
FTEN Recreation Trails (20 m buffer)	Yes	No	348	108
Total			**1,244**	**789**

Data source and comments:

BCGW files: WHSE_FOREST_TENURE.FTEN_RECREATION_POLY_SVW and WHSE_FOREST_TENURE.FTEN_RECREATION_LINES_SVW.

5.15 Growth and yield permanent sample plots and research installations

Across the province, a network of growth and yield permanent sample plots (PSP) is maintained by FLNRORD for the purposes of understanding forest growth and calibrating growth and yield models. Specific objectives for these plots have not been established under the *Forest Range and Practices Act*.

The objective for the PSP program is to maintain PSPs in perpetuity. An assessment of harvest practices in and around PSPs indicate that harvesting of active plots (within the plot and its buffer) is currently avoided. In this analysis, active plots plus a buffer distance of 100 metres will be removed from the THLB, regardless of the buffer identified in the dataset. There are 63 active PSPs within the Sunshine Coast TSA. An additional 36 PSPs were listed as inactive and were maintained in the THLB.

Data sources and comments:

BCGW files: WHSE_FOREST_VEGETATON.GRY_PSP_STATUS_ACTIVE and WHSE_FOREST_VEGETATION.RESPROJ_RSRCH_INSTLTNS_GOV_SVW.

5.16 Karst resources

Karst is a distinctive geological feature that develops over thousands of years from the dissolving action of water on carbonate bedrock, usually limestone, dolomite or marble. This geological process results in a unique landscape that functions as a complex hydrogeoecosystem, comprised of four main components: land, water, air and biota. Values associated with karst include hydrology, high biodiversity, mineralogy, recreation, cultural, scientific, and economic (including forestry).

Where karst features are identified during operational planning, a qualified professional is engaged to assess their significance and to recommend how to best manage the area (i.e., wildlife tree retention area, harvest, incremental buffer, or propose WHA). In some cases, limestone areas are harvested, while in others, areas are reserved from harvest based on their significance under the Government Action Regulation Order and best management practices identified for site specific attributes in the *Karst Management Handbook for BC (2003)*. While small areas of potential karst features have been mapped on Texada Island, no specific modelling criteria will be applied in this analysis.

Data source and comments:

BCGW files: WHSE_FOREST_VEGETATION.REC_KARST_INV_SVW and WHSE_LAND_USE_PLANNING.RKPM_KARST_POTENTIAL_AREA_SP.

5.17 Potentially unstable terrain

Terrain stability mapping is an inventory where landslide hazards and risks or slope stability may be affected by existing or potential development. Where terrain stability mapping is absent, environmentally sensitive area (ESA) mapping will be used to identify unstable terrain. Areas with logging history or future short-term planned harvest are considered stable, otherwise all terrain stability class V and ESA

class ES1 areas will be 100% removed from the THLB, while 30% of the terrain stability class 4 and ESA class ES2 will be 30% removed from the THLB (Table 19).

Table 19. Description of potentially unstable terrain

Category	Reduction (%)	Non-CFMLB (ha)	CFMLB (ha)	Logged** (ha)	Effective THLB* (ha)
Terrain Class V	100%	15,941	16,426	1,820	0
ES1	100%	67,068	67,284	2,360	0
Terrain Class IV	30%	17,870	18,756	12,484	5,931
ES2	30%	19,571	15,981	3,719	4,086
Total		**120,450**	**118,446**	**20,382**	**10,017**

**Areas with logging history are not excluded from THLB.*
*** 3.5% and 8.0% of the harvested area over the past decade have come from areas classified V/ES1 and IV/ES2, respectively.*

Data source and comments:

The spatial information for potentially unstable terrain was combined from: Interfor and BC Timber Sales terrain stability mapping, TRIM slopes greater than 60%, and ESA soils data.

As described in the previous TSR, an aspatial reduction of 32.3% was applied to the THLB without terrain stability mapping with slopes greater than 60%.

5.18 Environmentally sensitive areas (ESA) and problem forest types

ESA mapping that identifies areas potentially susceptible to disturbance (e.g., difficult to reforest) will be used to exclude areas from the THLB. Areas classified as (1) very sensitive or (2) moderately sensitive to disturbance, and are both entirely removed from the THLB (i.e., ESAs (1) and (2) for regeneration, avalanche hazard, and water values) (Table 20).

Table 20. Description of environmentally sensitive areas

Category	Non-CFMLB (ha)	CFMLB (ha)	Effective THLB (ha)
Regeneration (P1 or P2)	44,295	27,782	868
Avalanche (A1)	2,736	2,290	48
Water (H1 or H2)	236	173	37
Total*	**47,267**	**30,245**	**954**

**Accounts for overlaps between each ESA category. Areas with logging history are not excluded from THLB.*

Data source and comments:

ESA mapping is quite dated and only applied where more current information is unavailable.

5.19 Inoperable areas

Operability mapping is based on the presence or absence of physical barriers or limitations to harvesting, applicable logging methods and the merchantability of stands (Table 21). Since physical and economic conditions are highly variable throughout the province, interpretation and mapping may vary between management units. Operability definitions may also change over time as technologies evolve and markets change.

The operability classification for most of the Sunshine Coast TSA is based on mapping completed by the BC Forest Service in 1992. This mapping was updated for portions of the TSA in 1998 and again in 2010, when licensees were asked to review their chart areas and estimate where future harvest would occur beyond the current operable areas. The minor changes proposed were reviewed by district staff and added to the existing operability map.

The operability classification for former TFL 10 was more recently included to develop a consolidated operability layer. Portions of this layer were classified as marginally operable and two operability classes were differentiated by slope: conventional for slopes <=70% and helicopter for slopes >70%. Finally, the consolidated operability layer was adjusted as operable for areas with previous logging history and future short-term harvest plans.

Table 21. Area identified as inoperable for harvesting

Description	Code	Non-CFMLB (ha)	CFMLB (ha)	Effective THLB (ha)
Inoperable*	I or N or no value	1,293,807	156,790	91
Conventional operability	A (C in TFL)	145,897	259,999	171,630
Helicopter operability	C (H in TFL)	25,447	23,624	11,387
Marginally operable	M (TFL 10 only)	536	0	0
Total		**1,465,687**	**440,414**	**183,108**

**Areas with logging history are not excluded from THLB. Does include area for factors netted out before inoperability.*

5.20 Sites with low timber growing potential

Sites may have low timber growing potential due to various site factors such as nutrient availability, exposure, excessive moisture, or because they are not fully occupied by commercial tree species. When considering site conditions related to operating costs, these stands are typically unlikely to grow a merchantable crop of trees.

Where logging history is absent, stands with non-commercial species and stands unable to reach the minimum volume criteria by age 150 will be 100% removed from the THLB (Table 22). These minimum volume criteria were determined according to leading species and harvest method.

Table 22. Summary of stands with low timber growing potential

Leading species	Harvest method	Minimum m^3/ha @ 150 years	Non-CFMLB (ha)	CFMLB (ha)
Cedar	Conventional	300	786	956
	Helicopter	400	298	198
Douglas-fir	Conventional	300	3,299	5,759
	Helicopter	400	574	1,039
Hemlock/Balsam/Spruce	Conventional	300	3,405	3,905
	Helicopter	400	931	1,298
Pine/Birch	Conventional	All	1,724	2,320
	Helicopter	All	29	156
	Inoperable	All	1,634	2,771
Aspen	Conventional	All	0	15
	Helicopter	All	0	0
Cottonwood/Maple	Any	300	759	773
Red Alder	Any	250	443	2,600
Total			**13,881**	**21,790**

Data source and comments:

The projected volume from natural yield curves at age 150 is used to determine merchantability.

Non-commercial species may include stands that are physically operable and exceed low site criteria but are not currently utilized. For instance, pine- and birch-leading stands were excluded from the THLB.

5.21 Riparian reserve and management areas

Riparian areas frequently contain the highest number of plant and animal species found in forests, and provide critical habitats, home ranges, and travel corridors for wildlife. These areas maintain ecological linkages throughout the forest landscape, connecting hillsides to streams and upper headwaters to lower valley bottoms.

Riparian management objectives have been established to minimize or prevent impacts of forest and range activities directly on aquatic resources values (e.g., water quality, aquatic ecosystems) and the values in the surrounding area (e.g., wildlife habitat). Objectives for riparian management are identified under the Forest Planning and Practices Regulation (FPPR) and incorporated into Forest Stewardship Plans.

Implementation of objectives include establishment of riparian reserve zones and/or riparian management zones based on the identified classification for lakes, wetlands, and streams (as per FPPR). Lake and wetland classification is based on feature size and BEC. Stream classification is based on stream width, fish presence and community watershed status. Riparian reserve zones require full cover retention along the stream, lake, or wetland, while riparian management zones identify some retention requirements that must be met over the stream length or water body perimeter.

5.21.1 Streams and rivers

A stream reach is a relatively homogeneous section of a stream having a sequence of repeating structural characteristics (or processes) and fish habitat types. The key physical factors used to determine reaches in the field are channel pattern, channel confinement, gradient, and streambed and bank materials. Stream reaches generally show uniformity in these characteristics and in stream discharge. The FPPR classification for streams takes a simpler approach and is based on stream width and fish presence, and whether the streams are within a community watershed.

Since a consolidated spatial dataset of stream classification is not available, a modelled fish passage dataset will be used in the stream classification process. This modelled dataset was created in June 2019 by FLNRORD and is considered to be the best overall data available, despite some known limitations. The dataset is based on the freshwater atlas stream network, derived from TRIM I stream linework (TRIM II streams are not included). TRIM features are delineated through air photo interpretation and have varying degrees of accuracy, particularly when it comes to smaller streams. TRIM commonly under-represents the number of streams in the wetter, coastal areas of the province and field surveyors may regularly find small streams which do not exist in the model. The modelled stream classifications were originally created for the purposes of prioritizing sites for culvert assessment and remediation.

In the modelled fish passage data, all mapped streams downstream of known fish observation sites are considered viable fish habitat. Moving upstream from known fish observation sites, a stream is inferred to be potentially fish bearing until a known barrier to fish passage is encountered, after which it is considered non-fish bearing.

The fish passage data is used in combination with stream order data to assign the following stream classifications that are consistent with the FPPR:

- All streams downstream of a fish-bearing segment are also fish-bearing;
- Stream order 1 is S4 if fish-bearing or within a community watershed, otherwise S6;
- Stream order 2 is S3 if fish-bearing or within a community watershed, otherwise S5;
- Stream order 3 is S2 if fish-bearing, otherwise S5;
- Stream order 3 is S3 if within a community watershed, otherwise S5;
- Stream order 4 is S1b if fish-bearing, otherwise S5;
- Stream orders 5, 6, 7 are S1b.

Linking stream order to stream classification is based on orthophoto review of stream order and licensee operational stream classifications. Overall, the riparian buffers generated by the modelled stream classification and effective buffer widths matched well with actual riparian reserves. The stream order divisions aligned most closely in areas where they could be correlated with field information. S1a streams were derived from a separate TRIM data layer for double-line rivers.

5.21.2 Lakes and wetlands

Properly functioning lakes store large amounts of water, are important in managing floods and droughts, and replenish groundwater, positively influencing water quality downstream and provide habitat for fish, invertebrates and birds. Lakes also provide important recreational and tourism opportunities. Lakes are well mapped in the province and spatial data is readily available. Lake classifications are based on lake size and the BEC unit in which they occur. The Sunshine Coast TSA includes two types of lakes: natural and reservoir (man-made).

A wetland is a swamp, marsh, or other similar area that supports natural vegetation that is distinct from the adjacent upland areas. More specifically, a wetland is an area where a water table is at, near, or above the surface or where soils are water-saturated for a sufficient length of time that excess water and resulting low oxygen levels are principal determinants of vegetation and soil development. Wetlands are mapped by the province and spatial data is readily available. The FPPR wetland classification is based on the size of the wetland, the BEC unit in which it occurs, and its proximity to other wetlands.

5.21.3 Riparian buffers

The FPPR defines the riparian reserve and riparian management zone widths for streams, lakes, and wetlands; these correspond to the older Forest Practices Code *Riparian Management Area Guidebook* widths. Once classified, streams, wetlands, and lakes are buffered according to the FPPR, Forest and Range Evaluation Program, and licensee current practice. Table 23 shows the widths for reserve and management zones plus the retention percentage within the management zone. The effective reserves buffer width combines the reserve zone and retained proportion of the management zone.

In this analysis, riparian buffers will be applied as spatial reductions to the THLB, using average buffer widths. In practice, these buffers can vary between blocks. Unless varied in an operational plan, the reserve zone is required on both sides of applicable streams. Management zone retention levels are flexible and are determined by forest professionals based on the site conditions.

Table 23. Riparian area description

Class	Definition	Reserve zone width (m)	Management zone width (m)	Percent (%) retention in management zone	Effective reserves buffer width* (m)
L1L	Lake > 1,000 ha	0	0	0%	0
L1	Lake > 5 ha	10	0	0%	10
L2	Lake 1-5 ha in CDF or CWHxm, dm, ds	10	20	25%	15
L3	Lake 1-5 ha	0	30	25%	7.5
L4	Lake 0.5-1 ha in CDF, CWHxm, dm, or ds	0	30	25%	7.5
NCL	Non-classified small lake				
W1	Wetland > 5 ha	10	40	25%	20
W2	Wetland 1-5 ha in CDF, CWHxm, dm, ds	10	20	25%	15
W3	Wetland 1-5 ha	0	30	25%	7.5
W4	Wetland 0.5-1 ha in CDF, CWHxm, dm, ds	0	30	25%	7.5
W5	Wetland complex	10	40	25%	20
NCW	Non-classified small wetland				
S1A	Stream >= 100 m wide	0	100	50%	50
S1B	Stream > 20 and < 100 m wide	50	20	50%	60
S2	Fish-bearing stream > 5 and <= 20 m wide	30	20	50%	40
S3	Fish-bearing stream 1.5-5 m wide	20	20	50%	30
S4	Fish-bearing stream < 1.5 m wide	0	30	25%	7.5
S5	Non-fish-bearing stream > 3 m wide	0	30	25%	7.5
S6	Non-fish-bearing stream <= 3 m wide	0	20	5%	0

**For linear feature the effective buffer width is applied equally on each side.*

Data source and comments:

Modelled Stream Classification: Fish Passage GIS Analysis (Version 2.2, BC Ministry of Environment), which is based on the following layers:

- Stream lines: BCGW file WHSE_BASEMAPPING.FWA_STREAM_NETWORKS_SP
- Point locations of known and recorded fish observations: BCGW file WHSE_FISH.FISS_FISH_OBSRVTN_PNT_SP
- Point locations of water obstacles: BCGW file WHSE_BASEMAPPING.FWA_OBSTRUCTIONS_SP
- Point locations of all known obstacles to fish passage from several fisheries datasets: BCGW file: WHSE_FISH.FISS_OBSTACLES_PNT_SP

Rivers: BCGW file WHSE_BASEMAPPING.FWA_RIVERS_POLY

Lakes: BCGW file WHSE_BASEMAPPING.TRIM_EBM_WATERBODIES. Lakes will be classified according to criteria above. NCL are all lakes less than the minimum size criteria.

