# Tree Farm License 26

## MANAGEMENT PLAN #10

**Version 1.3**

**November 27, 2019**

**Project 1493-1**

*Prepared for:*

*District of Mission*
*33835 Dewdney Trunk Rd*
*Mission, BC V2V 4L9*
*www.mission.ca*
*604-820-3784*

*Prepared by:*

*Forsite Consultants Ltd.*
*330 – 42nd Street SW*
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*Salmon Arm, BC, V1E 4R1*
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FORSITE
Forest Management Specialists

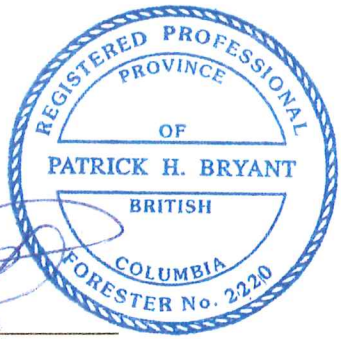
# Submission Page

Mission Municipal Forest - Tree Farm License 26
Management Plan #10

Licensee: District of Mission

This Management Plan #10 was prepared by:


Cosmin Man, RPF
Forsite Consultants Ltd.




Patrick H. Bryant, RPF
Forsite Consultants Ltd.

This Management Plan #10 was submitted on behalf of the District of Mission by:


Chris Gruenwald, RPF
Director of Forestry, District of Mission


Kelly Kitsch, RFT
Forestry Technologist, District of Mission

# Management Plan #10 Approval Letter

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Reference: 252250

November 26, 2019

Mrs. Kelly Cameron, RFT
Forestry Technologist
District of Mission
33835 Dewdney Trunk Road
Mission, British Columbia
V2V 4L9

Dear Kelly:

Thank you for the Tree Farm Licence 26 DRAFT MANAGEMENT PLAN #10 Version 1.1, June 19, 2019, (MP #10).

Please address the comments outlined in the table below prior to submitting the final version of MP #10 to the Chief Forester for approval. It is acceptable for you to incorporate similar or related edits to those indicated.

| Electronic page | Comments |
|---|---|
| numerous | Correct all references to "Annual Allowable Cut" to "Allowable Annual Cut" |
| numerous | Correct all references to "forecasts" and "forecasting" to "projects", "projections" or "projecting". |
| 16<br>17 | Ensure all acronyms are defined the first time they are provided<br>"MHA" on page 9<br>"NHLB" on page 10 |
| 22 | Correct "Ministry of Forests, Lands, Natural Resources and Rural Development (FLNRRD)" to "Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)" |
| 50 | Clarify how much of the 6,713 ha THLB is removed as future roads, trails and landings. Based upon information provided, it appears another 68 hectares is removed over time as future roads, trails and landings. |
| 62 | Should the reference for Spruce utilization be 17.5 rather than 12.5? If so, please correct the text to denote the corrected utilization, and provide advice as to what this correction could mean to the projected timber supply. |



Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Forest Analysis and Inventory Branch
Mailing Address:
PO Box 9512 Stn Prov Govt
Victoria BC V8W 9C2
Telephone: 250-356-5947
Fax: 250-387-5999

| | |
|---|---|
| 62<br>Cont'd | As little spruce is harvested within TFL 26, it is unlikely this change in utilization would significantly change the projected harvest. The inclusion of a statement with similar advice (possibly with a little quantification as to the percent of the projected harvest that is spruce) would suffice. I do not believe there is any necessity to complete additional analysis. |
| | Update the Management Plan to include new correspondence that is appropriate for inclusion. |

While you are not required to address the following, we believe incorporating these recommendations would improve the management plan:

| Electronic page | Comment |
|---|---|
| 52 | Should "landing" be "landings"? |
| 54 | Could the section heading "2.11.2 Long-Term Reserves" is on this page be formatted such that the section heading is not on a separate page from the content? |
| 55 | Should "by" be deleted in this text "non-merchantable stands were defined by as older than 200 years"? |
| 57 | It would be informative if tables such as Table 12 could include the area considered to be THLB. For example, how many of the 98 hectare UREP near Morgan Lake is THLB? |
| 60 | It would be informative if table 13 indicated the hectares of THLB for each AU. |
| 64 | Should "was fertilized again in 2008" be "had previously been fertilized in 2008"? |
| 70 | Could the report be formatted to retain the table 24 header with the remainder of the table information? |
| 76 | The "t" should likely be deleted in "It is important to note that for t this analysis," |
| 77 | Should the plural s in CWSs ("Hydrological recovery within CWSs was controlled") be removed? |
| 77 | The report indicates "[a]s a result, VQO objectives had a relatively high negative impact on the harvest flow." Could you quantify this impact? |
| 79 | Is it possible to improve the formatting so Table 29 is not split (or is split more cleanly)? |
| 81 | Is the area is presented in the first table total area, forested area or THLB? It would be beneficial for this to be clarified. |

| | |
|---|---|
| 82 | With respect to the legend at the bottom of the page, it would be beneficial for the same colour associations to be utilized consistently throughout the MP. |
| 86 | Should "on" be "of" in "Use on LiDAR-enhanced forest inventory"? |
| 86 | "(in line with operational reality." requires a closing bracket. |
| 94 | Should "the" be "with" in the text "This analysis was conducted the Patchworks™,"? |
| 97, 98 | Formatting could be improved such that the note does not overlap with the legend. |

Ensure all references to the document being a draft are removed for your final submission.

You are reminded that the public review process, including information sharing with First Nations, is subject to the terms and conditions outlined in Part 3 of the Personal Information Protections Act. For example, if information used to delineate indigenous community lands within TFL 26 has been provided in confidence: care will have to be taken to ensure this information is not revealed through the public release of analysis data and maps; you will have to advise government that your analysis data contains confidential information; and you may need to provide two copies of analysis data (on containing the confidential information and one without the confidential information).

Consultation is considered to be ongoing with aboriginal communities through this process and we will keep you apprised as additional engagement occurs.

Additional information or clarification may be requested as the decision support stage approaches conclusion. Such additional information will not necessarily need to be incorporated into the management plan.

Yours truly,

Doug Beckett, RPF
Regional Timber Supply Forester
Forest Analysis and Inventory Branch

# Executive Summary

This is the tenth Management Plan prepared for the Mission Municipal Forest (MMF) - Tree Farm License 26 held by the District of Mission. The completed plan meets the requirements of the *Tree Farm License Management Plan Regulation* (B.C. Reg. 280/2009) and is comprised of four key components:

- Public Review Strategy that describes the approach for engaging First Nations and reviewing each component of the management plan process with the public.
- Management Plan that includes a general description of MMF land base, a brief history of the MMF, the title and a description of each of the publicly available planning documents used to guide forest management and operations in the TFL area, and a summary of the public review and First Nations referral process;
- Timber Supply Analysis of the short term and long term availability of timber for harvesting in the MMF area, including the impact of management practices on the availability of timber;
- Information Package includes supporting documentation for the Timber Supply Analysis.

The Management Plan must be approved by the Deputy Chief Forester who considers the Timber Supply Analysis produced to determine the allowable annual cut (AAC) for this license.

The current AAC for Tree Farm License 26 is 45,000 m³, established on March 26, 2010. The Timber Supply Analysis for this Management Plan #10 examined the current harvest practices and incorporated new information on inoperable areas, inventory, growth and yield, and other constraints across the landscape. Taking into account the community values, strategic vision, and yet undeveloped opportunities in the Mission Interpretive Forest, the District of Mission proposes an increase in AAC to 56,602 m³.

# Contents

# List of Figures



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# List of Acronyms

| | |
|---|---|
| AAC | Allowable Annual Cut |
| BEC | Biogeoclimatic Ecosystem Classification |
| CWH | Coastal Western Hemlock BEC zone |
| FLNRORD | BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development |
| FPPR | Forest Planning and Practices Regulation |
| FRPA | Forest and Range Practices Act |
| FSP | Forest Stewardship Plan |
| LiDAR | Light Detection and Ranging |
| MH | Mountain Hemlock BEC zone |
| MHA | Minimum Harvest Age |
| MMF | Mission Municipal Forest |
| NHLB | Non-harvestable Land Base |
| OGMA | Old Growth Management Area |
| PRRO | People of the River Referral Office |
| RFT | Registered Forest Technologist |
| RPF | Registered Professional Forester |
| TFL | Tree Farm License |
| TSA | Timber Supply Area |

# Document Revision History

| Version | Date | Description |
|---|---|---|
| 0.1 | March 29, 2019 | First version distributed to project team for review and comment. |
| 0.2 | May 14, 2019 | Updated version based on input from the project team. |
| 1.0 | June 3, 2019 | Initial draft shared with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development for a content review. |
| 1.1 | June 19, 2019 | Several minor edits identified through FLNRORD informal content review.<br>Released for public review and First Nations referral. |
| 1.2 | November 4, 2019 | Several minor corrections and updated section 7.2 Public and First Nations Review of the Draft Management Plan #10.<br>Submitted to British Columbia's Chief Forester for approval. |
| 1.3 | November 27, 2019 | Several changes to text based on Forest Analysis and Inventory Branch recommendations.<br>Included summary of recent comments received in Table 7. |

# 1 Introduction

This Management Plan, the tenth for the Mission Municipal Forest (MMF) - Tree Farm License (TFL) 26 held by the District of Mission, meets the requirements of the *Tree Farm License Management Plan Regulation* (B.C. Reg. 280/2009). This regulation, enacted by the provincial government in November 2009 (with associated amendments to the Forest Act), includes content requirements, submission timing and public review requirements for TFL Management Plans. These content requirements replace the Management Plan content requirements listed in the TFL document and reduce the duplication of Forest Stewardship Plan matters (objectives and strategies).

This document provides a general description and history of the TFL, lists the primary planning documents that guide the management of the TFL and summarizes outcomes from the public review and First Nations referral process. The Management Plan also includes, as appendices, the accepted Information Package and a draft Timber Supply Analysis.

# 2 Description of the Mission Municipal Forest

The MMF is located to the north of the community of Mission, a municipality of approximately 38,000 people, in the northern half of the District of Mission, in southwestern BC (Figure 1). Approximately 88% of the MMF is Crown land (Schedule B) and the remaining 12% is municipal land (Schedule A). The MMF is split into two similar-sized parts; on each side of the lower arm of Stave Lake.

The MMF lies mostly within Coastal Western Hemlock (CWH) biogeoclimatic ecosystem classification (BEC) zone, with small portion within the Mountain Hemlock (MH) BEC zone at higher elevations. The terrain within MMF is variable; most of the area is between 100 metres and 700 metres elevation. Mt. Crickmer, located in the northwest corner of the MMF, rises to the highest elevation of 1,356 metres.

The total area of the MMF is approximately 10,935 hectares from which 9,875 hectares (90%) is considered the forest management land base that contributes towards meeting non-timber and other management objectives (e.g., biodiversity) and 7,289 hectares (67%) is considered available for timber harvesting. As individual harvest openings are planned, further reductions are implemented to address non-timber values for an effective harvest area of 6,563 hectares (60%).

It was formed in 1958 as an outcome of the report

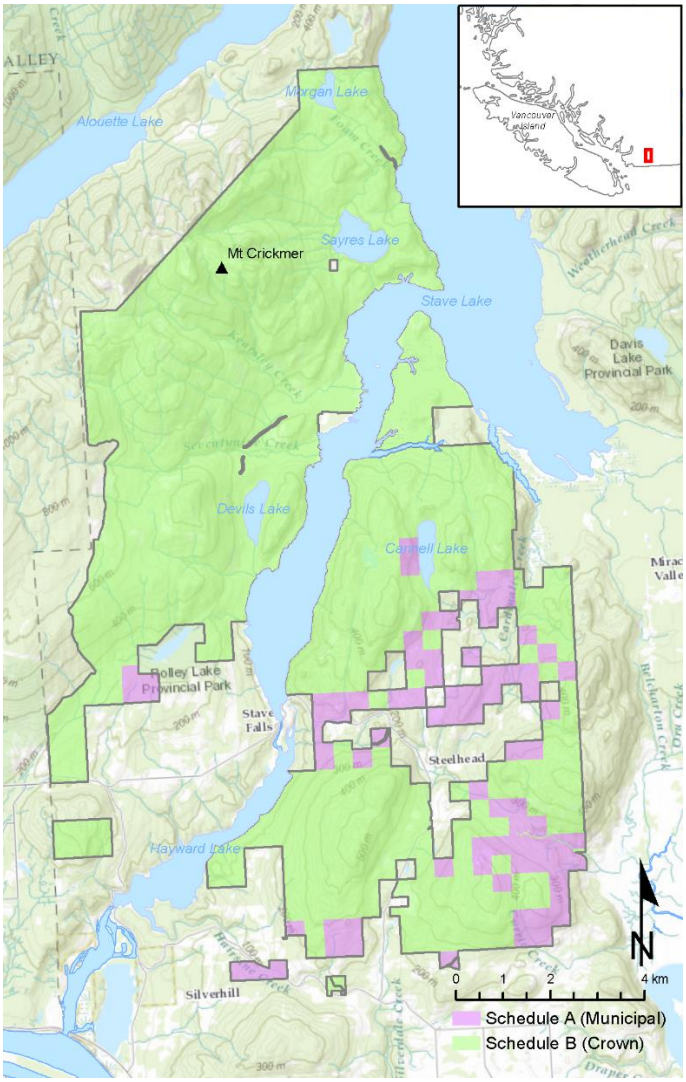



*Figure 1 Location of the Mission Municipal Forest - TFL 26*

from Gordon Sloan and the Royal Commission on the Forest Resources of British Columbia of 1945, where there was a recommendation that municipalities manage the local forests. Operating for over 60 years, Mission will share their experiences of addressing the challenges of managing their area based working forest in the lower mainland, access management, recreational interests, educational programming and deepening relations with their First Nations neighbours.

The license area is located within the traditional territory of the Sto:lo Nation, specifically the Katize, Kwantlen, Matsqui, Musqueam, Leqa:mel, and Semiahmo First Nations, Peters Band, Seabird Island Band, and People of the River Referral office (Sumas Band, Sto:lo Tribal Council, Sto:lo Nation), and as of April 2019, Shxw'owhamel First Nation.

# 3 History of the Mission Municipal Forest

## 3.1 LICENSE HOLDER AND ADMINISTRATION

The Mission TFL 26 was awarded to District of Mission on July 22, 1958. The municipality owned over 1,000 hectares, which were incorporated into a Forest Reserve under the Municipal Act in 1948. In 1958, the provincial government committed more crown land to grant TFL 26 as the first and only municipally held TFL in BC until 1993.

The District's Forestry Department manages Mission TFL 26, also known as the MMF.

## 3.2 CONSOLIDATIONS AND SUBDIVISIONS

The District of Mission has been the sole licensee of TFL 26 since its establishment in 1958.

## 3.3 MAJOR BOUNDARY CHANGES

One major boundary changes has occurred since the current Management Plan 9. A land swap was recently completed, whereby four parcels of land within the District of Mission, but outside of TFL 26, were added to the TFL 26 (approximately 473 hectares from the Fraser Timber Supply Area - TSA) under Instrument 36. In exchange, land along the southwestern boundary was removed from TFL 26 (approximately 321 hectares) and incorporated into the adjacent First Nation Woodlands License N2Z.

## 3.4 ALLOWABLE ANNUAL CUT HISTORY

Table 1 shows the complete history of Allowable Annual Cut (AAC) for TFL 26. The current AAC accounts for 0.28% of the total provincial TFL AAC and 0.06% of the total AAC from all tenures in BC. A portion of the current AAC is apportioned to the BC Timber Sales (1,602 cubic metres or 3.56%).

*Table 1 AAC History*

| Date | AAC ($m^3$/year) | Rationale |
|---|---|---|
| 1958 | 12,035 | |
| 1964, 1969, and 1974 | Subsequent increases* | |
| 1979 | 32,281 | Improved inventories and yield estimates |
| 1983 and 1988 | Subsequent increases* | |
| 1989 | 41,200 | Area additions and site productivity reclassification |
| July 01, 1996 | 45,000 | Improved operability mapping |
| August 01, 2001 | 45,000 | |
| March 26, 2010 (current) | 45,000 | |

**information on the actual AAC values was not available.*

# 4 Publicly Available Planning Documents

## 4.1 REGIONAL AND LANDSCAPE LEVEL PLANS

Only one land use designation applies to the MMF. A Ministerial Order under the Land Act dated February 4, 2013 established land use objectives for Old Growth Management Areas (OGMA) within the two Landscape Units (Hatzic and Alouette) where the MMF is located. The goal of these objectives is to contribute to landscape-level biological diversity.

## 4.2 OPERATIONAL PLANS

The Forest Stewardship Plan (FSP) specifies results and strategies consistent with government objectives that apply to the land base. FSPs are the main planning document guiding forest operations; prepared and submitted in accordance with the Forest Planning and Practices Regulation (FPPR) Sections 7, 14, and 26 and Forest and Range Practices Act (FRPA) Section 196(3). Two FSPs currently apply to areas within the MMF:

- FSP 65(3) – 2017 to 2022. District of Mission.
- FSP 643 – 2017-2022. BC Timber Sales, Chinook Business Area, and signatories of the plan (i.e., Leq'a:mel Forestry Limited Partnership).

## 4.3 PLANS REQUIRED BY INDEPENDENT FORESTRY CERTIFICATION PROGRAMS

The forest management activities within the MMF have been continuously certified to the ISO 14001:2004 standard since December 2004 to 2010. The District of Mission maintains a comprehensive Environmental and Safety Management System to maintain standards but have chosen not to renew certification since 2010.

The District of Mission Forestry Department has been SAFE Company Certified with the BC Forest Safety Council continuously since December 2006. The District of Mission maintains a comprehensive Environmental and Safety Management System in support of maintaining certification under this standard.

# 5 Linking Community Values to Management

## 5.1 VISION

*The best in sustainable community forestry values will be developed and delivered in the MMF, in an efficient manner. Mission residents will be proud of the MMF, can expect a valuable stream of benefits from their forest and will be able to incorporate it into their daily lives. The MMF will be a forest operation known throughout BC for its innovation and leadership.*

## 5.2 MISSION STATEMENT

*The MMF is a community forest operating under the highest possible standards. The MMF exists for the people of Mission, by creating a sustainable balance of various economic, social, scientific and environmental forest values as well as providing memorable forest experiences to Mission residents and its visitors*

## 5.3 MUNICIPAL FOREST STRATEGIC PLAN

- The District of Mission Forestry Department operates as part of the overall municipal team and follows the District of Mission (section 5.1), purpose and service standards.
- Provide and consider a wide range of forestry values including forest-based recreation opportunities.
- Respect environmental stewardship and sustainability principles as well as legislative requirements.
- Utilize science and research-based forest knowledge to ensure management, environmental and sustainability decisions are realistic and will result in the desired outcomes.
- Regarding safety, strive for every worker to go home safely at the end of each workday.
- Employ continual improvement practices with the belief that all processes can be improved, workers need to know what a good job is, and to focus on the process when results are not as expected.
- Practice integrity in our actions with each other, our clients and the public. Create trust through mutual respect.
- Employ market logging and log value maximization strategies in general, although consider timely opportunities for other uses or purposes of some of the MMF logs.
- The primary economic measure is to maintain economic self-sufficiency for the MMF operation. Then produce profits, which can be used to create other forms of community benefit, but profit that properly considers the cost of providing the extent and balance of community forest values desired in a credible MMF operation.
- In times of scarce resources, work in an efficient and effective manner to develop or maintain the desired outcomes.
- To best realize the vision and the desired outcomes in an efficient manner, maintain a core group of District of Mission staff to do most management, professional, technological, clerical and supervisory roles with most of the labour and specialty functions being done by contracting/consulting.
- Focus on creating value (i.e. environmental and economic) and potential forest experiences (i.e. recreation, education, green-spaces, social, spiritual) from the MMF for District of Mission residents and its visitors. Due to the high percentage of crown land along with the accompanying legislation, consider the benefits of the MMF also from a provincial perspective.
- Attain a sustainable forest management certification for the MMF. Maintain this certification as long as there are adequate, identifiable reasons to continue.
- Achieve partnerships or alliances with other government, First Nations, private, commercial, recreational and hobby groups, so that mutually beneficial forest value benefits are obtained.
- To survive an often turbulent and changeable forestry business climate, consider evolving strategic innovation ideas as they arise including modifying the strategic plan with just cause.
- To be a resource to other District of Mission departments on tree and forest land use issues.

## 5.4 RESOURCE MANAGEMENT GOALS

The following section contains the broad social, economic and resource management goals for the MMF and are consistent with the guiding principles and goals.

#### 5.4.1 SOCIAL

- Sustain the current forestry sector, which provides the economic stability for the local community.
- Ensure the protection and safety of people and property through wildfire management.
- Practice open dialogue with the community on resource management.
- Collaborate with persons and other resource groups and stakeholders within the MMF.

#### 5.4.2 ECONOMIC

- Support local businesses with the expertise in resource management to the extent practicable.
- Utilize the timber resource allocated to the MMF.
- Promote First Nations and local government relations through economic development opportunities.
- Encourage and initiate innovative forest practices, which can help sustain and/or increase the AAC over the long-term.

#### 5.4.3 ENVIRONMENTAL

- Achieve a high level of environmental standards through forest certification.
- Promote sustainable harvest practices, which are consistent with legislation.
- Be consistent with forestry legislation and with higher level plans under FRPA.
- Collaborate with provincial government to ensure habitat to support key wildlife.

### 5.5 MANAGEMENT OF BOTANICAL FOREST PRODUCTS

The MMF manages requests for harvesting and collection of botanical forest projects under municipal policy Minor Forest Products & Activity Report LIC.18. Requests for products are reviewed and if appropriate issued under a commercial or person permit. Permits are tracked and reported with internal annual reporting.

# 6 Establishing the Allowable Annual Cut

## 6.1 TIMBER SUPPLY ANALYSIS

The Timber Supply Analysis examines the short- and long-term availability of harvesting timber within the MMF and considers how management practices influence the availability of merchantable timber. This analysis requires key supporting information including: resource inventories, proposed timber specifications, a description of the model and analytical methods used to formulate the timber supply and facilitate the management and conservation of the non-timber resource values, plus any other relevant information.

#### 6.1.1 SUPPORTING DOCUMENTATION FOR TIMBER SUPPLY ANALYSIS

The Timber Supply Analysis for the MMF was prepared by Forsite Consultants Ltd. (see Appendix 3). Harvest projections were modelled using the best available information on current forest management and the land base available for timber harvesting after objectives for non-timber were met. Details on the analysis assumptions are described in an Information Package made available for public review and First Nations engagement, and later

accepted by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development's (FLNRORD) Forest Analysis and Inventory Branch on December 12, 2018 (see Appendix 2).

### 6.1.2 PROPOSED ALLOWABLE ANNUAL CUT

Section 8 of the *Forest Act* requires the chief forester to consider a number of specified factors in determining AACs for timber supply areas (TSAs) and TFLs.

In accordance with Section 23(3) of the *Interpretation Act*, the deputy chief forester is expressly authorized to carry out the functions of the chief forester, which include those required under Section 8 of the Forest Act.

Based on results from the timber supply analysis prepared for the MMF (section 6.1), and taking into account the community values, strategic vision, and yet undeveloped opportunities in the Mission Interpretive Forest, the allowable annual cut proposed for TFL 26 is 56,602 cubic metres.

# 7 Public Review and First Nations Referral

The District of Mission submitted a public review strategy to the FLNRORD on June 25, 2018, which was subsequently approved by the Regional Executive Director on July 19, 2018 (see Appendix 1). As outlined in the strategy, two products from this management plan process were made available for public review and First Nations engagement:

- a draft information package, and
- a draft management plan – including the final Information Package and draft Timber Supply Analysis.

In both cases, similar approaches were applied to invite the public and First Nations to review and comment on the draft material presented:

- access to a printed copy at various locations,
- access to an electronic document and maps through a website link,
- email distribution to Agencies,
- email distribution to First Nations, and
- newspaper advertisements.

All distributions and responses received were shared with the FLNRORD.

## 7.1 PUBLIC AND FIRST NATIONS REVIEW OF THE DRAFT INFORMATION PACKAGE

The draft Information Package was the first product made available for review. It described the information used to support the Timber Supply Analysis; including data inputs and assumptions. The review period for this draft document was scheduled from September 13 to November 13, 2018. The draft Information Package consisted of a 33-page document, maps, and a temporary web map service for online viewing of various spatial data.

### 7.1.1 DISTRIBUTION

On September 13, 2018, the District of Mission distributed the draft Information Package material to the agencies, First Nations and local governments and associations specified in the tables below. Each distribution included an email with hyperlinks to access the document, plus a temporary web map to view spatial data to be used in the analysis. These emails were distributed to contacts listed in Table 2, Table 3, and Table 4, and included:

- request for confirmation that the email was received,

- offer to print the documents and/or maps and to meet with First Nations' representatives,
- details on the timing of the review period (60 days) and locations to view the products locations listed below,
- brief summary highlighting changes (where applicable) proposed from the existing Management Plan #9, and
- contact for submitting questions and comments.

*Table 2 Agency Contacts Reviewing the Draft Information Package*

| Agency | Contact | Delivered by |
|---|---|---|
| FLNRORD – Timber Supply Forester | Doug Beckett | email |
| FLNRORD – Senior Analyst | Jim Brown | email |
| FLNRORD – Chilliwack Natural Resources District – District Manager | Mike Peters | email |
| FLNRORD – Chilliwack Natural Resources District - Senior Licensed Authorizations Officer | Jack Sweeten | email |
| FLNRORD – Coast Area, Section Head, Forest Stewardship | Craig Wickland | email |
| FLNRORD – Coast Area, Forest Pathologist | Stefan Zeglen | email |
| FLNRORD – Forest Inventory, Forest Mensurationist | Wenli Xu | email |
| FLNRORD – Growth and Yield Application Specialist | Mario DiLucca | email |
| FLNRORD – Chilliwack Natural Resources District - Advisor, First Nations Relations | Catharine Charman | email |

*Table 3 First Nations Contacts Reviewing the Draft Information Package*

| First Nation | Group or Association | Contact | Delivered by |
|---|---|---|---|
| Katzie | | Chief and Council | Canada Post |
| Kwantlen | | Chief and Council | Canada Post |
| Matsqui | | Chief and Council | Canada Post |
| Musqueam | | Chief and Council | Canada Post |
| Peters Band | | Chief and Council | Canada Post |
| People of the River Referral Office | Sumas Band<br>Leq'a:mel FN<br>Sto:lo Nation | Maretta Beger | Sto:lo Connect webpage |
| Seabird Island Band | | Chief and Council | Canada Post |
| Semiahmoo | | Chief and Council | Canada Post |
| Leq:amel* | Was to be notified through People of the River Referral Office (PRRO) – have now indicated they wish to be consulted (via Jan 8,2019 meeting) | | Shawn Gabriel<br>Referral engagement email |

**Shxw'owhamel First Nation will be included in draft Management Plan 10 information sharing and consultation.*

*Table 4 Local Governments and Associations Reviewing the Draft Information Package*

| Group / Association | Representative | Delivered by |
|---|---|---|
| District of Mission Council | Mayor & Council | email |
| Fraser Valley Regional District (Electorate Area F) | Dave Urban<br>Margaret-Ann Thornton | Canada Post |
| Durieu McConnell Creek Ratepayers Association | Shari Conroy | email |
| Stave Lake Leaseholders Association | Alvin Johnson,<br>Noreen Beauvais | email<br>email |
| BC Timber Sales-Chinook | Manager | Canada Post |
| Rec Sites and Trails BC | Tom Blackbird | Canada Post |
| Kenworthy Creek Community Watershed | Robert Dale | Canada Post |
| Abbotsford Water Sewer Commission | John McAuley | Canada Post |
| Tim Horton Childrens Foundation | Dave Newnham | Canada Post |
| Teal Jones Group | John Pichugin | Canada Post |
| Zajac Ranch for Children | Mel and Wendy Zajac | Canada Post |
| BC Institute of Technology | Jonathan Smyth | email |
| Trapper | Murray Galbraith | email |
| School District 75 | Colleen Hannah | email |
| West Coast Kids Cancer Foundation | Colin Worth | email |
| BC Hydro | Steve Higginbottom | email |
| Cascadia Environmental Ltd. | K&K Woodland license | email |
| 4 Wheel Drive Assoc. of BC | Kim Reeve, Dan Wishart | email |
| Backcountry Horsemen of BC | Rose Schroeder | email |
| Fraser Valley Mountain Bike Association | Rocky Blondin,<br>Dan Schubert | email<br>email |
| Steelhead Community Association | Jana Tennant | email |
| TrailsBC/The Great Trail | Leon Lebrun | email |
| Right Nutts ATV Club | Jacquie Horn,<br>Jason Coutere | email<br>email |
| Southwestern All Terrain Trails | Cal Kaytor | email |
| Stave Falls Community Association | Julia Renkema | email |
| PUBLIC – Via Social Media (Manager of Civic Engagement) | Michael Boronowski, | email |

Throughout the 60-day review period, copies of the draft Information Package document were also made available for review during regular working hours at the following locations:

- District of Mission, Forestry Office, 33835 Dewdney Trunk Road, and 8645 Stave Lake St, Box 20 Mission, BC V2V 4L9, 604-820-3700,
- Ministry of Forests, Lands, and Natural Resource Operations, Chilliwack District office, 46360 Airport Road, Chilliwack, BC, V2P 1A5, 604-702-5700, and
- District of Mission website (https://www.mission.ca/seeking-review-comments-tree-farm-management-plan/).

### 7.1.2 NEWSPAPER ADVERTISEMENTS

The District of Mission ran newspaper advertisements regarding the draft Information Package, on two separate occasions, in consecutive weeks, in the publications listed in Table 5. The advertisement indicated the public viewing locations, the length of time for review, web addresses to access or download each product, and contact

information (phone, fax, email) for submitting comments.

*Table 5 Newspaper Advertisements for the Draft Information Package*

| Newspaper | Distribution | Advertisement Dates |
|---|---|---|
| Mission City Record | Weekly | September 21 and October 15, 2018 |

### 7.1.3 SUMMARY OF COMMENTS RECEIVED

Only one comment on the draft Information Package was received from the public review and First Nation referral process (Table 6).

*Table 6 Comments Received on the Draft Information Package*

| Provided By | Summary of Comments or Questions |
|---|---|
| David Urban, Manager of Outdoor Recreation Planning, Fraser Valley Regional District | November 5, 2018 – reviewed the package from a recreational perspective. No specific comments, broad remark of thanks related to ongoing support the District has given towards the construction of the Experience the Fraser Canyon to coast Trail in the TFL. |

### 7.1.4 SUMMARY OF REVISIONS

While the comments and questions received did not result in any significant changes to the Information Package, the following adjustments were made before proceeding with the Timber Supply Analysis:

- Corrected several spelling errors and section numbering
- Section 2.11: added reference to coastal hardwood management strategy
- Section 2.3: added a paragraph to clarify that the Base Case scenario used the LiDAR-enhanced forest inventory
- Section 2.4: added brief description of key forest health issues raised by district staff
- Section 3.1: updated analysis unit definitions to line-up with the updated methodology of developing yield curves for the existing managed stands.
- Section 3.2 (Table 13): updated methodology to estimate yield curves for existing managed stands. Update regeneration assumptions for future managed stands to account for early age growth reduction of Douglas-fir due to Swiss needle cast.
- Section 3.5: added rationale for minimum harvest ages (MHA) of old coniferous and young deciduous stands that did not meet MHA criteria. Added report for the proportion of the projected harvest comprised from stands with less than 475 cubic metres per hectare.
- Section 3.8: updated methodology and fertilization responses and moved to section 7.4. The Base Case does not consider fertilization.
- Section 3.9 (Table 18): removed genetic gains for Western hemlock (Hw).
- Section 3.10: added text to improve the forest health description with respect to related to Swiss needle cast, root disease.
- Section 3.11: added discussion on the timber volume check – inventory vs. yield/forest estate model inputs.

- Section 4.1 (Table 19): added current percentage of old area for each reporting unit.
- Section 4.1 (Table 20): clarified maximum disturbance allowed as 50% under age 80
- Section 4.2.1: clarified the information source used to develop assumptions related to rotational reserves.
- Section 4.5: added 2 more patch sizes to allow some flexibility on harvest openings between 40-50ha.
- Section 5.2: clarified how the harvest flows are determined with Patchworks™.
- Section 5.3: clarified that disturbance in the non-harvestable land base (NHLB) was not implemented.
- Section 7.2: updated discussion as the LiDAR Enhanced Forest Inventory was incorporated into the Base Case, while the original forest inventory was applied as a sensitivity analysis.
- Appendix 1: added statistics for existing managed stands from RESULTS, used to inform yield curves development of existing managed stands.

The FLNRORD accepted the Information Package on December 12, 2018 (Appendix 2).

## 7.2 PUBLIC AND FIRST NATIONS REVIEW OF THE DRAFT MANAGEMENT PLAN #10

As per the Public Review Strategy (June 2018), First Nations Communities, Public, Stakeholders, User Groups and Government were provided the opportunity to comment on the Draft Management Plan #10.

Two notifications were placed in the Mission City Record July 5 and August 2, 2019.

An open house was held Saturday August 24 from 12 – 7pm.

The draft MP10 was posted on www.mission.ca for review and comment.

The following Table 7 is a summary of public and First Nation responses received and engagements pertaining to those responses.

*Table 7 Comments Received on the Draft Management Plan #10*

| Provided By | Summary of Comments or Questions | Response |
|---|---|---|
| Tracy Lister, Footprint Press Mission BC | August 24, 2019 Happy to see protection of old growth management areas and potential old growth areas. Prefer large buffers around parkland. Looking for information on Northern Goshawk. | August 28, 2019 Contact names provided for Goshawk experts |
| David Urban, Manager of Outdoor Recreation Planning, FVRD | July 29, 2019 - No comments but encouraging to see plan distributed so broadly. | No response provided. |
| Doug Beckett Regional Timber Supply Forester FLNRORD | November 22, 2019 – Request corrections to grammar/acronyms within MP10.<br>Suggestions to update text, tables, formatting in Info Package and Timber Supply Analysis for clarification of THLB, and formatting. | Changes made to each of MP10, Public Review Strategy, Info Package and Timber Supply Analysis to ensure consistency.<br><br>Final MP10 and Appendices submitted to Chief Forester on November 2019 |

| Provided By | Summary of Comments or Questions | Response |
|---|---|---|
| Matsqui | July 31, 2019 - Questions about what Matsqui should be focusing on within the new MP10.<br><br>August 22, 2019 - In pursuing of a FNWL and NRFL – Matsqui is interested in excess volume m³ not being pursued by TFL26.<br><br>September 6, 2019 – Meeting at Matsqui office with C. Charman (FLNRORD), K. Cameron (DOM), Chris Gruenwald (DOM)Meeting Summary:<br>-Excess volume requested from, how and why AAC increased,<br>-Old Growth concerns<br>-Looking for spiritual sites and medicinal plants<br>-fertilizer use, herbicide<br>-employment opportunities<br>-firewood | July 31, 2019 – Advised to request that guidance from C. Charman (FLNRO), and we could meet at Matsqui office to discuss further.<br>August 22, 2019 – Invitation to Open House, advised of the proposed conservative approach to AAC increase.<br><br>September 6, 2019 – AAC-Chief Forester would be required to determine this opportunity as area-based licence is no permitted to tranfer to another licensee<br>-DOM can accommodate as requested,<br>-Clarified DOM use of fert and no herbicides<br>-DOM can provide opportunities or information on forestry companies hiring<br>-firewood delivered October 10, 2019<br><br>September 19, 2019 - Emailed information on current old growth and expected increase of old growth over time from TSA page 2 and 6.<br>-DOM to offer Matsqui in-kind assistance in applications for FNWL/NRFL, work on a fuel management strategy. |
| Tyler Burnson, Land and Resources Coordinator Seyem' Qwantlen (Kwantlen) | September 6, 2019 - Kwantlen Traditional Territory where they assert Aboriginal rights and title. No further comments, please advise of any future updates. | No response required. |
| Maretta Berger People of the River Referral Office | July 3, 2019 - GIS modeled archeological potential indicated. Cultural Heritage Impact Assessments to be conducted by a professional archaeologist. | No response provided. CHIA and Arch assessments to be completed in the Cutting Permit and Road Permit Application Stages as per Strategic Engagement Agreement. |

| Provided By | Summary of Comments or Questions | Response |
|---|---|---|
| Shawn Gabriel, Referrals Officer Leq'a:mel First Nation | July 24, 2019 - Stated no formal referral received for Timber Supply Review, and requested re-engagement on TSR.<br><br>September 25, 2019 – email that formal response will be sent on or before October 1 – nothing received. | August 21, 2019 - Consultation Meeting held at Leq'a:mel office (Staff/Hedberg & Assoc). Provided the draft Info Package and TSR January 8, 2019. Provided TSR and Draft MP10 for input June 24, 2019 for 60 days. All aspects of plan and AAC discussed. Additional 30 days of review provided, comments to be received by October 3, 2019. |
| | October 29, 2019 - Emailed concern over timber supply analysis and identified increase in volume, which could be an economic loss to Leq'a:mel. In the process of defining a consultation and accommodation protocol agreement – will identify upcoming date to meet and discuss a relationship. | October 29, 2019 – Email to acknowledge Leq'a:mel requires time to determine UNDRIP impacts. |
| | November 12, 2019 – Emailed series of questions regarding CHR and other resources management, monitoring, WTA-OGMAs, recreation, Elk management | November 19, 2019 – Provided responses and clarification to each question. |

# 8 Reporting

Annual reports provide overview and summary information on all the key activities in MMF, including crew and contract production data, project and obligation descriptions and status for various forestry projects, financial information, community contributions, staffing and forestry weather station data. Annual reports are available from the Forestry Department office by request.

# 9 Commitments

Not applicable at the time this document was prepared.

# Appendix 1 Public Review Strategy

BRITISH COLUMBIA

File: 19710-30/TFL 26

July 19, 2018

Kelly Kitsch, RFT
Forest Technologist
District of Mission,
P.O. Box 20,
33825 Dewdney Trunk Road,
Mission, B.C.
V2V 4L9

Dear Kelly Kitsch:

Thanks you for your submission on June 25, 2018 of a Public Review Strategy for Management Plan No. 10 for Tree Farm Licence 26.

As required by Section 6 (2) of the Tree Farm Licence Management Plan regulation, I hereby approve your public Review Strategy for Management Plan No. 10 for Tree Farm Licence 26.

Please be advised that the public review process, including information sharing with First Nations, is subject to the terms and conditions outlined in Part 3 of the Personal Information Protections Act.

Yours truly,

Mike Peters
Acting Regional Executive Director
South Coast Natural Resource Region

**Ministry of Forests, Lands, Natural Resource Operations and Rural Development** Chilliwack Natural Resource District
Mailing Address: 46360 Airport Road Chilliwack, BC, V2P 1A5
Tel: (604) 702-5700
Fax: (604) 702-5711

# Public Review Strategy for Management Plan 10

## Tree Farm Licence 26 (TFL26)

June 2018

*Prepared by:*
*Kelly Kitsch, RFT #0367*
*District of Mission*

# Table of Contents

# INTRODUCTION

Tree Farm Licence 26 (TFL26) is located within the District of Mission, north of the city center and generally surrounding the west side of the Stave Reservoir.

TFL26 as administered by the Ministry of Forests, Lands, Natural Resources and Rural Development (FLNRRD) Chilliwack Natural Resource District office located in Chilliwack. Located in the heart of the Fraser Valley, Mission lies just 60km east of Vancouver in the most populous region of the province. Mission has a current population of just under 39,000 residents (2016 census).

TFL26 is recognized as the first community managed forestry operation in British Columbia, with the licence awarded to Mission in 1958.

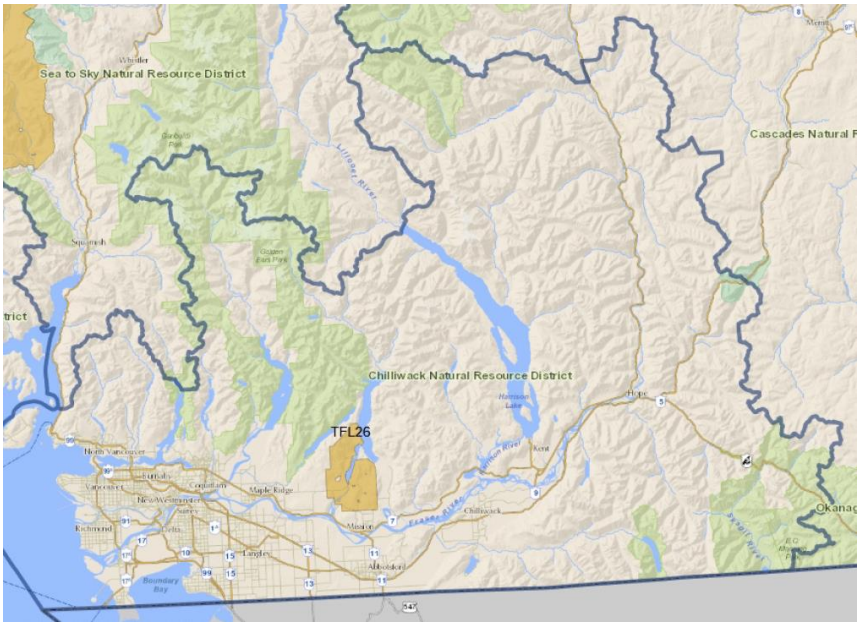



Figure 1. TFL26 location map in scale with Chilliwack Forest District)

The current Allowable Annual Cut (AAC) for TFL26 is 43,398m³/yr, which came into effect March, 1998 under Management Plan 9. An additional 1602 m³/yr of volume is available as provided to the BC Timber Sales program.

**Table 1 – Historical AAC for TFL 26**

| Plan | Effective Date | Annual Allowable Cut |
|---|---|---|
| Management Plan 8 | March 2000 - February 2010 | 45,000 m³ |
| Management Plan 9 | March 2010 - February 2020 | 45,000 m³ |

In accordance with Section 8 of the *Forest Act*, a tree farm licence must be offered for replacement every 10 years and part of the replacement includes a reanalysis of timber supply information, including any new developments, constraints, land additions and deletions, updated inventories, land based management determinations, wildlife habitat accommodations, and other land stewardship considerations in effect since the previous timber supply analysis.

This Public Review Strategy is the first step in defining the process in which information will be communicated to the Public, First Nations, Stakeholders, and User Groups who may have information to provide throughout the process, where their interests may be impacted by the AAC determination, or have further information to support the timber supply review.

Figure 2 illustrates the estimated timeline that is required by the province for meeting the determination dates required by the Chief Forester in order to approve Management Plan 10 for TFL26.

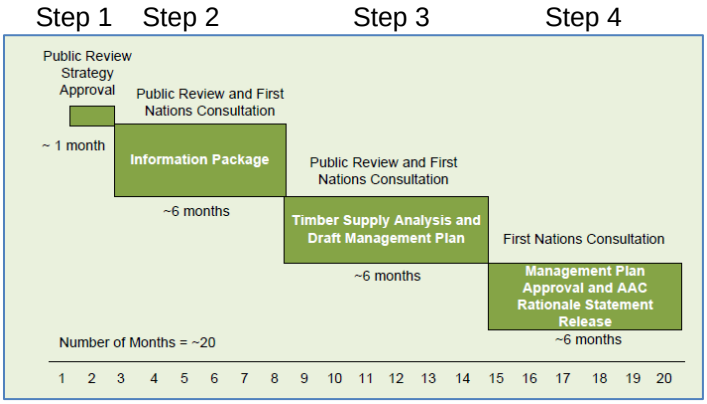



Figure 2

Table 2 is the order for all steps described above (some timelines may be adjusted still meeting final target date):

**Table 2 – Planned Sequence of Events**

| Step | | Stage | Approximate Date(s) |
|---|---|---|---|
| 1 | Public Review Strateg | TFL26 submits Public Review Strategy | May 2018 |
| 1 | | Regional Executive Director approves Public Review Strategy | June 2018 |
| 2 | Information Report | TFL26 prepares, submits, refers and advertises for review of draft Information Report | June 2018 – August 2018 |
| 2 | | Information Report review Period (at least 60 days) takes place | September 2018 – October 2018 |
| 2 | | Government review and comments submitted to TFL26 | October 2018 – December 2018 |
| 3 | Timber Supply Analysis and Draft Management Plan | TFL26 prepares, submits, refers and advertises Draft Management Plan 10 for review (including the Timber Supply Analysis and updated Information Report) | December 2018 – April 2019 |
| 3 | | Management Plan 10 review period (at least 60 days) takes place | May 2019 – July 2019 |
| 3 | | TFL26 holds public Open House at Leisure Centre | June 2019 |
| 4 | MP10 and AAC determination | Government review comments submitted to TFL26 | August 2019 |
| 4 | | TFL26 considers any comments received and submits a Final Management Plan 10 | August 2019 |
| 4 | | Chief Forester approves Management Plan 10 and determines Allowable Annual Cut | March 2020 |

# COMMUNICATION STRATEGIES

**First Nations**

Procedural aspects of consultation have not been designated to the District of Mission for this determination and therefore consultation with First Nation communities will be conducted by FLNRORD. To avoid duplication and avoid confusion, Mission will liaise with Provincial representatives in information sharing, notifications, and requests for information in order to address the needs of each First Nation and groups of First Nations. This may include Mission directly referring documents or FLNRORD forwarding documents on behalf of Mission. The District of Mission will provide opportunities to meet with Chief, Council and the respective communities at their convenience.

Consultation will be conducted as per any process agreement between the government and the First Nation. These agreements include Forest Consultation and Revenue Sharing Agreements (FCRSA) and a Strategic Engagement Agreement (SEA) with Sto:lo communities. For those communities that do not have a process agreement they will be consulted with as per *Haida (2004)*. Copies of Information Reports, Timber Supply Reviews and Management Plan 10 will be provided to those First Nations listed below, in paper format or digitally as requested. The People of the River Referral Office (PRRO), who manages the referral for the signatory communities to the SEA, will receive this information as per the process set out in the Sto:lo SEA.

TFL26 lies within the following First Nation's unceded ancestral lands and traditional territories:

**Table 3 – First Nations Communities Contact List**

| First Nation | Contact | Agreements |
|---|---|---|
| Katzie | 10946 Katzie Road<br>Pitt Meadows, BC V3Y 2G6 | FCRSA |
| Kwantlen | 23690 Gabriel Land<br>PO Box 108<br>Fort Langley, BC V1M 2R4 | FCRSA |
| Matsqui | PO Box 10<br>Matsqui, BC V4X 3R2 | FCRSA |
| Musqueam | 6735 Salish Drive<br>North Vancouver,BC V6N 4C4 | |
| People of the River Referral Office<br>*Strategic Engagement Agreement | Maretta Berger<br>Bldg 10-7201 Vedder Road<br>Chililwack, BC V2R 4G5 | SSEA |
| Peters Band | 16870 Peters Road RR#2<br>Hope, BC V0X 1L2 | FCRSA |
| Seabird Island Band | 2895 Chowat Road<br>PO Box 650<br>Agassiz, BC V0M 1A0 | FCRSA |
| Semiahmoo | 16049 Beach Road<br>Surry, BC V3S 9R6 | |

*Due to timelines, First Nations' consultation dates may not necessarily coincide with public review periods.*

**Public**

The general public will be made aware of the process, requests for information, review of analysis and plans and final determinations through a variety of media. Mission defines the public as any individual who has interest in the lands and/or management of TFL26. Water Licence holders will fit in this category as the location and ownership of individual water licence holders will change throughout this process and publications listed below should adequately address their opportunity for review and comment. Public who have made enquiries in the most recent development of the current Forest Stewardship Plan 2017-2021 will be contacted with written notification if not otherwise noted under stakeholder or user groups, and are listed in Table 2.

Mission City Record (Black Press) – is the local newspaper reaching every household in Mission. It is also distributed throughout the city in various businesses and community spaces. The District of Mission also prints a well read "Mission City Page" published every Friday with the current activities that pertain to the municipality featured prominently on whole or half pages. Ads will be placed twice per stage of the Management Plan process advising of the availability of the following documents, or opportunities to receive or request information for:

- the Information Report and Public Review
- the Information Analysis and Draft Management Plan 10
- the Final Management Plan 10

An Open House will be held at the Mission Leisure Center from 4pm to 8pm to display the information, analysis and draft management plan for review and comment at the beginning of the 60 day review and comment period.

The Manager of Civic Engagement and Corporate Initiative manages the District of Mission website, Facebook page, Twitter account, press releases, and all other civic engagement processes. The Mission website www.mission.ca will prominently display a link to the preparation of Management Plan 10 on its home page, with all information residing on its own page.

The District of Mission Facebook page https://www.facebook.com/DistrictofMission/ and Twitter Account @mission_bc will advise followers of the link to the Management Plan 10 home page and reference calls for public review.

**Stakeholders**

Mission defines stakeholders as those public individuals, groups, licensees or agencies that have formalized tenures, rights, or agreements within lands under TFL26's defined geographic boundaries.

Each stakeholder will be provided with written communication regarding the Management Plan 10 replacement process, including requests for input and the future dissemination of information as it becomes available throughout the process, up to and including a copy of the final approved plan. The following Table 4 lists the current active list of known stakeholders as of the date of this strategy:

**Table 4 – Stakeholders**

| Name | Representing | Contact |
|---|---|---|
| Abbotsford Mission Water Sewer | Cannell Lake Watershed | John McAuley |
| BC Timber Sales | Chinook | Timber Sale Manager |
| BCIT | Adjacent Licensee - WL | Steve Finn |
| FLNRO | Chilliwack Natural Resource District | Mike Peters, DM |
| Fraser Valley Regional District | Local Government Crown-Community Interface Policy | David Urban – Parks Margaret-Ann Thornton |
| Katzie First Nation | Adjacent Licensee FNWL | Strategy will be as listed under First Nations |
| Kenworthy Creek Community Watershed | Water Purveyor | Robert Dale |
| Kwantlen First Nation | Adjacent Licensee FNWL | Strategy will be as listed under First Nations |
| Ministry of the Environment | Province of BC | John Kelly |
| Murray Galbraith | Trapper | |
| Rec Sites and Trails BC | Chilliwack Natural Resource District | Tom Blackbird |
| School District 75 | Institutional Interest | Colleen Hannah |
| Teal Jones Group | Adjacent Licensee - FL | John Pichugin |
| Tim Horton Childrens Foundation | Institutional Licence Holder Adjacent to TFL26 | Dave Newnham |
| West Coast Kids Cancer Foundation | Institutional Interest | Colin Worth |
| Zajac Ranch for Children | Institutional Licence Holder | Mel and Wendy Zajac |

## User Groups

Mission defines user groups as those individuals, formal or informal groups, or agencies that have an interest in lands under TFL26's defined geographic boundaries. These groups may be community based, recreation focused or other and generally have a key contact point.

Each known user group will be provided with written communication regarding the Management Plan 10 replacement process, including requests for input and the future dissemination of information as it becomes available throughout the process, up to and including a copy of the final approved plan. The following table 5 lists the current active list of known user groups as of the date of this strategy:

**Table 5 – User Groups**

| Name | Group or Activity Represented | Contact |
|---|---|---|
| 4 Wheel Drive Association of BC | 4 Wheel Driving | Kim Reeve, Dan Wishart |
| Backcountry Horsemen of BC | Horseback riding | Rose Schroeder |
| Cascade Off-road Motorcycle Club | | Eugene Hulak |
| Fraser Valley Mountain Bike Association | Mountain Biking | Rocky Blondin, Dan Schubert |
| Hatzic/Durieu/McConnell Creek Ratepayers Association | Hatzic, Durieu, McConnell Creek | Shari Conroy |
| Right Nutts ATV Club | All-terrain Vehicle driving | Jacquie Horn |
| Southwestern All Terrain Trails | | Cal Kaytor/Bruce Ledingham |
| Stave Falls Community Association | Stave Falls, Mission BC | Julia Renkema |
| Stave Lake Cabin Owners Association | Lease Holders – Stave East | Alvin Johnson, Noreen Beauvais Lynda Wallace Diana Johnson |
| Steelhead Community Association | Steelhead, Mission BC | Jana Tennant |
| Trails BC/The Great Trail | | Leon Lebrun |

## Internal Communication

An internal memo will be circulated to the District of Mission Council explaining the Management Plan process. It is expected this will be forthcoming the month following the October 2018 municipal elections. This memo will also be discussed at a public council meeting where newspaper reporters are typically present.

The information and link will be placed on the District's intranet site "Pipeline" for notification to all staff, similar to the timeframe planned for the Council memo.

The Manager of Civic Engagement and Corporate Initiatives will be notified to assist throughout the process for internal staff and external communications.

**Government**

All correspondence sent and comments received by the District of Mission during the Management Plan 10 process will be copied to the appropriate Forests, Lands and Natural Resource Operations and Rural Development (FLNRORD) contact – Chilliwack Natural Resource District and/or Forest Analysis and Inventory Branch (FAIB).

As required by the *TFL Management Plan Regulation*, the final MP10 submission (to FAIB) will include a description of this strategy and a summary of the comments received. A communications log will be appended to each draft/final document. Final documents will summarize how each comment received was accommodated and a description of the changes made to the MP as a result.

# Appendix A: Sample Notices - Stakeholders/Public/User groups

*not all sample notices included

**Personal Letter - Sample**

Dear [*insert*]:

**Re: Mission Tree Farm Licence 26 – Management Plan #10**
**{*Draft Information Report*} or {Draft Management Plan #10 } or {Final Management Plan #10}**

The District of Mission is seeking public review and comment on the {insert document name} relating to Management Plan 10 for Tree Farm Licence 26 (TFL26).

Management Plan 10 is being prepared in order to meet the requirements of the *Tree Farm Licence Management Plan Regulation* and this notice is provided under section 6(1).

The Management Plan consists of a land based summary of TFL26 along with the Timber Supply Review Analysis report and Information Report and references the other guiding higher level plans and legislation (2017-2021 Forest Stewardship Plan). This information is provided to the Ministry of Forests, Lands and Natural Resource Operations and Rural Development in order to set a new Allowable Annual Cut for TFL26. We have included a brochure "Timber Supply Review – Tree Farm Licences" for your information regarding the process.

You may view and comment on the {insert document name} for MP10, from {insert date} through {insert date}. Viewing appointments can be arranged by calling our office at 604-820-3762 or by downloading the plan at https://www.mission.ca/municipal-hall/departments/forestry/reports-and-plans/

Written comments will be accepted until 4:30pm {insert date}.

For further information, please contact

Kelly Cameron, RFT
Forest Technologist
District of Mission
Box 20, Mission BC V2V 4L9
forestry@mission.ca

**Newspaper - Sample**

**Tree Farm Licence 26 Draft Management Plan #10 {*Draft Information Report*} or {Draft Management Plan #10 } or {Final Management Plan #10} available for Review and Comment**

The District of Mission (DOM) is the licence holder for Tree Farm Licence 26 (TFL26). TFL26 is located within the District of Mission, north of the city center and generally surrounding the west side of the Stave Reservoir and covers roughly 10,500 hectares. 88% of the landbase is provincial crown land and 12% is municipal private property.

In accordance with the *Tree Farm Licence Management Plan Regulation*, preparation of Management Plan 10 is underway.

A timber supply review is required in order to identify the best available economic, environmental and social information to support the chief forester's Allowable Annual cut determination. This is reflective of current forest management practices, identifying First Nations and public interests and concerns that may be impacted by an AAC determination.

The {insert document name} is available for public review from {insert date} through to {insert date} at the following locations:

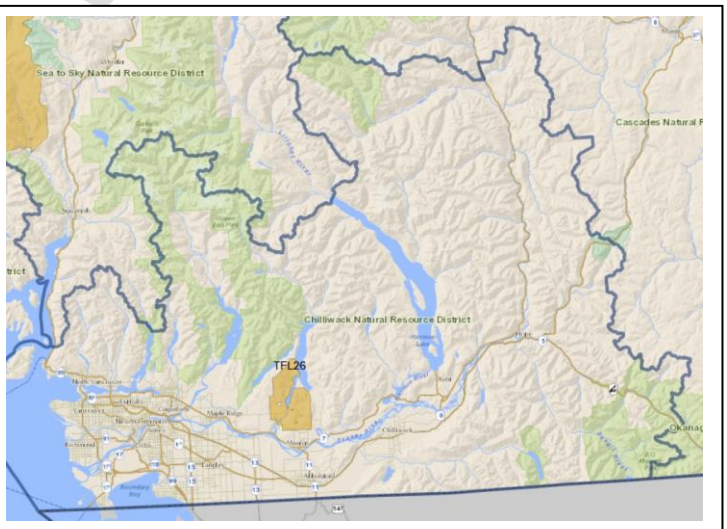
- 8:00 am – 4:30 pm Forestry Office, 33835 Dewdney Trunk Road, Mission BC
- 8:30 am – 4:00 pm Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 46360 Airport Road, Chilliwack BC

You can also find the {insert document name} at:
https://www.mission.ca/municipal-hall/departments/forestry/reports-and-plans/

**Please submit written comments to:**

**Tree Farm Licence 26**
**District of Mission**
**Box 20**
**Mission, BC V2V 4L9**

**Email: forestry@mission.ca**



# Appendix 2 Information Package

Reference: 245798

December 12, 2018

Kelly Cameron, RFT
Forestry Technologist
District of Mission
33835 Dewdney Trunk Road
Mission, British Columbia
V2V 4L9

Dear Kelly:

Thank you for the draft TFL 26 Information Package (IP).

The draft *Tree Farm Licence 26 – Management Plan #10 Timber Supply Analysis Information Package*, Version 1.1 dated September 11, 2018 is conditionally accepted. The conditions of the acceptance are that:

- the Information Package (IP) will be updated based upon the following comments, and based upon any other changes that are deemed necessary as you process the data and complete the analysis; and
- An updated and corrected IP will be included in the appendix of the Management Plan (MP) along with the Analysis Report.

Consultation is considered to be ongoing with indigenous communities through this process and we will keep you apprised as additional engagement occurs. As such, in addition to the following review comments, further comments may be provided as a result of ongoing consultation. It is understood that your ability to accommodate any new review comments will be subject to the progress you have made in preparing the draft Management Plan (MP) and analysis.

Update the IP to address (as best as is possible) the following suggested edits. It is acceptable for you to incorporate other similar or related edits:

| Page | Section | Comment |
|---|---|---|
| 1 | 1 | Correct "Coast Forest Region" to "South Coast Region" |
| 4 | 2.2 | Missing closed bracket |
| 8 | 2.1 to 2.16 | Section 2.1 to 2.4 are on pages 3 to 8. Then another group of Section 2.1 to 2.4 are on pages 8 to 11. Should sections 2.1 to 2.16 be renumbered from page 8 onwards? |
| 14 | 2.14 | Correct "In this analysis, the annual harvest area was estimated to 90 ha/year"<br>Possibly to "In this analysis, the annual harvest area was estimated to be 90 ha/year" |



Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Forest Analysis and Inventory Branch
Mailing Address: PO Box 9512 Stn Prov Govt Victoria BC V8W 9C2
Telephone: 250-356-5947
Fax: 250-387-5999

| | | |
|---|---|---|
| 15 | 2.15 | The total area of 143 hectares does not appear to be consistent with the area noted in Table 4. |
| 15 | 2.16 | The 3.75% netdown for future roads, trails and landings does not appear to be mentioned in Table 4. |
| 23/23 | 4.2.1 | Two sections are numbered as 4.2.1. Rotational Reserves on page 23 and Temporary Reserves on page 24. Should these have different section numbers? |
| 32 | 7 | Correct "The following subsections describe sensitivity analyses were some level"<br>Possibly to "The following subsections describe sensitivity analyses where some level" |
| 33 | 7.3 | Correct "Change MHA criteria from 225 $m^3$/ha (just above than the lowest value in year"<br>Possibly to "Change MHA criteria from 225 $m^3$/ha (just above the lowest value in year" |

Ensure clarification, discussion, and area and volume summaries are provided in the IP or the analysis to provide greater insight with respect to the following issues:

| Page | Section | Comment |
|---|---|---|
| 12 | 2.7 | A coastal hardwood management strategy which encourages reforestation of a small proportion of each district with broadleaf species has been in existence since 2008. Include mention of this strategy in the analysis and note the extent you are (or have been) managing broadleaf species (e.g. possibly the growing of red alder adjacent to urban areas to improve fire breaks). |
| 16 | 3.2 | Provide to Wenli Xu Wenli.Xu@gov.bc.ca the VDYP yield tables, the inventory data for VDYP7 input files (Polygon csv file and Layer csv file), command file, output error message file and output yields for review. The VDYP yield tables must be accepted by Wenli for use in the analysis. |
| 17 | 3.2 | Work with Craig Wickland and/or District Stewardship staff to clarify or improve the Table 13 regeneration assumptions for area within the CWH dm site series 01. |
| 17 | 3.2 | Work with Craig Wickland and/or District Stewardship staff to clarify or improve the Table 13 regeneration assumptions for area within the CWH dm site series 06. |
| 17 | 3.2 | Work with Craig Wickland and/or District Stewardship staff to clarify or improve the Table 13 assumption of regenerating 30 percent of the area within the CWH dm site series 03 with Cw. |
| 18 | 3.5 | Report the proportion of the projected harvest that is comprised from stands with less than 475 cubic metres per hectare. |
| 21 | 3.9 | It is unclear why a genetic gain of 8% for Western hemlock (Hw) is noted in Table 18 when Table 13 assumes no planting of Hw. Provide clarification within the analysis report. |

| | | |
|---|---|---|
| 21 | 3.10 | Work with Stefan Zeglen to clarify or improve the forest health description with respect to swiss needle cast within the CWH dm and CWH vm1 areas of TFL 26.<br><br>The incidence of swiss needle cast is moderate to severe within the CWHdm and CWHvm1 areas of TFL 26<br><br>The Analysis report should describe:<br>o the potential timber supply implications the Swiss needle cast may cause. Including information that quantifies by area, volume and timber supply over time the current infestation and that at risk of infestation;<br>o potential strategies the licensee may use to mitigate losses from the swiss needle cast;<br>o your participation in a study aiming to improve the estimates of the swiss needle cast volume loss. The status of the study and any results (even if preliminary). Include discussion as to how the loss estimates may be applied in future analysis (i.e. application of a non-recoverable loss; application of stand specific adjustments to TASS/TIPSY yields; or application of other stand specific adjustments. |
| 21 | 3.10 | Work with Stefan Zeglen to clarify or improve the forest health description with respect to root disease within the CWH dm areas of TFL 26.<br><br>A description of the current occurrence and distribution of root disease, and areas at risk of infestation should be included in the analysis report. Potential strategies (i.e., stumping, planting of resistant or immune species) to mitigate losses from root disease should also be included in the analysis report. |
| 21 | 3.10 | Include greater detail as to the information used to derive the non-recoverable loss (NRL) assumptions. Describe the time period the data represents and the sources utilized (AOS, licensee inventory, professional observation and judgment) to derive and quantify the NRL assumptions. |
| 22 | 4.1 | Does TFL 26 have any operational targets for patch size and distribution? If so, provide information as to what patch size and distribution objectives guide the management within TFL 26.<br><br>If not too onerous, please provide:<br>o a description of natural patch size distribution for TFL 26 as per current science; and<br>o reflections as to the extent this natural patch size distribution is or is not realized due to past and proposed management activity. |

| | | |
|---|---|---|
| 23/24 | 4.2.1 | Work with Craig Wickland and/or District Stewardship staff to clarify or improve the volume reductions within Partial Retention and Retention Visual Quality Objective areas.<br>Craig would like to know if:<br>o RESULTS data was utilized to determine the amount of basal area, per cent retention and the distribution of the retention within areas designated with Visual Quality Partial Retention and Retention;<br>o the per cent aggregate retention versus the dispersed retention within these VQO polygons is known?<br><br>Craig suggests the additional 1 or 2 per cent retention seems low. He suggests dispersed retention that exceeds 8 m2 per hectare basal area has a significant impact on the growth and yield of Douglas-fir. Where the dispersed retention exceeds 8 m2 per hectare of basal area or where there is significant edge effect from aggregate retention, Craig suggests applying a variable retention adjustment factor to the Douglas-fir leading stands. |
| 29 | 5.2 | Regarding the harvest flow objective:<br><br>*Determine the maximum non-declining harvest rate than can be achieved while maintaining a non-declining THLB standing volume in the last 100 years of the 300-year planning horizon. Then, attempt to harvest more in the short term while maintaining the non-declining standing volume in the mid- and long-terms. The changes from one decade to the next cannot be more than ±10%.*<br><br>Please feel free to discuss with Doug Beckett variations to the described approach to generating a base case. The objectives described are not hard rules. |
| 29 | 5.2 | Provide additional alternative harvest projections in the analysis report. Alternative harvest projections – especially alternative harvest projections with elevated initial harvest levels – can help with informing the Chief Forester as to the risks associated with uncertainty. Section 8 (8) (b) of the *Forest Act* indicates the Chief Forester must consider *the short and long term implications to British Columbia of alternative rates of timber harvesting from the area.* |
| 32 | 7 | Does TFL 26 have any operational targets for mature forest in addition to that describe in Section 4.1 Table 21? If so, provide information as to what mature objectives guide the management within TFL 26. We recognize and accept that seral objectives are not actually modelled, but rather tracked in the timber supply model. With this in mind and if it is not too onerous, please include discussion:<br><br>o a description of mature plus old for TFL 26 as per current science;<br>o as to how the mature plus old seral objectives track over |

| | | |
|---|---|---|
| | | time; and<br>o reflect on what may happen to the projected harvest flow if the mature objectives were to be achieved. |
| Other | Other | Provide a timber volume check in the analysis report that compares the initial sum of merchantable volume in the forest inventory to the initial sum of merchantable volume in the timber supply model. |

Ensure the data and the analysis is prepared in a manner that allows the creation of summaries by area, volume, species, management objectives and timber supply contribution for the lands associated with each of the indigenous communities with interests within TFL 26. If information used to delineate indigenous community lands within TFL 26 has been provided in confidence: care will have to be taken to ensure this information is not revealed through the public release of analysis data and maps; you will have to advise government which of your analysis data contains confidential information; you may need to provide two copies of analysis data (one containing the confidential information and one without the confidential information).