Wetlands: BCGW file WHSE_BASEMAPPING.TRIM_EBM_WETLANDS. Wetlands that meet the proximity requirements for W5 classification will be classified accordingly, however buffers are still applied on the individual wetlands rather than the outer perimeter of the complex (assumption that identified buffers, merged, would approximate W5 retention).

5.21.4 Ocean buffer

Through the recent Integrated Stewardship Strategy, First Nations observed that buffers of undisturbed forest adjacent the ocean shoreline are maintained primarily to protect fish stocks. While actual widths vary considerably, an average 15 metre buffer along the Pacific Ocean shoreline, or 1105 hectares of CFMLB, will be included as riparian area that is 100% excluded from the THLB.

5.22 Stand-level biodiversity - wildlife tree retention

Biodiversity planning is a requirement under the *Forest and Range Practices Act* and done in accordance with the Landscape Unit Planning Guide (MFR, 1999). Objectives for retaining old growth forest and stand structure through wildlife tree retention are described in the guide (Section 5.2.11 of the Landscape Unit Planning Guide).

Legal orders that establish LUs include objectives that aim to maintain stand-level structural diversity by retaining wildlife retention areas (WTRA) within the boundaries of each cutblock to meet targets for each BEC subzone in the LU.

The *Forest and Range Practices Act* also establishes an objective to maintain structural diversity in managed stands by WTRA in each cutblock. The FPPR identifies the total WTRA required each year is a minimum of 7% of the total area of harvested cutblocks; for an individual cutblock the total WTRA is a least 3.5% of the cutblock. Licensees may vary the requirement by specifying an acceptable alternative in their Forest Stewardship Plan.

In practice, WTRAs often overlap with areas that are otherwise restricted from harvest with spatial or aspatial requirements; such as riparian areas, sensitive or inoperable terrain, habitat areas, and OGMAs. Therefore, the net THLB impact from WTRAs is typically much less than the established targets (Table 24). Actual WTRA results show that over the past decade, licensees have paid close attention to meeting these established targets.

In this analysis, past WTRAs will be spatially excluded from the THLB as polygons identified in RESULTS for blocks harvested from 2011 to 2020. Overlaps with other factors will be accounted for through the netdown process.

For future WTRAs, the THLB will be aspatially reduced where WTRAs cannot be aligned with other spatial netdown areas. A 200-metre buffer will be placed around forested stands outside of the timber harvesting land base where WTRAs are not required. Within the remaining THLB area, the THLB will be aspatially reduced according to the established targets (Table 24).

*Table 24. WTRA targets and actuals**

Landscape unit	BEC variant	WTRA (%)	Actual WTRA*
Bishop	All	7%	
Brem	All	7%	8.8%
Brittain	All	7%	11.0%
Bunster	CDFmm	7%	
	CWHdm	10%	10.5%
	CWHvm2	10%	10.8%
	CWHxm1	8%	9.8%
	CWHxm2	7%	
	MHmm1	6%	
Bute East	All	7%	9.5%
Bute West	All	7%	8.7%
Chapman	CWHdm	10%	13.0%
	CWHvm1	12%	
	CWHvm2	12%	
	CWHxm1	7%	10.8%
	MHmm1	6%	
Cortes	All	7%	10.8%
Deserted	All	7%	
Haslam	All	7%	9.0%
Homathko	CWHds1	9%	10.9%
	CWHms1	5%	
	ESSFmw	7%	
	MHmm2	4%	
Homfray	All	7%	9.3%
Howe	All	7%	14.7%
Jervis	All	7%	9.4%
Lois	CWHdm	14%	14.2%
Lois Narrows	CWHvm2	14%	13.2%
	CWHxm1	12%	
	CWHxm2	12%	
	MHmm1	11%	
	All	7%	8.6%
Powell Daniels	CWHdm	11%	
Powell Lake	CWHdm	10%	
Powell Lake	CWHvm1	12%	13.7%
	CWHvm2	12%	
	MHmm1	8%	
Quatam	All	7%	8.7%
Salmon Inlet	All	7%	9.5%
Sechelt	All	7%	11.9%
Skwawka	CWHdm	15%	
Skwawka Southgate	CWHvm1	11%	
	CWHvm2	11%	
	MHmm1	6%	
	MHmmp	6%	
	All	7%	9.7%
Texada	All	7%	10.1%
Toba	All	7%	

**Actual WTRA percentages summarized from RESULTS for blocks harvested from 2011 to 2020.*

Data source and comments:

BCGW files: WHSE_LAND_USE_PLANNING.RMP_LANDSCAPE_UNIT_SVW, WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY, and WHSE_FOREST_VEGETATION.RSLT_OPENING_SVW.

The previous TSR applied the same assumption for net THLB impact for WTRAs based on The Forest Practices Code Timber Supply Analysis, February 1996.

6 CURRENT FOREST MANAGEMENT ASSUMPTIONS

6.1 Harvesting

6.1.1 Recent harvest performance

Harvested volumes from the TSA have declined for an overall average of 86% of the AAC over the past decade and 70% over the past five years (Figure 2). Note that these volumes include harvest partitions for red alder and other deciduous-leading stands. Between 2011 and 2020, the actual harvest of red alder amounted to 30% of the 95 000 m³ partition, while the harvest of other deciduous species was over four times the 3000 m³ partition.

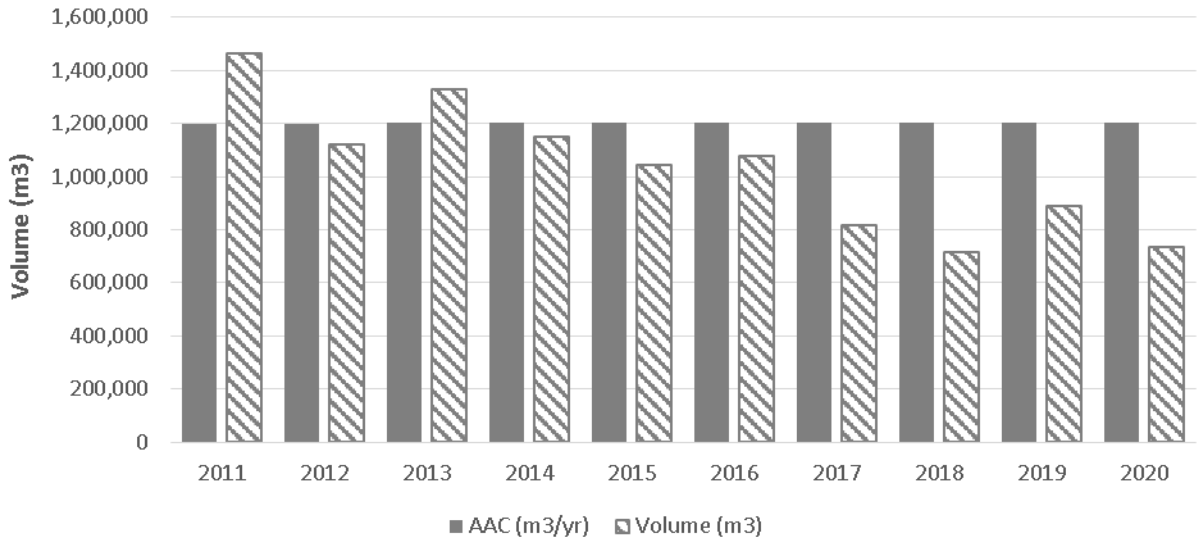

Figure 2. Annual harvest volumes compared to the allowable annual cut (AAC).

6.1.2 Merchantability specifications

The Coast Timber Merchantability Specifications in the *Provincial Logging Residue and Waste Measurement Procedures Manual* specify utilization levels for billing harvested timber used in monitoring the AAC. Utilization levels define the maximum stump height and diameter, minimum top diameter (inside bark), slab thickness, and log length. For yield table projections in the timber supply analysis, the specifications for minimum stump diameter are converted to a corresponding breast height diameter (DBH) (Table 25).

Table 25. Harvest merchantability criteria

Leading species and age	Slab thickness (cm)	Maximum stump height (cm)	Minimum top DIB (cm)	Corresponding minimum DBH (cm)
Conifer > 120 years	10 (15 for Cedar)	30	10	17.5
Conifer <=120 years	10 (15 for Cedar)	30	10	12.5
Red alder and other deciduous > 40 years	10	30	10	17.5
Red alder and other deciduous <= 40 years	10	30	15	12.5

6.1.3 Volume exclusions

In this analysis, stands with leading tree species that are considered non-merchantable (i.e., pine, aspen, birch) were removed from the THLB (Section 5.20). However, incidental harvest of these species from mixed-species stands, currently 2% of the available volume, will contribute to the harvest flow. This only applies to natural stands, as modeled volumes for existing and future managed stands do not include planting of these non-merchantable species. In practice, non-merchantable species can also contribute towards meeting stand-level biodiversity requirements (i.e., riparian, WTRA).

6.1.4 Minimum harvestable criteria

The minimum harvestable criteria is the earliest age or volume at which stands are considered to be economically viable for harvest within the timber supply model. Most stands are harvested well beyond the minimum harvestable criteria because of management objectives for other resource values (e.g., requirements for the retention of older forest for mature- or old-seral objectives) or because of optimizing a complex range of timber objectives (e.g., harvest profile, cutblock adjacency, sustainability criteria).

For this analysis, minimum harvest criteria will be set on managed stands only, as the age when a stand meets both of the following criteria:

- Minimum volume of 300 m³ per hectare for conventional harvesting and 400 m³ per hectare for helicopter harvesting. The minimum volume for alder-leading stands is 250 m³ per hectare.
- 95% of its maximum mean annual increment (MAI).

The minimum harvest age for existing natural stands will be set to age 40. These stands were established prior to 1977 and are expected to be ready for harvest anytime.

Data source and comments:

The previous TSR applied similar minimum volume criteria (by leading species and site productivity class), but not by harvest system and no criterion for age at MAI. From operational cruise data collected over the past decade, less than one percent of the total harvest was taken from stands below the minimum volume criterion.

6.1.5 Harvest scheduling and profile

The order that stands are harvested can influence the overall timber supply. Licensees select stands to harvest after considering many physical, economic, and environmental factors. Timber supply models provide several ways to control the harvest scheduling, such as maximum volume or hectare, oldest first, most productive first, youngest maximum mean annual increment age, or through optimization. This analysis will apply an optimization approach that first meets all non-timber objectives and then harvests timber volume as a by-product; profiled at a sustainable rate over the entire planning horizon (i.e., long-term harvest equals growth).

This analysis will initially report the harvest schedule over time by species. After these results are considered, a sensitivity analysis may be included to implement limits on harvesting key tree species.

Data source and comments:

The previous TSR used an oldest-first harvest scheduling approach, subject to all timber and non-timber objectives being met and applied minimum harvest levels for Douglas-fir- and redcedar-leading stands.

From operational cruise data collected over the past decade, less than one percent of the total harvest was taken from stands below the minimum volume criterion.

6.2 Silviculture

Since 1987, major licensees have had a legal responsibility for basic silviculture. To assess this requirement, licensees conduct regeneration surveys on each cutblock and report results in the FLNRORD database Reporting Silviculture Updates and Land Status Tracking System (RESULTS). Summary

information from RESULTS will be the basis for developing regeneration assumptions in this analysis.

6.2.1 Silvicultural systems

The most common silvicultural system applied in the Sunshine Coast TSA is clearcut with reserves. This system produces a range of opening sizes containing even-aged forests and cutting of adjacent openings is restricted until green-up conditions are met. The clearcut with reserve silvicultural system also maintains older forest patches within or adjacent to harvest blocks. These remnants are intended as wildlife tree patches, riparian areas, and island remnants to conserve old growth characteristics.

In this analysis, all harvesting will be modelled as the clearcut with reserves silvicultural system, considering areas that require increased wildlife tree retention (Section 5.22). Alternative silvicultural systems (e.g., group or individual selection cutting) may occasionally be considered adjacent to communities along the Strait of Georgia, but at this time they are not applied in the analysis.

6.2.2 Regeneration delay

Sometimes delays in regenerating stands can occur from the time a stand is harvested to when the site is in considered fully regenerated. Harvest openings throughout the Sunshine Coast TSA typically have no impediments to prompt and successful regeneration. However, some plantations may face challenges associated with cold sites at high elevation or browsing and trampling from wildlife.

Regeneration delay is applied as an input for developing yields for existing and future managed stands and ranges between 1 and 4 years depending on the analysis unit (see Appendix 1).

Data source and comments:

RESULTS database will be used to determine regeneration delays for existing and future managed stands.

6.2.3 Not satisfactorily restocked areas

The FLNRORD backlog policy defines not satisfactorily restocked areas as productive forest land denuded (bare) prior to 1987 that has not been regenerated to the desired stocking standards. In this analysis, not satisfactorily restocked areas are considered through regeneration delays sourced from the RESULTS database.

6.2.4 Incremental silviculture

Incremental silviculture practices, such as juvenile spacing and fertilization, are activities beyond those required to meet basic silviculture obligations.