This is to confirm, as per the decision made on December 4th, 2018, that the base case will be supported by the enhanced LiDAR inventory with LiDAR heights with corrected ages as it is considered to be the best available information. The results of sensitivity analysis assessing the projected timber supply had the original inventory and site productivity been relied upon will be provided in the analysis report.

Please feel free to contact me directly for further clarification.

Yours truly,

Doug Beckett, RPF
Timber Supply Forester
Forest Analysis and Inventory Branch

# Tree Farm Licence 26 – Management Plan #10

## TIMBER SUPPLY ANALYSIS INFORMATION PACKAGE

**Version 1.3**

**November 27, 2019**

**Project 1493-1**

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# List of Acronyms

| | |
|---|---|
| AAC | Allowable Annual Cut |
| AU | Analysis Unit |
| BA | Balsam (*Abies amabilis*) |
| BCLCS | BC Land Classification System |
| BEC | Biogeoclimatic Ecosystem Classification |
| CW | Western redcedar (*Thuja plicata*) |
| CWH | Coastal Western Hemlock BEC zone |
| DBH | Diameter at Breast Height |
| EM | Existing Managed |
| EN | Existing Natural |
| ESA | Environmentally Sensitive Area |
| FD | Douglas-fir (*Pseudotsuga menziesii*) |
| FLNRORD | BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development |
| FM | Future Managed |
| FMLB | Forest Management Land Base |
| FPPR | Forest Planning and Practices Regulation |
| FSP | Forest Stewardship Plan |
| GIS | Geographical Information System |
| HW | Western hemlock (*Tsuga heterophylla*) |
| LiDAR | Light Detection and Ranging |
| LU | Landscape Unit |
| MH | Mountain Hemlock BEC zone |
| MHA | Minimum Harvest Age |
| NHLB | Non-Harvestable land Base |
| NSR | Not Satisfactorily Restocked |
| OAF | Operational Adjustment Factor |
| OGMA | Old Growth Management Area |
| RESULTS | Reporting Silviculture Updates and Land Status Tracking System |
| RMA | Riparian Management Area |
| RMZ | Riparian Management Zone |
| RRZ | Riparian Reserve Zone |
| SI | Site Index |
| TEM | Terrestrial Ecosystem Mapping |
| TFL | Tree Farm Licence |
| THLB | Timber Harvesting Land Base |
| TIPSY | Table Interpolation Program for Stand Yields |
| TSA | Timber Supply Area |
| TSR | Timber Supply Review |
| UREP | Use, Recreation and Enjoyment of the Public |
| VAC | Visual Absorption Capacity |
| VDYP | Variable Density Yield Prediction |
| VLI | Visual Landscape Inventory |
| VQO | Visual Quality Objective |
| VRI | Vegetation Resource Inventory |
| WTP | Wildlife Tree Patch |
| WTR | Wildlife Tree Retention |
| YC | Yellow cypress (*Chamaecyparis nootkatensis*) |

# Document Revision History

| Version | Date | Description |
|---|---|---|
| 0.1 | Jul 25, 2018 | First draft with notes delivered to client for review. |
| 0.2 | Aug 23, 2018 | Second draft with edits and additions throughout. |
| 1.0 | Aug 28, 2018 | First draft delivered to FAIB for a content review prior to the public review. |
| 1.1 | Sep 11, 2018 | Updates from FAIB content review. Version used for public review.<br><br>o Added section 1.5 Higher Level Plans.<br>o Added section 2.15 Wildlife Habitat.<br>o Added section 2.18 Not-Satisfactorily Restocked Conditions.<br>o Sections 3.2 Growth and Yield Models and 3.8 Fertilization, updated fertilization assumptions<br>o Section 4 Non-Timber Assumptions, included area statistics in applicable tables.<br>o Table 27 – update to include alternate harvest flows and harvest profiles reporting. |
| 1.2 | Jun 3, 2019 | Updates from FLNRORD and public reviews. Version attached to Management Plan 10.<br><br>o Section 2.3 – added a paragraph to clarify that the Base Case scenario used the LiDAR-enhanced forest inventory.<br>o Section 2.4 – added brief description of key forest health issues raised by district staff.<br>o Section 2.12 – included reference to the coastal hardwood management strategy.<br>o Table 20 – clarify maximum disturbance allowed as 50% under age 80.<br>o Section 3.1 – updated analysis unit definitions to line-up with the updated methodology of developing yield curves for the existing managed stands.<br>o Section 3.2 – updated methodology to estimate yield curves for existing managed stands. Update regeneration assumptions for future managed stands to account for early age growth reduction of Douglas-fir due to Swiss needle cast.<br>o Section 3.5 – added rationale for MHAs of old coniferous and young deciduous stands that did not meet MHA criteria. Clarify where the 475 $m^3$/ha value is coming from.<br>o Section 3.8 – updated methodology and fertilization responses and moved to section 7.4. The Base Case does not consider fertilization.<br>o Section 3.9 – removed genetic gains for hemlock.<br>o Section 3.11 – added the timber volume check – inventory vs. yield/forest estate model inputs.<br>o Section 4.1 (Table 19) – added current percentage of old area for each reporting unit.<br>o Section 4.5 – added 2 more patch sizes to allow some flexibility on harvest openings between 40-50ha.<br>o Section 5.2 – clarified how the harvest flows are determined with Patchworks™.<br>o Section 5.3 – clarified that disturbance in the NHLB was not implemented.<br>o Section 7.2 – changed so the no LiDAR-enhanced inventory is the sensitivity analysis.<br>o Added Appendix 1 with statistics for existing managed stands from RESULTS, used to inform yield curves development of existing managed stands. |
| 1.3 | Nov 27, 2019 | o Several changes to text based on Forest Analysis and Inventory Branch recommendations.<br>o Included future road aspatial netdowns in Table 4, which altered the Long-term THLB by 150 ha (see section 2.21). |

# Acknowledgements

Kelly Cameron, RFT, with the District of Mission, provided the data, documentation, and local experience needed to support assumptions used in the analysis.

Key staff with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNORD) and the Forest Analysis and Inventory Branch (FAIB) included:

- Doug Beckett, RPF, who provided expert guidance on the requirements for the Management Plan approval process,
- Dave Waddell, RPF, who derived individual stand yields for existing managed stands based on provincial datasets, and
- Chris Butson, who generated new forest inventory attributes based on LiDAR data.

Key staff with Forsite involved in preparing this Timber Supply Analysis Information Package included:

- Cosmin Man, RPF, who prepared the Information Package and subsequent analysis,
- Patrick Bryant, RPF, who supervised the project and reviewed the documentation and analysis,
- Jeremy Hachey, RPF, who provided support in developing regeneration assumptions and yield tables, and
- Jessica Koroll and Cole Levesque, who provided GIS support and created the web map service.

# 1 Introduction

The Corporation of the District of Mission, the holder of the Tree Farm Licence (TFL) 26, is undertaking a Management Plan #10 (MP10) process – due for approval by March 26, 2020. TFL 26 is administered from the Chilliwack Natural Resource District Office within the South Coast Region. As part of the MP10 process, a timber supply analysis will be conducted to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting. This Timber Supply Analysis Information Package was prepared to support the timber supply analysis and to describe the information that is material to the analysis, including data inputs and assumptions.

## 1.1 PURPOSE

The purpose of this Timber Supply Analysis Information Package is to provide a detailed account of the factors related to timber supply that the Chief Forester must consider under the Forest Act when determining an allowable annual cut (AAC) and how these will be applied in the timber supply analysis. This Information Package was made available over a 60-day period to First Nations and the public for review and comment.

## 1.2 HISTORY

The District of Mission has been the sole licensee holder of TFL 26 since its time of establishment on July 22, 1958.

## 1.3 AAC HISTORY

The AAC history for TFL 26 since its time of issuance is included in Table 1. The current AAC for TFL 26 accounts for 0.28% of the total provincial TFL AAC and 0.06% of the total AAC from all tenures in BC.

*Table 1 AAC History*

| Date | AAC ($m^3$/year) |
|---|---|
| 1958 | 12,035 |
| 1964, 1969, and 1974 | Subsequent increases* |
| 1979 | 32,281 |
| 1983 and 1988 | Subsequent increases* |
| 1989 | 41,200 |
| July 01, 1996 | 45,000 |
| August 01, 2001 | 45,000 |
| March 26, 2010 (current) | 45,000 |

**information on the actual AAC values was not available. It is assumed that the subsequent increases lead to the AAC determinations in key years, 1979 and 1989, due to improvements of inventories and yield estimates, and area additions and site productivity reclassification, respectively.*

## 1.4 LOCATION OF TFL 26

TFL 26 is located to the north of the community of Mission, a municipality of approximately 38,000 people, in the northern half of the District of Mission, in southwestern BC (Figure 1). Approximately 88% of the TFL is Crown land (Schedule B) and the remaining 12% is municipal land (Schedule A). The TFL is split into two similar-sized parts; on each side of the lower arm of Stave Lake.

The area of TFL 26 totals approximately 10,900 ha and lies mostly within Coastal Western Hemlock (CWH)

biogeoclimatic ecosystem classification (BEC) zone, with small portion within the Mountain Hemlock (MH) BEC zone at higher elevations. The terrain within TFL 26 is variable; most of the area is between 100 m and 700 m elevation. The highest elevation point is 1,356 m known as Mt. Crickmer, in the northwest corner of the TFL.

A land swap was recently completed, whereby four parcels of land within the District of Mission, but outside of TFL 26 were included under Instrument #36. In exchange, land within TFL 26 along the south western boundary will be included within an adjacent First Nation Woodlands Licence. This analysis will incorporate these changes.

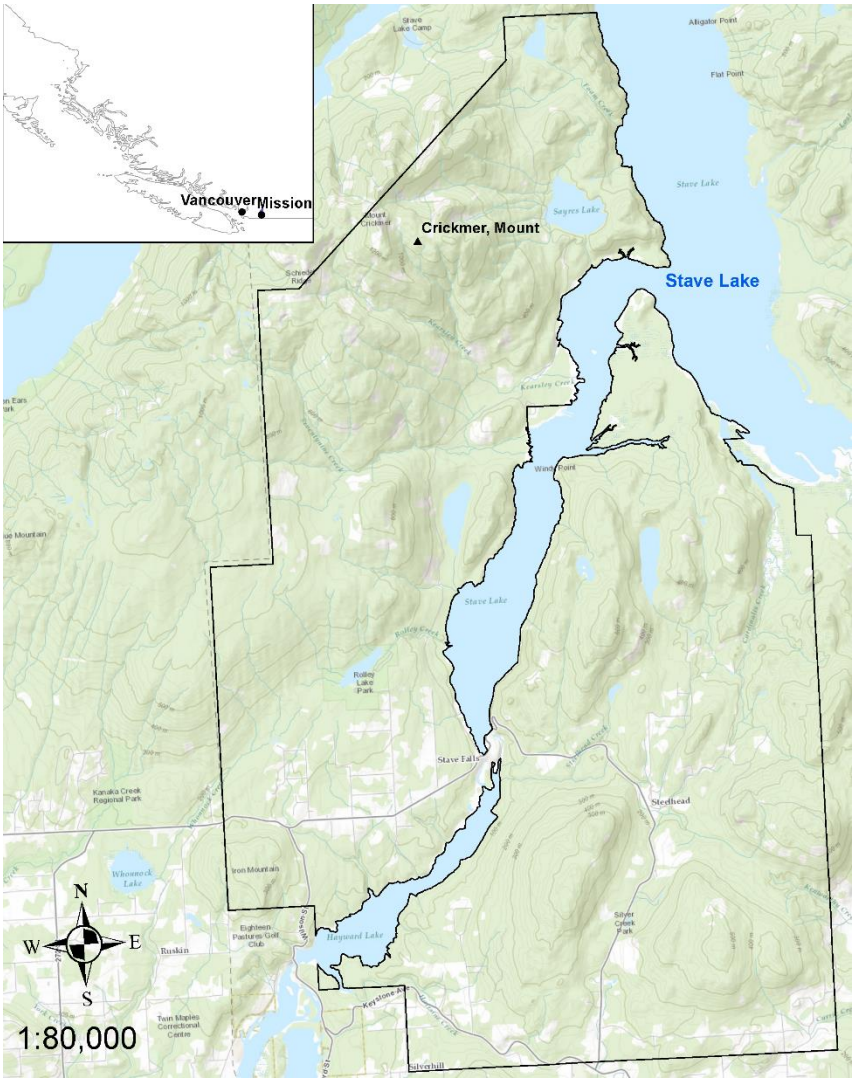



***Figure 1 Location of TFL 26***

## 1.5 HIGHER LEVEL PLANS

Within the Chilliwack Natural Resource District, landscape unit plans have been established under Ministerial Order with objectives set by government. The TFL26 overlaps with Hatzic and Alouette landscape units which were included into the Ministerial Order 'Land Use Objectives for Old Growth Management Areas (OGMAs) within the Alouette, Fraser Valley South, Hatzic, Pitt, Stave, and Widgeon Landscape Units (LUs) Situated within the Chilliwack Forest District - February 4, 2013'. The guidance to develop the OGMAs is included in the Lower Fraser Sustainable Resource Management Plan (January 2013). The aforementioned Ministerial Order established OGMAs, which

were 100% excluded from harvesting. In addition, the aforementioned Ministerial Order indicates the minimum requirements of old seral forest to be retained. These targets were tracked to determine how the established OGMAs perform over time (section 4.1).

To date, there are no other established or draft higher level plans to include areas within this TFL.

# 2 Land Base Assumptions

## 2.1 DATA SOURCES

For this timber supply analysis, the data and their sources are shown in Table 2. These data were collected with the aim to appropriately consider all management objectives for TFL 26. The data were combined into a resultant file that was used to support the forest estate modelling.

*Table 2 Source Data*

| Data | Source | Feature Name | Effective |
|---|---|---|---|
| **Administrative Information** | | | |
| TFL 26 Boundary | Numerous (DataBC, District) | TFL 26 | 2018 |
| Landscape Units | WHSE_LAND_USE_PLANNING | RMP_LANDSCAPE_UNIT_SVW | 2018 |
| **Management Guidance** | | | |
| Community Watersheds | WHSE_WATER_MANAGEMENT | WLS_COMMUNITY_WS_PUB_SVW | 2018 |
| Visual Landscape Inventory | WHSE_FOREST_VEGETATION | REC_VISUAL_LANDSCAPE_INVENTORY | 2018 |
| Terrain Stability | District (Hardcopy maps, Mylars) | Terrain | 2018 |
| Operability | District (Hardcopy Map) | operability | 2018 |
| Slope Classes | LiDAR (Forsite) | slope | 2018 |
| OGMA legal | WHSE_LAND_USE_PLANNING | RMP_OGMA_LEGAL_CURRENT_SVW | 2018 |
| Reserves (non-legal) | District of Mission (Kelly Cameron) | reserves | 2018 |
| Research Installations | WHSE_FOREST_VEGETATION | RESPROJ_RSRCH_INSTLTNS_SVW | 2018 |
| Recreation (Interpretive, UREP) | WHSE_FOREST_TENURE | FTEN_RECREATION_POLY_SVW | 2018 |
| **Inventories** | | | |
| Biogeoclimatic Zones (BEC v10) | WHSE_FOREST_VEGETATION | BEC_BIOGEOCLIMATIC_POLY | 2018 |
| Vegetation Resource Inventory | WHSE_FOREST_VEGETATION | VEG_COMP_LYR_R1_POLY | 2017 |
| RESULTS Openings | WHSE_FOREST_VEGETATION | RSLT_OPENING_SVW | 2018 |
| RESULTS Cover Reserves | WHSE_FOREST_VEGETATION | RSLT_FOREST_COVER_RESERVE_SVW | 2018 |
| RESULTS Forest Cover Inventory | WHSE_FOREST_VEGETATION | RSLT_FOREST_COVER_INV_SVW | 2018 |
| RESULTS Activities (Incremental) | WHSE_FOREST_VEGETATION | RSLT_ACTIVITY_TREATMENT_SVW | 2018 |
| LRDW Consolidated Cutblocks | WHSE_FOREST_VEGETATION | VEG_CONSOLIDATED_CUT_BLOCKS_SP | 2018 |
| Planned Harvest | District of Mission (Kelly Cameron) | block_bnd | 2018 |
| Forsite consolidated cutblocks and reserves | Forsite | Cutblocks_consolidated | 2018 |
| FWA inventories for lakes, rivers, wetlands, and streams | WHSE_BASEMAPPING | FWA_LAKES_POLY, FWA_RIVERS_POLY, FWA_WETLANDS_POLY, FWA_STREAM_NETWORKS_SP | 2015 |
| Wetlands | District of Mission (Kelly Cameron) | wetlands | 2018 |
| Classified Stream Network | District of Mission (Kelly Cameron) | creek_capt | 2018 |
| Consolidated streams | Forsite | Streams | 2018 |
| Digital Road Atlas | WHSE_BASEMAPPING | DRA_DGTL_ROAD_ATLAS_MPAR_SP | 2018 |
| FTEN road section lines | WHSE_FOREST_TENURE | FTEN_ROAD_SECTION_LINES_SVW | 2018 |
| Roads Lv8 | District of Mission (Kelly Cameron) | Road_Lv8 | 2018 |
| Roads capt | District of Mission (Kelly Cameron) | road_capt | 2018 |
| Consolidated Road Network | Forsite | Roads | 2018 |
| Transmission Lines | WHSE_BASEMAPPING | GBA_TRANSMISSION_LINES_SP | 2018 |

| Data | Source | Feature Name | Effective |
|---|---|---|---|
| Other Non-Forest | District of Mission (Kelly Cameron) | NF_Others | |
| VDYP7 input table | VEG_COMP_VDYP7_INPUT_LAYER | Input polygons and input layer | 2017 |
| Terrestrial Ecosystem Mapping | District of Mission (Kelly Cameron) | TEM | 2017 |
| Provincial Site Productivity Layer | DataBC | Sprod_30 | 2018 |

## 2.2 TFL BOUNDARY

In preparation for the TFL replacement process, TFL staff have recently worked with FLNRORD to develop a clear description of the TFL boundary, including identification of Schedule A (Private Crown Grant) and Schedule B (Crown) lands. Results from this exercise have been incorporated into the source data for this timber supply analysis.

Under Instrument #36, a land swap was recently completed whereby four parcels of land situated within the District of Mission but outside of TFL 26 (approximately 473 ha from the Fraser TSA), were exchanged for land within TFL 26 along the south western boundary (approximately 321 ha that will be added to the adjacent First Nation Woodlands Licence N2Z).

## 2.3 FOREST INVENTORY

For this analysis, the vegetation resource inventory (VRI) was accessed from DataBC with growth projected to January 01, 2017. Most of this inventory was captured to the standard required in the 1980s (i.e., not VRI), with some areas augmented throughout the 1990s, and has since been updated for harvest disturbances from the RESULTS and dedicated Free-Growing projects (Figure 2). The inventory for the Fraser TSA did not include TFL 26 because, at that time, the TFL inventory was considered relatively new and significantly higher in quality than the TSA inventory.

With FAIB's assistance, the base case scenario used recently collected LiDAR data to update the forest cover inventory for tree heights, which ultimately affects current estimates of site index or age, and projected volume. A sensitivity analysis was conducted to explore the harvest level impacts when using the standard VRI attributes rather than the LiDAR-updated inventory.

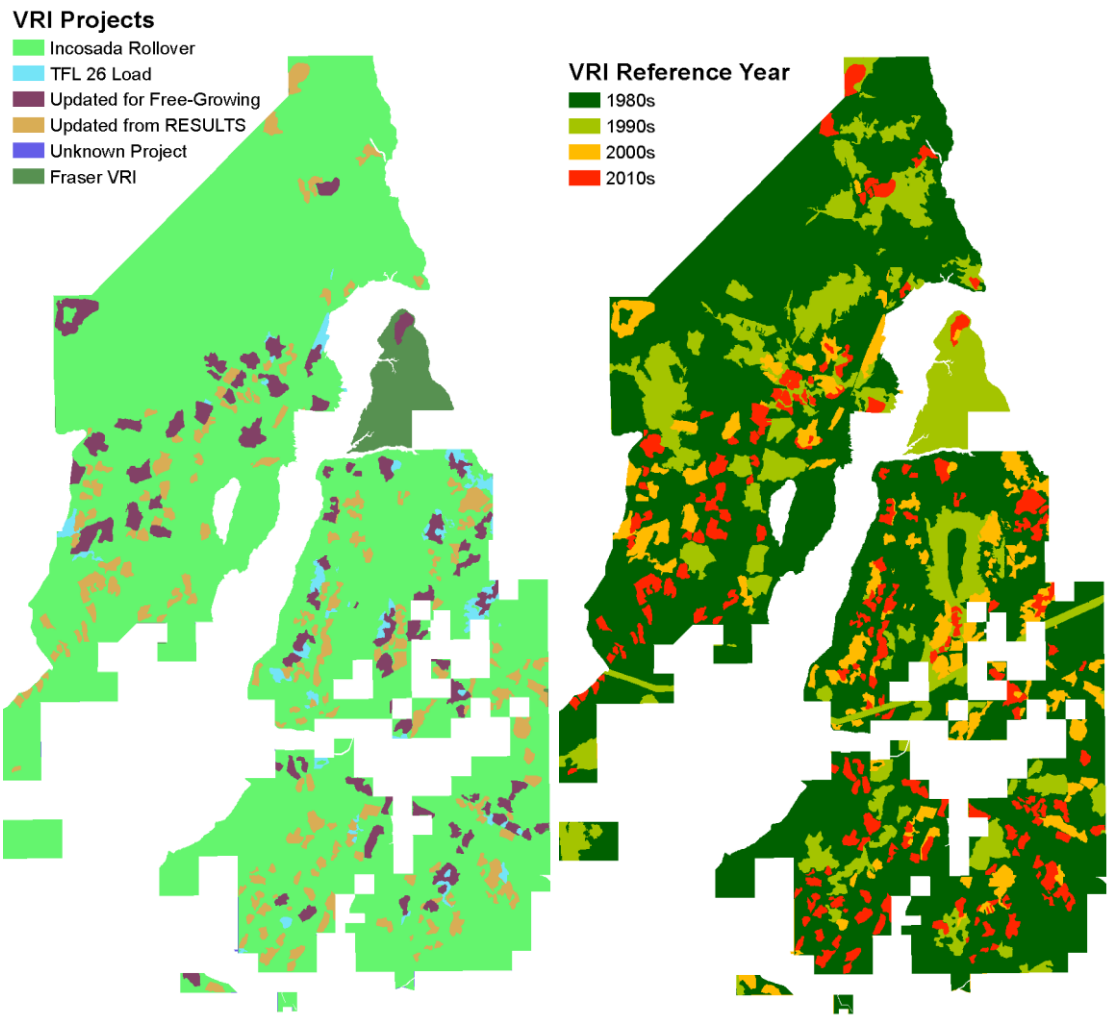



*Figure 2 Forest Inventory Projects and Reference Year*

The existing vegetation inventory was further updated for harvest disturbances to June 26, 2018 using the RESULTS datasets. It was observed that the projected ages did not align well with harvest dates reported for approximately 423 ha. Calculated age differences of greater than 5 years were then corrected according to Table 3.

*Table 3 Description of VRI Age Updates*

| Description | Action |
|---|---|
| RESULTS data are available where OPENING_ID > 0 (n= 66; ~278 ha) | Update [Age_2018] based on RESULTS age. |
| RESULTS data are not available for older blocks where OPENING_ID = 0 (n= 23; ~167 ha) | Calculate [Age_2018] based on HARVEST_DATE field in VRI and account for 1 year regeneration delay. |

In 2017-2018, the District of Mission collected LiDAR data, in part, to update key attributes in the existing inventory including stand heights, site index (and/or age) and projected volume. These inventory updates were conducted in collaboration with the Forest Inventory and Analysis Branch (FAIB), and were completed in time to be used in MP#10. A sensitivity analysis was identified to compare results from the existing VRI data with those from the updated LiDAR inventory (section 7.2).

## 2.4 FOREST HEALTH

The incidence of Swiss needle cast is moderate to severe within young Douglas-fir plantations in the CWHdm and CWHvm1. Since these foliar diseases thrive during damp and mild spring conditions, there are likely more occurrences. At this time, longer term impacts have not been determined but the district has installed monitoring transects in several young stands to measure defoliation levels over time and is considering doing some work in TASS/canopy modeling. Regeneration assumptions for future managed stands were adjusted to account for early age growth reduction of Douglas-fir due to Swiss needle cast (section 3.2).

While the landscape level hazard for Phellinus and Armilaria root diseases is considered high in the CWHdm (BC Ministry of Forests, 2015), the relative impact on volume is unclear. At this time, potential strategies (i.e., stumping, planting of resistant or immune species) to mitigate losses from root disease have not been implemented. Similar to the Fraser TSR, any volume losses associated with root disease are considered through the standard adjustments to managed stand yield projections (section 3.7).

## 2.5 LAND BASE SUMMARY

TFL 26 covers 10,935 ha, of which approximately 1,060 ha (9.7%) is non-forested land (Table 4, Figure 3). The remaining area, approximately 9,875 ha, is the forest management land base (FMLB) that can contribute towards meeting non-timber and other management objectives (e.g., biodiversity). For modelling purposes, a subset of the FMLB is identified as the timber harvesting land base (THLB). The long-term THLB is 6,563 ha (66% of the FMLB, 60% of Total Area). The difference between FMLB and THLB is called non-harvestable land base (NHLB).

In Table 4, the Total Area refers to the gross area for each factor. Once the non-forest and roads are removed, the gross area within FMLB is reported under the Total Area column. The Effective Area refers to the net area that is covered by each factor. Because there are overlaps between various factors in the net-down hierarchy, the gross and net area are not always equal. For example, a factor accounted for at an earlier stage in the net-down process can overlap with a factor accounted for at a later stage. Thus, the factor accounted earlier includes the overlaps with the factors accounted later.

*Table 4 Land Base Definition*

| Factor | | Schedule A | | Schedule B | | TFL 26 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total Area (ha) | Effective Area (ha) | Total Area (ha) | Effective Area (ha) | Total Area (ha) | Effective Area (ha) | % of Total Area | % of FMLB |
| **Total Area** | | **1,246** | | **9,690** | | **10,935** | | **100.0%** | |
| less: | | | | | | | | | |
| | Not Typed | 8 | 8 | 47 | 47 | 55 | 55 | 0.5% | |
| | Not Vegetated | 42 | 42 | 372 | 372 | 414 | 414 | 3.8% | |
| | Not Treed | 13 | 13 | 192 | 192 | 204 | 204 | 1.9% | |
| | Alpine | 0 | 0 | 61 | 0 | 61 | 0 | 0.0% | |
| | Treed Wetlands | 8 | 0 | 193 | 0 | 201 | 0 | 0.0% | |
| | TEM Non Forest | 36 | 10 | 464 | 129 | 500 | 139 | 1.3% | |
| | Roads and Utility | 57 | 25 | 206 | 159 | 263 | 184 | 1.7% | |
| | Other Non-Forest | 0 | 0 | 52 | 14 | 52 | 14 | 0.1% | |
| | Water Bodies | 1 | 0 | 300 | 50 | 300 | 50 | 0.5% | |
| **Forest Management Land Base (FMLB)** | | | **1,148** | | **8,727** | | **9,875** | **90.3%** | **100.0%** |
| less: | *within FMLB* | | | | | | | | |
| | Inoperable | 0 | 0 | 240 | 240 | 240 | 240 | 2.2% | 2.4% |
| | Terrain Class 4 | 22 | 20 | 85 | 49 | 107 | 69 | 0.6% | 0.7% |
| | Terrain Class 4R | 47 | 18 | 1,027 | 288 | 1,074 | 306 | 2.8% | 3.1% |
| | Terrain Class 5 | 41 | 32 | 827 | 691 | 868 | 723 | 6.6% | 7.3% |
| | Marginal Sites | 4 | 4 | 127 | 48 | 131 | 52 | 0.5% | 0.5% |
| | OGMA | 0 | 0 | 736 | 315 | 736 | 315 | 2.9% | 3.2% |
| | Non-Legal Reserves | 157 | 104 | 734 | 549 | 890 | 652 | 6.0% | 6.6% |
| | Riparian Reserve | 86 | 53 | 321 | 127 | 407 | 180 | 1.6% | 1.8% |
| | Recreation Values | 0 | 0 | 31 | 27 | 31 | 27 | 0.3% | 0.3% |
| | Research Areas | 0 | 0 | 24 | 20 | 24 | 20 | 0.2% | 0.2% |
| **Timber Harvesting Land Base (THLB)** | | | **917** | | **6,373** | | **7,289** | **66.7%** | **73.8%** |
| less: | | | | | | | | | |
| | WTR Area (7.4-9.4%) | | 69 | | 507 | | 576 | 5.3% | 5.8% |
| | Future Roads (3.75% of unlogged) | | 19 | | 131 | | 150 | 1.4% | 1.5% |
| **Long Term THLB** | | | **829** | | **5,734** | | **6,563** | **60.0%** | **66.5%** |

**MP8/9 approach where different**

In MP9 (Mission Municipal Forest, 2010), the gross TFL area was estimated at 10,854 ha (81 ha less than current analysis), the FMLB at 9,706 ha (169 ha less than current analysis), and long-term THLB at 7,236 ha (53 ha more than current analysis). For this comparison, the MP8/9 figures were reordered so that Use, Recreation and Enjoyment of the Public reserves (UREP) at Morgan and Sayres Lakes were considered within the gross TFL area, and roads were excluded from FMLB. Thus, the numbers presented here for the comparison purposes are different than the ones published in the MP9 AAC rationale.

The main difference in gross area involves the small boundary changes since MP8 (Mission Municipal Forest, 2001) and MP9. Some of these changes are linked to legal instruments, while others are based on adjustments reflected on the approved Forest Stewardship Plan (FSP) map. Major differences in the FMLB/THLB between the two analyses include:

- Old growth management area (OGMA) and non-legal reserves considered in MP10; in MP8/9 called specific geographic areas yet significantly lower compared to OGMAs and non-legal reserves in MP10.

- Terrain stability in MP10 (Environmentally Sensitive Areas and terrain stability mapping in MP8/9) and marginal stands from terrestrial ecosystem mapping (TEM) in MP10 (from ESA in MP8/9).
- Non-merchantable Ba and Hw stands in MP9 (not considered in MP10).
- Non-commercial species (deciduous leading stands) in MP8/9 (not considered in MP10).
- Reductions for future in-block retentions (0.15 to 2.5% in MP8/9, 7.4% to 9.4% in MP10).

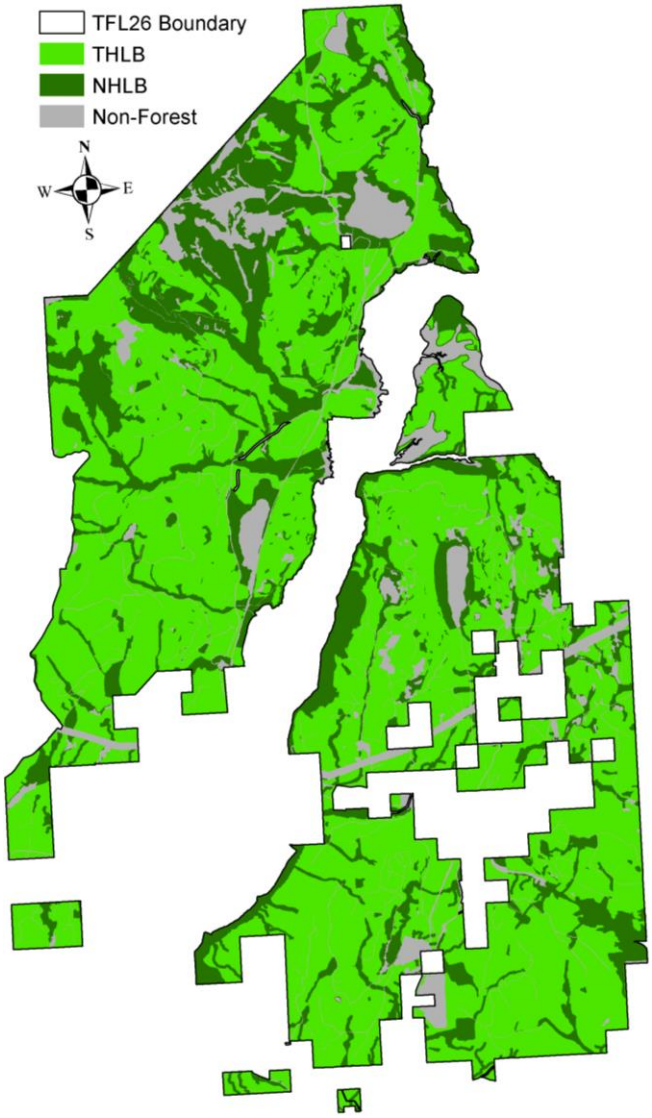



***Figure 3 Land Base Definition***

## 2.6 PARTIAL NETDOWN METHODOLOGY

Because this analysis includes aspatial assumptions involving partial netdowns to the THLB, a GIS algorithm was used to produce a cohesive, spatially-explicit THLB. The following process was applied to spatially identify – for modelling purposes – the most appropriate stands to include in the THLB, while meeting the partial removal quota.

1. Where partial netdowns apply, assign any areas that were previously logged as THLB.

2. Calculate the netdown quota remaining after assigning these logged areas as THLB (e.g., for a 30% netdown for factor A the new quota was (1-0.3)*(THLB logged area within A + potential THLB within A not netted out for other reasons) - THLB logged area within A).
3. Select the stands with highest unit volume and closest to the existing THLB until the remaining netdown quota is met. Inevitably, overlaps with other netdown factors occur and some stands with overlapping partially netdown factors might be selected (only once) to meet the partial removal quota for one particular netdown factor. Ideally, polygons with more than one partial netdown factor would be excluded from the THLB.

The end result is a coherent spatially-explicit THLB that can be used for modelling and subsequent planning purposes.

## 2.7 NON-FOREST LAND BASE

The non-forested land base includes areas that are covered by water bodies, non-vegetated, wetlands, and existing roads, landings, transmission lines, or simply not typed (undefined) in the vegetation resources inventory (VRI) (Table 5). The existing roads and landings were consolidated in a layer using the latest digital road atlas, forest tenure road segments and sections (from data BC), and forest roads from the District of Chilliwack (Road-Lv8, road_capt). The consolidated linear roads were buffered on each side as described in Table 6. The Forest Tenure Roads (from DataBC) was used to extract the recreation trail line features (class=recreation) and then confirmed with TFL staff. Transmission line features were sourced from DataBC and buffers assessed for each line segment and latest imageries/LiDAR hill-shade. Finally, other non-forest features (e.g., gravel pit south of Mill Pond) were also excluded from the FMLB.

***Table 5 Non-Forest Areas***

| Non Forest Class | Criteria |
|---|---|
| Not Typed | BCLCS Level 1 = U (or NULL) (no logging history) |
| Non Vegetated Land | BCLCS Level 1 = N (no logging history) |
| Vegetated Not Treed | No logging history and:<br>• BCLCS Level 1 = V and BCLCS Level 2 = N and BCLCS Level 3<> U<br>• BCLCS Level 1 = V and BCLCS Level 2 = N and BCLCS Level 3 = U and SPECIES_CD_1 is not null |
| Alpine | BCLCS Level 3 = A (no logging history) |
| Treed Wetlands | BCLCS Level 3 = W (no logging history) |
| TEM Non Forest | SGRP not in ['ZO', 'MP', 'MR', 'DR'] (no logging history) |
| Linear Buffers | RTLD_ID >0 |
| Other non-forest | NF_MISC_ID>0 |
| Water Bodies | Lakes, wetlands, and rivers not properly captured by VRI/TEM |

*Table 6 Buffer Widths for Existing Linear Features*

| Linear Feature Class | Buffer Width (each side) (m) | Notes |
|---|---|---|
| Primary, Municipal | 7.5 | |
| Secondary | 5 | |
| Tertiary | 3.5 | |
| Wilderness (deactivated), in-block | 2.5 | |
| Trails | 1.5* | |
| Landings | 0 | included in buffer widths for roads |
| Wilderness (closed canopy) | 0 | |
| Transmission lines | 5-30 | |

**Short buffer widths were ignored because they typically result in many sliver polygons during GIS processing. In addition, the narrower linear feature are overgrown by vegetation and no additional netdown is required.*

**Data source and comments**

Buffer widths were determined from samples measured from the LiDAR hill-shade and SPOT 6 imagery.

**MP8/9 approach where different**

In MP8 (MP9 netdown table not available), the net non-forest area (including roads and trails) was 1,148 ha (91 ha more than current analysis).

## 2.8 OPERABILITY

The operability line from previous MPs was maintained in current analysis. There were no changes required to the previous operability line, which was developed based on local knowledge and experience of operational staff. While past harvesting has not yet breached this operability line, some areas may be considered for helicopter logging.

## 2.9 TERRAIN STABILITY

Terrain polygons with slope stability class V and IV exhibit unstable soils for both timber harvesting and road construction. The available volumes for these polygons were reduced by 80% and 30%, respectively, as shown in Table 7. Class IVR polygons are sensitive to road building but generally not timber harvesting and have a 10% reduction applied. These netdown reductions were based on operational experience and discussions with staff from the Chilliwack Natural Resource District.

*Table 7 Unstable Terrain*

| Terrain Class | Netdown Reduction (%) | FMLB (ha) | Net Area (ha) | THLB (ha) |
|---|---|---|---|---|
| V | 80 | 868 | 723 | 41 |
| IV | 30 | 107 | 69 | 37 |
| IVR | 10 | 1,074 | 306 | 706 |
| **Total** | | **2,048** | **1,098** | **784** |

**Data source and comments**

Terrain stability mapping (Terrain Survey Intensity Level C) was completed in 1999 and produced terrain polygons with slope stability classes (Class I to V). Class IVR polygons, representing areas that are potentially sensitive to road building but not harvesting, were designated on the northern portion of the TFL. Recent work by Golder and

Associates replaced many Class IV polygons in the southern portion of the TFL as IVR.

**MP8/9 approach where different**

While gross area figures were not reported in MP8/9, the total net area was 811 ha. Given that the partial netdown quota considers logged areas and that the log areas between the two analyses was different, it was difficult to compare the terrain differences between these two analyses.

## 2.10 MARGINAL SITES FOR TIMBER PRODUCTION

Marginal sites for timber production were 100% excluded from THLB (Table 8).

*Table 8 Marginal Sites for Timber Production*

| BEC | Site Series |
|---|---|
| CWHdm | 11,12,20 |
| CWHvm1 | 13,14 |
| CWHvm2 | 20 |
| MHmm1 | 02,09,21 |

**Data source and comments**

Marginal sites for timber production were identified from the Terrain Ecosystem Mapping (TEM) and field guidebook for site identification and interpretation for the Vancouver Forest Region.

**MP8/9 approach where different**

In MP8/9, environmentally sensitive area (ESA) excluded from the THLB (100% exclusion) included areas with regeneration problems and those prone to avalanche. The ESA, as the name implies, are areas sensitive to a range of factors including soils, recreation, avalanche, wildlife, and regeneration concerns. The spatial data for ESAs was not available for this analysis so the newer TEM was used to identify sites with marginal timber production that would most likely experience regeneration problems. Avalanche-prone areas were netted out using non-forest VRI, non-forest TEM, and terrain stability.

## 2.11 LANDSCAPE-LEVEL RETENTION

### 2.11.1 Old Growth Management Areas

Old growth management areas (OGMA) were 100% removed from the THLB.

**Data source and comments**

OGMAs were legally established to meet landscape-level biodiversity objectives within landscape units (LU) Hatzic and Alouette.

**MP8/9 approach where different**

The OGMAs were not established at the time of MP8/9.

### 2.11.2 Long-Term Reserves

Long-term reserves were identified and maintained as non-legal (i.e., not established under a legal order) reserves

to meet biodiversity objectives for reserving old seral forests (Table 9). Long-term reserves are located where timber harvesting is not expected for more than one rotation. Accordingly, these reserves were 100% removed from the THLB.

*Table 9 Long-Term Reserves*

| Description | FMLB (ha) | Net Area (ha) | THLB (ha) |
|---|---|---|---|
| Long-term reserves (more than one rotation) | 890 | 652 | 0 |

**Data source and comments**

Areas identified as long-term (non-legal) reserves were included in the current FSP (2018).

**MP8/9 approach where different**

These spatial reserves were not available in MP8/9.

## 2.12 NON-COMMERCIAL SPECIES

In previous analyses deciduous leading stands were 100% excluded from the THLB. The Chief Forester order to postpone the AAC determination for 5 years (May 29, 2006), recommended that deciduous-leading stands be included in the THLB. Therefore, this analysis included deciduous-leading stands and assumed that once logged, they would then be converted to conifer-leading stands (see section 3).

Since 2008, a coastal hardwood management strategy has encouraged reforestation of a small proportion of each district with broadleaf species. Hardwood species are not actively managed within TFL26 but a few small areas adjacent to communities, urban areas, and campgrounds are left as broadleaf species leading stands, especially red alder, to improve biodiversity and to act as fire breaks.

## 2.13 NON-MERCHANTABLE STANDS

In previous analysis, non-merchantable stands were defined as older than 200 years and growing on poor sites where crown closure was <50%. In previous analysis, it was estimated that non-merchantable stands covered a gross area of 196 ha (117 ha net area). This netdown factor was not used in this analysis. Instead, it was given more flexibility to the model to develop a harvesting schedule that meets volume requests.

## 2.14 RIPARIAN RESERVE AND MANAGEMENT ZONES

Riparian reserve and management zones were developed as indicated in section 47-49 of the Forest Planning and Practices Regulation (FPPR) using BC Freshwater Atlas data (rivers, lakes, and wetlands) and classified streams data developed from LiDAR-derived data (linear features and gradients), known classification information, and professional judgement. The rivers were assumed to be S1 streams while lakes and wetlands were classified according to their BEC variant and size. To simplify modelling, an effective buffer width was determined for each riparian class to include 100% of the riparian reserve zone (RRZ) plus the percentage of basal area retention within the riparian management zone (RMZ), as detailed in section 52 of the FPPR (Table 10). For example, stream class S2 requires a RRZ of 30 m (100% exclusion from THLB) plus a RMZ of 20 m (50% retention, or 50% reduction from THLB); the effective buffer width (on each side of the linear feature) is then 30 m + (0.5 x 20 m) = 40 m.

*Table 10 Riparian Buffer Widths for Streams*

| Riparian Class | RRZ (m) | RMZ (m) | RMZ Retention (%) | Buffer Width (m) |
|---|---|---|---|---|
| S1, rivers | 50 | 20 | 50 | 60 |
| S2 | 30 | 20 | 50 | 40 |
| S3 | 20 | 20 | 25 | 25 |
| S4 | 0 | 30 | 5 | 1.5* |
| S5 | 0 | 30 | 5 | 1.5* |
| S6 | 0 | 20 | 0 | 0 |

**Small buffer widths typically result in many sliver polygons during GIS processing. For this analysis, we assumed that operational planners address these relatively small riparian buffers within stand-level retention areas.*

*Table 11 Riparian Buffer Widths for Lakes and Wetlands*

| Riparian Class | Size (ha) | BEC | RRZ (m) | RMZ (m) | RMZ Ret (%) | Buffer Width (m) |
|---|---|---|---|---|---|---|
| L1A | >=1,000 | All | 10 | 0 | 25 | 10 |
| L1B | <1,000 | All | 10 | 0 | 25 | 10 |
| L2 | >=1 and <=5 | CWHdm | 10 | 20 | 25 | 15 |
| L3 | >=1 and <=5 | All different than L2 | 0 | 30 | 25 | 7.5 |
| L4 | >=0.5 and <1 | CWHdm | 0 | 30 | 25 | 7.5 |
| W1 | >5 | All | 10 | 40 | 25 | 20 |
| W2 | >=1 and <=5 | CWHdm | 10 | 20 | 25 | 15 |
| W3 | >=1 and <=5 | All different than W2 | 0 | 30 | 25 | 7.5 |
| W4 | >=0.5 and <1 | CWHdm | 0 | 30 | 25 | 7.5 |
| W5 | N/A | Two or more W1 within 100 m<br>A W1 and one or more non-W1 within 80 m<br>Two or more non-W1 within 60m | 10 | 40 | 25 | 20 |

**MP8/9 approach where different**

The RMZ retention percentages and effective buffer widths were the same as those applied in the previous analysis. The spatial stream network and classification was vastly improved from MP9 by using LiDAR-derived streams and stream classification.

## 2.15 WILDLIFE HABITAT

While there were no wildlife habitat areas (WHA) and no ungulate winter range (UWR) orders within this TFL, the stand- and landscape-level biodiversity and green-up and adjacency objectives aim to manage for wildlife habitat (section 4).

## 2.16 RECREATION VALUES

Two areas identified as use, recreation and enjoyment of the public (UREP) – Morgan and Sayres Lake – were assumed to contribute to the analysis as described in Table 12. The majority of the Morgan Lake UREP area falls into established OGMAs so no additional netdowns were applied here. The recreation reserve located south of Rocky Point was 100% removed from the THLB. Other recreation-related reserves were identified that contributed to landscape-level biodiversity and were handled as forest cover requirements (see section 4.1).

*Table 12 Recreation Values*

| Recreation Value | Description | Total Area (ha) | FMLB Area (ha) | Net Area (ha) | THLB Area (ha) |
|---|---|---|---|---|---|
| Morgan Lake | UREP near Morgan Lake (0% exclusion from THLB) | 146 | 68 | 0 | 0 |
| Recreation Reserves | Recreation Reserve south of Rocky Point (100% exclusion from THLB) | 31 | 31 | 27 | 0 |

**MP8/9 approach where different**

Morgan and Sayres Lakes recreation areas were excluded from the TFL. The reserve south of Rocky point was not included within TFL 26.

## 2.17 RESEARCH RESERVES

Areas established as research reserves were identified in the latest dataset from DataBC. These areas were 100% excluded from THLB.

**MP8/9 approach where different**

Research reserves were not considered in MP8/9.

## 2.18 NOT-SATISFACTORILY RESTOCKED CONDITIONS

The TFL 26 staff promptly regenerates all harvested areas within 1 year to minimize the time that forest land is left non-vegetated. Therefore, there were no THLB reductions for the not-satisfactorily restocked (NSR) stands.

## 2.19 CULTURAL HERITAGE RESOURCES

Approximately 1 ha/year is reserved from harvest to accommodate the areas with culturally modified trees and known archeological features identified through archaeological surveys. These areas are highly sensitive and were not made publicly available. In this analysis, the annual harvest area was estimated to be 90 ha/year (current AAC of 45,000 $m^3$/year divided by average standing volume of 500 $m^3$/ha), and the 1 ha/year represents approximately 1.1%. It was assumed that the WTR reduction was sufficient to include the cultural heritage resources.

**MP8/9 approach where different**

Cultural heritage resources were not considered in MP8/9.

## 2.20 STAND-LEVEL RETENTION

Besides the reserves identified above for landscape-level retention (section 2.11), rotational and temporary reserves (section 4.2) were maintained as stand-level requirements to maintain sufficient biodiversity across TFL 26 and over time. These were applied as spatial assignments of the THLB area for existing stands and aspatial reductions for future stands: 7.4%, plus 1% and 2% for harvested stands within Partial Retention and Retention VQOs.

**MP8/9 approach where different**

Wildlife Tree Patches were applied as a spatial reduction (51.1 ha). A GIS exercise was then conducted to determine the required WTR for each BEC subzone. After considering previous netdowns for other reserves (e.g., riparian), additional WTR areas were modelled as an aspatial reduction distributed across each resultant polygon (additional 0.16% to 2.5%; total 143 ha).

### 2.21 FUTURE ROADS, TRAILS, AND LANDINGS

The following procedure was applied to estimate land base netdowns associated with future roads, trails, and landings:

1) Consolidate existing road network (primary, secondary, tertiary, in-block, and wilderness (deactivated)).
2) Identify the THLB area that this road network has 'developed' for harvesting by applying a 200 m effective buffer width from each side of the road centre line.
3) Determine the overall percentage of 'developed' THLB area (i.e., divide area of buffered roads described in Table 6 by the 'developed' THLB area determined in step 2).
4) Apply the percentage calculated in step 2 as an area reduction to all future managed stands regenerated after harvesting existing natural stands (i.e., no logging history).

For TFL 26, this procedure resulted in a netdown of 3.75% for future roads, trails, and landings (i.e., road netdown within the current THLB of 184.5 ha divided by the 'developed' THLB area of 4,913.0 ha).

**MP8/9 approach where different**

A similar approach was used to determine yield reductions for future managed stands. After the first harvest, stand yields were reduced by 3.8%.

# 3 Growth and Yield Assumptions

## 3.1 ANALYSIS UNITS

Stands are typically grouped into analysis units (AU) to reduce the complexity and volume of information in the model and to assign potential treatments and transitions on yield curves following disturbances. However, given the improvements in modelling capabilities and relatively small land base, the current forest analysis tools can be used to model details at smaller spatial unit level (e.g., VRI polygon, RESULTS opening ID). Thus, the following approach was undertaken to assign AUs:

- Stand age <=60 years with harvest history (i.e., logged since 1958 when the TFL was first established) were classified as existing managed stands.
- Existing natural stands: one unique AU for each individual VRI polygon. Yields were developed in the Variable Density Yield Prediction (VDYP), one yield for each VRI polygon (section 3.2).
- Existing managed stands: AUs were developed using terrestrial ecosystem mapping (TEM) BEC variant and site series groups and then grouped into 3 management eras (1958-1987, 1988-2007, and 2008-2018) based on the availability of RESULTS data, and significant changes in genetic gains.

- Future managed stands Or Management Era 4 (2018+): AUs were developed using terrestrial ecosystem mapping (TEM) BEC variant and site series groups. Yields were developed in TIPSY using regeneration assumptions guided by the current FSP.

Given the vast number of AUs in this analysis, area summaries for existing AUs were not included in this document.

**MP8/9 approach where different**

Stands were aggregated into 18 natural stand AUs and 16 managed stand AUs; aggregated by leading species, inventory type group, and site index range.

## 3.2 GROWTH AND YIELD MODELS

The yield curves developed for the forest estate model were prepared using the following stand projection models:

- Existing natural stands: Variable Density Yield Prediction (VDYP) console (v. 7.30a, Build 299) for each VRI polygon. The VDYP input polygon and layer data current to May 12, 2017 were used as inputs. A yield table was generated for each inventory polygon and each inventory polygon was assigned to a unique AU. This approach accounts for different utilization levels assumed in this analysis (section 3.2).
- Existing managed stands: Yields were developed using the Table Interpolation Program for Stand Yields (TIPSY) (v. 4.4, Ministry Standard Database, September 2017). The provincial site productivity layer was used to determine area-weighted average site indices for each species and for each managed AU. Natural ingress of Hemlock and Balsam was incorporated into the regenerated TIPSY yields (Table 13). District of Mission staff provided spacing history records and combined with the old Inventory linework and annotation, a spatial record of spacing could be produced (Figure 4). Spacing typically reduced stand density to a target of 700 sph, which along with default TIPSY assumptions, was used to develop yields for pre-commercial thinning (PCT). Fertilization responses were applied to the already fertilized stands (section 3.8). Future fertilization applications were set-up for the eligible existing managed stands for the first 20 years of the planning horizon.
    - Management Era 1 (1958-1987): This management era had no RESULTS data available and silviculture history was either non-existent or difficult to extract from historic media. As such, no genetic gains were associated with this management era and VRI species distribution used to inform species composition.
    - Management Era 2 (1988-2007): This management era had substantial silviculture records in RESULTS databases which also made possible tracking seedlots and their corresponding genetic gains (Appendix 1). RESULTS database profiling including species composition, planted density, genetic worth, and regeneration delay was used to inform TIPSY regeneration assumptions.
    - Management Era 3 (2008-2018): This management era had substantial silviculture records in RESULTS databases and it was characterized by significantly higher genetic gains compared to Management Era 2. RESULTS database profiling including species composition, planted density, genetic worth, and regeneration delay was used to inform TIPSY regeneration assumptions.
- Future managed stands (Management Era 4 (2018+)): TIPSY (v. 4.4, Ministry Standard Database, September 2017). A yield table was developed for each future managed AU guided by regeneration assumptions described in the current FSP (2018) (Table 13). The provincial site productivity layer was used to determine area-weighted average site indices for each species and for each future managed AU. Because fertilization was modelled only for the first 20 years of the planning horizon, no future managed

stands met the age criteria for fertilization. Regeneration assumptions were also adjusted to account for early age growth reduction of Douglas-fir due to Swiss needle cast.

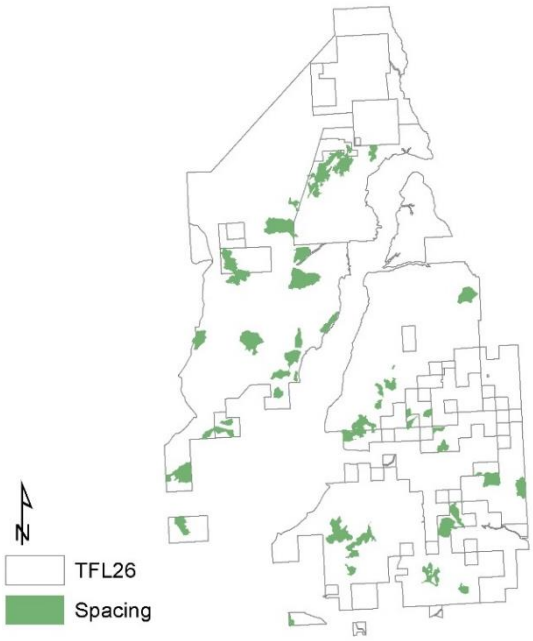



*Figure 4 Juvenile Spacing History*

*Table 13 Regeneration Assumptions for Existing and Future Managed Stands*

| Era | AU | THLB (ha) | SGRP | BGC_LBL | SITE_SERIES | Met | Prop | Del | SPH | Sp1 | Pc1 | Sp2 | Pc2 | Sp3 | Pc3 | Sp4 | Pc4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 101 | 304 | ZO | CWHdm | 1 | P | 0.8 | 1 | 1,200 | Fd | 70 | Cw | 30 | | | | |
| 1 | 101 | | ZO | CWHdm | 1 | N | 0.2 | 2 | 3,000 | Hw | 100 | | | | | | |
| 1 | 102 | 231 | ZO | CWHvm1 | 1 | P | 0.9 | 1 | 1,200 | Fd | 60 | Cw | 40 | | | | |
| 1 | 102 | | ZO | CWHvm1 | 1 | N | 0.1 | 2 | 3,000 | Hw | 100 | | | | | | |
| 1 | 103 | 186 | ZO | CWHvm2 | 1 | P | 0.8 | 1 | 1,200 | Yc | 50 | Hw | 20 | Fd | 20 | Ba | 10 |
| 1 | 103 | | ZO | CWHvm2 | 1 | N | 0.2 | 2 | 2,000 | Ba | 50 | Hw | 50 | | | | |
| 1 | 104 | 54 | ZO | MHmm1 | 1 | P | 0.8 | 1 | 1,200 | Yc | 80 | Cw | 20 | | | | |
| 1 | 104 | | ZO | MHmm1 | 1 | N | 0.2 | 2 | 2,000 | Hm | 60 | Ba | 40 | | | | |
| 1 | 105 | 165 | DR | CWHdm | 3 | P | 0.8 | 1 | 1,200 | Fd | 70 | Cw | 27 | Ba | 3 | | |
| 1 | 105 | | DR | CWHdm | 3 | N | 0.2 | 2 | 3,000 | Hw | 100 | | | | | | |
| 1 | 107 | 8 | DR | CWHvm2 | 3 | P | 0.75 | 1 | 1,200 | Yc | 60 | Cw | 40 | | | | |
| 1 | 107 | | DR | CWHvm2 | 3 | N | 0.25 | 2 | 2,000 | Hw | 50 | Ba | 50 | | | | |
| 1 | 109 | 1 | MP | MHmm1 | 06,07,09 | P | 0.5 | 1 | 1,200 | Ba | 60 | Yc | 40 | | | | |
| 1 | 109 | | MP | MHmm1 | 06,07,09 | N | 0.5 | 2 | 2,000 | Hm | 100 | | | | | | |
| 1 | 110 | 42 | MR | CWHdm | 05,06,07 | P | 0.95 | 1 | 1,200 | Fd | 50 | Cw | 50 | | | | |
| 1 | 110 | | MR | CWHdm | 05,06,07 | N | 0.05 | 2 | 2,000 | Hw | 100 | | | | | | |
| 1 | 111 | 15 | MR | CWHvm1 | 05,06,07 | P | 0.45 | 1 | 1,200 | Fd | 53 | Cw | 39 | Ba | 8 | | |
| 1 | 111 | | MR | CWHvm1 | 05,06,07 | N | 0.55 | 2 | 2,000 | Hw | 100 | | | | | | |
| 1 | 112 | 14 | MR | CWHvm2 | 05,06,07 | P | 0.95 | 1 | 1,200 | Cw | 40 | Yc | 40 | Ba | 20 | | |
| 1 | 112 | | MR | CWHvm2 | 05,06,07 | N | 0.05 | 2 | 2,000 | Hw | 80 | Ba | 20 | | | | |
| 1 | 113 | 14 | MR | MHmm1 | 5 | P | 0.9 | 1 | 1,200 | Cw | 40 | Yc | 40 | Ba | 20 | | |
| 1 | 113 | | MR | MHmm1 | 5 | N | 0.1 | 2 | 2,000 | Hw | 80 | Ba | 20 | | | | |
| 1 | 151 | 151 | ZO | CWHdm | | N | 1 | 1 | 4,200 | Fd | 70 | Cw | 30 | | | | |
| 1 | 152 | 117 | ZO | CWHvm1 | | N | 1 | 1 | 4,200 | Fd | 60 | Cw | 40 | | | | |
| 1 | 153 | 13 | ZO | CWHvm2 | | N | 1 | 1 | 3,200 | Yc | 50 | Hw | 20 | Fd | 20 | Ba | 10 |
| 1 | 155 | 34 | DR | CWHdm | | N | 1 | 1 | 3,200 | Fd | 70 | Cw | 27 | Ba | 3 | | |
| 1 | 160 | 17 | MR | CWHdm | | N | 1 | 1 | 3,200 | Fd | 50 | Cw | 50 | | | | |
| 1 | 161 | 0 | MR | CWHvm1 | | N | 1 | 1 | 3,200 | Fd | 53 | Cw | 39 | Ba | 8 | | |
| 2 | 201 | 429 | ZO | CWHdm | 1 | P | 0.8 | 1 | 1,200 | Fd | 70 | Cw | 27 | Ba | 3 | | |
| 2 | 201 | | ZO | CWHdm | 1 | N | 0.2 | 2 | 3,000 | Hw | 100 | | | | | | |

| Era | AU | THLB (ha) | SGRP | BGC_LBL | SITE_SERIES | Met | Prop | Del | SPH | Sp1 | Pc1 | Sp2 | Pc2 | Sp3 | Pc3 | Sp4 | Pc4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 202 | 320 | ZO | CWHvm1 | 1 | P | 0.9 | 1 | 1,200 | Fd | 57 | Cw | 39 | Ba | 4 | | |
| 2 | 202 | | ZO | CWHvm1 | 1 | N | 0.1 | 2 | 3,000 | Hw | 100 | | | | | | |
| 2 | 203 | 33 | ZO | CWHvm2 | 1 | P | 0.5 | 1 | 600 | Yc | 79 | Hw | 20 | Cw | 1 | | |
| 2 | 203 | | ZO | CWHvm2 | 1 | N | 0.5 | 2 | 2,000 | Ba | 70 | Hm | 30 | | | | |
| 2 | 204 | 51 | ZO | MHmm1 | 1 | P | 0.5 | 1 | 600 | Yc | 79 | Hw | 20 | Cw | 1 | | |
| 2 | 204 | | ZO | MHmm1 | 1 | N | 0.5 | 2 | 2,000 | Ba | 70 | Hm | 30 | | | | |
| 2 | 205 | 91 | DR | CWHdm | 3 | P | 0.8 | 1 | 1,200 | Fd | 70 | Cw | 27 | Ba | 3 | | |
| 2 | 205 | | DR | CWHdm | 3 | N | 0.2 | 2 | 3,000 | Hw | 100 | | | | | | |
| 2 | 209 | 1 | MP | MHmm1 | 06,07,09 | P | 0.5 | 1 | 1,200 | Yc | 60 | Ba | 40 | | | | |
| 2 | 209 | | MP | MHmm1 | 06,07,09 | N | 0.5 | 2 | 2,000 | Hm | 100 | | | | | | |
| 2 | 210 | 104 | MR | CWHdm | 05,06,07 | P | 0.95 | 1 | 1,200 | Fd | 68 | Cw | 25 | Ba | 7 | | |
| 2 | 210 | | MR | CWHdm | 05,06,07 | N | 0.05 | 2 | 2,000 | Hw | 100 | | | | | | |
| 2 | 211 | 20 | MR | CWHvm1 | 05,06,07 | P | 0.45 | 1 | 1,200 | Fd | 53 | Cw | 39 | Ba | 8 | | |
| 2 | 211 | | MR | CWHvm1 | 05,06,07 | N | 0.55 | 2 | 2,000 | Hw | 100 | | | | | | |
| 2 | 212 | 0 | MR | CWHvm2 | 05,06,07 | P | 0.95 | 1 | 1,200 | Cw | 40 | Yc | 40 | Ba | 20 | | |
| 2 | 212 | | MR | CWHvm2 | 05,06,07 | N | 0.05 | 2 | 2,000 | Hw | 80 | Ba | 20 | | | | |
| 2 | 251 | 168 | ZO | CWHdm | 1 | N | 1 | 1 | 4,200 | Fd | 70 | Cw | 27 | Ba | 3 | | |
| 2 | 252 | 38 | ZO | CWHvm1 | 1 | N | 1 | 1 | 4,200 | Fd | 57 | Cw | 39 | Ba | 4 | | |
| 2 | 255 | 21 | DR | CWHdm | 3 | N | 1 | 1 | 4,200 | Fd | 70 | Cw | 27 | Ba | 3 | | |
| 2 | 260 | 17 | MR | CWHdm | 05,06,07 | N | 1 | 1 | 3,200 | Fd | 68 | Cw | 25 | Ba | 7 | | |
| 2 | 261 | 2 | MR | CWHvm1 | 05,06,07 | N | 1 | 1 | 3,200 | Fd | 53 | Cw | 39 | Ba | 8 | | |
| 3 | 301 | 360 | ZO | CWHdm | 1 | P | 0.8 | 1 | 1,200 | Cw | 52 | Fd | 48 | | | | |
| 3 | 301 | | ZO | CWHdm | 1 | N | 0.2 | 2 | 3,000 | Hw | 100 | | | | | | |
| 3 | 302 | 160 | ZO | CWHvm1 | 1 | P | 0.9 | 1 | 1,200 | Cw | 66 | Fd | 34 | | | | |
| 3 | 302 | | ZO | CWHvm1 | 1 | N | 0.1 | 2 | 3,000 | Hw | 100 | | | | | | |
| 3 | 303 | 1 | ZO | CWHvm2 | 1 | P | 0.8 | 1 | 1,400 | Fd | 74 | Cw | 26 | | | | |
| 3 | 303 | | ZO | CWHvm2 | 1 | N | 0.2 | 2 | 2,000 | Hw | 100 | | | | | | |
| 3 | 305 | 36 | DR | CWHdm | 3 | P | 0.8 | 1 | 1,300 | Cw | 62 | Fd | 38 | | | | |
| 3 | 305 | | DR | CWHdm | 3 | N | 0.2 | 2 | 3,000 | Hw | 100 | | | | | | |
| 3 | 310 | 50 | MR | CWHdm | 05,06,07 | P | 0.95 | 1 | 1,200 | Fd | 50 | Cw | 50 | | | | |
| 3 | 310 | | MR | CWHdm | 05,06,07 | N | 0.05 | 2 | 2,000 | Hw | 100 | | | | | | |
| 3 | 311 | 2 | MR | CWHvm1 | 05,06,07 | P | 0.45 | 1 | 1,200 | Cw | 70 | Cw | 30 | | | | |
| 3 | 311 | | MR | CWHvm1 | 05,06,07 | N | 0.55 | 2 | 2,000 | Hw | 100 | | | | | | |
| 4 | 1 | 3,322 | ZO | CWHdm | 1 | P | 0.8 | 1 | 1,200 | Cw | 70 | Fd | 30 | | | | |
| 4 | 1 | | ZO | CWHdm | 1 | N | 0.2 | 2 | 3,000 | Hw | 100 | | | | | | |
| 4 | 2 | 1,675 | ZO | CWHvm1 | 1 | P | 0.9 | 1 | 1,200 | Cw | 70 | Fd | 30 | | | | |
| 4 | 2 | | ZO | CWHvm1 | 1 | N | 0.1 | 2 | 3,000 | Hw | 100 | | | | | | |
| 4 | 3 | 344 | ZO | CWHvm2 | 1 | P | 0.8 | 1 | 1,200 | Cw | 70 | Yc | 20 | Fd | 5 | Ba | 5 |
| 4 | 3 | | ZO | CWHvm2 | 1 | N | 0.2 | 2 | 2,000 | Hw | 100 | | | | | | |
| 4 | 4 | 158 | ZO | MHmm1 | 1 | P | 0.8 | 1 | 1,200 | Ba | 80 | Yc | 20 | | | | |
| 4 | 4 | | ZO | MHmm1 | 1 | N | 0.2 | 2 | 2,000 | Hm | 100 | | | | | | |
| 4 | 5 | 727 | DR | CWHdm | 3 | P | 0.8 | 1 | 1,200 | Fd | 70 | Cw | 30 | | | | |
| 4 | 5 | | DR | CWHdm | 3 | N | 0.2 | 2 | 3,000 | Hw | 100 | | | | | | |
| 4 | 6 | 0 | DR | CWHvm1 | 03,04 | P | 0.8 | 1 | 1,200 | Cw | 70 | Fd | 30 | | | | |
| 4 | 6 | | DR | CWHvm1 | 03,04 | N | 0.2 | 2 | 2,000 | Hw | 100 | | | | | | |
| 4 | 7 | 37 | DR | CWHvm2 | 3 | P | 0.75 | 1 | 1,200 | Cw | 70 | Fd | 20 | Yc | 10 | | |
| 4 | 7 | | DR | CWHvm2 | 3 | N | 0.25 | 2 | 2,000 | Hw | 100 | | | | | | |
| 4 | 8 | 0 | DR | MHmm1 | 2 | P | 0.2 | 1 | 1,200 | Yc | 70 | Ba | 30 | | | | |
| 4 | 8 | | DR | MHmm1 | 2 | N | 0.8 | 2 | 2,000 | Hm | 100 | | | | | | |
| 4 | 9 | 3 | MP | MHmm1 | 06,07,09 | P | 0.5 | 1 | 1,200 | Ba | 60 | Yc | 40 | | | | |
| 4 | 9 | | MP | MHmm1 | 06,07,09 | N | 0.5 | 2 | 2,000 | Hm | 100 | | | | | | |
| 4 | 10 | 787 | MR | CWHdm | 05,06,07 | P | 0.95 | 1 | 1,200 | Cw | 70 | Fd | 30 | | | | |
| 4 | 10 | | MR | CWHdm | 05,06,07 | N | 0.05 | 2 | 2,000 | Hw | 100 | | | | | | |
| 4 | 11 | 188 | MR | CWHvm1 | 05,06,07 | P | 0.45 | 1 | 1,200 | Cw | 60 | Ba | 30 | Fd | 10 | | |
| 4 | 11 | | MR | CWHvm1 | 05,06,07 | N | 0.55 | 2 | 2,000 | Hw | 100 | | | | | | |
| 4 | 12 | 34 | MR | CWHvm2 | 05,06,07 | P | 0.95 | 1 | 1,200 | Ba | 75 | Cw | 20 | Yc | 5 | | |
| 4 | 12 | | MR | CWHvm2 | 05,06,07 | N | 0.05 | 2 | 2,000 | Hw | 80 | Ba | 20 | | | | |
| 4 | 13 | 14 | MR | MHmm1 | 5 | P | 0.9 | 1 | 1,200 | Ba | 75 | Yc | 25 | | | | |
| 4 | 13 | | MR | MHmm1 | 5 | N | 0.1 | 2 | 2,000 | Hm | 50 | Ba | 50 | | | | |

** Site Series includes marginal sites for timber production; Site Group Units (SGRP) are ZO=Zonal; DR=Dry; MP=Moist/Poor; MR=Moist/Rich. Shaded rows indicate analysis units that have had juvenile spacing applied. A value of 50 was added to the original, un-thinned analysis unit number.*

**MP8/9 approach where different**

Older version of TIPSY and VDYP were used to generate yields for each AU. In MP9, the regeneration assumptions for existing/future managed stands did not include fertilization assumptions for treated stands. No assumptions for natural ingress.