RESULTS includes records of past juvenile spacing treatments on approximately 1080 hectares of stands established prior to 1999. Because the spatial for these treatments was absent, assumptions for the most likely stands suitable for juvenile spacing will be applied as Douglas-fir leading stands on cool, gentle zonal or enhanced sites in the CDF, CWHdm and CWHxm. It is estimated that the treatment left a residual stand of 600 stems per hectare and resulted in lower quality logs on higher productive sites (i.e., site index > 33 metres).

There are also limited records of other major juvenile spacing programs that occurred throughout the Sunshine Coast in the 1980s. Assumptions for the most likely stands suitable for juvenile spacing will be estimated to be Douglas-fir leading stands on cool, gentle zonal or enhanced sites in the CDF, CWHdm and CWHxm. Each treatment will leave a residual stand of 500-600 stems per hectare with no negative impact on log quality because these treatment involved thinning from below and well after significant inter-tree competition had started.

Past fertilization treatments were recorded in RESULTS and in B.A. Blackwell's historical fertilization records since 1996, for approximately 9300 hectares covered by unlogged Douglas-fir leading stands. Because the spatial data for these treated stands is absent, assumptions for the most likely stands suitable for fertilization will be applied as mature, managed Douglas-fir leading stands on non-constrained or non-enhanced sites. The age of stands at time of fertilization application will be 20-35 years (see Appendix 1 for complete regeneration assumptions).

Data source and comments:

Forest Ecosystem Solutions Ltd., B.A. Blackwell & Associates Ltd., and Ecologic Research. Integrated Stewardship Strategy, Sunshine Coast Timber Supply Area. Draft Data Package. Version 3.2. October 26, 2020.

BCGW file: WHSE_FOREST_VEGETATION.RSLT_ACTIVITY_TREATMENT_SVW.

6.3 Integrated resource management

The Crown forests of the Sunshine Coast TSA are managed for many values. Existing objectives and management strategies for these values are identified within various instruments including legislation, higher level plans, Orders issued through the *Forest Range and Practices Act* or *Land Act*, and approved Forest Stewardship Plans.

Multiple resource issues may be present on the same forested area. For example, an area that requires a minimum of mature- and old-seral forest may also be visually sensitive with specific visual objectives. Forest estate models can schedule harvest events to accommodate these overlapping objectives. The following sections describe forest cover objectives that will be applied in this analysis.

6.3.1 Landscape-level biodiversity

Managing for biodiversity is required under the *Forest and Range Practices Act*. To protect biodiversity at the landscape level, old forest is retained in every landscape unit (LU) according to its biodiversity emphasis option (BEO), and the appropriate natural disturbance type (NDT).

Old growth management areas (OGMAs – Section 5.10) were established for most LUs to simulate the geographic distribution of older forest characteristics across the Sunshine Coast TSA. For specific LUs without established OGMAs, forest cover requirements will be applied according to the Order Establishing Provincial Non-Spatial Old Growth Objectives (NSOGO - Table 26).

Table 26. Old seral stage requirements by LU and BEC

LU Name	BEO	NDT	BEC	Old definition (years)	Min target (%)
Bishop	Intermediate	NDT1	MH	>250	19
		NDT2	CWH	>250	9
			ESSF	>250	9
Brem	Intermediate	NDT1	CWH	>250	13
			MH	>250	19
		NDT2	CWH	>250	9
Deserted	High	NDT1	CWH	>250	19
			MH	>250	28
		NDT2	CWH	>250	13
Narrows	Intermediate	NDT1	CWH	>250	19
			MH	>250	28
		NDT2	CWH	>250	13
Toba	High	NDT1	CWH	>250	19
			MH	>250	28
		NDT2	CWH	>250	13

6.3.2 Cutblock size and adjacency

Cutblock adjacency objectives aim to ensure that the structural characteristics maintained after harvest are consistent with the temporal and spatial distribution of openings that would result from a natural disturbance. This is an important consideration for values related to hydrology and landscape-level biodiversity.

Under the FPPR, cutblock size on the BC coast is limited to a maximum 40 hectares. Larger openings may be created as long as the structural characteristics of the harvested cutblock resembles a naturally disturbed opening. The FPPR also specifies that timber must not be harvested on a new cutblock until the tallest trees on at least 75% of the net area to be reforested on all adjacent cutblocks are at least three metres in height, otherwise referred to as "green-up".

Cutblock size and adjacency requirements will be modelled using two approaches. First, a surrogate objective will be applied where the THLB area under three metres height within each LU is restricted to 25%. The age when each stand reaches three metres height will be determined for each stand as yield tables are developed (Section 6.4.3). Second, the spatial model will control adjacent harvesting by limiting the size of cutblocks less than 100 metres apart to 40 hectares in size. To accomplish this spatially, two harvest patch rules will be applied simultaneously (cutblock sizes and targets are detailed in Table 27):

- **Group cutblocks**: To account for riparian areas and road right-of-ways, openings harvested within a 10-year period and within 20 metres of each other will be grouped to a maximum size of 40 hectares. Figure 3 shows "X" representing the maximum distance used to group adjacent hatched openings. The hatched cutblocks are grouped into the contiguous black-coloured cutblock. Here, the model has the flexibility to change the spatial pattern of grouped cutblocks

over time to accommodate a complex range of management objectives that are sensitive to spatial arrangement of harvesting (e.g., visual objectives). To align better with operational reality, distribution of cutblocks is fine-tuned to control small openings (i.e., no blocks under one hectare but some between one and five hectares) and, where appropriate, allow cutblocks that exceed 40 hectares slightly (e.g., leaving a small area behind might make it too expensive to harvest it on a separate future cycle).

- **Separate cutblocks**: To implement the adjacency requirement, the model will be configured to maintain a minimum distance (Y) between adjacent, grouped cutblocks (black outline).

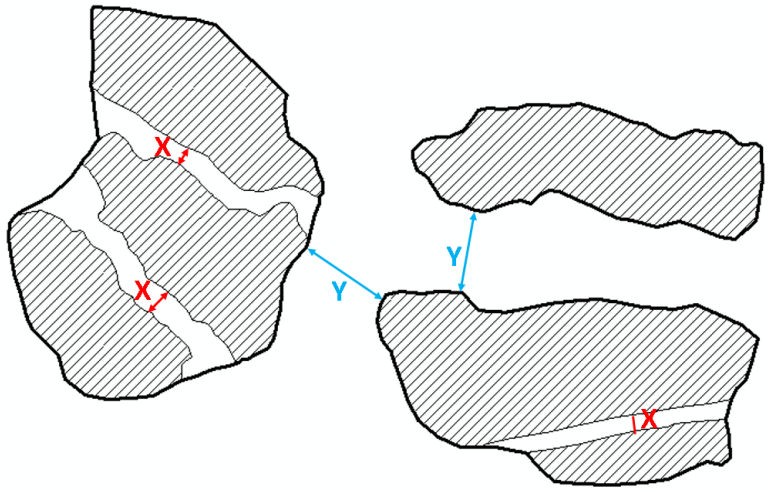

Figure 3. Cutblock adjacency and harvest openings (example).

Table 27. Cutblock size and adjacency targets

Group Cutblocks				Separate Cutblocks			
Size (ha)	**Distance (m)**	**Target (%)**	**Weight**	**Size (ha)**	**Distance (m)**	**Target (%)**	**Weight**
<=1	20	Max 0%	High	<=40	100	None	None
>1 and <=5	20	Max 10%	Medium	>40 and <=50	100	Max 5%	High
>5 and <=40	20	None	None	>50	100	Max 0%	High
>40 and <=50	20	Max 5%	High				
>50	20	Max 0%	High				

6.3.3 Community watersheds

Water in community watersheds is a value identified in the *Forest and Range Practices Act* that forest licensees are required to specify results and strategies for to meet, in part, the objective set by government for water quality. Objectives for water in community watersheds are established under Section 8.2 of the FPPR. Within the Sunshine Coast TSA, 23 of the 26 designated community watersheds overlap the CFMLB for a total of 14 952 hectares (Table 28). Forest practices within community watersheds are typically guided by hydrological assessments completed, as required, for each the watershed. Over the past decade, less than one percent of the harvested area has come from within community watersheds.

Without a standardized management approach, this analysis will apply a forest cover requirement that maintains a maximum of 5% of the CFMLB within each community watershed less than five metres in height over the planning horizon. This is intended to mimic a harvest restriction of one percent per year.

Table 28. Community watersheds

Community watershed	Non-CFMLB (ha)	CFMLB (ha)	Effective THLB (ha)
Ball Park	838	89	62
Bowyer	4	0	0
Chapman	3,633	2,643	1,038
Community Creek	5	76	43
Cranby	471	419	311
Dakota	656	2,583	1,696
Dysart	4	42	39
Fircom	58	41	0
Gambier	574	128	22
Gray	3,371	1,054	0
Greer	1	17	0
Harbott	17	29	1
Haslam/Lang	11,530	1,536	601
Helena	330	248	164
Jefferd	95	221	185
Laurena	13	0	0
Little Quarry Lake	26	118	45
McNair	290	1,549	645
McNeill Lake	80	1,450	1,185
Milne	301	137	92
Priest Lake	590	544	281
Silver	5	0	0
Sliammon Lake	4,416	12	9
Thulin Lake	389	296	244
Waugh Lake	324	466	320
West Lake	586	1,219	330
Total	**28,608**	**14,915**	**7,313**

Data source and comments:

BCGW file: WHSE_WATER_MANAGEMENT.WLS_COMMUNITY_WS_PUB_SVW.

Previous TSR included 25 community watersheds. Two of these community watersheds are no longer located within the Sunshine Coast TSA due to boundary changes.

6.3.4 Visual quality objectives

Visual quality is a value identified in the *Forest and Range Practices Act.* Visual quality objectives (VQO) were established to ensure that forest planning and practices fit the size, shape, and location of cutblocks and roads to the natural character of each landscape. For this analysis, the VQOs will be modelled according to the 2003 *Bulletin – Modelling Visuals in TSR III* for each Visual Landscape Inventory polygon using Plan-to-Perspective (P2P) ratios, Visually Effective Green-up (VEG) heights determined for 5% slope class increments, and maximum percentage alterations for a given visual absorption capacity (VAC).

The specific parameters to determine VEG heights for each visual landscape inventory polygon and maximum percent alterations are provided in Table 29 and Table 30. A total of 699 current and 658 proposed visual landscape inventory polygons overlap with the CFMLB. The following criteria will be determined for each polygon:

- Area-weighted average slope;
- VEG height assigned based on relations shown in Table 29 and using the area-weighted average slope;
- Age when VEG height is reached based on the yield curve of each stand (existing and future); and,
- The maximum percent alteration calculated for each slope class as the P2P ratio (Table 29) multiplied by the maximum percent alteration in perspective view (Table 30). For example, the lowest maximum percentage alteration (except where it is already 0) is for slope class ≥70%, VQO class R (retention) and medium VAC: 1.04 x 0.75 = 0.78%. The highest percent alteration: 4.68*30=140.2%. In cases where the maximum percentage alteration exceeds 100% there will be no target set in the forest estate model.

Table 29. P2P ratios and VEG heights by slope class

Category	Modified visual unit slope classes for P2P ratios and VEG heights														
Slope %	<5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	≥70
P2P Ratio	4.68	4.23	3.77	3.41	3.04	2.75	2.45	2.22	1.98	1.79	1.6	1.45	1.29	1.17	1.04
VEG Height (m)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	6.5	7.0	7.5	8.0	8.5	8.5	8.5

Table 30. VQO by percent alterations

VQO	VAC	Max % alteration in perspective view	Current			Proposed		
			VLIs #	CFMLB (ha)	Effective THLB (ha)	VLIs #	CFMLB (ha)	Effective THLB (ha)
Preservation (P)	Low	0	10	1,631	200	0	0	0
	Medium	0	9	425	140	7	1,316	270
	High	0	0	0	0	0	0	0
	None	0	0	0	0	0	0	0
Retention (R)	Low	0	60	7,965	2,744	5	632	229
	Medium	0.75	57	3,607	1,714	141	29,144	14,219
	High	1.5	1	1	0	6	1,442	831
	None	0.75	0	0	0	0	0	0
Partial Retention (PR)	Low	1.6	125	29,813	12,970	16	3,776	1,810
	Medium	4.3	272	88,958	49,854	339	131,843	67,900
	High	7	36	11,107	7,123	47	22,629	15,625
	None	4.3	0	0	0	1	636	521
Modification (M)	Low	7.1	24	6,153	2,104	16	1,450	507
	Medium	12.55	89	23,885	11,722	71	17,212	7,949
	High	18	9	1,473	911	4	584	255
	None	12.55	0	0	0	0	0	0
Maximum Modification (MM)	Low	18.1	0	0	0	0	0	0
	Medium	24.05	0	0	0	0	0	0
	High	30	0	0	0	0	0	0
	None	24.05	0	0	0	0	0	0
Total			**692**	**175,018**	**89,482**	**653**	**210,664**	**110,115**

A proposed change to the current visual landscape inventory will also be considered as a sensitivity analysis to understand the impacts associated with the proposed changes.

Data source and comments:

BCGW file: WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_INVENTORY.

The Government Actions Regulation can be accessed online: https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/legislation-regulation/forest-range-practices-act/government-actions-regulation

Bulletin – Modelling Visuals in TSR III (2003): https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/visual-resource-mgmt/vrm_modeling_visuals_bulletin.pdf?bcgovtm=CSMLS

6.3.5 Community interface zone

District staff have identified community interface zones adjacent to communities located along the Strait of Georgia where timber harvesting is expected to be contentious (Table 31). These areas may include a significant number of historic trails that have not been established or authorized either under the *Forest and Range Practices Act* or the Forest Practices Code. When operating in these areas, licensees may be required take measures to protect these trails and address other identified values. Over the past decade, approximately 7% of the harvested area has come from community interface zones that represent approximately 6% of the THLB.

To address reduced harvest rates expected within the community interface zones, this analysis will apply a forest cover requirement that maintains a maximum of 25% of the THLB to be below the green-up height of five metres over the planning horizon. The age where five metres is reached will be determined for each stand during the yield development stage (Section 6.4.3).

Table 31. Community interface zones

Community interface zone	Non-CFMLB (ha)	CFMLB (ha)	Effective THLB (ha)
Cortes Island	9,923	914	128
Gambier Island	4,325	2,513	420
Half Moon Bay	20,442	12,564	7,799
Nelson Island North	680	1,251	327
Nelson Island South	315	541	289
Nelson Island West	255	128	52
Powell River	16,623	4,643	2,869
Rainy River	849	1,127	707
Read Island	1,372	59	40
Refuge Cove	101	111	49
Stuart Island	379	192	97
Surge Narrows	211	0	0
Texada Island	6,716	2,527	1,704
Total	**62,191**	**26,570**	**14,481**

Data source and comments:

DSC spatial file: CIZ.

Previous TSR included the same forest cover requirement but district staff has since reduced the overall size of the zone.

6.3.6 Marbled Murrelet habitat

The 85 WHAs established for Marbled Murrelet that conserves 6208 hectares of CFMLB as Marbled Murrelet nesting habitat (Section 5.8) do not meet the target established under a Section 7 Notice (FPPR) for protecting suitable nesting habitat. The minimum area of 10 270 hectares set for the Sunshine Coast District is used to support the planning process and guide the establishment of future spatial reserves.

Suitable Marbled Murrelet (MAMU) habitat is defined as old, natural forest with specific attributes based on field surveys. To date, field surveys have identified approximately 30 405 hectares of suitable MAMU habitat within the CFLMB of the Sunshine Coast TSA. However, only stands older than 140 years are considered actual MAMU habitat.

In this analysis, the actual MAMU habitat (i.e., stands older than 140 years within the designated suitable habitat zones within and outside of WHAs) will be tracked for each aggregated landscape unit (Table 32). A sensitivity analysis will assess the impact of implementing these targets on various indicators, including harvest rate (Section 8.4).

Table 32. Marbled Murrelet suitable habitat and targets for sensitivity analysis

Aggregated LU	LU	Non-CFMLB (ha)	CFMLB (ha)	Effective THLB (ha)	Target %	Target (ha)
Bute	Brem	271	2,608	950	85	7,815
	Bute East	505	2,570	294		
	Bute West	667	3,002	284		
	Quatam	155	1,014	155		
Georgia	Bunster	90	5	2	91	3,808
	Cortes	296	2,462	459		
	Homfray	236	1,718	257		
Homathko	Bishop	73	962	1	85	2,939
	Homathko	483	1,658	166		
	Southgate	20	494	76		
	Toba	6,614	344	45		
Jervis	Brittain	69	1,357	159	90	7,791
	Deserted	20	899	67		
	Jervis	147	2,834	368		
	Narrows	45	1,316	189		
	Skwawka	44	2,250	178		
Powell	Haslam	8	0	0	81	330
	Lois	281	0	0		
	Powell Daniels	2,224	0	0		
	Powell Lake	1,101	55	22		
	Texada	45	353	121		
Sechelt	Chapman	300	456	180	85	3,949
	Howe	113	652	128		
	Salmon Inlet	114	1,005	118		
	Sechelt	63	2,533	813		
Total		**13,985**	**30,547**	**5,032**		**26,632**

Data source and comments:

Spatial dataset provided by Senior Ecosystem Biologist - Coast (FLNRORD).

6.4 Forest health

6.4.1 Forest health issues

A number of forest health damaging agents are present within the Sunshine Coast TSA. These agents include insects, pathogens, animals, and abiotic events; many of which have the potential to cause timber losses. The Forest Health Program of FLNRORD evaluates the impact of forest health damaging agents on forest resource values and when necessary prescribes and implements management practices to prevent damages.

A review of the 2020 aerial overview surveys (AOS) summary for the Sunshine Coast TSA, along with the broader summary of 2021-2023 Coastal Timber Supply Areas Forest Health Overview, and discussions with the FLNRORD's Forest Health Officer, indicates the following:

- Balsam Wooly Adelgid has been confirmed in four sites north of Jervis Inlet.
- Black bear damage and volume loss has increased within the Ramsay Arm, Quatam River and lower Toba Inlet over the past 10 years. Larger diameter Douglas-fir has been damaged and killed within the Quatam River area.
- Douglas-fir beetle populations have been increasing in recent years within TFL 39 due to recent windfall events and selective harvesting operations. Damage was reported annually at 400 to 800 hectares from 2011 to 2014. Since 2011, trap-tree baiting and removal is used to reduce beetle populations near Powell River and on the Sechelt Peninsula, especially in areas recently impacted by wildfire. Still, trace and light recent attack are mapped every year across the TSA.
- Mountain pine beetle populations are at endemic levels, with scattered patch mortality occurring in over-mature pine stands within the Homathko & Southgate valleys (2006).
- Laminated root rot is the main concern with high levels of infection occurring in the Okeover Inlet area near Powell River and on the Sechelt Peninsula near Homesite Creek.
- Hemlock looper defoliation was noted in the Rainy River drainage in 1999. The population increased dramatically by 2002 with about 800 hectares being defoliated in Rainy River and McNab Creek in Howe Sound. In the summer of 2019, the Sunshine Coast (Brittain River & Rainy River) and North Vancouver experienced predominantly light severity defoliation as looper populations were building. In 2020, 10 413 hectares of looper defoliation were mapped with the Aerial Overview Survey (AOS).
- Western redcedar dieback and mortality caused by drought has waxed and waned in coastal forests for the last two decades but the trend is toward local extirpation of Cw on drier sites. Ground observations note it is still more prevalent than is seen from the air, with dieback resulting in thin crowns, dead tops, and eventual mortality. Western redcedar is susceptible to drought due to its shallow root system, which can be adversely affected if insufficient precipitation is received on sites with shallow or coarse-textured, well-drained soils and high exposure to southerly aspects.

Regular reviews of timber supply and the ability to revisit the AAC decision earlier than scheduled are important approaches to address abnormal or catastrophic events that are difficult to predict and highly variable from year to year. Non-recoverable losses of timber following these events are estimated and described below (Section 6.4.2).

The impact of pests at endemic levels is considered in the stand projection models applied in this analysis. Endemic levels are inherent within the empirical-based model used to project natural stand yields (Section 7.1). Endemic impacts are considered in managed stand yields through operational adjustment factors (Section 7.2.3).

Other information sources such as young stand monitoring and stand density monitoring, and advice from forest health experts, also are presented to the chief forester for consideration in determining if modelled stand volume predictions are appropriate for the level of forest health impacts observed.

As described in the climate change section, a sensitivity analysis will be included to assess the potential impact of western redcedar dieback on very dry to fresh sites within the CDFmm, CWHdm, and CWHxm subzones. Based on the FLNRORD's Forest Health Officer recommendations, the sensitivity analysis will use the analysis unit stratification described in section 7.2 to kill all of the redcedar on existing stands for warm/warm sub-montane and medium to poor productivity sites, while half of the redcedar will be killed on existing stands for remaining dry and zonal sites of the subzones referenced above. The dead redcedar volume will be tracked as a potential salvage opportunity. Future managed stand yields on these sites will replace redcedar with other acceptable species (e.g., Douglas-fir, Western White Pine).

6.4.2 Non-recoverable losses

Non-recoverable losses (NRL) are estimates of timber volume destroyed or damaged on the THLB by natural causes such as fire, wind, and disease that are not recovered through salvage operations and therefore remain unutilized. These timber volumes do not include endemic losses that are incorporated within growth and yield model projections or epidemic losses specifically modelled.

The FLNRORD provided estimates of the volume lost annually to forest health factors based on the forest health overview flight mapping. The summary uses the flight mapping, the VRI, and the previous TSR THLB to estimate the volume lost to each factor and account for any record of salvage harvesting that has occurred following the disturbance. The summary was prepared for data collected for the period 2008 to 2017, providing a nine-year average of NRLs for the Sunshine Coast TSA (Table 33). Future NRLs will be subtracted post-modelling from the forecasted harvest rate.

Table 33. Estimated average non-recoverable losses

Cause of loss	Annual loss within CFMLB (m^3/year)	Annual loss within THLB (m^3/year)	Annual salvaged volume within THLB (m^3/year)	Annual non-salvaged volume within THLB (m^3/year)
Flooding	2,066	791	0	791
Drought	941	360	0	360
Fire	9,803	3,752	1,180	2,572
Mountain Pine Beetle	3,888	1,488	21	1,467
Douglas-fir Bark Beetle	8,301	3,177	1,063	2,114
Spruce Beetle	520	199	0	199
Western Balsam Bark Beetle	15	6	0	6
Unknown	43	16	0	16
Total	**25,578**	**9,789**	**2,264**	**7,526**

Data source and comments:

The 2008-2017 volume loss estimates were averaged for each forest health factor and prorated for the entire THLB under the premise that salvage only occurred within the THLB.

6.4.3 Disturbance on the non-harvestable land base

The forested land base may be disturbed by many factors including natural events such as fire, pests, and wind, and anthropological events such as forest harvesting and road building. These disturbances influence both timber supply and requirements for non-timber objectives. Most non-timber objectives are related to the maintenance of desired forest conditions such as a specified age structure or proportion of old forest and are applied to the entire FMLB. Accordingly, the natural disturbances on the NHLB and the role they have in altering forest conditions over time should be accounted for, rather than allowing the

forest to age continually and contribute inappropriately to forest cover requirements.

Natural disturbances will be modelled in this analysis as stochastic events reflecting the natural range of variation for the mean stand-replacing disturbance interval and the estimated fraction of stands that escape these events. The natural disturbance events will be simulated only on the NHLB (Table 34). The key values (mean interval and old seral definition) are taken from the *BC Biodiversity Guidebook* by BEC zone and NDT. Then, the expected percentage of stands older than a certain age (i.e., old age definition) was determined using the Van Wagner (1978) negative exponential function. The age of the oldest stand (i.e., the disturbance interval modelled) is estimated as the ratio between the mean disturbance interval and the cumulative proportion of stands younger than the old seral definition. A random disturbance year (one year per cycle) will then be assigned to each polygon such that one disturbance event occurred in each cycle.

Table 34. Natural disturbances in the non-harvestable land base

BEC	NDT	Mean disturb interval (years)	Old seral definition (years)	Old seral NRV (NRV) e(-MDI/OSD)	Oldest stand (OLD) (years) MDI/(1-NRV)	NHLB (ha)	NHLB annual area disturbed NHLB/OLD	% disturbed
CDF	NDT2	200	250	29%	280	2,426	9	0.36%
CMA	NDT5	0	0	0%	0	5,516	0	0.00%
CWH	NDT1	250	250	37%	395	89,371	226	0.25%
CWH	NDT2	200	250	29%	280	106,172	379	0.36%
ESSF	NDT2	200	250	29%	280	777	3	0.36%
MH	NDT1	350	250	49%	686	53,042	77	0.15%
Total						257,305	694	0.27%

MDI – Mean Disturbance Interval
OSD – Old Seral Definition
NRV – Natural Range of Variation

7 GROWTH AND YIELD

Estimates of the volume available from forest stands over time is a critical input for timber supply modelling. Growth and yield models are used to generate these volume estimates based on various characteristics of each forest stand. BC has a strong history in growth and yield modelling, with robust models playing an important role in making strategic decisions about forest resources.

Two of the Ministry's growth and yield models will be used in this analysis. The Variable Density Yield Projection (VDYP) model was specifically developed to project growth and yield on the mature forest inventory (natural stands), while the Tree and Stand Simulator (TASS) model is based on regeneration characteristics of a managed forest stand.

For this analysis, the yield tables will be divided into two general forest management categories: (1) stands with no harvest or silviculture history established prior to 1977 (i.e., natural stands) and (2) stands with a harvest history established in or after 1977 (i.e., managed stands). Natural stands (category 1) will have yield curves developed using VDYP. Managed stands (category 2) will be further divided into planted and naturally established stands; with yield curves generated using TASS.

A yield curve is typically assigned to a forest stand or group of stands with similar tree species composition, timber growing potential, and treatment regimes. The vegetation resource inventory (VRI) delineates stands with similar properties (i.e., forest inventory polygons) and a VDYP yield curve for each of these inventory polygons will be used in this analysis. After stands are harvested in the timber supply model, they will be placed on the corresponding aggregate future TASS curve (Section 7.3).

7.1 VDYP stands (natural stands)

Stands established prior to 1977 will have yield curves created using the VDYP model. However, Douglas-fir leading stands established between 1957 and 1976 in BEC units where most of the previous juvenile spacing and/or fertilization occurred will be modelled with TASS to properly account for past silviculture activities.

7.1.1 Model

Yield tables for natural stands will be derived using VDYP version 7. This is an empirical model that has been parameterized based on a large permanent sample plot database collected from mature natural forests in BC. Input information for VDYP is provided by the attributes of individual VRI polygons.

7.1.2 Decay, waste and breakage

Decay, waste and breakage estimates are incorporated within VDYP based on BEC loss factors using a decay sample tree database that consists over 82,000 trees. The VDYP output was developed to provide estimates of live merchantable timber volume. Information about the dead potential component of a stand is not included in the timber supply model, but separate information about the potential amount will be provided to the chief forester for consideration in the AAC determination.

7.2 TASS stands (managed stands)

Stands with a history of silviculture treatments are expected to be regenerated and have density managed to specified conditions that better capture site productivity from TASS (managed) than VDYP (natural) stands. Generally, this category includes stands established after the legislative creation of basic silviculture obligations in 1987, although stands established prior to this date with a history of silvicultural management may also be classified as managed. Regeneration of managed stands, though mostly planted, can include stands that are naturally regenerated to appropriate stocking standards.

Site specific, field derived, silviculture information is stored in RESULTS that tracks silviculture information by managing the submission of openings, disturbances, silviculture activities and obligation declarations as required by the *Forest and Range Practices Act*. In this analysis, stands established since 1977 with a harvest history recorded in RESULTS will have yield curves created using TASS. Yield curves for Douglas-fir leading stands established between 1957 and 1976 in BEC units, where most of the juvenile spacing and/or fertilization occurred, will also be generated by TASS.

To generate yield curves, data is extracted and collated from RESULTS to derive species composition and density for both planted and natural components. Planted species composition is derived from planting numbers and any associated genetic worth is linked where appropriate by seedlot. Inventory survey data is used to adjust species composition to account for ingress and mortality. The following data is derived from the RESULTS data:

- planted species composition;
- planted density (total by species);
- genetic worth (by species);
- planting delay;
- percent of the opening that is planted;
- natural species composition;
- natural density (total by species); and,
- stand age.