## 3.3 SILVICULTURAL AND HARVEST SYSTEMS

While clearcut with reserves is the only silvicultural system utilized, some openings include dispersed retention of larger trees to address visual quality objectives (section 2.20). Otherwise, grouped reserve areas are comprised of other various stand-level retention including wildlife tree retention and riparian reserves.

Harvesting systems used include:

- Conventional, on slopes <=60%,
- Cable, on slopes >60%, and
- Helicopter, on slopes >60%, and in existing Cw- and Fd-leading stands, where Hw component is <30%.

The minimum harvest criteria described in section 3.5 were also applied to stands treated with these harvest systems.

## 3.4 UTILIZATION LEVELS

Utilization levels define the maximum stump height, minimum top diameter (diameter inside bark: dib) and minimum diameter at breast height (DBH) that are used to calculate merchantable volume. Net volumes calculated for all yield curves applied the assumptions detailed in Table 14.

*Table 14 Utilization Levels*

| Species | Stand Type | Minimum DBH (cm) | Maximum Stump Height (cm) | Minimum Top Diameter (dib in cm) |
|---|---|---|---|---|
| Pine | All | 12.5 | 30 | 10 |
| All Others | Existing Natural <121 yrs, Existing Managed, Future Managed | 12.5 | 30 | 10 |
| All Others | Existing Natural ≥121 yrs | 17.5 | 30 | 10 |

**MP8/9 approach where different**

Same criteria for minimum top diameter and maximum stump height. For all stands, DBH was set to 17.5cm.

## 3.5 MINIMUM HARVEST AGES

The minimum harvest age (MHA) was derived from yield estimates for each existing and future AU using the following harvest criteria:

- Minimum volume of 225 $m^3$/ha on cable and ground harvest systems

- Minimum volume of 600 m³/ha on helicopter harvest systems
- Minimum 90% of the culmination of mean annual increment (CMAI), and
- Minimum 60 years old.

**Data source and comments**

In determining the MHA criteria the following items were considered:

- Previous management plans: minimum volume (400-500 m³/ha) and CMAI, including volumes at CMAI for poor AUs (as low as 229 m³/ha)
- Latest Fraser TSR: minimum volume (150-400 m³/ha) and mean annual increment within 95% of CMAI
- An analysis of past harvest performance analysis conducted by FAIB showed that 95% of the volume harvested was from stands with more than 475 m³/ha.

A minimum volume of 225 m³/ha combined with the minimum 90% of the CMAI provides flexibility for the model to harvest the right stands at the right time in order to meet a harvest request and provide opportunity to convert some poor stands to more productive future stands. In addition, flexibility to the log sales opportunity is allowed given the market need for smaller size logs.

The minimum age of 60 was also included in the MHA criteria to avoid MHAs for future productive stands occurring before age 60, yet such stands could still be logged within 90% of CMAI and maximize economic return.

Approximately 80 ha of existing natural stands on THLB did not meet the above MHA criteria. These HM- and BA-leading stands older than 250 yrs, or deciduous leading (DR, MB) stands younger than 64 years. For these old coniferous leading stands, the MHA was revised to their current age to allow the model to consider these stands within the harvest schedule. For these young deciduous leading stands, the MHA was set to 40 years to allow the model to convert them to coniferous-leading stands. Recall, deciduous leading stands were not specifically removed from the land base (section 2.12). Operationally, these stands are often harvested within cutblocks made of more productive stands.

**MP8/9 approach where different**

MHAs were defined for each AU as the age where the yield reaches the minimum volume requirement (i.e., 'good', 'medium', 'poor' AUs at 600 m³/ha, 500 m³/ha, 400 m³/ha, respectively), or the culmination of mean annual increment, whichever is first. MHAs varied from 59 years (at 600 m³/ha) to 175 years (at 220 m³/ha).

## 3.6 REGENERATION DELAY

The regeneration delay applied for existing managed stands was derived from the survey data reported for each stand in RESULTS. For each future managed stand, regeneration delay was set to 2 years for the natural regeneration of Hw, and to 1 year for all planted stands.

**MP8/9 approach where different**

The regeneration delay for planted stands was 1 year. No assumptions for natural ingress.

## 3.7 OPERATIONAL ADJUSTMENT FACTORS

Managed stand yield projections produce potential yields that do not reflect typical forest conditions, so

operational adjustment factors (OAF) were applied. There are two OAFs: OAF 1 affects the magnitude of the yield curve and is constant across all ages, whereas the impact of OAF 2 accelerates with age. The OAF 1 represents uneven stocking or gaps and OAF 2 represents the impact of decay, waste and breakage in second-growth stands.

This analysis applied the standard levels accordingly: OAF1=0.85 and OAF2= 0.95.

**MP8/9 approach where different**

The same approach was used for applying OAFs.

## 3.8 FERTILIZATION

While fertilization records exist within TFL 26 (see Data Source and Comments below), assumptions to adjust these stands were not applied in the base case. Instead, these activities were considered within a sensitivity analysis (section 7.4). Stands fertilized in the past included ages ranging from 1 to 128 years. Thus, unique fertilizaiton gains were initially developed for each fertilized stand (or Opening ID). Aggregating the existing managed stands inhibited our ability to track details associated with the fertilization gains. Given the wide range of stand ages fertilized, applying gains to the corresponding AUs would not have provided accurate yield estimates. The THLB area with fertilization history was approximately 364 ha and an average volume gain estimate of 7,000 m³ (364 ha x 20 m³/ha fertilization gain). This potential volume would have been harvested in the short-term.

**Data source and comments**

Fertilization records were compiled from RESULTS Openings, RESULTS Activity, and data from TFL 26 staff. Results showed that before 2008, fertilization was applied by hand over small areas. In 2008 and 2014, two larger programs were conducted with aerial application (Table 15, Table 16). Note that the entire area fertilized in 2014 (215 ha) had previously been fertilized in 2008. Most of the fertilization occurred in Fd-leading stands and on zonal and dry site series groups.

*Table 15 Fertilized Area (ha) Records by VRI Leading Species*

| Year | BA | CW | Dec | FD | HW | No SPP | Total |
|---|---|---|---|---|---|---|---|
| 2000 | | 3 | 0 | 0 | 50 | 0 | 54 |
| 2001 | | 2 | | 25 | 1 | | 29 |
| 2002 | | 1 | 1 | 27 | 27 | 0 | 57 |
| 2005 | | 1 | | 5 | 0 | | 6 |
| 2007 | | 0 | 1 | 20 | 24 | | 45 |
| 2008 | 1 | 17 | 8 | 304 | 48 | 9 | 388 |
| 2014 | 1 | 1 | 1 | 203 | 9 | 1 | 215 |
| **Total** | **3** | **26** | **11** | **583** | **160** | **11** | **793** |

*Table 16 Fertilized Area (ha) Records by TEM Site Series Group and BEC*

| Year | Dry | | MP | MR | | | Zonal | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | CWHdm | CWHvm1 | CWHdm | CWHdm | CWHvm1 | CWHvm2 | CWHdm | CWHvm1 | CWHvm2 | |
| 2000 | | | | 18 | | | 36 | 0 | | 54 |
| 2001 | 10 | | | | | | 19 | | | 29 |
| 2002 | 3 | | | 0 | | | 53 | | | 56 |
| 2005 | | | | 0 | | | 6 | | | 6 |
| 2007 | 1 | 0 | | 2 | 1 | | 32 | 9 | | 45 |
| 2008 | 23 | 1 | 0 | 5 | 0 | 0 | 268 | 71 | 18 | 388 |
| 2014 | 16 | 1 | 0 | 2 | 0 | 0 | 115 | 62 | 18 | 215 |
| **Total** | **53** | **3** | **0** | **27** | **1** | **0** | **529** | **143** | **37** | **793** |

**MP8/9 approach where different**

Fertilization was not applied in developing future managed stand yields.

## 3.9 GENETIC GAINS

Improved growth from planting select seed was applied in TIPSY as genetic gains. These were applied to existing managed stands based on planting data from RESULTS, and to future managed stands based on the expected seedlots for this select seed (Table 17).

*Table 17 Genetic Gains for Managed Stands*

| Species | *Existing Managed Stands (%) | Future Managed Stands (%) |
|---|---|---|
| Douglas-fir | 0-14 | 14 |
| Western redcedar | 0-21 | 21 |

**Genetic gain summarized here as a range of values but applied according to actual trees planted in each stand*

**Data source and comments**

The list of seedlots for future managed stands[1] includes Cw = SL 63337, Fdc = 63302 (retired), 63232 (retired), while genetic gains were supplied through the provincial Seed Planning & Registry Application (SPAR).

**MP8/9 approach where different**

Genetic gains of 4% for Fd and 2% for Hw and Cw were applied for all managed stands.

## 3.10 NON-RECOVERABLE LOSSES AND NATURAL DISTURBANCES

Non-recoverable losses (NRL) represent estimated average annual volume that will not be recovered from loss due to natural catastrophic events like a significant insect epidemic, wildfire, windthrow, or some other stand-damaging agent (Table 18). These losses exceed those already accounted for through OAFs and netdown reductions.

[1] provided by Kelly Cameron, RFT

*Table 18 Non-recoverable Losses*

| Cause | NRL ($m^3$/year) |
|---|---|
| Wildfire | 10 |
| Windthrow | 112 |
| **Total** | **122** |

**Data source and comments**

While the extensive road system throughout the TFL supports salvage programs to reduce these NRLs, impacts on stands from fire are on the rise due to vandalism. The TFL staff estimated that fire losses account for approximately 10 $m^3$/year. This is 7 $m^3$/year more than in previous MP that considered data over 10 years prior.

The NRLs from windthrow is relatively minor. In previous MP, these annual NRLs were estimated at 112 $m^3$/year, including the blowdowns within WTRs. The TFL staff estimate this figure still represents current conditions.

**MP8/9 approach where different**

NRLs in MP8 were estimated to 115 $m^3$/year, the only difference being the wildfire losses (3 $m^3$/year compared to 10 $m^3$/year in current analysis).

### 3.11 TIMBER VOLUME CHECK

A timber volume check was conducted to compare the THLB standing volume summarized in the VRI with the initial THLB standing volume developed from the yield projections and configured in the model. For consistency, the comparison was done on the live volume of the THLB area covered by existing natural stands whose yields were projected in VDYP and not enhanced by LiDAR. The comparison showed that the VRI standing volume was 1,647 $m^3$ (0.07%) lower than the initial standing volume in the model (2,266,120 $m^3$ vs. 2,267,767 $m^3$). The long-term THLB area (gross THLB less in-block retention) of the existing natural stands was estimated to 3,686 ha (55% of the total long-term THLB of 6,712 ha).

When comparing total volume for existing natural and managed stands, the VRI volume was 174,291 $m^3$ (6.8%) lower than the initial standing volume in the model (2,562,079 $m^3$ vs. 2,736,370 $m^3$). Note that the volume of existing managed stands in the forest estate model was estimated from TIPSY and stand age adjusted to year 2018. Recall, RESULTS information was extensively used to improve volume estimates for existing managed stands by various management eras with different genetic gains and pre-commercial thinning intensities.

# 4 Non-Timber Assumptions

### 4.1 LANDSCAPE-LEVEL BIODIVERSITY

To meet the landscape-level biodiversity objectives, legal OGMAs were developed as part of the Lower Fraser Sustainable Resource Management Plan (January 2013), then established for the Alouette and Hatzic landscape units through the Ministerial Order issued on February 04, 2013. To augment this, a network of non-legal reserves were identified throughout the TFL (section 2.11.2).

While this analysis did not enforce targets to retain old seral forest within each BEC variant and landscape unit (LU), the objective was tracked to determine how the established OGMAs perform over time (Table 19). More than 19% of the area is currently reserved as OGMAs in NHLB, whereas the old seral forest requirements for some reporting units are not currently met. Specific targets for mature stands were not established.

*Table 19 Landscape-Level Biodiversity*

| LU | BEO | BEC | NDT | Minimum OGMA/Old Seral Requirement | FMLB (ha) | THLB (ha) | Current % Old |
|---|---|---|---|---|---|---|---|
| Alouette | Intermediate | CWHdm | 2 | 9% at >250 years | 217 | 169 | 0.0% |
| | | CWHvm1, vm2 | 1 | 13% at >250 years | 19 | 12 | 30.8% |
| | | MHmm1 | 1 | 19% at >250 years | 11 | 2 | 44.2% |
| Hatzic | Low | CWHdm | 2 | 9% at >250 years | 6,053 | 4,862 | 0.3% |
| | | CWHvm1, vm2 | 1 | 13% at >250 years | 3,102 | 1,990 | 6.7% |
| | | MHmm1 | 1 | 19% at >250 years | 473 | 254 | 51.1% |
| **Total** | | | | | **9,875** | **7,289** | |

In addition, two areas were identified and maintained as non-legal reserves to meet the District of Mission's recreation objectives for use, recreation and enjoyment to the public. Up to half of these areas are available for harvest and ideally under a selection silviculture system. As these areas comprise a very small fraction of the landbase, they were modelled as a forest cover requirement that maintains a minimum proportion of each reserve as mature seral (Table 20).

*Table 20 Other Reserves*

| Description | Maximum Disturbance Requirement | FMLB (ha) | THLB (ha) |
|---|---|---|---|
| Devil's Lake Recreational Reserve | 50% <80 years | 41 | 39 |
| Sayres Lake Recreational Reserve | 50% <80 years | 42 | 42 |
| **Total** | | **83** | **81** |

**Data source and comments**

Areas identified as other (non-legal) reserves were included in the current FSP (2018).

**MP8/9 approach where different**

OGMAs were not yet established. Instead, a non-spatial modelling approach was applied where the two landscape units were combined and the provincial distribution was used to calculate the percentages of the land base in each variant to be retained in old seral forest over time. Without further guidance, 45% of the area was assumed to be in lower BEO, 45% in intermediate BEO, and 10% in higher BEO.

## 4.2 STAND-LEVEL BIODIVERSITY

### 4.2.1 Rotational Reserves

Rotational reserves were identified as wildlife tree retention (WTR) areas from the provincial Reporting Silviculture Updates and Land Status Tracking System (RESULTS). Over the past 20 years, WTR areas designated in RESULTS varied between 0.4% and 22.0%, with an area-weighted average of 10.3%. (Table 21). Note the significant drop in WTR areas in 2005. Since then, the area-weighted average was 7.4% of the THLB, and 7.6% over the last 10 years.

*Table 21 Summary of Past Wildlife Tree Retention Areas*

| Cutblock Area (ha) | | | | | Retention | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Gross | Roads | NHLB | THLB | Retention Gross (ha) | Pct of Gross Cutblock | Retention in THLB (ha) | Pct of THLB Cutblock |
| 1998 | 52.2 | 1.2 | 0.7 | 50.2 | 11.9 | 22.9% | 11.1 | 22.0% |
| 1999 | 57.4 | 1.2 | 8.3 | 48.0 | 13.1 | 22.8% | 6.1 | 12.6% |
| 2000 | 73.7 | 1.4 | 0.0 | 72.3 | 13.0 | 17.6% | 12.7 | 17.6% |
| 2001 | 63.1 | 1.4 | 0.3 | 61.4 | 8.1 | 12.8% | 7.8 | 12.7% |
| 2002 | 111.4 | 2.2 | 13.8 | 95.4 | 17.4 | 15.6% | 14.3 | 15.0% |
| 2003 | 99.7 | 2.7 | 1.1 | 95.9 | 11.2 | 11.2% | 10.2 | 10.6% |
| 2004 | 64.7 | 1.1 | 1.5 | 62.1 | 11.8 | 18.2% | 11.0 | 17.7% |
| 2005 | 62.3 | 1.1 | 0.6 | 60.5 | 2.2 | 3.5% | 1.9 | 3.1% |
| 2006 | 67.0 | 1.3 | 2.1 | 63.6 | 3.6 | 5.4% | 3.5 | 5.6% |
| 2007 | 89.5 | 2.8 | 3.6 | 83.1 | 10.1 | 11.3% | 8.2 | 9.9% |
| 2008 | 65.3 | 1.3 | 1.8 | 62.2 | 7.8 | 11.9% | 7.5 | 12.0% |
| 2009 | 55.2 | 1.5 | 0.0 | 53.7 | 2.9 | 5.2% | 2.8 | 5.3% |
| 2010 | 83.7 | 2.3 | 0.1 | 81.3 | 7.6 | 9.1% | 7.5 | 9.3% |
| 2011 | 50.5 | 1.0 | 0.3 | 49.2 | 1.7 | 3.3% | 1.2 | 2.5% |
| 2012 | 104.3 | 1.8 | 1.7 | 100.8 | 11.6 | 11.2% | 10.6 | 10.5% |
| 2013 | 51.1 | 0.9 | 1.8 | 48.3 | 0.2 | 0.4% | 0.2 | 0.4% |
| 2014 | 70.1 | 1.8 | 0.4 | 67.9 | 4.6 | 6.5% | 4.6 | 6.7% |
| 2015 | 65.5 | 1.8 | 0.7 | 63.0 | 8.6 | 13.2% | 8.5 | 13.5% |
| 2016 | 42.8 | 0.6 | 1.9 | 40.3 | 3.9 | 9.1% | 2.6 | 6.4% |
| 2017 | 50.5 | 1.8 | 1.1 | 47.6 | 1.6 | 3.2% | 1.5 | 3.1% |
| **1998 to 2017** | **1,379.9** | **31.2** | **42.0** | **1,306.7** | **152.9** | **11.1%** | **133.7** | **10.2%** |
| **2005 to 2017** | **857.8** | **20.0** | **16.3** | **821.5** | **66.5** | **7.7%** | **60.6** | **7.4%** |
| **2008 to 2017** | **639.0** | **14.8** | **9.9** | **614.3** | **50.5** | **7.9%** | **47.0** | **7.7%** |

In addition, rotational reserves were identified and maintained as non-legal reserves to meet biodiversity objectives for reserving old seral forests. These were consolidated with the WTR areas reported in RESULTS and added to the model's dataset as spatial features linked to an adjacent harvest opening.

*Table 22 Rotational Reserves*

| Description | Gross Area FMLB (ha) | THLB Area (ha) |
|---|---|---|
| Existing rotational reserves | 190 | 172 |

For existing stands, rotational reserve areas were excluded from harvesting over one rotation. In the model, these areas were spatially identified and locked from being harvested until the adjacent cutblock became available for harvest (i.e., one rotation). The rotation length varied for each VRI feature ID/Opening ID. This was arbitrarily set to 80 years for existing natural stands (i.e., no Opening ID), while existing managed stands were based on the assigned minimum harvest ages (MHA) over the entire cutblock (i.e., both harvested and WTR areas for each Opening ID).

For future stands, an aspatial area reduction of 7.4% was applied as in-block retention. Harvested cutblocks within partial retention and retention visual quality objectives (VQO) were applied with another 1% and 2%, respectively.

**Data source and comments**

Rotational reserves were compiled from WTR areas reported in the RESULTS data plus non-legal areas identified as

rotational reserves included in the current FSP (2018).

The additional retention for VQOs was based on the licensee's estimates that, for cutblocks harvested since 1998, approximately 1 to 2% of the overall stand volume was excluded as internal, dispersed retention across all species and age classes[2]. This dispersed retention for visuals, which does not exceed 8 m²/ha, was applied according to VQO: 1% for Partial Retention and 2% for Retention.

**MP8/9 approach where different**

Wildlife Tree Patches were applied as a spatial reduction (51.1 ha). A GIS exercise was then conducted to determine the required WTR for each BEC subzone. After considering previous netdowns for other reserves (e.g., riparian), additional WTR areas were modelled as an aspatial reduction distributed across each resultant polygon (additional 0.16% to 2.5%; total 143 ha).

### 4.2.2 Temporary Reserves

The RESULTS data also identified temporary reserves to address various non-timber objectives (e.g., BIO, VIS, OTH). These areas may be harvested within the rotation length of the adjacent opening but typically after the opening achieves green-up. However, these temporary reserves must be situated relatively close to an existing road system to avoid excessive damage to the established regeneration.

Since only 7.3 ha were identified as temporary reserves, they were not modelled for existing or future stands.

**Data source and comments**

Temporary reserves were spatially assigned from reserve areas reported in the RESULTS data with a silviculture objective code of BIO, VIS, or OTH.

## 4.3 COMMUNITY WATERSHEDS

Two community watersheds were established within the TFL 26 area: Cannell Lake and Kenworthy Creek (Table 23). In this analysis, the disturbance level was controlled in both watersheds through an equivalent clearcut area (ECA) limit of maximum 30%. The ECA is a coarse-level metric that tracks the disturbance and hydrological recovery of each stand within a watershed reporting unit (i.e., community watershed). A 100% ECA means that the area has been recently disturbed with its hydrological impact similar to a recently clear-cut stand, hence the name of equivalent clearcut area. As the disturbed stand grows, the hydrological impact is reduced (i.e., the disturbed stand recovers from the hydrological perspective).

*Table 23 Community Watersheds*

| Community Watershed Name | FMLB (ha) | THLB (ha) |
|---|---|---|
| Cannell Lake | 154 | 92 |
| Kenworthy Creek | 295 | 226 |
| **Total** | **449** | **318** |

Given the separate accounts for natural non-forest (0% ECA), private (75% ECA), and permanent anthropogenic disturbances (AD) (100% ECA), new ECA targets were calculated relative to the modelled FMLB area within each

[2] Kelly Cameron, RFT personal communication

watershed using the following approach:

- Determine the area for private lands, AD, natural non-forest, and FMLB.
- Determine the maximum area allowed to be disturbed.

*Max Area ECA (ha) = Watershed Gross Area (ha) * ECA target (%).*

- Determine the Area ECA generated from AD and private lands.

*Area ECA AD+Private = Max Area ECA (ha) – (Area AD (ha) x ECA (100%) – Area Private (ha) x ECA (75%)).*

- Determine the new max ECA.

*New Max ECA (%) = (Max Area ECA (ha) – Area ECA AD + Private (ha)) /FMLB area (ha)*

Hydrological recovery curves were developed for each AU following the guidance from (Winkler & Boon, 2015), and assuming a maximum height of 25 m to address stands with low site productivity where tree heights will never reach 25 m. The percent ECA relative to the stand height was calculated as follows:

$$ECA[\%] = 100 * \left(1 - e^{-0.24 * (height[m]-2)}\right)^{2.909}$$

Heights for each AU were determined during the yield development (section 3.2).

**MP8/9 approach where different**

Cannell Lake watershed was removed from the THLB. The ECA was set to max 30%.

## 4.4 VISUAL QUALITY OBJECTIVES

Visual quality objectives (VQOs) are modelled for each VLI polygon using Plan to Perspective (P2P) ratios, Visually Effective Green-up (VEG) heights were determined for 5% slope class increments, and maximum percentage alterations. The P2P ratios and VEG heights by slope class, as well as, the VQO percentage alterations by visual absorption capacity (VAC) are detailed in Table 24 and Table 25, respectively.

A total of 46 VLI polygons were established within TFL 26, 2 of them being completely outside of the THLB and no targets were developed nor tracked in the model. For each of the 44 VLI polygons, the following were determined:

- Future AU covering the largest area.
- Area-weighted average slope.
- VEG height assigned based on relations shown in Table 24 and using the areas-weighted average slope.
- Age when VEG height is reached based on the yield curve of each future AU.
- The maximum percent alteration calculated for each slope class as the P2P ratio (Table 24) x maximum % alteration in perspective view (Table 25). For example, the largest maximum percentage alteration is for slope class 0-5%, VQO class M (modification) and high VAC: 4.68 x 18.0 = 84.2%. The lowest: 1.04*0.1=0.104%.

Within the FMLB for each VLI polygon, the area younger than the age at VEG height needed to be lower than the area calculated as the maximum percentage alteration.

*Table 24 P2P Ratios and VEG Heights by Slope Class*

| Category | Modified Visual Unit Slope Classes for P2P Ratios and VEG Heights | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Slope % | 0-5 | 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 | 55. | 6.0 | 6.5 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 8.5 | 8.5 |

*Table 25 VQO by Percent Alterations*

| VQO Zone | VAC | Max % Alteration in Perspective View | FMLB (ha) | THLB (ha) |
|---|---|---|---|---|
| Retention | Medium | 0.7 | 46 | 2 |
| Partial Retention | Low | 1.6 | 2,363 | 1,740 |
| | Medium | 4.3 | 2,586 | 1,948 |
| | High * | 7 | 5 | 4 |
| Modification | Medium | 12.5 | 140 | 120 |
| | High | 18 | 364 | 315 |
| **Total** | | | **5,504** | **4,129** |

** The recent TFL boundary changes overlapped approximately six hectares FMLB from a 434 ha VLI polygon with retention VQO.*

**MP8/9 approach where different**

A VEG height of 4 m was used in all cases. Slope was not used to determine the maximum percent alteration in perspective view.

## 4.5 CUTBLOCK ADJACENCY AND GREEN-UP

The practice requirement for biodiversity under FPPR (Sec 64 and 65) sets maximum cutblock size and cutblock adjacency rules that were implemented in this analysis to limit the size of continuous, non-treed openings across the landscape. The model was configured to control harvesting adjacent to another cutblock by limiting the size of cutblocks that are less than 100 m apart, to 40 ha in size. Two harvest patch rules were applied simultaneously to model these assumptions spatially (cutblock sizes and targets are detailed in Table 28):

1) Group cutblocks: group harvest openings within 50 m of each other, within a 10-year period, and up to a maximum size of 40 ha. In the example shown (Figure 5), 'X' represents the maximum distance used to group adjacent openings.

2) Separate cutblocks: set the minimum distance ('Y') allowed between adjacent grouped cutblocks (already capped at 40 ha).

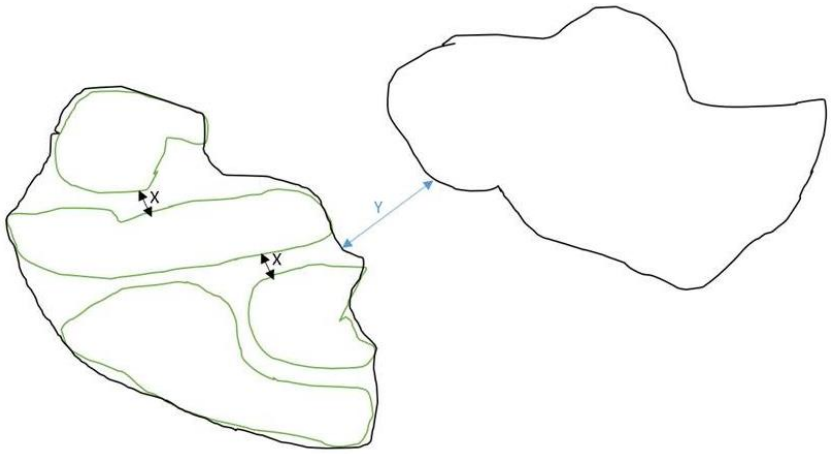



*Figure 5 Cutblock Adjacency and Harvest Openings (example)*

*Table 26 Cutblock Adjacency - Harvest Opening Targets*

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

Finally, to meet the FPPR biodiversity objectives, the THLB area under 3 m tall within each landscape unit was capped to 33%. The age where each stand reached 3 m height was determined during the yield development stage (section 3.2).

**MP8/9 approach where different**

In MP8/9, the cutblock adjacency was modelled as an early seral objective, where the THLB area <3m within each landscape unit was capped to 33%.

# 5 Modeling Assumptions

## 5.1 FOREST ESTATE MODEL

The PATCHWORKS ™ modeling software was used for projections and analysis. This suite of tools is sold and maintained by Spatial Planning Systems Inc. of Deep River, Ontario (Tom Moore - www.spatial.ca).

PATCHWORKS is a fully spatial forest estate model that can incorporate real world operational considerations into a strategic planning framework. It utilizes a goal seeking approach and an optimization heuristic to schedule activities across time and space in order to find a solution that best balances the targets and/or goals defined by the user. Targets can be applied to any aspect of the problem formulation. For example, the solution can be influenced by issues such as mature/ old forest retention levels, young seral disturbance levels, patch size distributions, conifer harvest volume, growing stock levels, snag densities, Coarse woody debris levels, ECAs, specific mill volumes by species, road building/ 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 found. 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' flexible interactive approach is unique in several respects:

- PATCHWORKS' interface allows for highly interactive analysis of trade-offs between competing sustainability goals.
- PATCHWORKS software integrates operational-scale decision-making within a strategic-analysis environment: realistic spatial harvest allocations can be optimized over long-term planning horizons. PATCHWORKS can simultaneously evaluate forest operations and log transportation problems using a multiple-product to multiple-destination formulation. The model can identify in precise detail how wood flows to mills over a complex set of road construction and transportation alternatives.
- 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.).
- 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 – even comparisons of multiple indicators across multiple scenarios.

## 5.2 MODELLING RULES

Table 27 lists the general assumptions that were incorporated in the forest estate model to improve efficiency or produce results that are spatially more realistic.