For this analysis, RESULTS data will be aggregated for similar stand characteristics (analysis units (AU)) based on seven criteria: (1) management era, (2) BEC variant, (3) slope/aspect/elevation class, (4) TEM site series group, (5) productivity, (6) leading species, and (7) past silviculture history (Table 35). The TASS regeneration assumptions for all AUs are included in Appendix 1.

Table 35. Analysis unit stratification

AU criteria (# classes)	Description			
Management Era (3)	1-Stands established before 1999 (mature existing managed stands) 2-Stands established in 1999 and between 1999 and 2021 (young existing managed stands) 3-Stands established in 2021 and later (future managed stands)			
BEC variant (8)	CDFmm, CWHdm, CWHds1, CWHms1, CWHvm1, CWHvm2, CWHxm1/2 (grouped CWHxm1 and CWHxm2), and MH/ESSF (all variants).			
Slope/Aspect/ Elevation Class (8)	Class	Slope	Aspect	Elevation
	1-Gentle and Cool	Any	Any for slope <=35% or 286 to 134 degrees for slope >35%	Any
	2-Gentle and Cool Sub-montane*			<=800 m
	3-Gentle and Cool Montane*			>800 m
	4-Warm	>35%	135 to 285 degree	Any
	5-Warm Sub-montane*			<=1,000 m
	6-Warm Montane*			>1,000 m
	7-All Montane	Warm Montane or Gentle and Cool Montane		
	8-Any	Any		
	**applies to CWHms1 only*			
TEM site series group (6)	1-Constrained: dry and wet 2-Enhanced: moist to very moist and rich to very rich 3-Zonal: site series 01		4-Zonal+Constrained 5-Any 6-None: no TEM	
Productivity (3)	Two classes are established on relatively high variability sites in terms of productivity (expressed as a site index (SI)-top height in metres at age 50). Highly variable site productivity includes AUs with relatively large areas (e.g., CWHdm Gentle and Cool zonal, CWHxm1/2 Gentle and Cool zonal). A third class is established on relatively uniform sites with no productivity categories. 1-Good (SI_{Fd}>33 m or SI_{Fd}>34 m or SI_{Hw}>27 m depending on species composition) 2-Med-Poor (all other SI on highly variable sites) 3-Any or no class			
Leading species (5)	1-Western redcedar (Cw) 2-Red alder (Dr) 3-Douglas-fir (Fdc)		4-Western hemlock (Hw) 5-Yellow cedar (Yc)	
Silviculture history (4)	1-Fertilized (Fert) 2-Juvenile spaced (JS) 3-Fert+JS 4-None			

7.2.1 Model

Yield tables for managed stands will be generated using the biologically based, spatially explicit, individual tree model TASS that predicts the potential growth and yield of even-aged, single-species managed stands for 10 commercial tree species which cover all needs for this analysis. The core purpose of TASS is to predict silvicultural treatment response by modelling individual tree crown dynamics and their relationship to bole growth and wood quality. The focus on crown dynamics makes TASS particularly well suited for predicting response to treatments such as fertilization, juvenile spacing, commercial thinning, and pruning. TASS version 3.0 will be used to generate yields for pine and spruce

while all other species will use TASS version 2.07.

Yield models such as TASS require detailed information such as species composition, planted and natural ingress density, regeneration delay, and silviculture history. Most of this information comes from the inventory survey information provided to RESULTS for each harvest opening. Complete regeneration assumptions for all managed stands are included in Appendix 1.

7.2.2 Site index

Site index is a common measure of forest site productivity and forest growth used in BC, enabling forest managers to predict forest stand growth and yield. Site index is based on the top height (metres) of a stand at breast-height age 50 years. While FLNRORD has formalized standards for deriving site index for the potential productivity of a site, the term site index is derived and used in a variety of contexts.

The VRI, or inventory, site index is based on a normalized set of coefficients calibrated to reflect the range of heights for a given tree species. These will be used to generate yield tables in VDYP.

TASS yield tables will be generated using the provincial site productivity layer (version 7.0) that estimates site index of commercial tree species for individual stands. The estimates are based on ecosystem data from predictive or terrestrial ecosystem mapping (PEM or TEM) and Site Index – BEC correlations (SIBEC). Where PEM or TEM information is unavailable, data from various growth and yield projects are used to create a biophysical model that provides site productivity estimates.

Data source and comments:

FLNRORD FAIB Site Productivity Layer, Version 7.0 (2019/2020).

7.2.3 Operational adjustment factors

Operational adjustment factors (OAF) are used to adjust volume estimates from TASS to account for factors that affect achievement of potential growth that are not specifically modelled. The yield tables generated by TASS reflect the growth relationships observed in research plots established by FLNRORD and industry. Research plots are generally located in fully stocked, even-aged stands of uniform site, and in forests with little or no pest activity. As a result, TASS yields reflect the potential yield of a specific site, species and management regime given full stocking. The OAFs are required to adjust these potential yields to better reflect operational considerations.

In TASS, two OAFs are used to modify the potential yields. OAF 1 is a static reduction across all time periods that, for example, may reflect non-productive openings within a forest. OAF 2 is a dynamic reduction that increases over time that, for example, may reflect a forest health issue that increases as a stand ages. The standard OAF 1 value of 15% will be applied to account for less than ideal tree distributions (4%), small non-productive areas (4%), endemic pests and disease (4%), and random risks such as windthrow (3%). The standard OAF 2 value of 5% that accounts for decay, waste and breakage will also be applied. These standard OAFs are based on a general assessment from the literature on differences between actual and potential yields on managed sites.

Existing and future managed Douglas-fir stands are susceptible to root disease and resulting volume losses. Laminated and armillaria root diseases are more common in CDF, CWHxm, CWHdm and CWHds1 BEC subzones. Based on the regional pathologist's recommendation, the OAF 2 values for these BEC subzones will be increased from 5% to 12.5% for existing and future managed Douglas-fir stands.

7.2.4 Tree improvement

Licensees are obliged to use the best available seed source when regenerating sites with planted stock. Planted stock may have faster growth than natural trees that regenerate on the site due to either the use of high quality genetically improved seed from seed orchards or the use of seed harvested from superior wild trees.

Information on the use of select seed in the Sunshine Coast TSA and the associated genetic gains are available from the Seed Planning and Registry Application of the Forest Improvement and Research Management Branch. RESULTS information provides a seed source for individual plantations and thus enables linkage to the genetic gain database.

The seed use and its genetic worth recorded in RESULTS for each existing managed stand is considered in generating the yield table for each stand. An area-weighted average of seed use and the associated genetic worth between 1997 and 2016 will be used to estimate current performance for each of the aggregate analysis units representing young existing managed stands (i.e., established in 1999 and between 1999 and 2020) (Table 36). For future managed stands, the area-weighted average genetic worth between 2014 and 2016 will be used. Genetic worth will not be applied for mature existing managed stands (i.e., managed stands established prior to 1999).

Table 36. Genetic worth for young existing and future managed stands

BEC variant	Species	Weighted average genetic gain (%)	
		Existing managed young stands	Future managed stands
CDFmm	Fd	8.7	11.2
	Cw	2.7	8.6
CWHdm	Fd	6.6	10.1
	Cw	6.8	9.7
CWHds1	Fd	4.7	9.7
	Cw	4.1	5.1
CWHms1	Fd	1.7	1.8
	Cw	0.3	0.3
CWHvm1	Fd	5.9	8.4
	Cw	4.7	9.5
CWHvm2	Fd	2.7	7.0
	Cw	0.3	0.7
CWHxm1/2	Fd	7.2	9.9
	Cw	4.9	10.7
MH/ESSF All	All	0	0

Data sources and comments:

Seed Planning and Registry Application of the Forest Improvement and Research Management Branch and RESULTS database.

7.3 Future managed stands

Regeneration assumptions for future managed stands will be based on summaries from RESULTS for the initial species composition and density. These summaries include planting records and regeneration or free-growing surveys for openings identified as even-aged. Data is generalized to the opening and then assigned to the spatial forest cover polygon. Existing stands are assigned a future managed stand yield associated with the appropriate analysis unit (see Appendix 1). These yields incorporate estimates of site index based on the site productivity layer and adjustments for genetic gain for appropriate species planted.

8 FOREST ESTATE MODELLING

8.1 Forest estate model

This analysis will employ the PATCHWORKS™[6] forest estate model; a spatial model that can incorporate real world operational considerations into a strategic planning framework. It utilizes a goal seeking approach with heuristic optimization techniques to schedule activities across time and space to find a solution that best balances the targets and/or goals defined by the user. Targets can be applied to influence various criteria such as: mature and old forest retention levels, young seral disturbance levels, patch size distributions, conifer harvest volume, growing stock levels, snag densities, coarse woody debris levels, equivalent clearcut areas, specific mill volumes by species, road building and hauling costs, delivered wood costs, net present values, etc. The PATCHWORKS™ model continually generates alternative solutions until the user decides a stable solution has been derived (typically when improvements to the solution are deemed insignificant (e.g., less than 0.01% over 300,000 consecutive iterations). Solutions with attributes that fall outside of specified ranges (targets) are penalized and the goal-seeking algorithm works to minimize these penalties, resulting in a solution that reflects the user objectives and priorities.

PATCHWORKS™ has a flexible interactive approach that is unique in several respects:

- Allocation decisions can be made considering one or many objectives simultaneously, and objectives can be weighted for importance relative to each other (softer vs. harder constraints).
- Allocation decisions can include choices between stand treatment types (clearcut vs. partial cut, fertilization, rehabilitation etc.).
- The interface allows for highly interactive analysis of trade-offs between competing sustainability goals.
- Unlimited capacity to represent a problem; only solution times limit model size.
- Fully customizable reporting on economic, social and environmental conditions over time.
- Reports are built web-ready to share analysis results easily, including comparisons of multiple indicators across multiple scenarios.
- The software integrates operational-scale decision-making within a strategic-analysis environment where realistic spatial harvest allocations can be optimized over long-term planning horizons. It can simultaneously evaluate forest operations and log transportation problems using a multiple-product to multiple-destination formulation. It can also identify, in precise detail, how wood flows to mills over a complex set of road construction and transportation alternatives.

8.2 Established scenario

The established scenario is intended to provide a baseline harvest flow that the chief forester can use as a reference to understand the timber supply dynamics given legally-established forest management requirements and other assumptions. Like most TSRs, the established scenario will reflect a harvest flow starts with the current AAC and transitions to a mid-term harvest level before moving to a stable, long-term harvest level.

[6] Spatial Planning Systems Inc. of Deep River, Ontario, www.spatial.ca

Alternative harvest flows, based on different initial harvest levels and general pattern, will be examined using the established forest management assumptions. From these alternatives, an established scenario will be selected that, in conjunction with the current practice scenario and the sensitivity analyses, will represent timber supply dynamics.

8.3 Current practice scenario

The current practice scenario will reflect additional management practices that are not legally established but forest managers currently implement to address operational, economic, or First Nations requirements (Table 37).

Table 37. Differences between established and current practice scenarios

Factor	Established scenario	Current practice scenario
Strategic land use plan for the shíshálh Nation	No assumption	Exclude conservation areas from THLB
Age class 8&9 in swiya	No assumption	Exclude from THLB
CDF in swiya	No assumption	Exclude from THLB
Avoidance areas	No assumption	Exclude from THLB

8.4 Sensitivity analyses

Sensitivity analyses help to quantify potential uncertainty around data and management assumptions, including which variables have the greatest influence on harvest forecasts. Specific assumptions are investigated through these analyses to enhance our understanding of possible impacts on timber supply and other values. Table 38 lists the sensitivity analyses that will be completed for both the established and current practice scenarios in this analysis. Additional sensitivity analyses may be completed as needs are identified.

Table 38. Sensitivity analyses to assess influence of identified forest management issues

Issue to be tested	Sensitivity levels
Natural stand volumes	Adjust all natural stand volume tables by +/– 10%
Managed stand volumes	Adjust all managed stand volume tables by +/– 10%
THLB	Adjust the THLB area by +/- 10%
Minimum harvestable criteria	Change the minimum harvestable criteria for managed stands from 95% to 90% CMAI
Species profile	Set a maximum harvest levels for key tree species according to their current species compositions on the THLB.
Avoidance areas	Reduce the THLB by excluding harvest avoidance areas, which include shíshálh conservation areas
Low site cut-offs	Reduce the THLB by revising the minimum threshold for conifer species accordingly: • 300 to 400 m³/ha for conventional harvest methods; and, • 400 to 600 m³/ha for helicopter harvest methods
OGMAs	Replace NSOGO with licensee OGMAs where available.
Natural disturbance	Do not account for natural disturbance on the NHLB
Proposed WHAs	Remove proposed WHAs (Northern Goshawk) from the THLB
Proposed VQOs	Replace current with proposed VQOs and associated maximum disturbance allowances
Deer Winter range	Remove from the THLB draft UWRs within the shíshálh territory and implement a forest cover requirement within suitable habitat for the outstanding budget amount (TBD) outside
MAMU actual habitat	Apply targets for MAMU habitat (>140 years) within each designated suitable habitat zone
Forest Health	Apply Cw dieback assumptions to assess potential impact of climate change
Priority old growth deferral areas	Remove from the THLB priority old growth deferral areas

8.5 Carbon profile

Forest carbon is becoming an increasingly important consideration in forest management; not only in BC but globally. This analysis will assess the carbon profile for the Sunshine Coast TSA by estimating the carbon stored in the forest ecosystem subject to all normal natural processes (e.g., growth and decay, disturbance, gas exchanges within the atmosphere, carbon transitions between various pools, etc.) and the portion of carbon that leaves the forest ecosystem or stored in harvested wood products. Finally, a net carbon balance will be forecasted over the planning horizon to assess the carbon performance where a negative value indicates the TSA is a carbon source (i.e., more carbon is lost from the TSA than is stored), while a positive value indicates that the TSA is a carbon sink (i.e., more carbon is stored in the TSA than is lost).

8.5.1 Model

Carbon dynamics within forest ecosystems are complex and determined by many factors. To address this issue, the Canadian Forest Service developed the Carbon Budget Model for the Forest Sector (CBM-CFS3) model (Kurz et al., 2009) that has undergone significant testing and verification via numerous peer-reviewed published papers and technical reports. The CBM-CFS3 uses age-volume yield curves to estimate carbon in live biomass and an iterative process based on the inventory, historical, and last stand-replacing disturbances to initiate the dead organic matter pools. The CBM-CFS3 is used by the Canadian government to estimate and report the carbon storage and greenhouse gas emissions of Canadian forests under international agreements.

For this analysis, the CBM-CFS3 model will be used to estimate carbon storage and greenhouse gas emissions within the forest ecosystems of the TSA. The type and extent of harvest disturbances determined via the timber supply analysis conducted in PATCHWORKS will be transferred along with the inventory, yield curves, and transition rules into CBM-CFS3 where the carbon storage and greenhouse gas emissions from the forest ecosystem will be forecasted. Default CBM-CFS3 assumptions associated with the Pacific Maritime ecozone and clearcut with slash burn disturbance matrix will be employed.

The harvested carbon reported by CBM-CFS3[7] will then be compared to the Verified Carbon Standard VM0034 methodology (Canadian Forest Carbon Offset Methodology, version 3.3 (April 2020)[8]) to estimate carbon storage and related emissions to harvested wood products. The VM0034 methodology was developed by the BC Ministry of Environment for forestry-related carbon projects and provides detailed assumptions for estimating carbon stored in harvested wood products and related greenhouse gas emissions, including harvesting activities, log transport, and manufacturing. The simple approach of the VM0034 will be employed where 45% of the harvested wood products will end in use in North America, 45% offshore, 10% will be used for bioenergy production, and no methane flaring capture technologies will be available for landfills.

The carbon storage and emissions will be aligned to tonnes of carbon dioxide equivalent which is the universal measure for greenhouse gas emissions. This is necessary to integrate gasses with different global warming potential values into the carbon profile assessment. The global warming potential is the heat absorbed by any greenhouse gas in the atmosphere as a multiple of the heat that would be absorbed by the same mass of carbon dioxide. The 100-year global warming potential for each greenhouse gas type is accessed from the 5th assessment of the IPCC (www.ipcc.ch): 1 for carbon dioxide, 28 for methane, and 265 for nitrous oxide. Thus, methane is 28 times a more potent greenhouse gas than carbon dioxide, and nitrous oxide is 265 time more potent than carbon dioxide.

[7] Kurz, W.A., Dymond, C.C., White, T.M., Stinson, G., Shaw, C.H., Rampley, G.J., Smyth, C., Simpson, B.N., Neilson, E.T., Tyofymow, J.A., Metsaranta, J., Apps, M.J. (2009). CBM-CFS3: A model of Carbon-dynamics in forestry and land-use change implementing IPCC standards. *Ecol. Model.*, *220*, 480-504.

[8] VM0034 methodology: https://verra.org/methodology/vm0034-canadian-forest-carbon-offset-methodology-v2-0-2/

9 ASSOCIATED ANALYSIS AND REPORTING

The primary focus of the TSR will be to develop a timber supply analysis of the current TSA land base and forest management practices. The *Data Package* is an initial document that describes the available information and direction for information collection and analysis.

To summarize results of the timber supply analysis, a *Discussion Paper* will be released for public review. Information used in the analysis is described in this *Data Package* and updated based on information identified during the consultation, public review, and analysis process.

The timber supply analysis should be viewed as a "work in progress" since further analysis may be needed following the release of the *Discussion Paper* to complete or refine existing analyses or to address issues identified during the consultation and review process.

A public review period has been established to solicit comments and concerns about the *Data Package* and subsequently the *Discussion Paper* for FLNRORD consideration. Submissions and new information made available prior to the analysis may lead to changes in the data listed in this package. Until the analysis is completed, it is not possible to finalize the values shown in some of the tables in this document. An *Updated Data Package* will incorporate the finalized values used in the analysis.

Outcomes from First Nations engagement and consultation is an important component of the information considered by the chief forester. Information received from First Nations, where possible, is incorporated into the *Data Package* and timber supply analysis. Further, all information and comments received from First Nations are documented and presented in a summary document to the chief forester for consideration.

The chief forester's AAC determination will be documented through the public release of an *AAC Determination Rationale*. This rationale identifies reasons for the decision and discusses specific considerations, and provides recommendations where the chief forester has identified deficiencies in information or a need for improved stewardship.

10 INFORMATION SOURCES

2021. *Forest and Range Practices Act*. See http://www.bclaws.ca/civix/document/id/complete/statreg/02069_01;

2021. *Forest Act*. See Section 8 Allowable Annual Cut http://www.bclaws.ca/civix/document/id/complete/statreg/96157_02;

2021. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Electronic Commerce Appraisal System **(**ECAS**)**. See https://www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/timber-pricing/electronic-commerce-appraisal-system;

2021. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Reporting Silviculture Updates and Land Status Tracking System (RESULTS) Application. See https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/silviculture/silviculture-reporting-results;

2021. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. The BC Geographic Warehouse. See https://www2.gov.bc.ca/gov/content/data/geographic-data-services/bc-spatial-data-infrastructure/bc-geographic-warehouse;

2021. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Archaeology in British Columbia. February 2, 2021. Victoria, BC. See https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/archaeology;

2021. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Approved Legal Orders. See https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions;

2021. BC Ministry of Environment. Approved Orders. See http://www.env.gov.bc.ca/wld/frpa/;

2020. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. North Island Timber Supply Area, Timber Supply Review Data Package. July 2020. Victoria, BC. See https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/48tsdp_2020.pdf;

2020. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Integrated Stewardship Strategy, Sunshine Coast Timber Supply Area. Draft Data Package. Prepared by Forest Ecosystem Solutions Ltd., B.A. Blackwell & Associates Ltd., and Ecologic Research. Version 3.2. October 26, 2020;

2020. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Provincial Timber Management Goals, Objectives & Targets, Management Unit Targets Report, Sunshine Coast TSA. August 8, 2020;

2019. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Provincial Site Productivity Layer. See https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-inventory/site-productivity/provincial-site-productivity-layer;

2019. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2019. Coast Appraisal Manual. Timber Pricing Branch. Victoria, BC. See https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/timber-pricing/coast-timber-pricing/coast-appraisal-manual/cam_2019_master_1a.pdf;

2017. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Provincial Timber Management Goals, Objectives & Targets. July 10, 2017. Victoria, BC. See https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/silviculture/timbergoalsobjectives2017apr05_revised.pdf;

2015. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2015. 2015-17, Coastal Timber Supply Areas, Forest Health Overview. Victoria, BC. See https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest_Health/TSA_FH_Strategies/2015-Coast%20FH%20Strategy.pdf;

2012. BC Ministry of Forests, Lands and Natural Resource Operations. Sunshine Coast Timber Supply Area, Rationale for Allowable Annual Cut (AAC) determination. Effective January 16, 2012. Victoria, BC. See https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/sunshine_coast_tsa_rationale.pdf;

2011. BC Ministry of Forests, Lands and Natural Resource Operations. Sunshine Coast Timber Supply Area, Data Package, Updated April 2011. Victoria, BC. See https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/sunshine_coast_tsa_data_package.pdf;

2011. BC Ministry of Forests, Lands and Natural Resource Operations. Sunshine Coast Timber Supply Area, Public Discussion Paper, Revised September 23, 2011. Victoria, BC. See https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/sunshine_coast_tsa_public_discussion_paper.pdf;

2008. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2008. British Columbia's Forest Fertilization Strategy. Forests For Tomorrow. Victoria, BC. See https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/land-based-investment/forests-for-tomorrow/provincial_fertilization_strategy2008.pdf;

2005. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Provincial Logging Residue and Waste Measurement Procedures Manual. Effective January 1, 2005. https://www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/timber-pricing/forest-residue-waste/provincial-logging-residue-and-waste-measurements-procedure-manual;

2003. BC Ministry of Forests, Lands and Natural Resource Operations. Bulletin – Modelling Visuals in TSR III. December 12, 2003. Victoria, BC. See https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/visual-resource-mgmt/vrm_modeling_visuals_bulletin.pdf;

1999. Ministry of Forests and Ministry of Environment, Lands & Parks. Landscape Unit Planning Guide. March 1999. Victoria, BC. See https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/policies-guides/lup_guide.pdf;

1995. BC Ministry of Forests and BC Ministry of Environment. Biodiversity Guidebook. September 1995. Victoria, BC. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/frep/frep-docs/biodiversityguidebook.pdf;

1978. Van Wagner, C.E. Age-class distribution and forest fire cycle. Can.J.For.Res 8: 220-227. doi: 10.1139/x78-034.

11 ACRONYMS

AAC – Allowable Annual Cut
AIA – Archaeological Impact Assessment
AOA – Archaeological Overview Assessment
AOS – Aerial Overview Survey
AU – Analysis Unit
BC – British Columbia
BCGW – British Columbia Geographic Warehouse
BCTS – British Columbia Timber Sales
BEC – Biogeoclimatic Ecosystem Classification
BEO – Biodiversity Emphasis Option
CBM – Carbon Budget Model
CDF – Coastal Douglas-fir (BEC Zone)
CEF – Cumulative Effects Framework
CFA – Community Forest Agreement
CFMLB – Crown Forest Management Land Base
COSEWIC – Committee on the Status of Endangered Wildlife in Canada
CWH – Coastal Western Hemlock (BEC Zone)
DBH – Diameter at Breast Height
DIB – Diameter Inside Bark
DSC – Sunshine Coast Natural Resource District
ECAS – Electronic Commerce Appraisal System
ESA – Environmentally Sensitive Area
ESSF – Englemann Spruce- Subalpine Fir (BEC Zone)
FAIB – Forest Analysis and Inventory Branch
FLNRORD – Ministry of Forests, Lands, Natural Resource Operations and Rural Development
FPPR – Forest Planning and Practices Regulation
FRPA – Forest and Range Practices Act
FTEN –Forest Tenure Administration
FTOA - Forest Tenure Opportunity Agreement
GAR - Government Action Regulation
GIS – Geographic Information System
IPP – Independent Power Projects
IWMS – Identified Wildlife Management Strategy
JS – Juvenile Spacing
LU – Landscape Unit
MAMU – Marbled Murrelet
MECCS – Ministry of Environment and Climate Change Strategy
MH – Mountain Hemlock (BEC Zone)
MOE - Ministry of Environment and Climate Change Strategy
NDT – Natural Disturbance Type
NHLB – Non-Harvestable Land Base
NOGO – Northern Goshawk
NRFL – Non-Replaceable Forest Licence
NRL – Non-Recoverable Losses
OAF – Operational Adjustment Factor
OGMA – Old Growth Management Area
PEM – Predictive Ecosystem Mapping
PSP – Permanent Sample Plot
RESULTS – Reporting Silviculture Updates and Land Status Tracking System
RFL – Replaceable Forest Licence
SI – Site Index
SIBEC – Site Index Estimates by Biogeoclimatic Ecosystem Classification

TASS – Tree and Stand Simulator
TEM – Terrestrial Ecosystem Mapping
TFL – Tree Farm Licence
THLB – Timber Harvesting Land Base
TL – Timber Licence
TRIM – Terrain Resource Information Management (BC Government)
TSA – Timber Supply Area
TSR – Timber Supply Review
UWR – Ungulate Winter Range
VAC – Visual Absorption Capacity
VDYP – Variable Density Yield Projection
VEG – Visually Effective Green-up
VQO – Visual Quality Objective
VRI – Vegetation Resources Inventory
WHA – Wildlife Habitat Area
WL – Woodlot Licence
WTRA – Wildlife Tree Retention Area

12 YOUR INPUT IS NEEDED

Public input is a vital part of establishing the allowable annual cut. Feedback is welcomed on any aspect of this *Data Package* or any other issue related to the timber supply review for the Sunshine Coast TSA.

Ministry staff would be pleased to answer questions to help you prepare your response. Please send your comments to the contact below.

Your comments will be accepted until February 25, 2022 for consideration with respect to the *Data Package*. A further comment period will be made available following the release of a *Public Discussion Paper* that outlines the results of a timber supply analysis.

You may identify yourself on the response if you wish. If you do, you are reminded that responses will be subject to the *Freedom of Information and Protection of Privacy Act* and may be made public. If the responses are made public, personal identifiers will be removed before the responses are released.

For more information or to send your comments, contact:

Adam Hockin, RPF, Senior Authorizations Officer
BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Sunshine Coast Natural Resource District
7077 Duncan Street, Powell River BC V8A 1W1

Electronic mail: engageSunshineCoastForestDistrict@gov.bc.ca

Telephone: (604) 485-0700

For information on the Timber Supply Review visit the Timber Supply Review and Allowable Annual Cut web site at https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut\

Further information regarding the technical details of the timber supply review process and timber supply analysis is available on request by contacting Forests.ForestAnalysisBranchOffice@gov.bc.ca.