*Table 27 Modeling Assumptions*

| Criteria | Assumption |
|---|---|
| Minimum Polygon Size | Minimum size of the polygon within the resultant was set depending on the data source:<br>• 10 m² for road/riparian buffers<br>• 100 m² for larger area features (VRI, VLI etc.)<br>• 1,000 m² for very large administrative boundaries (e.g. ownership, landscape unit etc.) |
| Blocking | To improve modeling performance, resultant polygons within 20 m were blocked (or grouped) where possible by maintaining the same land base definition and 5-year age classes. The model was configured for a target harvest opening size of 40 ha. |
| Planning Horizon | A 300-year planning horizon was applied and reported in 10-year increments (i.e., 30 periods). 2018 was used as the initial modelling year. |
| Harvest Flow Objectives | Determine the maximum non-declining harvest flow while maintaining a non-declining THLB standing volume in the last 100 years of the 300-year planning horizon. The changes from one decade to the next cannot be more than ±10%.<br><br>With Patchworks™, the following approach is applied:<br>• Set the model to develop a 'no-constraints' harvest flow over 1 million iterations (i.e., as high as possible with no restrictions on period changes or standing volume). Initially, the only constraints applied were related to treatment operability windows (e.g., minimum harvest ages) and transition rules.<br>• Activate non-timber objectives (i.e., ECAs for community watersheds, maximum harvest rates by LU (i.e., max 33% below green-up), maximum 50% of the THLB area allowed under 80 years for the two recreation zones (Devil Lake and Sayres), and VQOs), and run the harvest schedule for another million iterations.<br>• Activate spatially-explicit cutblock adjacency objectives with somewhat low weights (i.e., 2 sets of patch objectives set – one that allows the model to group individual blocks into harvest openings of up to 40 ha in each decade, and the other that ensures the 40-ha harvest openings are at least 100 m apart). With these spatial objectives, an existing harvest schedule was needed to allow the model to group harvest openings more effectively. In this configuration, run the model for another million iterations before increasing weights on very small openings (max 0% <1ha in size) and small harvest openings (max 10% 1-5ha in size).<br>• Implement a target to ensure the standing volume on the THLB does not decline over the last 100 years of the 300-year planning horizon. Allow the model to develop the harvest schedule until the change in objective function over 500,000 consecutive iterations reaches less than 0.0000001%. Because this particular land base was relatively small, the analyst could run the model longer to develop the best solution possible. This was called the Max Flow run.<br>• Develop a non-declining harvest flow by manually adjusting the total harvest target that fits best the Max Flow Run. |
| Harvest Profiles | There was no specific management of the harvest profiles in this analysis. However, harvest rates by leading and individual species, harvesting system, and slope classes were tracked and reported. |

**MP8/9 approach where different**

MP8 utilized the FSOS model, a spatially explicit simulation model that determined the harvest rate using an oldest-first algorithm. It is unclear how the spatial resultant and model were set-up.

## 5.3 DISTURBANCE IN THE NHLB

Disturbances initiated by natural factors (e.g., wildfires, insects) are an intrinsic part of any forest ecosystem dynamic. In some analyses, a constant area can be randomly disturbed annually throughout the NHLB. This area is typically determined based on the BEC zones present, their associated natural disturbance intervals, and old seral definitions, as outlined in the Biodiversity Guidebook (BC Ministry of Forests and BC Ministry of Environment, Lands and Parks, 1995). However, this approach is not appropriate for smaller landbases as it can over-emphasize constraints that a larger landbase is able to absorb simply because of its size. Thus, no natural disturbance within the NHLB was implemented in this analysis. Stand age in the NHLB just increased over the entire planning horizon; a consequence that did not affect height-based constraints like watersheds or visuals, while landscape-level biodiversity is already addressed through reserves.

# 6 Current Forest Conditions

## 6.1 BIOGEOCLIMATIC CLASSIFICATION

Biogeoclimatic zones within TFL26 include the CWH and MH zones (Figure 6). More than half (63%) of the FMLB in the TFL is classified as CWH dm variant, followed by the CWH vm1 variant (24%), CWH vm2 variant (8%) and MH mm1 variant (5%).

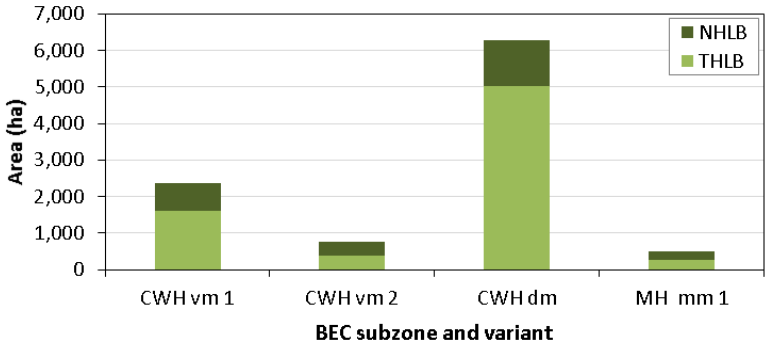



*Figure 6 BEC zone/subzone /variant distribution*

## 6.2 AGE CLASS

The current age class distribution for the TFL is illustrated in Figure 7. Most of the NHLB (73%) and THLB (89%) are less than 100 years of age, reflecting the past harvest history on the TFL. Approximately 5% of the forested land base is older than 200 years.

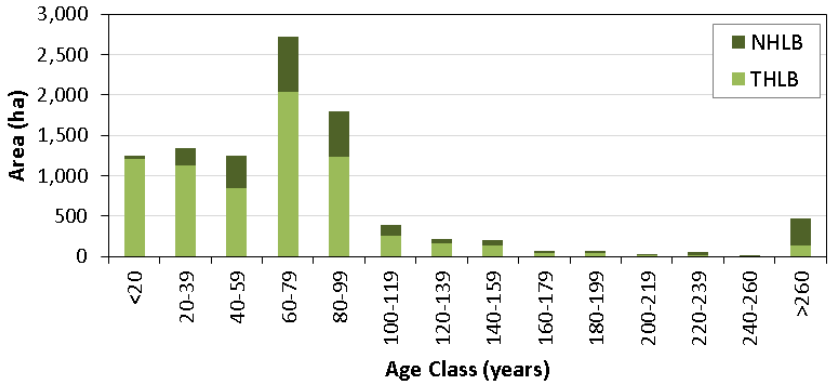



*Figure 7 Age class distribution (Current)*

## 6.3 LEADING SPECIES

The THLB is dominated by western hemlock (HW) leading stands (50% of the THLB), of which, approximately 82% are considered natural (i.e., no logging history since 1958 – last 60 years) (Figure 8). Douglas-fir (FD) leading stands cover approximately 26% of the THLB (58% are considered natural), while the remaining THLB is covered by western redcedar (CW) leading (11%), deciduous leading (7%), amabilis fir (BA) leading 3%, and the remaining 3% by other leading species (e.g., yellow cypress (YC), western white pine (PW)). The latest VRI did not include species information for approximately 107 ha of the THLB. Since these stands had been logged, the species composition and regeneration assumptions were compiled from the RESULTS data. It is important to note that for this analysis, approximately 26% of the THLB stands are considered managed stands (i.e., logging history and age ≤60 years in 2018).

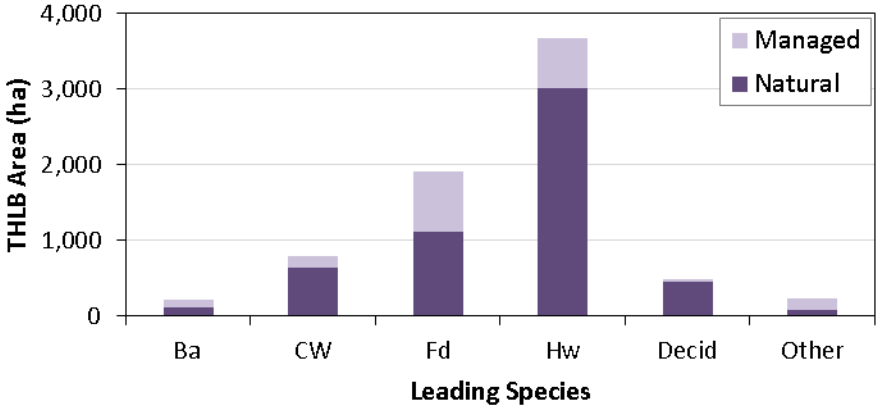



*Figure 8 THLB Distribution by Leading Species and Logging History*

## 6.4 SITE INDEX

Site index (SI) is a relative measure of stand productivity as the top height in meters at stand age of 50 years. The area-weighted average SI across the THLB, based on the current inventory, was estimated to 26.1 m (Figure 9). Using estimates of the managed SI sourced from the provincial site productivity layer, the area-weighted average SI was estimated to 28.3 m; approximately 2.2 m higher compared to the current inventory. Stands on the THLB with inventory SI between 18 and 26 m typically shifted towards managed SI >26 m.

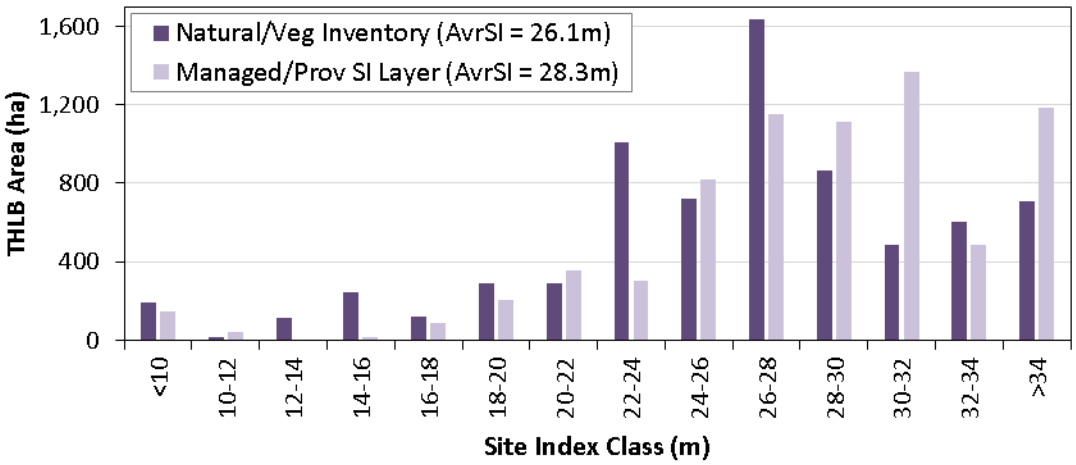



*Figure 9 THLB Distribution of Inventory and Provincial Managed Site Indices*

## 6.5 NON-TIMBER OBJECTIVES

The non-timber objectives modelled in this analysis included landscape- and stand-level biodiversity, hydrological recovery within community watersheds (CWS), and visual quality objectives (VQO). Landscape-level biodiversity objectives were addressed through established Old Growth Management Areas (OGMA) and stand-level biodiversity via additional reserves between and within cutblocks. CWS and VQO objectives were addressed with forest cover requirements that limit the disturbance levels permitted over time. These constraints had a negative impact on the harvest flow. Hydrological recovery within CWSs was controlled using Equivalent Clearcut Area (ECA) thresholds, which resulted in a very minor decrease on harvest flow since the THLB area within CWS (~4%) is relatively small (Figure 10). In contrast, the THLB within VQO polygons represents approximately 57% of the THLB. From the perspective view, most visual polygons were allowed a maximum percentage alteration of 1.6-4.7% (VQO retention and partial retention). From a planimetric (modelled) view, the maximum disturbances permitted within each VQO polygon ranged between 54% and 0.7%, based on the allowable VQO alteration percentage, visual absorption capacity (VAC), slope, and green-up heights (also depending on species and managed SI).

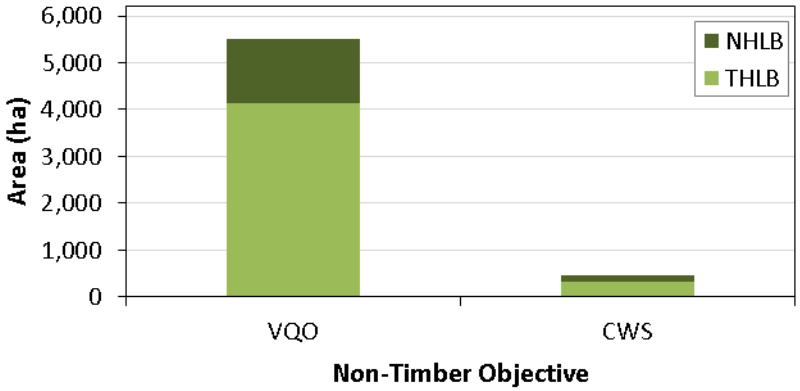



*Figure 10 Area Distribution by Non-Timber Objectives and Land Base Classification*

# 7 Sensitivity Analyses

The assumptions and modelling approaches described above were used to develop a baseline or base case scenario for comparing results against other approaches. The following subsections describe sensitivity analyses where some level of uncertainty exists in the data integrity or assumptions applied in the base case scenario.

## 7.1 RIPARIAN RETENTION FROM FRASER TSR

The last TSR for the Fraser TSA (BC Ministry of Forests, Lands and Natural Resource Operations, 2013) used significantly higher retention percentages for the RMZ assigned to streams. This sensitivity analysis explored the impact on harvest rate when the RMZ were aligned to the Fraser TSR (Table 28). The THLB was reduced by approximately 60 ha (from 7,289 ha to 7,229 ha) when the larger buffer widths were applied to the streams.

*Table 28 Buffer Widths Differences between Base Case and Sensitivity Analysis*

| Riparian Class | Base Case | | | | Sensitivity Analysis | | | |
|---|---|---|---|---|---|---|---|---|
| | RRZ (m) | RMZ (m) | RMZ Ret (%) | Buffer Width (m) | RRZ (m) | RMZ (m) | RMZ Ret (%) | Buffer Width (m) |
| S1, rivers | 50 | 20 | 50 | 60 | 50 | 20 | 50 | 60 |
| S2 | 30 | 20 | 50 | 40 | 30 | 20 | 50 | 40 |
| **S3** | 20 | 20 | **25** | **25** | 20 | 20 | **50** | **30** |
| **S4** | 0 | 30 | **5** | **1.5*** | 0 | 30 | **25** | **7.5** |
| **S5** | 0 | 30 | **5** | **1.5*** | 0 | 30 | **25** | **7.5** |
| S6 | 0 | 20 | 0 | 0 | 0 | 20 | 5 | 1* |

**Small buffer widths typically result in many sliver polygons during GIS processing. For this analysis, we assumed that operational planners address these relatively small riparian buffers within stand-level retention areas.*

## 7.2 NO LIDAR-ENHANCED FOREST INVENTORY

With FAIB's assistance, the base case scenario used recently collected LiDAR data to update the forest cover inventory for tree heights, which ultimately affects current estimates of site index or age, and projected volume. A sensitivity analysis was conducted to explore the harvest level impacts when using the standard VRI attributes rather than the LiDAR-updated inventory.

## 7.3 MINIMUM AVERAGE HARVEST VOLUME

MHAs derived based on yield estimates (section 3.2) can have significant impacts on timber harvest levels. Two sensitivity analyses were run to examine the potential impacts:

1) Ensure a minimum average harvest volume per decade of 475 m³/ha is maintained. The average value was determined from the appraisal data from last 10 years (2009-2017, no harvest in years 2005-2008). Here, the MHAs were adjusted so the minimum volume was a minimum of 475 m³/ha for conventional and cable harvest systems. For the helicopter system, the minimum volume was kept at 600 m³/ha. In addition, the MAI needed to be within 90% of the CMAI. Some existing natural AU did not meet these conditions and they were made unavailable to harvest for the entire planning horizon (approximately 351 ha THLB).

2) Change MHA criteria from 225 m³/ha (just above the lowest value in year 2002 (209 m³/ha) from the STONE harvest performance assessment) to 350 m³/ha conventional harvest system and 400 m³/ha heli-harvest system (similar to assumption applied in adjacent Fraser TSA). The MAI needed to be within 90% of the CMAI.

## 7.4 INCLUDE FERTILIZATION

History of fertilization practices within this TFL exists and future fertilization opportunities will most likely become available given the location and the relatively high growing capacity of the stands within this TFL. A sensitivity analysis was designed to explore the fertilization opportunity as detailed in Table 29. The forest estate model will have options to fertilized the candidate stands and then logged them in a very narrow window (20 years past MHA to maximize fertilization gains), or grow the stands unfertilized until they reach the MHA and then consider logging.

In the case of Douglas-fir leading stands, the TIPSY default fertilization responses of a pure Douglas-fir stand were assumed (Table 29). Here, the 1 fertilization application regime assumed the only application to occur at age 60, whereas the 2 fertilization application regime assumed that application 1 would occur at age 53, and application 2 at age 60 (7 years later). In the case of western redcedar leading stands, conservative estimates were assumed following discussions with experts in this field (e.g., Ann Wong). The absolute gains in $m^3$/ha were made available to the forest estate model 7 years after the fertilization applications (e.g., 1 fertilization application regimes, the gains will occur starting at age 67; 2 fertilization applications regime, the gains will occur at age 60 (from application 1 at age 53), and age 67 (from the application at age 60)).

*Table 29 Fertilization Criteria*

<table>
<tr><th>Element</th><th>Criteria</th></tr>
<tr><td>Eligible Stands</td><td>○ Existing managed stands<br>○ Site Group Zonal<br>○ BEC: CWHdm, CWHvm1, and CWHvm2<br>○ Leading species: Fd, Cw<br>○ Current age: 10 years younger than MHA for 1 application, 20 years younger than MHA for 2 applications</td></tr>
<tr><td>Costs</td><td>○ $450 per hectare for each treatment</td></tr>
<tr><td>Budget</td><td>○ Maximum $250,000 per decade for only the first two decades (i.e., 20 years)</td></tr>
<tr><td>Timing Windows and Treatment Response</td><td>○ Volume increments applied 7 years after treatments (one or two per eligible stand)<br>○ Locked from harvesting for 7 years after last application<br>○ Volume increments completely removed 21 years after one-application treatment, 42 years after first application of two-application treatment.<br><br>
<table>
<tr><th>Applications (every 7 yrs)</th><th>Stand Age Application Window</th><th>Harvest Window</th></tr>
<tr><td>1</td><td>10 years before MHA to MHA</td><td>20 years past MHA</td></tr>
<tr><td>2</td><td>20 years before MHA to MHA</td><td>20 years past MHA</td></tr>
</table>
Absolute gains ($m^3$/ha) for each eligible AU given leading species and site index.
<table>
<tr><th>AU</th><th>Lead Spp</th><th>Site Index</th><th>FD_1applic</th><th>FD_2applic</th><th>CW_1applic</th><th>CW_2applic</th></tr>
<tr><td>101/151</td><td>Fd</td><td>31.5</td><td>21</td><td>43</td><td></td><td></td></tr>
<tr><td>102/152</td><td>Fd</td><td>27</td><td>30</td><td>63</td><td></td><td></td></tr>
<tr><td>201/251</td><td>Fd</td><td>31.6</td><td>20</td><td>42</td><td></td><td></td></tr>
<tr><td>202/252</td><td>Fd</td><td>27.7</td><td>30</td><td>63</td><td></td><td></td></tr>
<tr><td>301</td><td>Cw</td><td>30.6</td><td></td><td></td><td>12</td><td>24</td></tr>
<tr><td>302</td><td>Cw</td><td>29.6</td><td></td><td></td><td>12</td><td>24</td></tr>
<tr><td>303</td><td>Fd</td><td>33.1</td><td>12</td><td>26</td><td></td><td></td></tr>
</table>
All at 80% Efficiency</td></tr>
</table>

## 7.5 GENETIC GAINS APPLIED TO FUTURE STANDS

While improved seed with higher genetic worth is becoming more available, the volume gain, seed use and planted-to-natural weightings needed to compute future genetic gains may not be reliably projected. Two sensitivity analyses were run to examine the potential impacts:

1) No genetic gains applied to future managed stands, and

2) Half of the genetic gain expected where genetic worth and or seed availability may not be correct.

# 8 References

BC Ministry of Forests and BC Ministry of Environment, Lands and Parks. (1995). *Biodiversity Guidebook.* Victoria: BC Ministry of Forests, Lands and Natural Resource Operations.

BC Ministry of Forests, L. a. (2015). *2015-17 Coastal Timber Supply Areas Forest Health Overview.*

BC Ministry of Forests, Lands and Natural Resource Operations. (2013). *Fraser Timber Supply Area. Timber Supply Review. Data Package.* Victoria, BC: BC Ministry of Forests, Lands and Natural Resource Operations.

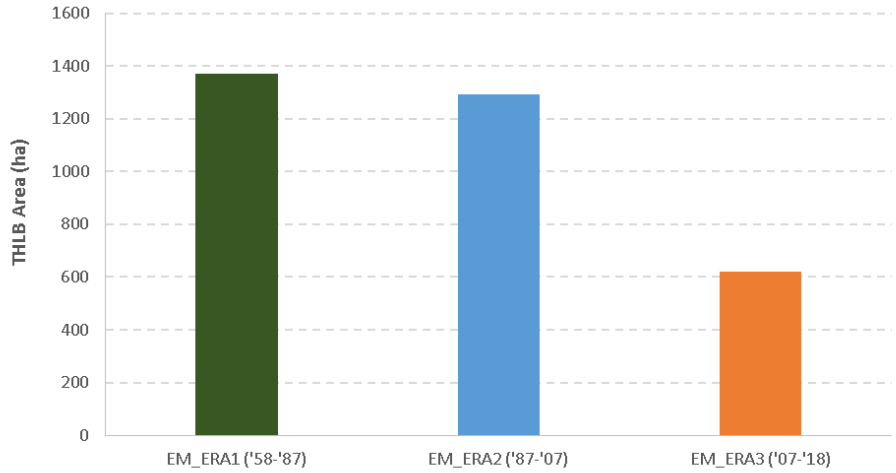
Mission Municipal Forest. (2001). *Tree Farm Licence 26 - Proposed Management Plan 8.* Mission, BC: District of Mission.

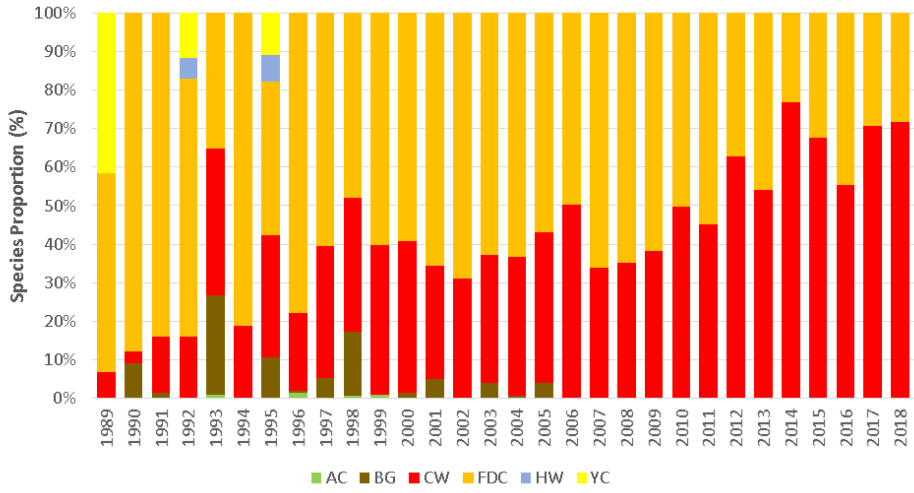
Mission Municipal Forest. (2010). *Mission Tree Farm Licence No. 26 - Management Plan 9.* Mission, BC: District of Mission.

Winkler, R., & Boon, S. (2015). *Revised snow recovery estimates for pine-dominated forests in interior British Columbia.* Victoria, B.C.: Prov. B.C., Exten. Note 116.

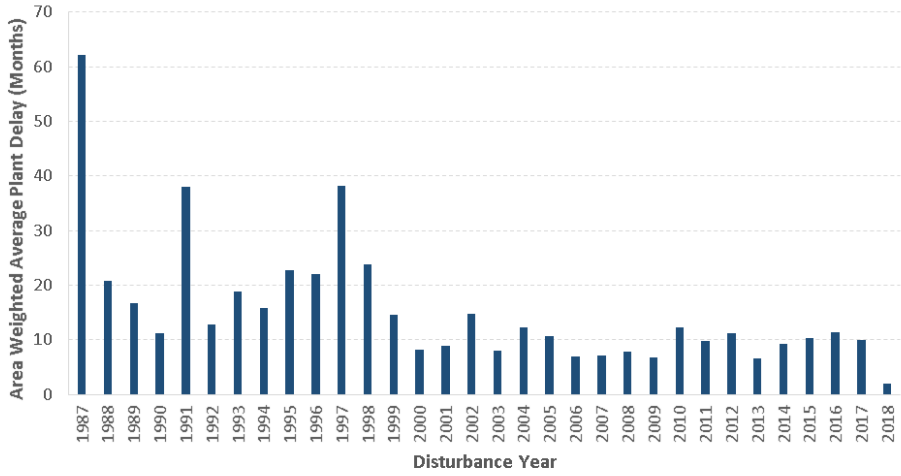
# Appendix 1 RESULTS Statistics for Existing Managed Stands

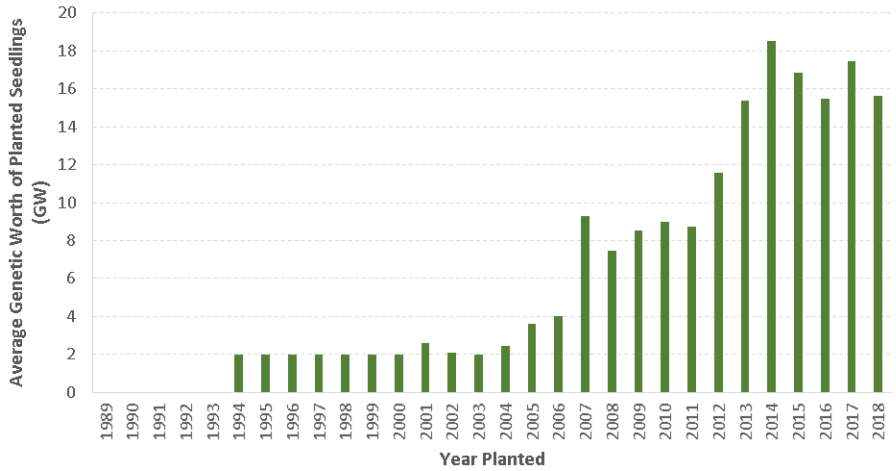
The following charts were summarized from RESULTS data to inform yield curve development for existing managed stands

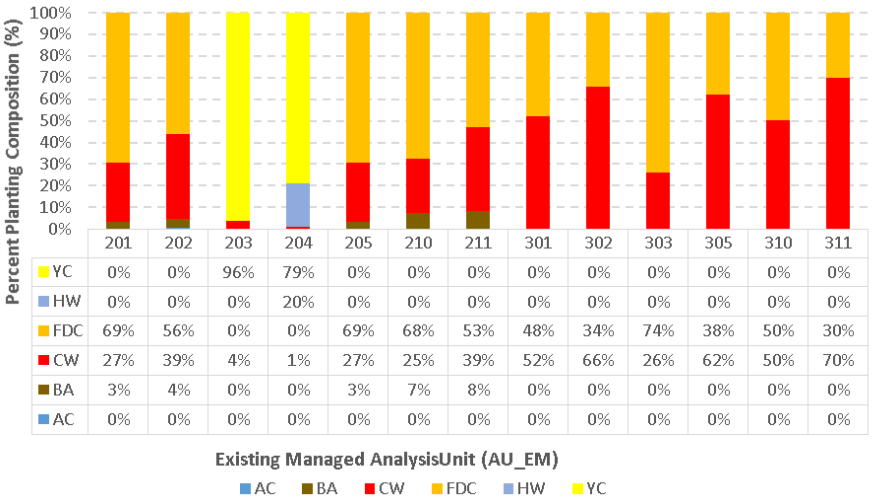


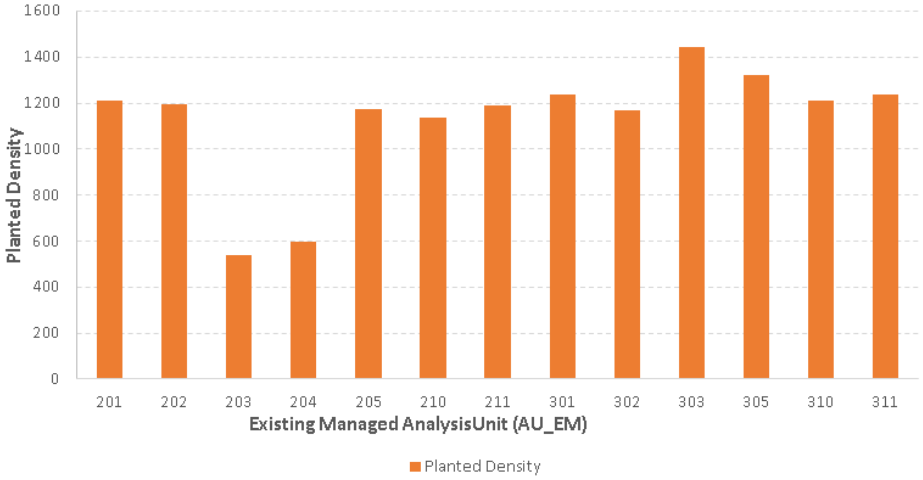

Planted Density (stems/ha)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Plant Year

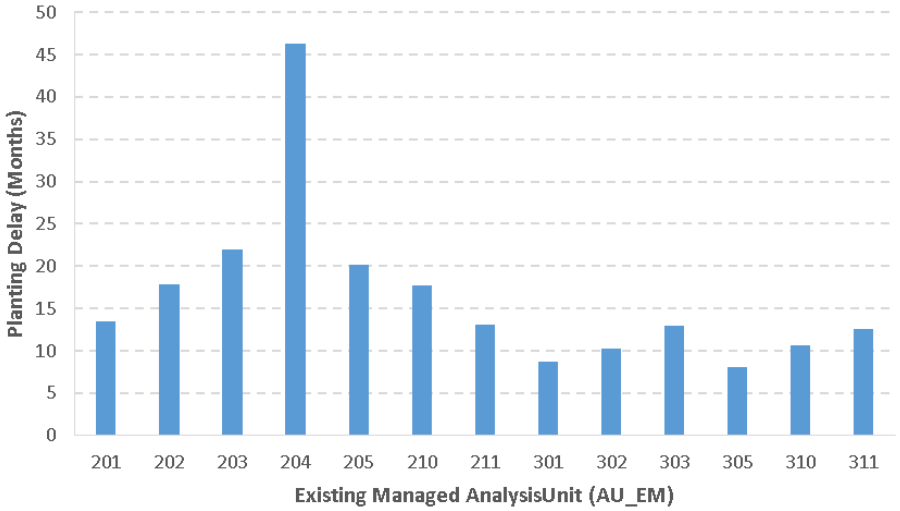

Area Weighted Average Plant Delay (Months)
70
60
50
40
30
20
10
0
1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Disturbance Year


Average Genetic Worth of Planted Seedlings (GW)
20
18
16
14
12
10
8
6
4
2
0
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Year Planted




| | 201 | 202 | 203 | 204 | 205 | 210 | 211 | 301 | 302 | 303 | 305 | 310 | 311 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YC | 0% | 0% | 96% | 79% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| HW | 0% | 0% | 0% | 20% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| FDC | 69% | 56% | 0% | 0% | 69% | 68% | 53% | 48% | 34% | 74% | 38% | 50% | 30% |
| CW | 27% | 39% | 4% | 1% | 27% | 25% | 39% | 52% | 66% | 26% | 62% | 50% | 70% |
| BA | 3% | 4% | 0% | 0% | 3% | 7% | 8% | 0% | 0% | 0% | 0% | 0% | 0% |
| AC | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |



# Appendix 3 Timber Supply Analysis

# Tree Farm Licence 26 – Management Plan #10

## TIMBER SUPPLY ANALYSIS

**Version 1.2**

**November 27, 2019**

**Project 1493-1**

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# Executive Summary

This report documents the timber supply analysis for Management Plan #10 for Tree Farm Licence 26 (TFL 26) held by the Corporation of the District of Mission. Reviews of the projected timber supply for Tree Farm Licences are typically completed once every ten years to capture changes in data, practices, policy or legislation influencing forest management. The last analysis for TFL 26 was completed in 2001 with an Allowable Annual Cut (AAC) established at 45,000 m³. The 2001 analysis was subsequently used to inform a second AAC determination in 2010 that maintained the current AAC at 45,000 m³.

The timber supply analysis provides projections of future harvest levels over time with consideration of a wide range of physical, biological, social, and economic factors. These factors encompass both the timber and non-timber values found in forests and ensure that timber-harvesting objectives are balanced against social and ecological values such as wildlife, biodiversity, watershed health, and recreational opportunities.

An Information Package (IP) that provides detailed technical information and assumptions regarding current forest management practices, policy and legislation for use in this analysis underwent 60 days of public review beginning in September 2018, and was accepted by the Ministry of Forests, Lands, Natural Resource Operations & Rural Development (FLNRORD) on December 12, 2018. An updated Information Package that reflect changes made in response to the public review and discussions with the FLNRORD is included as an appendix to Management Plan #10.

This report focuses on a forest management scenario known as the "Base Case" scenario that reflects current management practices in TFL 26. A number of sensitivity analyses are also presented that assess how results might be affected by uncertainties in data or assumptions. Together, these analyses form a solid foundation for discussions with government, First Nations, and stakeholders in the determination of an appropriate timber harvesting level.

TFL 26 consists of approximately 10,935 ha of crown land (88%) and municipal land (12%) in southwestern British Columbia. The TFL is split into two similar-sized parts on each side of the lower arm of Stave Lake, to the north of the community of Mission. The forest management land base was estimated to approximately 9,875 ha (90% of total TFL), and timber harvesting land base to 7,289 ha (67% of total TFL). The key changes affecting forest management since the 2001 analysis include:

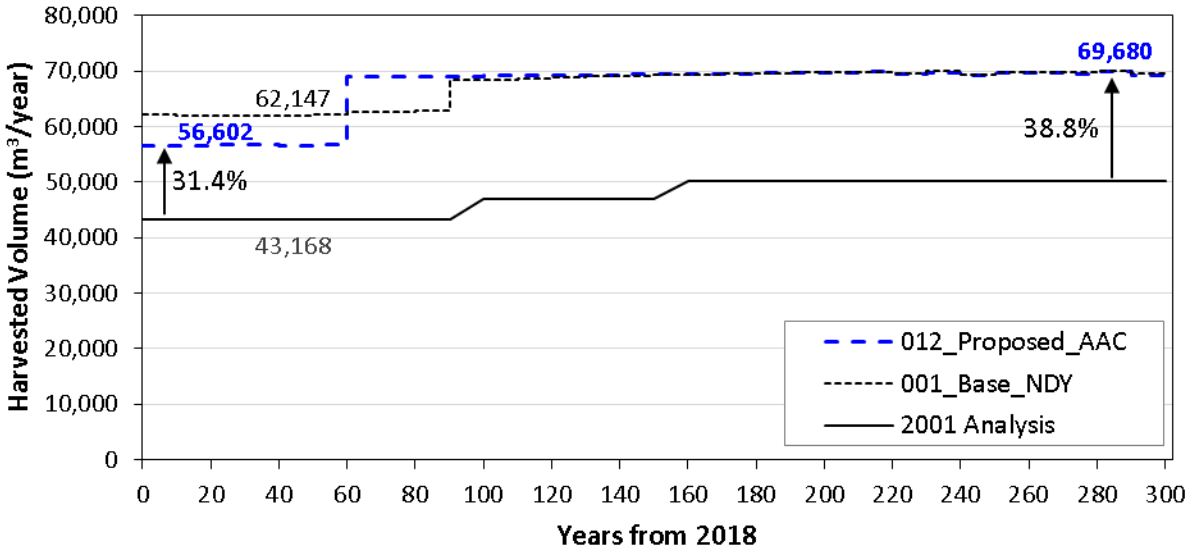
- Exchange of area to the adjacent First Nation Woodland Licence N2Z for four parcels of land situated within the District of Mission but outside of TFL 26.
- Establishment of spatial old growth management areas (OGMAs).
- Use of LiDAR-enhanced forest inventory and provincial site index estimated for managed stands.
- Use of TEM to identify non-forest areas, marginal site, and analysis units (in line with operational reality).
- Use of improved modelling tools (newer growth and yield models and a spatially explicit heuristic forest estate model).

The Base Case scenario maintains approximately 62,500 m³/year (44% more than the 2001 analysis and 37.8% more than the current AAC) for a period of 90 years, after which the harvest flow reaches the long-term value of 69,500 m³/year (see chart below). When compared to the 2001 analysis, the mid-term harvest flow for the Base Case is approximately 44% higher, and the long-term level is approximately 39% higher.

The harvest flows were sensitive in particular to changes of THLB area and to changes of yield estimates (see table

below). Changes to riparian buffer widths for streams or removing from harvesting all stands that never reached a standing volume of 475 m³/ha reduced the short-term harvest flows by 2.3% and 5.8%, respectively. Reducing the yields of existing natural stands by not using the LiDAR-enhanced forest inventory reduced the short-term harvest flows by 6.2%. Reducing the future yields by reducing the genetic worth to half and to zero, decreased the short-term-harvest flows by 3.0% and 6.3%, respectively. Adding fertilization treatment options for the existing managed stands younger than their corresponding minimum harvest ages did not increase or shorten the mid-term. Finally, this TFL was not sensitive when the minimum harvest ages were aligned to those applied to the adjacent Fraser TSR.

The District of Mission recommends the proposed harvest rate of 56,602 m³/year ((see blue dashed line in chart below), which considers factors that were not specifically included in the analysis (i.e., Mission Interpretive Forest Site, recreational infrastructure, forest health, and climate change). This proposed harvest rate provides the District of Mission with some flexibility to adjust to these potential pressures on the timber harvest and to reduce its financial risk by stabilizing revenue and staffing capacity.




| Scenario ID | Description | Harvest Volume (m³/year) | | | Difference from [001] | | |
|---|---|---|---|---|---|---|---|
| | | Short-term | Mid-term | Long-term | Short-term | Mid-term | Long-term |
| 001 | Base Case | 62,058 | 68,377 | 69,735 | | | |
| 002 | Riparian Fraser TSR | 60,655 | 67,349 | 69,333 | -2.3% | -1.5% | -0.6% |
| 003 | No LiDAR Inventory | 58,237 | 64,659 | 70,779 | -6.2% | -5.4% | 1.5% |
| 004 | MHA at 475 m³/ha | 58,476 | 64,345 | 65,582 | -5.8% | -5.9% | -6.0% |
| 005 | MHA Fraser TSR | 61,689 | 68,602 | 69,826 | -0.6% | 0.3% | 0.1% |
| 006 | Fertilization | 61,725 | 68,104 | 69,608 | -0.5% | -0.4% | -0.2% |
| 007 | No Future GW | 58,151 | 62,875 | 64,304 | -6.3% | -8.0% | -7.8% |
| 008 | Half Future GW | 60,211 | 65,711 | 67,242 | -3.0% | -3.9% | -3.6% |
| 012 | Proposed AAC | 56,602 | 56,602 | 69,860 | -8.8% | -17.2% | 0.2% |

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# Document Revision History

| Version | Date | Description |
|---|---|---|
| 0.1 | May 9, 2019 | First draft with notes delivered to client for review. |
| 1.0 | June 3, 2019 | Initial draft shared with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development for a content review. This version attached as appendix to the Draft Management Plan #10. |
| 1.1 | June 17, 2019 | Several minor edits identified through FLNRORD informal content review. |
| 1.2 | November 27, 2019 | Several changes to text based on Forest Analysis and Inventory Branch recommendations. |

# Acknowledgements

Forsite acknowledges and thanks the following individuals who contributed in preparing this Timber Supply Analysis.

- Kelly Cameron, RFT, and Chris Gruenwald, RPF with the District of Mission, provided the data, documentation, and local experience needed to support assumptions used in the analysis.
- Doug Beckett, RPF and Jim Brown, RPF with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNORD) and the Forest Analysis and Inventory Branch (FAIB) who provided expert guidance on the requirements for the Management Plan approval process, and
- Jack Sweeten, RPF with FLNRORD and the Chilliwack Natural Resources District who provided and facilitated input from local regional and district staff.
- Cosmin Man, RPF with Forsite, who prepared the analysis, summary information and report, and
- Patrick Bryant, RPF with Forsite, who supervised the project, directed the analysis, and reviewed the report.

# List of Acronyms

| | |
|---|---|
| AAC | Allowable Annual Cut |
| AU | Analysis Unit |
| BA | Balsam (*Abies amabilis*) |
| BEC | Biogeoclimatic Ecosystem Classification |
| CW | Western redcedar (*Thuja plicata*) |
| CWH | Coastal Western Hemlock BEC zone |
| CWS | Community Watershed |
| ECA | Equivalent Clearcut Area |
| EM | Existing Managed |
| EN | Existing Natural |
| ESA | Environmentally Sensitive Area |
| FD | Douglas-fir (*Pseudotsuga menziesii*) |
| FLNRORD | BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development |
| FM | Future Managed |
| FMLB | Forest Management Land Base |
| GW | Genetic Worth |
| HW | Western hemlock (*Tsuga heterophylla*) |
| LiDAR | Light Detection and Ranging |
| LRSY | Long Range Sustained Yield |
| LU | Landscape Unit |
| MAI | Mean Annual Increment |
| MH | Mountain Hemlock BEC zone |
| MHA | Minimum Harvest Age |
| NDY | Non-Declining Yield |
| NHLB | Non-Harvestable Land Base |
| NRL | Non-recoverable Losses |
| OGMA | Old Growth Management Area |
| RESULTS | Reporting Silviculture Updates and Land Status Tracking System |
| RMZ | Riparian Management Zone |
| SI | Site Index |
| TEM | Terrestrial Ecosystem Mapping |
| TFL | Tree Farm Licence |
| THLB | Timber Harvesting Land Base |
| TIPSY | Table Interpolation Program for Stand Yields |
| TSA | Timber Supply Area |
| TSR | Timber Supply Review |
| VAC | Visual Absorption Capacity |
| VDYP | Variable Density Yield Prediction |
| VQO | Visual Quality Objective |
| VRI | Vegetation Resource Inventory |
| YC | Yellow cypress (*Chamaecyparis nootkatensis*) |

# 1 Introduction

The Corporation of the District of Mission, the holder of the Tree Farm Licence (TFL) 26, is undertaking a Management Plan #10 (MP10) process – due for approval by March 26, 2020. TFL 26 is administered through the Chilliwack Natural Resource District Office within the South Coast Region. As part of the MP10 process, a timber supply analysis was conducted to examine the short- and long-term effects of current forest management practices on the available timber harvest.

The timber supply analysis provides projections of future harvest levels over time with consideration of a wide range of physical, biological, social and economic factors. These factors encompass both, the timber and non-timber values found in our forests and ensure that timber harvest objectives are balanced against social and ecological values such as wildlife, biodiversity, watershed health, and recreational opportunities.

An Information Package provides detailed technical information and assumptions regarding current forest management practices, policy and legislation for use in this analysis. The District of Mission prepared the Information Package for this analysis, which was made available for review by the public and First Nations over 60 days beginning in September 2018 and was accepted by the FLNRORD on December 12, 2018. An updated Information Package that reflects minor changes made in response to the public review (Forsite Consultants Ltd., 2019) is included in Appendix 2 of the Management Plan #10 document. The information package details the information needed to conduct the analysis (e.g., data inputs and assumptions) and much of this information is not repeated here.

This Analysis Report summarizes the results of the timber supply analysis for the Base Case scenario that reflects current management practices on the TFL. It includes alternative harvest flows as well as several sensitivity analyses to provide insight into how results may be affected by uncertainties in data or assumptions. This Analysis Report provides focus for public discussion and will provide British Columbia's Chief Forester with much of the information needed to establish a new Allowable Annual Cut (AAC). This Analysis Report only provides insight into the likely future timber supply for TFL 26, which supports the District of Mission's proposed harvest rate. The final AAC will be determined by the Chief Forester through a published rationale document.

Reviews of the projected timber supply for TFLs are typically completed every ten years to capture changes in data, practices, policy or legislation influencing forest management. The last analysis for TFL 26 was completed in 2001 with an Allowable Annual Cut (AAC) established at 45,000 $m^3$. The 2001 analysis was subsequently used to inform a second AAC determination in 2010 that maintained the current AAC at 45,000 $m^3$.

# 2 Project Area

The TFL26 is located to the north of the community of Mission, a municipality of approximately 38,000 people, in the northern half of the District of Mission, in southwestern British Columbia (Figure 1). Approximately 88% of the TFL is Crown land (Schedule B) and the remaining 12% is municipal land (Schedule A). The TFL is split into two similar-sized parts; on each side of the lower arm of Stave Lake.

The TFL lies mostly within Coastal Western Hemlock (CWH) biogeoclimatic ecosystem classification (BEC) zone, with a small portion within the Mountain Hemlock (MH) BEC zone at higher elevations. The terrain within the TFL is variable; most of the area is between 100 m and 700 m elevation. The highest point within the District of Mission is Mt. Crickmer at 1,356 metres in elevation.

The total area of the TFL is approximately 10,935 hectares from which 9,875 hectares (90%) is considered the

forest management land base (FMLB) that contributes towards meeting non-timber and other management objectives (e.g., biodiversity) and 7,289 hectares (67%) is considered available for timber harvesting. As individual harvest openings are planned, further reductions are implemented to address non-timber values for an effective harvest area of 6,563 hectares (60%).

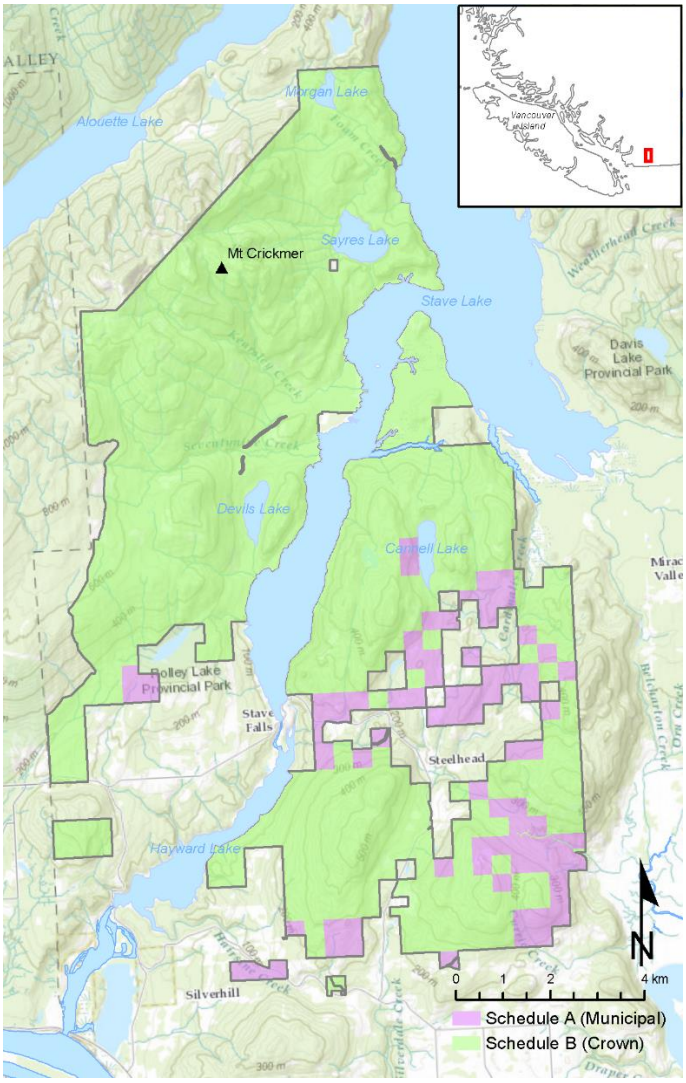


***Figure 1 Location of the Mission Municipal Forest - TFL 26***

# 3 Timber Values

The Base Case scenario presented in this report was based on the best information available and reflected management practices employed within the TFL. The current AAC for TFL 26 was established at 45,000 m³ (effective since August 1, 2001). Non-recoverable losses in the THLB were estimated to be 122 m³/year and, unless otherwise noted, were subtracted from the graphs, tables, and harvest projections in this report.

## 3.1 HARVEST FLOW

### 3.1.1 LONG RANGE SUSTAINED YIELD

The Long Range Sustained Yield (LRSY) is calculated as the sum of the future THLB area of each regenerated analysis unit, multiplied by the maximum mean annual increment (MAI) of the analysis unit. LRSY represents the theoretical maximum even-flow yield that can be sustained across the land base and is used as a benchmark to evaluate the model runs.

To achieve LRSY, each stand must be harvested at the age where the MAI is greatest. In practice, this does not occur for every stand because some stands may not be available for harvest at the specified age due to non-timber resource requirements. In addition, minimum harvest ages for this analysis were reduced from the optimum age to provide some modelling flexibility by allowing harvest once the stand has achieved 90% of the maximum MAI. In some cases, the model may harvest stands at this reduced age to offset non-timber objectives required on other portions of the land base.

The LRSY calculated for the Base Case scenario was 90,964 $m^3$/year. After accounting for non-recoverable losses (i.e. reducing by 122 $m^3$/year), a LRSY of 90,842 $m^3$/year was used to compare with other model runs.

### 3.1.2 DEVELOPING THE BASE CASE HARVEST FLOW

This analysis was conducted using Patchworks™, a heuristic, spatially explicit forest estate model. Because of the heuristic nature, the approach applied to develop sustainable harvest flows was different from those used in simulation or true-optimization forest estate models. Two harvest flows were developed to support the Base Case: Max Flow and Non-Declining Yield (Base NDY). The Max Flow run was first developed to demonstrate the maximum harvest flow that can be sustained over each period and then the Base NDY harvest flow was adjusted to maintain a steady harvest flow over multiple periods.

For the first harvest flow (Max Flow), the analyst applied the following steps:

1) Set the model to develop a 'no-constraints' harvest flow over 1 million iterations (i.e., as high as possible with no restrictions on period changes or standing volume). Initially, the only constraints applied were related to treatment operability windows (e.g., minimum harvest ages) and transition rules.

2) Activate non-timber objectives (i.e., ECAs for community watersheds, maximum harvest rates by LU (i.e., max 33% below green-up), maximum 50% of the THLB area allowed under 80 years for the two recreation zones (Devil Lake and Sayres), and VQOs), and run the harvest schedule for another million iterations.

3) Activate spatially-explicit cutblock adjacency objectives with somewhat low weights (i.e., 2 sets of patch objectives set – one that allows the model to group individual blocks into harvest openings of up to 40 ha in each decade, and the other that ensures the 40-ha harvest openings are at least 100 m apart). With these spatial objectives, an existing harvest schedule was needed to allow the model to group harvest openings more effectively. In this configuration, run the model for another million iterations before increasing weights on very small openings (max 0% <1ha in size) and small harvest openings (max 10% 1-5ha in size).

4) Implement a target to ensure the standing volume on the THLB does not decline over the last 100 years of the 300-year planning horizon. Allow the model to develop the harvest schedule until the change in objective function over 500,000 consecutive iterations reaches less than 0.0000001%. Because this particular land base was relatively small, the analyst could run the model longer to develop the best solution possible.

For the second harvest flow (Base NDY), the analyst included an extra step to the ones described above for the Max Flow:

5) Before setting the standing volume objective (step 4), adjust the model to manually develop a non-declining harvest flow.

The Base NDY harvest flow was developed as the Base Case scenario (Figure 2), with an initial harvest flow of ~62,000 m³/year maintained for the first 90 years, and then increasing to ~69,500 m³/year over the rest of the 300-year planning horizon.

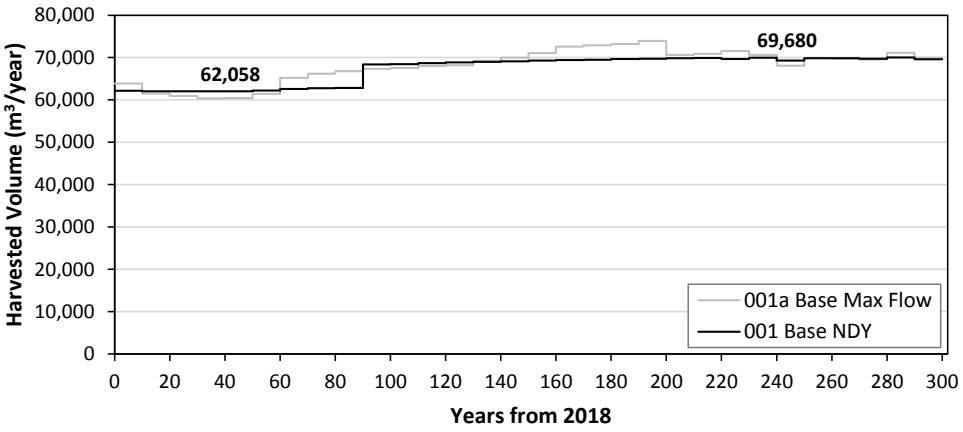


***Figure 2 Base Case – Harvest Flows - Max Flow and Base NDY***

## 3.2 OTHER METRICS

This section describes various attributes of harvested stands and the overall state of the forest modelled throughout the planning horizon. The information presented below was used to validate assumptions and review their relative impact on the overall composition of the forest to understand and evaluate the Base Case Scenario. Similar metrics were reported for all model runs but were only presented in this document to support key elements germane to this analysis.

### 3.2.1 GROWING STOCK

Growing stock was controlled in the model by implementing a target to ensure the standing volume on the THLB does not decline over the last 100 years (step 4 above), which is clearly demonstrated in Figure 3. Aside from a slight decline between the 3rd and 5th decade, the total growing stock associated with the Base NDY run continually increased until the 20th decade where it leveled off to approximately 3.8 million m³. The merchantable growing stock reached its lowest level (pinch point) of 1.8 million m³ in the 6th decade – still 2.9 times the harvest rate over that period.

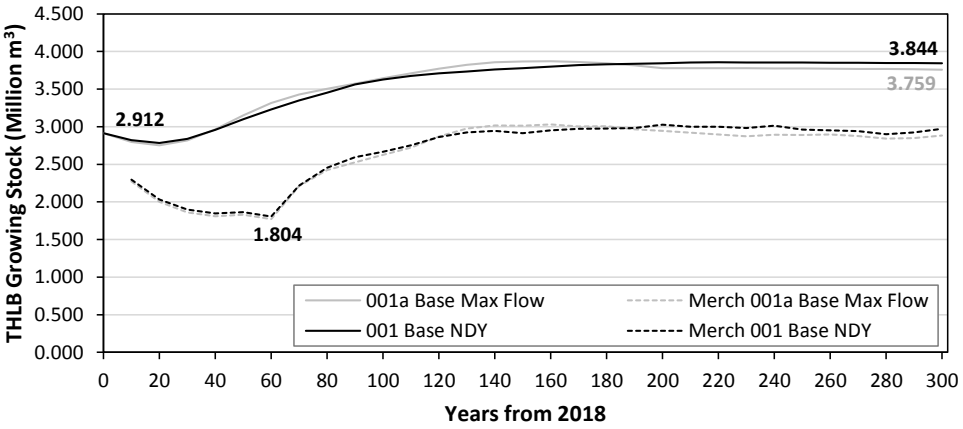


***Figure 3 Base Case – THLB Growing Stock (Total and Merch) - Max Flow and Base NDY***

### 3.2.2 AGE CLASS

The area distribution by age classes at years 0, 50, 100 and 250 is illustrated in Figure 4. The modelled forest nearly achieves a regulated state within 100 years as harvesting on the THLB transitioned to future managed stands, which were subsequently harvested close to their culmination age. By year 250 of the planning horizon, the most productive stands on the THLB contributed to the regulated state evenly distributed within age classes under 60 years. Some stands on the THLB were distributed over age classes between 60 and 160 years, which provide significantly higher volume. A relatively large portion of the THLB was never harvested to meet non-timber objectives – specifically VQOs. VQOs cover 57% of the THLB, where the model had to delay harvesting THLB to meet these objectives. Note that aspatial areas reserved as in-block retention continues to age in perpetuity as no disturbance was scheduled for these areas.

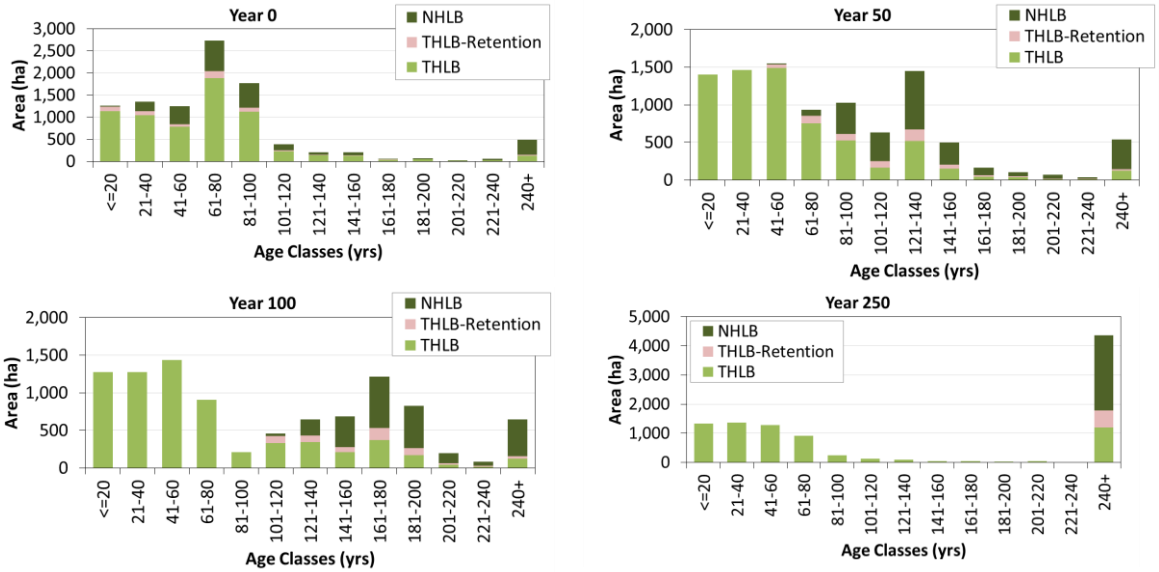


***Figure 4 Base Case – Area Distribution by Age Class (at 0, 50, 100, 250 years)***

### 3.2.3 HARVEST ATTRIBUTES

The model harvested existing stands (i.e., both existing natural (EN) and existing managed (EM) stands regenerated

before year 2018) over the first 60 years of the 300-year planning horizon (Figure 5). Following the pinch point (lowest level in merchantable growing stock) identified in the 6th decade, the model quickly transitioned to harvest future managed stands (FM) regenerated over the previous 60 years. Some existing stands continued to be harvested over the rest of the planning horizon.

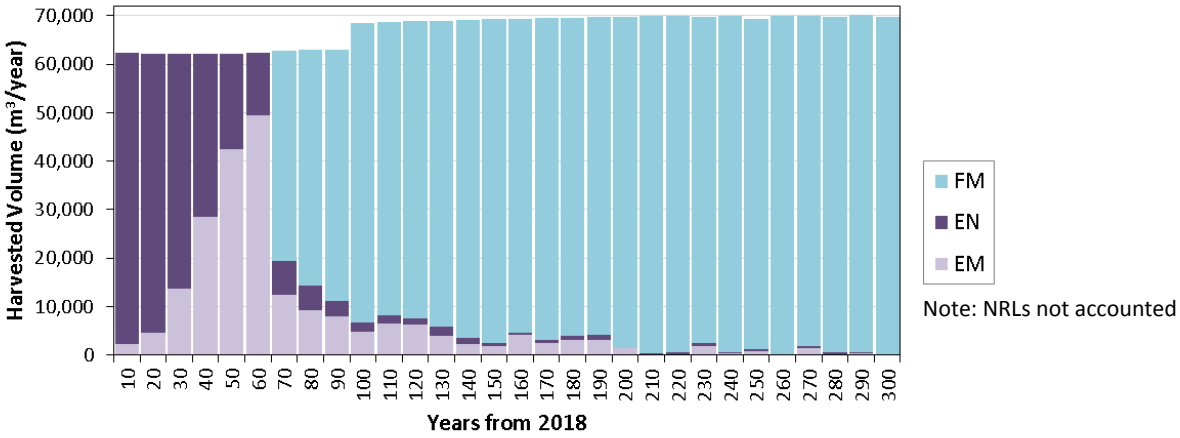


***Figure 5 Base Case – Harvested Volume by Management State***

The average age at harvest decreased from 102 years in decade 1, to 71 years by the end of the 300-year planning horizon (Figure 6). This reflects the harvest of older stands over the short- and mid-term, and the transition to harvesting younger, more productive stands over the long-term. The average volume at harvest increased from 625 m³/ha at the beginning of the planning horizon to 1,096 m³/ha by year 140, then varied between 1,159 m³/ha and 962 m³/ha over the long-term (Figure 6). Inversely to average volume harvested, the average area harvested annually decreased from 100 ha/year to a low of 61 ha/year by year 80, then varied between 60 and 76 ha/year for the rest of the 300-year planning horizon.

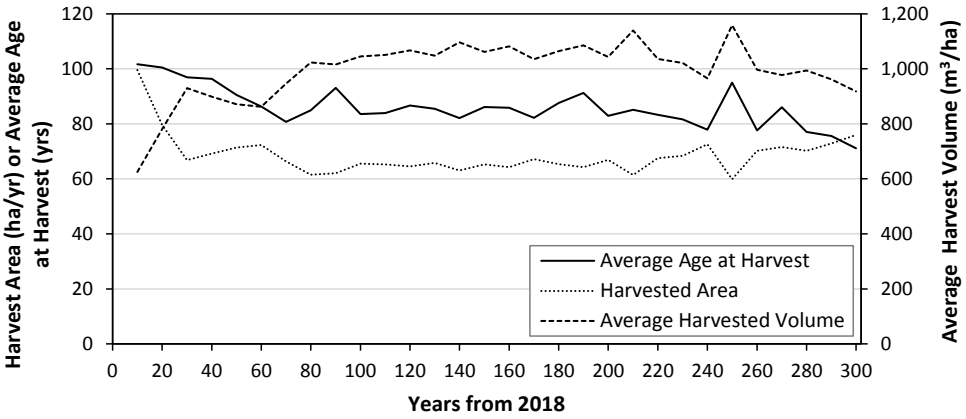


***Figure 6 Base Case – Average Age, Average Volume and Annual Area at Harvest***

In the short-term, most of the volume was harvested from stands older than 80 years (Figure 7), while, most of the volume was harvested from stands aged between 60 and 80 years in the mid-term. In the long-term, the volume harvested from the 60-80 age class remained relatively high with some exceptions (decades 15, 16, and 25). In these cases, the harvest came from older stands with higher standing volumes – particularly in decade 25. This

aligns well with Figure 6 where spikes were observed for the same decade (i.e., lower harvested area and higher average age and volume at harvest). These fluctuations were required to maintain a non-declining growing stock on the THLB over the last 100 years of the 300-year planning horizon.

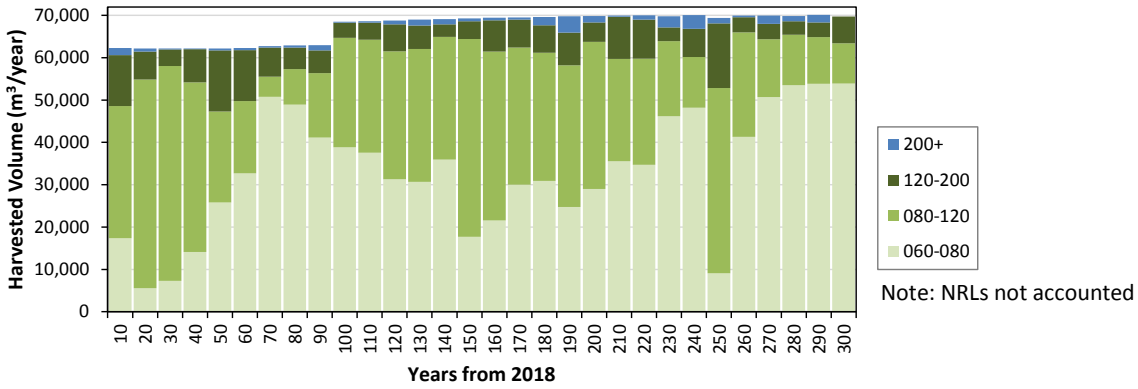


***Figure 7 Base Case – Harvested Volume by Age Class***

In the short-term, most of the volume was harvested from stands with average volumes between 475 and 800 m³/ha (Figure 8). Stands with average volume below 475 m³/ha contributed little to the harvest rate after the first period. The 475 m³/ha threshold reflects the lowest 95% from recent harvesting within the TFL and was reported strictly as a harvest performance benchmark. Over the mid-term, some stands were harvested with average volumes greater than 1,600 m³/ha. While uncommon, this is supported by existing managed stands (and no fertilization or genetic gains) where timber cruises report 1,350 m³/ha. In the long-term, most of the volume was harvested from stands with average volumes between 800 and 1,200 m³/ha.

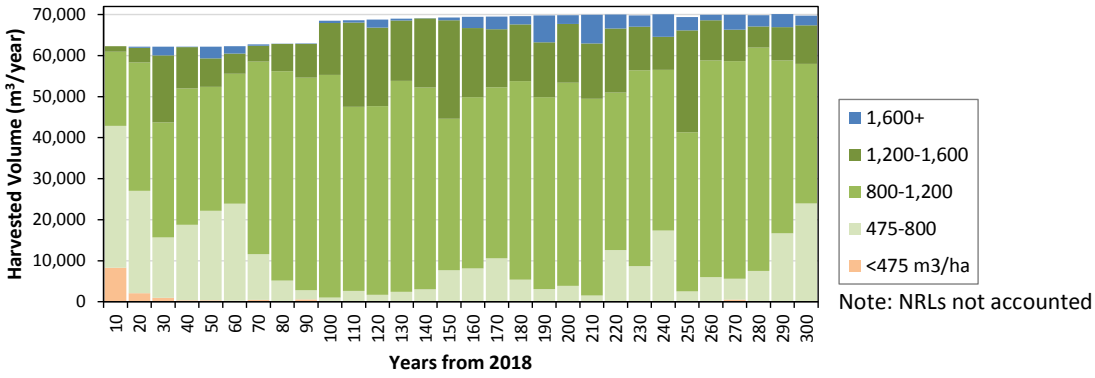


***Figure 8 Base Case – Harvested Volume by Average Volume Class at Harvest***

As illustrated in Figure 9, various tree species contributed to the harvest flow. Western hemlock (HW) comprised the majority of the harvest over the first 3 decades. For the following 3 decades, the harvest was dominated by Douglas-fir (FD). Western redcedar (CW) was the dominant species harvested over the rest of the 300-year planning period as future regeneration favoured CW to address forest health issues currently observed in FD (root disease and Swiss needle cast). Meanwhile, HW continued to comprise a significant component (~13%) of the harvest through natural ingress implemented in the yield curves.