Appendix 1. Regeneration Assumptions

Era	AU	Description	THLB	Planted	Regen Delay	Planted Composition	SI	OAF1	OAF2	Ingress	Ingress Composition	JS Age	JS Density	Fert Age
<1999	**1**	CDFmm_All	168	804	2	Fd89Cw10	27.3	15	12.5	1,337	Fd65Hw30Dr3Pw1			
<1999	**2**	CDFmm_All	43	804	2	Fd89Cw10	27.3	15	12.5	1,337	Fd65Hw30Dr3Pw1	15	600	20
<1999	**7**	CWHdm_Warm_zonal	879	910	3	Fd75Cw25	33.4	15	12.5	1,550	Fd13Cw6Dr2Hw77			
<1999	**8**	CWHdm_Warm_zonal	207	910	3	Fd75Cw25	33.4	15	12.5	1,550	Fd13Cw6Dr2Hw77			20
<1999	**9**	CWHdm_Warm_enhanced	158	956	2	Fd67Cw32	35.8	15	12.5	1,096	Dr8Fd5Cw4Hw81			
<1999	**10**	CWHdm_Warm_constrained	211	910	3	Fd75Cw25	28.6	15	12.5	1,550	Fd13Cw6Dr2Hw77			
<1999	**11**	CWHdm_Warm_zonal	27	910	4	Fd75Cw25	33.0	15	12.5	1,550	Fd13Cw6Dr2Hw77			
<1999	**12**	CWHdm_Warm_zonal	13	910	4	Fd75Cw25	33.0	15	12.5	1,550	Fd13Cw6Dr2Hw77			35
<1999	**13**	CWHdm_Gentle Cool_Zonal_Fd lead<50%	257	879	3	Fd45Cw33Bg20	33.8	15	12.5	2,222	Fd9Cw4Dr1Hw84			
<1999	**15**	CWHdm_Gentle Cool_Zonal_Fd lead>=50%	1,328	1,235	3	Fd61Cw23Bg14	33.8	15	12.5	1,502	Fd13Cw6Dr2Hw76	15	600	20
<1999	**16**	CWHdm_Gentle Cool_Zonal_Non_Fd lead	2,101	851	3	Fd43Cw34Bg21	34.2	15	12.5	2,294	Fd9Cw4Dr1Hw84			
<1999	**18**	CWHdm_Gentle Cool_enhanced	937	818	2	Fd60Cw21Bg18	36.6	15	12.5	1,528	Dr5Fd3Cw3Hw86			
<1999	**19**	CWHdm_Gentle Cool_enhanced	156	818	2	Fd60Cw21Bg18	36.6	15	12.5	1,528	Dr5Fd3Cw3Hw86	15	600	
<1999	**20**	CWHdm_Gentle Cool_constrained	548	901	3	Fd75Cw24	28.6	15	12.5	1,933	Fd17Cw10Dr3Hw68			
<1999	**21**	CWHdm_Gentle Cool_Zonal_Fd lead<50%	11	846	4	Fd65Cw34	33.0	15	12.5	2,294	Fd9Cw4Dr1Hw84			
<1999	**23**	CWHdm_Gentle Cool_Zonal_Fd lead>=50%	54	1,234	4	Fd76Cw23	33.0	15	12.5	1,502	Fd13Cw6Dr2Hw76	25	500	35
<1999	**24**	CWHdm_Gentle Cool_Zonal_Non_Fd lead	66	665	4	Fd55Cw44	33.7	15	12.5	2,654	Fd7Cw3Dr1Hw86			
<1999	**26**	CWHvm1_Gentle Cool_zonal_constrained	1,936	707	3	Fd33Cw66	22.2	15	5	2,605	Hw90Ba5Cw3Dr1			
<1999	**27**	CWHvm1_Gentle Cool_enhanced	1,149	630	3	Cw75Fd25	23.2	15	5	2,460	Hw91Ba3Dr4			
<1999	**28**	CWHxm_All_Zonal	879	868	2	Fd80Cw20	33.0	15	12.5	1,175	Fd35Hw59Cw3Dr1			
<1999	**29**	CWHxm_All_Zonal	160	868	2	Fd80Cw20	33.0	15	12.5	1,175	Fd35Hw59Cw3Dr1	15	600	20
<1999	**30**	CWHxm_All_Zonal	66	868	2	Fd80Cw20	33.0	15	12.5	1,175	Fd35Hw59Cw3Dr1			20
<1999	**31**	CWHxm_All_enhanced	112	873	2	Fd74Cw25	35.3	15	12.5	1,375	Dr23Fd17Hw53Cw5			
<1999	**32**	CWHxm_All_enhanced	164	873	2	Fd74Cw25	35.3	15	12.5	1,375	Dr23Fd17Hw53Cw5	15	600	
<1999	**33**	CWHxm_All_constrained	207	790	3	Fd57Cw21Pl21	29.1	15	12.5	3,240	Fd22Hw63Dr13			
<1999	**34**	CWHxm_All_Zonal	7	868	3	Fd80Cw20	31.8	15	12.5	1,175	Fd35Hw59Cw3Dr1			
<1999	**35**	CWHxm_All_Zonal	2	868	3	Fd80Cw20	31.8	15	12.5	1,175	Fd35Hw59Cw3Dr1	25	500	35
<1999	**38**	CWHxm_All_enhanced	2	873	3	Fd74Cw25	33.9	15	12.5	1,375	Dr23Fd17Hw53Cw5	25	500	
<1999	**39**	CWHdm_Warm	283	818	3	Fd45Cw36Bg18	33.6	15	12.5	1,628	Fd9Cw4Dr4Hw81			
<1999	**40**	CWHdm_Gentle Cool_Fd lead<50%	69	879	3	Fd45Cw33Bg20	33.3	15	12.5	2,222	Fd9Cw4Dr1Hw84			
<1999	**42**	CWHdm_Gentle Cool_Fd lead>=50%	214	1,235	3	Fd61Cw23Bg14	33.3	15	12.5	1,502	Fd13Cw6Dr2Hw76	15	600	20
<1999	**43**	CWHdm_Gentle Cool_Non_Fd lead	732	851	3	Fd43Cw34Bg21	34.1	15	12.5	2,294	Fd9Cw4Dr1Hw84			
<1999	**45**	CWHdm_Gentle Cool_Fd lead<50%	6	846	4	Fd65Cw34	31.9	15	12.5	2,294	Fd6Cw4Dr3Hw84			
<1999	**47**	CWHdm_Gentle Cool_Fd lead>=50%	0	1,234	4	Fd76Cw23	31.9	15	12.5	1,502	Fd10Cw6Dr5Hw76	25	500	35
<1999	**48**	CWHdm_Gentle Cool_Non_Fd lead	787	846	4	Fd65Cw34	33.6	15	12.5	2,294	Fd6Cw4Dr3Hw84			
<1999	**50**	CWHds1_Warm_Fd lead<50%	83	679	3	Fd49Cw34Bg16	31.8	15	12.5	1,208	Dr8Cw5Fd14Hw71			
<1999	**51**	CWHds1_Warm_Fd lead>=50%	265	929	3	Fd63Cw25Bg11	31.8	15	12.5	702	Dr14Cw9Fd24Hw50			20
<1999	**52**	CWHds1_Warm_Non_Fd lead	307	582	3	Fd39Cw41Bg19	20.3	15	12.5	1,428	Dr7Cw4Fd12Hw75			
<1999	**53**	CWHds1_Warm_Fd lead<50%	0	582	4	Fd58Cw41	31.2	15	12.5	1,428	Dr7Cw4Fd12Hw75			
<1999	**54**	CWHds1_Warm_Fd lead>=50%	0	832	4	Fd71Cw28	31.2	15	12.5	922	Dr11Cw7Fd18Hw62			35
<1999	**55**	CWHds1_Warm_Non_Fd lead	0	471	4	Fd48Cw51	21.0	15	12.5	1,648	Dr6Cw4Fd10Hw78			
<1999	**56**	CWHds1_Gentle Cool_Fd lead<50%	214	673	3	Fd55Cw25Bg18	33.0	15	12.5	1,554	Dr8Cw5Fd11Ba2Hw71			
<1999	**57**	CWHds1_Gentle Cool_Fd lead>=50%	645	998	3	Fd70Cw17Bg12	33.0	15	12.5	882	Dr15Cw10Fd20Ba5Hw49			20
<1999	**58**	CWHds1_Gentle Cool_Non_ Fd lead	934	582	3	Fd39Cw41Bg19	21.3	15	12.5	1,528	Dr8Cw5Fd11Ba2Hw71			
<1999	**59**	CWHds1_Gentle Cool_Fd lead<50%	0	541	4	Fd68Cw31	32.1	15	12.5	1,794	Dr12Cw5Fd5Ba2Hw75			
<1999	**60**	CWHds1_Gentle Cool_Fd lead>=50%	10	873	4	Fd80Cw19	32.1	15	12.5	1,122	Dr20Cw8Fd8Ba4Hw60			35
<1999	**61**	CWHds1_Gentle Cool_Non_ Fd lead	150	582	4	Fd39Cw60	22.5	15	12.5	1,528	Dr14Cw5Fd5Ba2Hw71			
<1999	**62**	CWHxm_All	947	652	2	Fd54Cw27Pl18	32.3	15	12.5	1,635	Fd25Hw70Cw2Dr1			
<1999	**63**	CWHxm_All	184	652	2	Fd54Cw27Pl18	32.3	15	12.5	1,635	Fd25Hw70Cw2Dr1	15	600	20

Era	AU	Description	THLB	Planted	Regen Delay	Planted Composition	SI	OAF1	OAF2	Ingress	Ingress Composition	JS Age	JS Density	Fert Age
<1999	**64**	CWHxm_All	47	652	2	Fd54Cw27Pl18	32.3	15	12.5	1,635	Fd25Hw70Cw2Dr1			20
<1999	**65**	CWHxm_All	108	873	3	Fd66Cw20Pl13	32.2	15	12.5	1,175	Fd35Hw59Cw3Dr1			
<1999	**66**	CWHxm_All	8	873	3	Fd66Cw20Pl13	32.2	15	12.5	1,175	Fd35Hw59Cw3Dr1	25	500	35
<1999	**68**	CWHvm1_Warm_Fd lead<50%	111	873	3	Fd46Cw53	22.0	15	5	2,264	Hw88Ba5Cw3Dr1			
<1999	**69**	CWHvm1_Warm_Fd lead>=50%	488	1,192	3	Fd60Cw39	34.0	15	5	1,644	Hw83Ba8Cw5Dr2			20
<1999	**70**	CWHvm1_Warm_Non_Fd lead	1,543	707	3	Fd33Cw66	22.1	15	5	2,605	Hw89Ba5Cw3Dr1			
<1999	**71**	CWHvm1_Warm_Fd lead<50%	6	784	4	Fd40Cw60	22.4	15	5	2,450	Hw79Ba5Cw3Dr11			
<1999	**72**	CWHvm1_Warm_Fd lead>=50%	44	1,095	4	Fd57Cw42	33.4	15	5	1,830	Hw72Ba7Cw4Dr14			35
<1999	**73**	CWHvm1_Warm_Non_Fd lead	84	630	4	Fd25Cw75	22.3	15	5	2,760	Hw82Ba4Cw3Dr9			
<1999	**74**	CWHvm1_Gentle Cool	1,925	943	3	Fd8Cw50Ba41	22.8	15	5	2,140	Hw87Ba6Cw4Dr2			
<1999	**75**	CWHvm2_Warm	3,919	915	3	Cw28Fd5Ba66	23.9	15	5	2,650	Ba32Hw64Dr2			
<1999	**76**	CWHvm2_Gentle Cool_Plt	5,019	943	3	Cw32Ba64Fd3	24.0	15	5	2,790	Ba35Hw62Dr1			
<1999	**77**	CWHvm2_Gentle Cool_Nat	2,968	0	0		26.0			3,850	Hw44Ba41Cw15			
<1999	**78**	CWHms1_Warm_Submontane	730	846	2	Fd21Cw14Ba50Se14	22.5	15	5	1,570	Ba32Hw67			
<1999	**79**	CWHms1_Gentle Cool_Submontane	995	653	3	Cw15Fd12Ba55Se15	23.5	15	5	2,090	Ba48Hw48Dr3			
<1999	**80**	CWHms1_Montane	193	762	3	Fd4Ba62Se33	20.8	15	5	1,850	Ba58Hw41			
<1999	**81**	MHmm_ESSF_All_Plt	2,061	850	4	Yc20Ba80	15.8	15	5	2,000	Ba55Hw30Yc15			
<1999	**82**	MHmm_ESSF_All_Nat	1,862	0	0		25.5	15	5	2,000	Hw65Ba28Yc7			
1999-20	**100**	CDFmm_All_zonal_constrained	242	796	2	Fd89Cw10	29.6	15	12.5	1,337	Fd65Hw30Dr3Pw1			
1999-20	**101**	CDFmm_All_enhanced	84	796	2	Fd89Cw10	30.1	15	12.5	1,237	Fd64Hw27Dr8			
1999-20	**102**	CWHdm_Warm_zonal_constrained	1,019	900	3	Fd75Cw25	33.7	15	12.5	1,550	Fd13Cw6Dr2Hw77			
1999-20	**103**	CWHdm_Warm_enhanced	242	962	2	Fd67Cw32	36.6	15	12.5	1,096	Dr8Fd5Cw4Hw81			
1999-20	**104**	CWHdm_Gentle Cool_Zonal_Good	3,372	1,046	3	Fd72Cw27	35.4	15	12.5	1,862	Fd11Cw5Dr1Hw81			
1999-20	**105**	CWHdm_Gentle Cool_Zonal_Med_Poor	1,356	1,046	3	Fd72Cw27	32.4	15	12.5	1,862	Fd11Cw5Dr1Hw81			
1999-20	**106**	CWHdm_Gentle Cool_enhanced_Conifer	921	962	2	Fd66Cw33	37.1	15	12.5	1,233	Dr7Fd4Cw4Hw83			
1999-20	**107**	CWHdm_Gentle Cool_enhanced_Dr	860	1,200	1	Dr100	36.0	15	5					
1999-20	**108**	CWHdm_Gentle Cool_constrained	310	891	3	Fd75Cw24	30.0	15	12.5	1,933	Fd17Cw10Dr3Hw68			
1999-20	**109**	CWHxm_All_Zonal	1,610	927	2	Fd75Cw18Pw6	33.6	15	12.5	1,060	Fd39Hw54Cw4Dr1			
1999-20	**110**	CWHxm_All_enhanced	352	1,069	2	Fd79Cw20	34.9	15	12.5	984	Dr45Fd24Hw25Cw4			
1999-20	**111**	CWHxm_All_constrained	126	1,047	3	Fd68Cw15Pw15	31.6	15	12.5	2,730	Fd26Hw53Dr16Pw3			
1999-20	**112**	CWHvm1_Gentle Cool_zonal_constrained	1,621	951	3	Fd50Cw49	35.0	15	5	2,109	Hw88Ba6Cw4Dr1			
1999-20	**113**	CWHvm1_Gentle Cool_enhanced_Conifer	391	936	3	Cw60Fd40	23.3	15	5	1,608	Hw94Ba4Dr1			
1999-20	**114**	CWHvm1_Gentle Cool_enhanced_Dr	254	1,200	1	Dr100	33.0	15	5					
1999-20	**115**	CWHds1_Warm	498	820	3	Fd71Cw28	31.8	15	12.5	922	Dr26Cw7Fd3Hw62			
1999-20	**116**	CWHds1_Gentle Cool	1,615	749	3	Fd77Cw22	33.1	15	12.5	1,362	Dr23Cw3Fd3Ba3Hw67			
1999-20	**117**	CWHdm_Warm	975	962	3	Fd69Cw30	34.4	15	12.5	1,333	Fd11Cw5Dr5Hw77			
1999-20	**118**	CWHdm_Gentle Cool_Good_Conifer	2,547	1,046	3	Fd72Cw27	35.1	15	12.5	1,862	Fd11Cw5Dr1Hw81			
1999-20	**119**	CWHdm_Gentle Cool_Good_Dr	639	1,200	1	Dr100	36.0	15	5					
1999-20	**120**	CWHdm_Gentle Cool_Med_Poor	1,095	1,046	3	Fd72Cw27	33.2	15	12.5	1,862	Fd11Cw5Dr1Hw81			
1999-20	**121**	CWHxm_All	740	962	2	Fd81Cw15Pw3	33.0	15	12.5	1,180	Fd35Hw49Dr10Cw4			
1999-20	**122**	MHmm_ESSF_All_Plt	229	850	4	Cw33Yc33Ba34	15.5	15	5	2,000	Ba55Hw30Yc15			
1999-20	**123**	MHmm_ESSF_All_Nat	80	0	0		25.4	15	5	2,000	Hw65Ba28Yc7			
1999-20	**124**	CWHms1_Warm_Submontane	205	879	2	Fd61Cw38	29.4	15	5	1,498	Ba34Hw65			
1999-20	**125**	CWHms1_Gentle Cool_Submontane	373	741	3	Cw45Fd20Ba20Se13	20.0	15	5	1,890	Ba57Hw42			
1999-20	**126**	CWHms1_Montane	245	612	3	Cw66Ba16Se16	19.2	15	5	2,150	Ba50Hw49			
1999-20	**127**	CWHvm1_Warm	1,519	1,034	3	Fd54Cw45	33.8	15	5	1,954	Hw87Ba6Cw4Dr1			
1999-20	**128**	CWHvm1_Gentle Cool	1,499	867	3	Fd45Cw54	22.3	15	5	2,295	Hw89Ba5Cw3Dr1			
1999-20	**129**	CWHvm2_Warm	1,206	903	3	Cw58Fd21Ba20	20.8	15	5	2,650	Ba32Hw65Dr1			
1999-20	**130**	CWHvm2_Gentle Cool_Plt	1,520	713	3	Cw74Ba25	20.7	15	5	3,240	Ba30Hw67Dr1			
1999-20	**131**	CWHvm2_Gentle Cool_Nat	534	0	0		26.1	15	5	3,850	Hw44Ba41Cw15			
2021+	**200**	CDFmm_All_zonal	2,009	784	2	Fd88Pw11	28.6	15	12.5	1,373	Fd64Hw31Dr3Pw1			
2021+	**201**	CDFmm_All_enhanced	508	796	2	Fd89Cw10	28.9	15	12.5	1,037	Fd61Hw30Dr7			
2021+	**202**	CDFmm_All_constrained	135	879	2	Fd89Pw10	24.0	15	12.5	1,191	Fd73Hw21Dr3Pw1			
2021+	**203**	CWHdm_Warm_Zonal_Good	2,906	986	3	Fd78Cw7Pw14	35.3	15	12.5	1,190	Fd17Cw8Dr2Hw70			
2021+	**204**	CWHdm_Warm_Zonal_Med_Poor	2,792	986	3	Fd78Cw7Pw14	31.1	15	12.5	1,190	Fd17Cw8Dr2Hw70			

Era	AU	Description	THLB	Planted	Regen Delay	Planted Composition	SI	OAF1	OAF2	Ingress	Ingress Composition	JS Age	JS Density	Fert Age
2021+	**205**	CWHdm_Warm_enhanced	1,077	891	2	Fd67Cw32	35.1	15	12.5	1,032	Dr8Fd5Cw4Hw80			
2021+	**206**	CWHdm_Warm_constrained	1,037	986	3	Fd85Pw14	27.7	15	12.5	1,190	Fd17Cw8Dr2Hw70			
2021+	**207**	CWHdm_Gentle Cool_Zonal_Good	14,868	1,165	3	Fd61Cw23Pw14	35.4	15	12.5	1,438	Fd14Cw7Dr2Hw75			
2021+	**208**	CWHdm_Gentle Cool_Zonal_Med_Poor	9,633	1,165	3	Fd61Cw23Pw14	31.3	15	12.5	1,438	Fd14Cw7Dr2Hw75			
2021+	**209**	CWHdm_Gentle Cool_enhanced_Conifer	6,767	962	2	Fd66Pw33	36.5	15	12.5	1,233	Dr7Fd4Cw4Hw83			
2021+	**210**	CWHdm_Gentle Cool_enhanced_Dr	951	1,200	1	Dr100	36.0	15	5					
2021+	**211**	CWHdm_Gentle Cool_constrained	3,422	977	3	Fd64Cw20Pw14	28.3	15	12.5	1,557	Fd21Cw13Dr3Hw61			
2021+	**212**	CWHxm_All_Zonal_Good	4,692	924	2	Fd75Pw25	34.4	15	12.5	1,060	Fd39Hw54Cw4Dr1			
2021+	**213**	CWHxm_All_Zonal_Med_Poor	3,926	924	2	Fd75Pw25	30.9	15	12.5	1,060	Fd39Hw54Cw4Dr1			
2021+	**214**	CWHxm_All_enhanced	1,977	1,069	2	Fd79Cw15Pw5	34.7	15	12.5	984	Dr45Fd24Hw25Cw4			
2021+	**215**	CWHxm_All_constrained	1,964	1,046	3	Fd71Pw28	28.6	15	12.5	2,730	Fd26Hw53Dr16Pw3			
2021+	**216**	CWHvm1_Warm_Zonal	3,418	1,129	2	Fd62Cw37	34.1	15	5	1,460	Hw82Ba9Cw6Dr1			
2021+	**217**	CWHvm1_Warm_enhanced	680	1,129	2	Fd62Cw37	34.2	15	5	1,460	Hw82Ba9Cw6Dr1			
2021+	**218**	CWHvm1_Warm_constrained	428	1,129	2	Fd62Cw37	29.7	15	5	1,460	Hw82Ba9Cw6Dr1			
2021+	**219**	CWHvm1_Gentle Cool_Zonal_Good	5,543	951	3	Fd50Cw49	35.2	15	5	2,109	Hw88Ba6Cw4Dr1			
2021+	**220**	CWHvm1_Gentle Cool_Zonal_Med_Poor	1,418	951	3	Fd50Cw49	32.3	15	5	2,109	Hw88Ba6Cw4Dr1			
2021+	**221**	CWHvm1_Gentle Cool_enhanced_Conifer	3,733	936	3	Cw60Fd40	23.2	15	5	1,608	Hw94Ba4Dr1			
2021+	**222**	CWHvm1_Gentle Cool_enhanced_Dr	513	1,200	1	Dr100	33.0	15	5					
2021+	**223**	CWHvm1_Gentle Cool_constrained	690	1,129	2	Fd62Cw37	30.8	15	5	1,460	Hw82Ba9Cw6Dr1			
2021+	**224**	CWHds1_Warm	2,307	820	3	Fd71Cw28	31.3	15	12.5	922	Dr26Cw7Fd3Hw62			
2021+	**225**	CWHds1_Gentle Cool_Good	4,311	749	3	Fd77Cw22	34.3	15	12.5	1,362	Dr23Cw3Fd3Ba3Hw67			
2021+	**226**	CWHds1_Gentle Cool_Med_Poor	3,278	749	3	Fd77Cw22	30.9	15	12.5	1,362	Dr23Cw3Fd3Ba3Hw67			
2021+	**227**	CWHdm_Warm	3,575	986	3	Fd78Cw7Pw14	33.3	15	12.5	1,140	Fd13Cw6Dr6Hw73			
2021+	**228**	CWHdm_Gentle Cool_Good_Conifer	8,391	1,094	3	Fd61Cw23Pw14	35.0	15	12.5	1,374	Fd15Cw7Dr2Hw74			
2021+	**229**	CWHdm_Gentle Cool_Good_Dr	404	1,200	1	Dr100	36.0	15	5					
2021+	**230**	CWHdm_Gentle Cool_Med_Poor	5,863	1,165	3	Fd61Cw23Pw14	32.4	15	12.5	1,438	Fd14Cw7Dr2Hw75			
2021+	**231**	CWHxm_All_Good	3,999	988	2	Fd76Cw11Pw11	34.2	15	12.5	945	Fd44Hw49Cw4Dr1			
2021+	**232**	CWHxm_All_Med_Poor	5,761	924	2	Fd75Pw25	31.4	15	12.5	1,060	Fd39Hw54Cw4Dr1			
2021+	**233**	MHmm_ESSF_Warm	2,885	850	4	Cw33Yc33Ba34	17.3	15	5	2,000	Ba55Hw30Yc15			
2021+	**234**	MHmm_ESSF_Gentle Cool_Plt	4,793	850	4	Cw33Yc33Ba34	16.6	15	5	2,000	Ba55Hw30Yc15			
2021+	**235**	MHmm_ESSF_Gentle Cool_Nat	1,690	0	0		23.2	15	5	2,000	Hw65Ba28Yc7			
2021+	**236**	CWHms1_Warm_Submontane	1,772	879	2	Fd61Cw38	28.5	15	5	1,498	Ba34Hw65			
2021+	**237**	CWHms1_Gentle Cool_Submontane	2,393	741	3	Cw45Fd20Ba20Se13	20.7	15	5	1,890	Ba57Hw42			
2021+	**238**	CWHms1_Warm_Montane	55	713	3	Cw57BaSe42	20.1	15	5	1,950	Ba55Hw44			
2021+	**239**	CWHms1_Gentle Cool_Montane	964	612	3	Cw66Ba16Se16	20.1	15	5	2,150	Ba50Hw49			
2021+	**240**	CWHvm1_Warm	4,038	1,129	2	Fd62Cw37	32.6	15	5	1,460	Hw82Ba9Cw6Dr1			
2021+	**241**	CWHvm1_Gentle Cool_Good_Conifer	2,075	986	3	Fd46Cw53	25.1	15	5	2,047	Hw87Ba6Cw4Dr1			
2021+	**242**	CWHvm1_Gentle Cool_Good_Dr	84	1,200	1	Dr100	33.0	15	5					
2021+	**243**	CWHvm1_Gentle Cool_Med_Poor	6,901	1,010	3	Fd49Cw50	21.7	15	5	1,890	Hw86Ba7Cw4Dr1			
2021+	**244**	CWHvm2_Warm	11,931	903	3	Cw58Fd21Ba20	20.4	15	5	2,650	Ba32Hw65Dr1			
2021+	**245**	CWHvm2_Gentle Cool_Plt	23,240	713	3	Cw74Ba25	20.4	15	5	3,240	Ba30Hw67Dr1			
2021+	**246**	CWHvm2_Gentle Cool_Nat	3,892	0	0		25.0	15	5	3,850	Hw44Ba41Cw15			
<1999	**1**	CDFmm_All	168	804	2	Fd89Cw10	27.3	15	12.5	1,337	Fd65Hw30Dr3Pw1			
<1999	**2**	CDFmm_All	43	804	2	Fd89Cw10	27.3	15	12.5	1,337	Fd65Hw30Dr3Pw1	15	600	20
<1999	**7**	CWHdm_Warm_zonal	879	910	3	Fd75Cw25	33.4	15	12.5	1,550	Fd13Cw6Dr2Hw77			
<1999	**8**	CWHdm_Warm_zonal	207	910	3	Fd75Cw25	33.4	15	12.5	1,550	Fd13Cw6Dr2Hw77			20
<1999	**9**	CWHdm_Warm_enhanced	158	956	2	Fd67Cw32	35.8	15	12.5	1,096	Dr8Fd5Cw4Hw81			
<1999	**10**	CWHdm_Warm_constrained	211	910	3	Fd75Cw25	28.6	15	12.5	1,550	Fd13Cw6Dr2Hw77			
<1999	**11**	CWHdm_Warm_zonal	27	910	4	Fd75Cw25	33.0	15	12.5	1,550	Fd13Cw6Dr2Hw77			
<1999	**12**	CWHdm_Warm_zonal	13	910	4	Fd75Cw25	33.0	15	12.5	1,550	Fd13Cw6Dr2Hw77			35
<1999	**13**	CWHdm_Gentle Cool_Zonal_Fd lead<50%	257	879	3	Fd45Cw33Bg20	33.8	15	12.5	2,222	Fd9Cw4Dr1Hw84			
<1999	**15**	CWHdm_Gentle Cool_Zonal_Fd lead>=50%	1,328	1,235	3	Fd61Cw23Bg14	33.8	15	12.5	1,502	Fd13Cw6Dr2Hw76	15	600	20
<1999	**16**	CWHdm_Gentle Cool_Zonal_Non_Fd lead	2,101	851	3	Fd43Cw34Bg21	34.2	15	12.5	2,294	Fd9Cw4Dr1Hw84			
<1999	**18**	CWHdm_Gentle Cool_enhanced	937	818	2	Fd60Cw21Bg18	36.6	15	12.5	1,528	Dr5Fd3Cw3Hw86			

Era	AU	Description	THLB	Planted	Regen Delay	Planted Composition	SI	OAF1	OAF2	Ingress	Ingress Composition	JS Age	JS Density	Fert Age
<1999	**19**	CWHdm_Gentle Cool_enhanced	156	818	2	Fd60Cw21Bg18	36.6	15	12.5	1,528	Dr5Fd3Cw3Hw86	15	600	
<1999	**20**	CWHdm_Gentle Cool_constrained	548	901	3	Fd75Cw24	28.6	15	12.5	1,933	Fd17Cw10Dr3Hw68			
<1999	**21**	CWHdm_Gentle Cool_Zonal_Fd lead<50%	11	846	4	Fd65Cw34	33.0	15	12.5	2,294	Fd9Cw4Dr1Hw84			