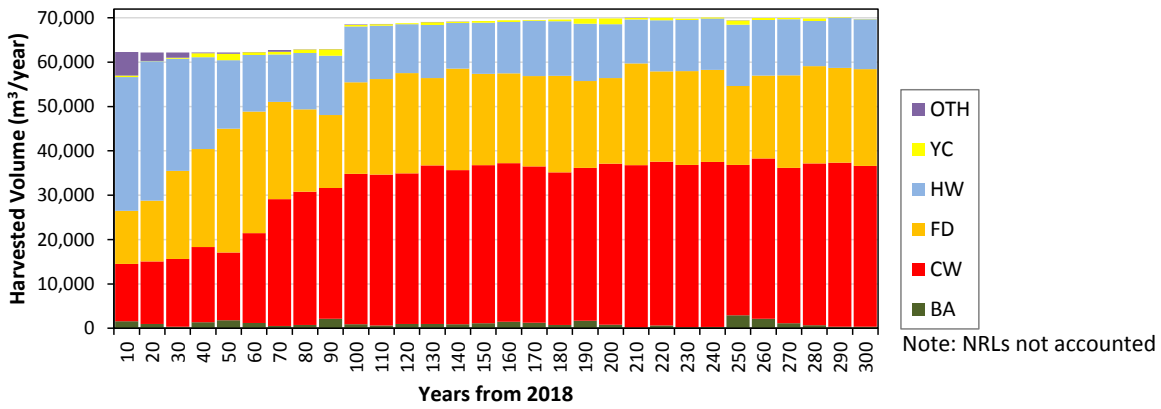


***Figure 9 Base Case – Distribution of Harvested Volume by Individual Species***

The model was configured to eliminate the small- and large-sized harvest openings. This objective was achieved by controlling the harvest blocks size distribution over the harvested area in each 10-year period of the planning horizon. The results indicated that the harvest block size distribution over the harvested area was limited to a minimum of 1 ha and to a maximum of 50 ha (Figure 10). In addition, the size class 1-5 ha was capped to 10% so most of the harvesting occurred in 5-40 ha spatially explicit blocks. Finally, the distance between the spatially explicit blocks was controlled to meet the green-up and adjacency objectives (i.e., the distance between individual-up-to-40 ha blocks was >100 m).

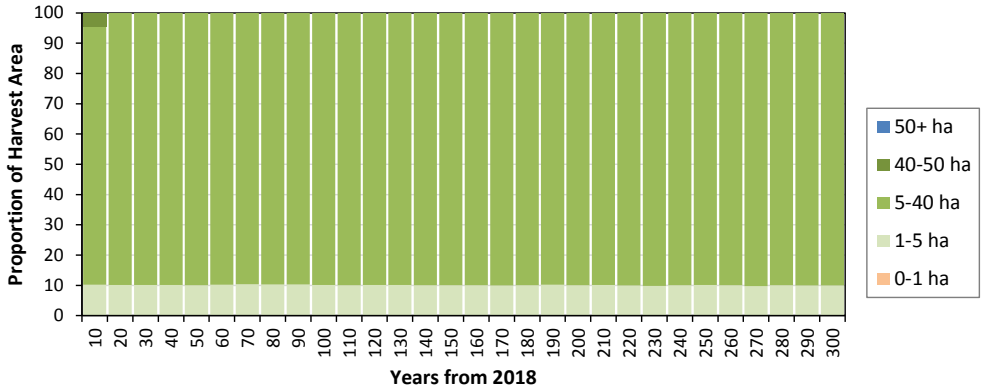


***Figure 10 Base Case – Harvest Block Size Distribution over the THLB***

Harvest systems were assumed to vary on steep slopes (>60%), that typically require the use of cable or other specialized harvest systems like tethered equipment. Using the LiDAR-derived elevation model, approximately 12.5% of the THLB is situated on slopes greater than 60%, from which 37% requires helicopter logging (i.e., CW- and FD-leading stands where HW composition is <30%). Without harvest profile objectives set, the model harvested most of the volume from ground-based harvesting systems with very little contribution from cable- or helicopter-harvest systems (Figure 11).

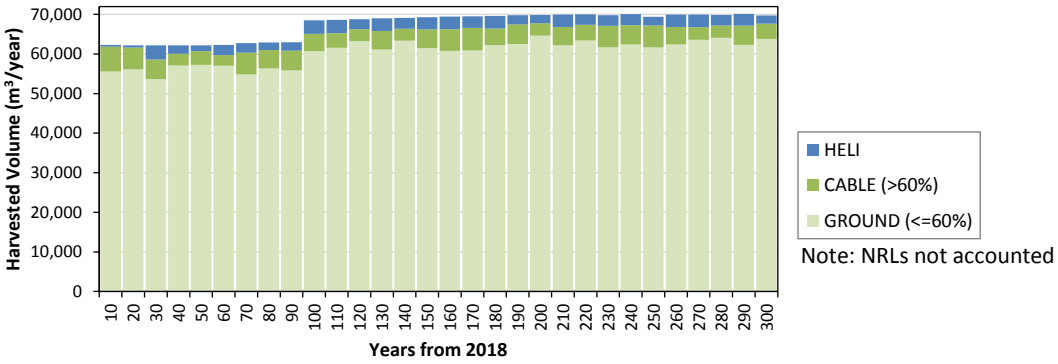


***Figure 11 Base Case – Harvested Volume by Harvesting System***

# 4 Non-Timber Values

While many non-timber values were addressed as reductions to the THLB or stand-level retention (e.g., riparian, research, cultural heritage resources, and some recreation areas), several non-timber objectives were modelled in the Base Case to ensure that these values were appropriately maintained on the land base over time. These objectives addressed values related to CWS (via ECA), green-up, harvest control in two recreation areas of interest, and VQOs. The performance of these objectives is summarized in Table 1. Here, the values indicate the percent difference between the target and the actual value of the objective:

- <95 (highlighted red) – the objective value violates the target (either above or below the target depending on the target type, maximum or minimum, respectively).
- 95-105 (highlighted light yellow) – the objective values is within +/- 5% of the target value; suggesting that the objective is constraining.
- >105 (highlighted dark green) – the objective value does not violate the target.
- Infinity (highlighted dark green) – no area contributes to the objective (i.e., division by zero).

Most of the constraining objectives were VQO polygons (i.e., highlighted light yellow). These objectives had a relatively high negative impact on the harvest flow (i.e., 36% over the short- to mid-terms and 25% over the long-term).

***Table 1 Non-Timber Objectives Summary***

| Objective | Max/Min Target (%) | FMLB (ha) | THLB (ha) | Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0 | 20 | 50 | 100 | 150 | 200 | 250 | 300 |
| Ratio.ECA.CWS.Cannelllake | 39 | 154 | 92 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.ECA.CWS.Kenworthy | 29 | 295 | 226 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.GRNUP.Alouette | 33 | 181 | 181 | >105 | >105 | >105 | Infinity | >105 | >105 | >105 | >105 |
| Ratio.GRNUP.Hatzic | 33 | 7,108 | 7,108 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.REC.DevilLake | 50 | 41 | 39 | >105 | >105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 |
| Ratio.REC.Sayres | 50 | 42 | 42 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.VQO.H.M.224171 | 44.1 | 62 | 52 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.VQO.H.M.224192 | 54.72 | 274 | 238 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.VQO.H.M.224242 | 49.5 | 11 | 11 | <95 | Infinity | Infinity | Infinity | >105 | >105 | Infinity | >105 |
| Ratio.VQO.H.M.224251 | 54.72 | 17 | 14 | >105 | Infinity | Infinity | >105 | >105 | >105 | >105 | >105 |
| Ratio.VQO.H.PR.224051 | 23.87 | 71 | 29 | Infinity | >105 | Infinity | >105 | >105 | Infinity | >105 | >105 |
| Ratio.VQO.H.PR.224124 | 15.54 | 141 | 93 | >105 | 95-105 | 95-105 | 95-105 | >105 | >105 | 95-105 | >105 |
| Ratio.VQO.H.PR.224134 | 13.86 | 92 | 65 | >105 | 95-105 | 95-105 | >105 | 95-105 | >105 | >105 | 95-105 |
| Ratio.VQO.H.PR.224138 | 8.19 | 247 | 116 | <95 | 95-105 | >105 | 95-105 | 95-105 | 95-105 | >105 | >105 |

| Objective | Max/Min Target (%) | FMLB (ha) | THLB (ha) | Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0 | 20 | 50 | 100 | 150 | 200 | 250 | 300 |
| Ratio.VQO.H.PR.224178 | 19.25 | 227 | 191 | >105 | >105 | >105 | 95-105 | >105 | >105 | 95-105 | >105 |
| Ratio.VQO.M.M.224118 | 2.864 | 33 | 31 | Infinity | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.VQO.M.M.224169 | 1.664 | 11 | 6 | >105 | 95-105 | >105 | 95-105 | >105 | >105 | >105 | >105 |
| Ratio.VQO.M.M.224227 | 2.56 | 95 | 83 | >105 | >105 | >105 | >105 | >105 | >105 | 95-105 | >105 |
| Ratio.VQO.M.PR.223955 | 1.664 | 2 | 1 | Infinity | Infinity | Infinity | Infinity | Infinity | Infinity | Infinity | Infinity |
| Ratio.VQO.M.PR.224011 | 3.552 | 73 | 43 | Infinity | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 |
| Ratio.VQO.M.PR.224034 | 2.864 | 100 | 86 | >105 | 95-105 | 95-105 | >105 | 95-105 | 95-105 | >105 | >105 |
| Ratio.VQO.M.PR.224062 | 3.552 | 411 | 228 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | >105 |
| Ratio.VQO.M.PR.224086 | 6.032 | 130 | 84 | Infinity | >105 | >105 | >105 | >105 | >105 | 95-105 | >105 |
| Ratio.VQO.M.PR.224110 | 2.56 | 5 | 4 | Infinity | Infinity | Infinity | Infinity | Infinity | Infinity | Infinity | Infinity |
| Ratio.VQO.M.PR.224115 | 3.168 | 35 | 35 | >105 | >105 | >105 | 95-105 | >105 | >105 | Infinity | >105 |
| Ratio.VQO.M.PR.224135 | 3.168 | 90 | 86 | <95 | 95-105 | 95-105 | >105 | 95-105 | >105 | 95-105 | >105 |
| Ratio.VQO.M.PR.224150 | 3.552 | 135 | 127 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 |
| Ratio.VQO.M.PR.224161 | 2.56 | 234 | 217 | <95 | 95-105 | 95-105 | 95-105 | 95-105 | >105 | 95-105 | 95-105 |
| Ratio.VQO.M.PR.224213 | 3.552 | 518 | 414 | >105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 |
| Ratio.VQO.M.PR.224215 | 3.552 | 136 | 96 | <95 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | >105 |
| Ratio.VQO.M.PR.224216 | 3.92 | 13 | 8 | >105 | >105 | >105 | >105 | >105 | >105 | 95-105 | >105 |
| Ratio.VQO.M.R.224029 | 3.92 | 4 | 2 | Infinity | Infinity | Infinity | Infinity | Infinity | Infinity | Infinity | Infinity |
| Ratio.VQO.L.PR.224021 | 3.92 | 26 | 21 | <95 | Infinity | >105 | Infinity | 95-105 | >105 | Infinity | >105 |
| Ratio.VQO.L.PR.224026 | 34.375 | 129 | 29 | Infinity | 95-105 | >105 | 95-105 | >105 | >105 | >105 | >105 |
| Ratio.VQO.L.PR.224030 | 14.625 | 133 | 94 | <95 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | >105 | 95-105 |
| Ratio.VQO.L.PR.224056 | 34.375 | 130 | 55 | Infinity | >105 | >105 | >105 | >105 | >105 | >105 | 95-105 |
| Ratio.VQO.L.PR.224064 | 7.697 | 74 | 37 | <95 | 95-105 | >105 | 95-105 | >105 | 95-105 | 95-105 | 95-105 |
| Ratio.VQO.L.PR.224076 | 4.472 | 139 | 102 | <95 | 95-105 | 95-105 | >105 | 95-105 | >105 | 95-105 | 95-105 |
| Ratio.VQO.L.PR.224087 | 10.535 | 479 | 402 | <95 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 |
| Ratio.VQO.L.PR.224094 | 6.235 | 35 | 18 | Infinity | Infinity | 95-105 | >105 | Infinity | >105 | >105 | >105 |
| Ratio.VQO.L.PR.224125 | 16.211 | 73 | 60 | <95 | >105 | 95-105 | >105 | 95-105 | >105 | 95-105 | >105 |
| Ratio.VQO.L.PR.224127 | 11.825 | 99 | 79 | <95 | >105 | 95-105 | 95-105 | 95-105 | >105 | 95-105 | >105 |
| Ratio.VQO.L.PR.224129 | 10.535 | 239 | 218 | <95 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 |
| Ratio.VQO.L.PR.224165 | 5.547 | 242 | 223 | <95 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 | 95-105 |
| Ratio.VQO.L.PR.224168 | 9.546 | 70 | 63 | >105 | >105 | 95-105 | >105 | 95-105 | 95-105 | 95-105 | >105 |
| Ratio.VQO.L.PR.224209 | 13.072 | 147 | 128 | <95 | 95-105 | 95-105 | >105 | 95-105 | 95-105 | 95-105 | 95-105 |
| Ratio.VQO.L.PR.224222 | 11.825 | 99 | 85 | <95 | 95-105 | 95-105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.VQO.L.PR.224231 | 8.514 | 25 | 16 | Infinity | >105 | Infinity | >105 | >105 | Infinity | >105 | >105 |
| Ratio.VQO.L.PR.224240 | 6.88 | 26 | 26 | <95 | <95 | Infinity | Infinity | Infinity | <95 | Infinity | Infinity |
| Ratio.VQO.L.PR.224244 | 0.728 | 126 | 115 | 95-105 | 95-105 | 95-105 | >105 | >105 | 95-105 | >105 | >105 |
| **Alouette Landscape Unit** | | | | | | | | | | | |
| Ratio.BIO.I.NDT1.CWHvm1 | 13 | 13 | 12 | <95 | <95 | <95 | <95 | <95 | <95 | <95 | <95 |
| Ratio.BIO.I.NDT1.CWHvm2 | 13 | 6 | 0 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.BIO.I.NDT1.MHmm1 | 19 | 11 | 2 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.BIO.I.NDT2.CWHdm | 9 | 214 | 166 | <95 | <95 | <95 | <95 | <95 | >105 | >105 | >105 |
| **Hatzic Landscape Unit** | | | | | | | | | | | |
| Ratio.BIO.L.NDT1.CWHvm1 | 13 | 2,341 | 1,593 | <95 | <95 | <95 | <95 | <95 | >105 | >105 | >105 |
| Ratio.BIO.L.NDT1.CWHvm2 | 13 | 762 | 397 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.BIO.L.NDT1.MHmm1 | 19 | 473 | 254 | >105 | >105 | >105 | >105 | >105 | >105 | >105 | >105 |
| Ratio.BIO.L.NDT2.CWHdm | 9 | 6,055 | 4,864 | <95 | <95 | <95 | <95 | <95 | >105 | >105 | >105 |

While this analysis did not enforce targets to retain old seral forest within each BEC variant and landscape unit (LU), the objective was tracked to examine how the established OGMAs perform over time. Within 200 years, all met the minimum targets except for one small unit (Alouette LU, CWHvm1). Specific targets for mature stands were not established. Implementing the landscape-level biodiversity targets to meet these requirements as soon as possible would influence the model to identify and retain mature stands to recruit as old stands over time. This would likely impact on harvest levels significantly over the short- and mid-terms but very little over the long-term.

# 5 Sensitivity Analyses

Sensitivity analyses are commonly performed to provide perspective on the impacts of changes to data or assumptions that are subject to uncertainty. Usually only one variable (data or assumption) applied in the Base Case is changed to explore how sensitive key indicators (e.g., harvest flow) respond to that variable. Sensitivity analyses are a key component of the timber supply analysis processes as they provide the Chief Forester with the information necessary to assess the potential uncertainty associated with the information used to develop the Base Case.

Developing harvest flows for sensitivity analyses is somewhat subjective. Thus, to provide meaningful comparisons, harvest flows were developed by maintaining, where possible, the current AAC. This could vary where the current AAC was clearly and significantly different and the mid-term harvest level would not be significantly impacted.

Table 2 lists the sensitivity analyses completed and compared against the Base Case scenario [001]. Results are further summarized in Table 3, while additional details and the results are provided in subsections below.

***Table 2 Sensitivity Analyses Description***

| Category | ID | Sensitivity | Description of Change |
|---|---|---|---|
| Land Base Definition | 002 | Riparian Retention from Fraser TSR | Changed the RMZ retention for S3, S4, S5 streams to those used in the Fraser TSR; reduced THLB by approximately 60 hectares. |
| Growth and Yield | 003 | No LiDAR-Enhanced Forest Inventory | Prepared natural stand yields in VDYP based on the standard VEG attributes rather than the LiDAR-updated inventory. |
| | 004 | Minimum Average Harvest Volume | Changed MHA criterion from 225 m³/ha to 475 m³/ha (ground/cable); also excluded stands with yields that never reach 475 m³/ha (~351 ha THLB). |
| | 005 | MHA from Fraser TSR | Changed MHA criteria by harvest method from 225 m³/ha (ground/cable) and 600 m³/ha (helicopter) to those used in the Fraser TSR: 350 m³/ha (ground/cable) and 400 m³/ha (helicopter). |
| | 006 | Fertilization | Provided a budget of $25,000 per year to fertilize eligible stands over the first 20 years. |
| | 007 | No Future GW | Removed genetic gains applied to future managed stands. |
| | 008 | Half Future GW | Reduced genetic gains applied to future managed stands by 50%. |
| Flow | 012 | Proposed AAC | Set the initial harvest at a rate proposed by the District of Mission. |

***Table 3 Sensitivity Analyses Summary Results***

| Scenario ID | Description | Harvest Volume (m³/year) | | | Difference from [001] | | |
|---|---|---|---|---|---|---|---|
| | | Short-term | Mid-term | Long-term | Short-term | Mid-term | Long-term |
| 001 | Base Case | 62,058 | 68,377 | 69,735 | | | |
| 002 | Riparian Fraser TSR | 60,655 | 67,349 | 69,333 | -2.3% | -1.5% | -0.6% |
| 003 | No LiDAR Inventory | 58,237 | 64,659 | 70,779 | -6.2% | -5.4% | 1.5% |
| 004 | MHA at 475 m³/ha | 58,476 | 64,345 | 65,582 | -5.8% | -5.9% | -6.0% |
| 005 | MHA Fraser TSR | 61,689 | 68,602 | 69,826 | -0.6% | 0.3% | 0.1% |
| 006 | Fertilization | 61,725 | 68,104 | 69,608 | -0.5% | -0.4% | -0.2% |
| 007 | No Future GW | 58,151 | 62,875 | 64,304 | -6.3% | -8.0% | -7.8% |
| 008 | Half Future GW | 60,211 | 65,711 | 67,242 | -3.0% | -3.9% | -3.6% |
| 012 | Proposed AAC | 56,602 | 56,602 | 69,860 | -8.8% | -17.2% | 0.2% |

## 5.1 RIPARIAN RETENTION FROM FRASER TSR

When the riparian retention criteria (i.e., buffer widths) from Fraser TSR was implemented, the THLB area was

reduced by approximately 60 ha, which reduced the harvest flow by 2.3% in the short- and mid-term, with an insignificant reduction over the long-term (Figure 12). The harvest flow likely recovered later in the planning period as the model spatially aligned the riparian areas with other overlapping constraints, such as VQOs.

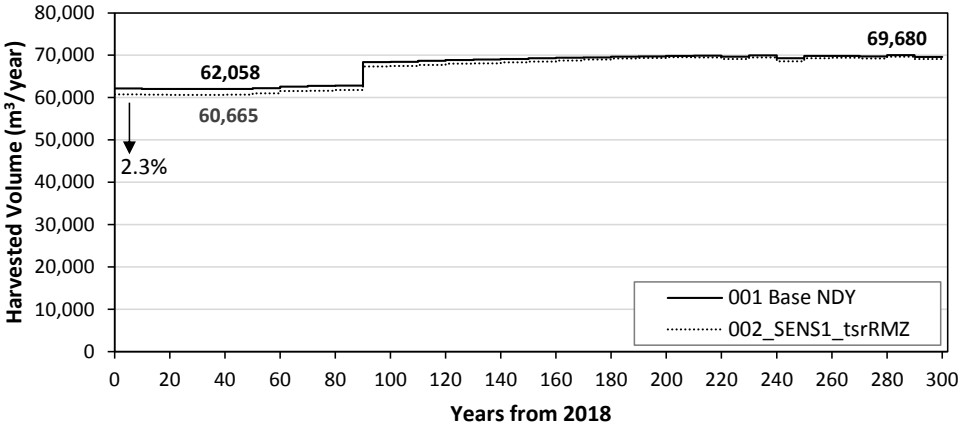


***Figure 12 Riparian Fraser TSR – Comparing Harvest Flows with the Base Case***

## 5.2 NO LIDAR-ENHANCED FOREST INVENTORY

Stand yields were a critical input into the timber supply analysis. The short- and mid-term timber supply is heavily influenced by the availability of timber from natural stands that make up the current growing stock, as these stands provide the timber harvesting opportunities before managed stands reach minimum harvest age required to become available for harvest. Natural stand yields were developed using the VDYP model, which predicts yields from stand attributes in the forest inventory. Uncertainty in these natural stand yields can result from inaccuracies in the VDYP model, decay estimates, or the stand attributes in the forest inventory.

The initial THLB growing stock decreased from 2.912 million m³ to 2.736 million m³ (-6.0%) when the standard vegetation inventory was used to develop natural stand yields – rather than the LiDAR-Enhanced Forest Inventory used to develop the Base Case. This decrease in available growing stock reflected a similar decrease on the short-term harvest rate (-6.2%), but the difference gradually reduced to 5.4% over the mid-term and became positive in the long-term (+1.5%) (Figure 13). The improved long-term performance was due to the initial delay from harvesting stands that had lower standing volumes compared to the Base Case NDY (run [001]); these stands transitioned to more productive, future managed stands that helped to meet VQO objectives within the relatively constrained land base. In addition, it took an extra 20 years, compared to the Base Case, to reach the long-term harvest flow. Therefore, it was possible to achieve a slightly higher long-term harvest level compared to the Base Case.

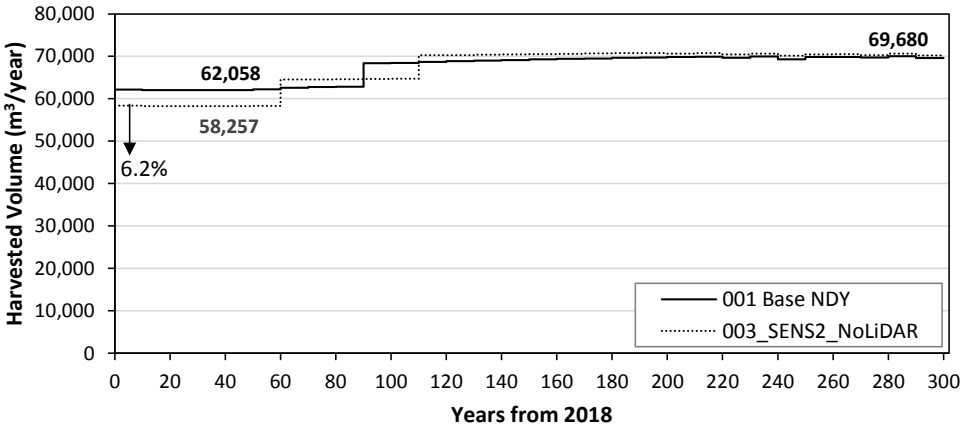


***Figure 13 No-LiDAR Inventory – Comparing Harvest Flows with the Base Case***

## 5.3 MINIMUM AVERAGE HARVEST VOLUME

Uncertainty around the age that stands become merchantable for harvest is linked to both, estimates for future growth and estimates of the future conditions that will define merchantability (i.e., markets and products). Past harvesting performance within TFL 26 indicated that most of stands harvested over the last 10 years had a standing volume of over 475 m³/ha. This value was used here to conduct a sensitivity analysis where the MHAs for ground and cable harvesting systems were defined at 475 m³/ha, while stands that never reached the 475 m³/ha threshold were excluded from harvesting (approximately 351 ha THLB – approximately 5.2% of the long-term THLB). Besides the THLB difference, these stands were delayed from harvesting because the MHAs were older compared to run [001]. The criterion to ensure harvested stands are within 90% of the maximum MAI was maintained for both runs ([001] and [004]).

Results showed the short-term harvest rate decreased by 5.8% (Figure 14). This difference increased over the mid- and long-terms to 5.9% and 6.4%, respectively.

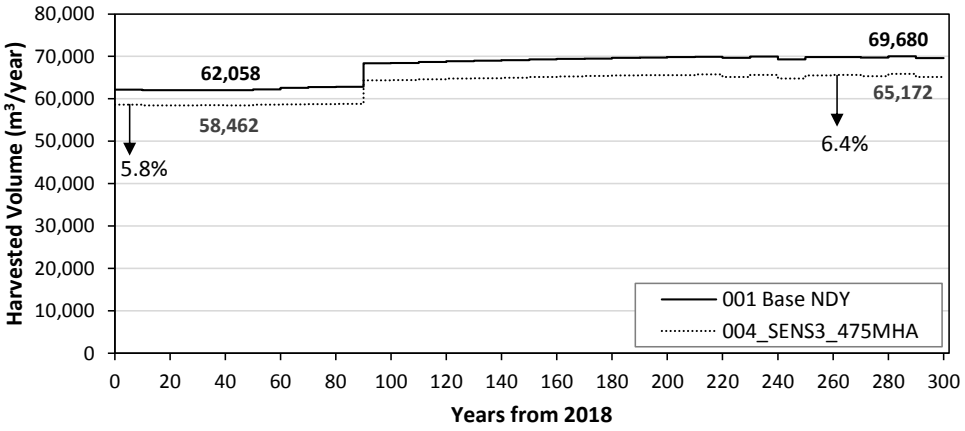


***Figure 14 475 MHA – Comparing Harvest Flows with the Base Case***

## 5.4 MINIMUM AVERAGE HARVEST VOLUME FROM FRASER TSR

Establishing MHAs associated with the maximum mean annual increment (MAI) optimizes growth potential and long-term harvest levels. Alternatively, allowing stands to be harvested earlier than maximum MAI provides flexibility to transition from short- to long-term harvest rates. A sensitivity analysis was conducted by aligning the MHA criteria with those used in the adjacent Fraser TSR (Ministry of Forests, Lands, and Natural Resource Operations, 2013), which required a minimum volume of 350 m³/ha for ground and cable harvest systems, and 400 m³/ha for helicopter harvest system. The criterion to ensure harvested stands are within 90% of the maximum MAI was maintained for both runs ([001] and [005]).

Results showed only minor differences in the harvest flow over the planning horizon (Figure 15). This occurred as the short-term harvest came from relatively old stands that were not impacted by the MHA changes, while the mid- and long-term harvest came from managed stands that were relatively more productive and less sensitive to MHA changes. In fact, it was possible to have minor positive impacts on the long-term harvest flows because the Fraser TSR MHA criteria included higher minimum volumes for ground and cable harvest system, which contributed to the vast majority of the harvested volume.

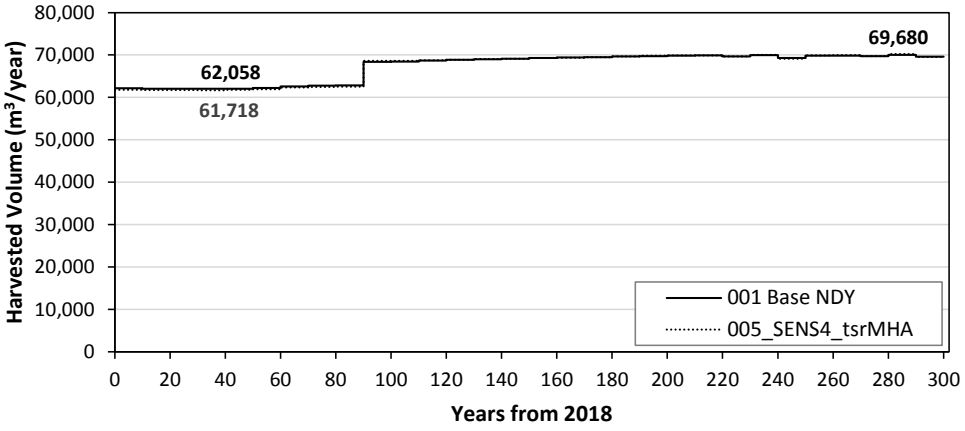


***Figure 15 Fraser TSR MHA – Comparing Harvest Flows with the Base Case***

## 5.5 INCLUDE FERTILIZATION

Nearly 800 ha of forest were fertilized in the past, while future fertilization opportunities will likely increase considering the location and the relatively high growing capacity of the stands within this TFL. This sensitivity analysis was conducted as a treatment option of one or two fertilization applications on eligible stands (defined by BEC, site series, leading species, and age), 7 or 14 years before the MHA, respectively. These criteria also forced the model to harvest the fertilized stands within a very narrow window that extended 20 years past the MHA. Finally, a budget of $25,000 per year was made available to the model for the first 20 years of the planning horizon where the cost for each fertilization treatment was set to $450/ha. Fertilization responses were developed in TIPSY based on species, SI, and number of applications.

Despite the increase in growth clearly implemented at the stand level, results did not show a visible increase on harvest rates at the forest level (Figure 16). Three key factors contributed to this somewhat unexpected result: (1) narrow window applied to harvest fertilized stands, (2) total yield of relatively young fertilized stands was still less than total yield of relatively older stands available for harvesting in the first 40 years of the planning horizon, and

(3) relatively constrained land base (e.g., VQOs). Only select stands were treated in the model (57% of the total $500,000 budget) within the narrow time windows, since harvesting was preferred on older stands with higher volumes (presumably) that improved the harvest flow without violating VQOs. These changes were sufficient to alter the Base Case harvest schedule that resulted in a very slightly lower harvest flow.

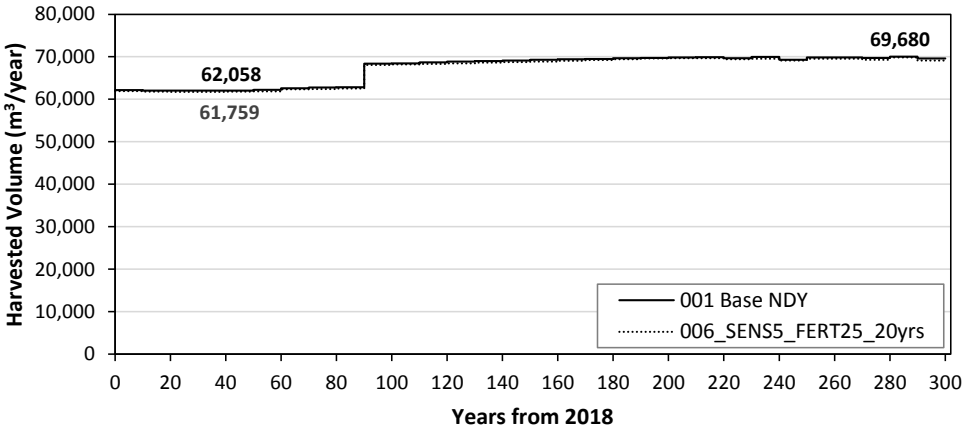


***Figure 16 Include Fertilization – Comparing Harvest Flows with the Base Case***

## 5.6 GENETIC GAINS APPLIED TO FUTURE STANDS

Estimates of genetic worth for future managed stands depend on seed availability and seedlings performance. Two sensitivity analyses were conducted to examine the impact on the harvest flow from genetic worth: 1) apply no genetic worth, and 2) apply half of the genetic worth estimated for all future stands.

Results showed that with no genetic worth applied to future managed stands, the short-term harvest flows decreased by 6.3% and this difference increased to 8.0% in the mid-term and 7.8% in the long-term (Figure 17). Similarly, with half of the genetic worth applied to the future managed stands, the short-term harvest rates decreased by 3.0% and this difference increased to 3.9% in the mid-term and 3.6% in the long-term (Figure 18). These results reflect a ripple effect that the reduced future managed yields had on MHAs and the time needed to meet the various non-timber objectives (e.g., ECA, VQO, Green-up). The MHAs were older with lower yields due to lower genetic worth and it took a longer time to reach the height needed to meet ECA, green-up, or the highly-constraining visual objectives. The model was unable to sustain the relatively high initial harvest flow over the mid- and long-term.

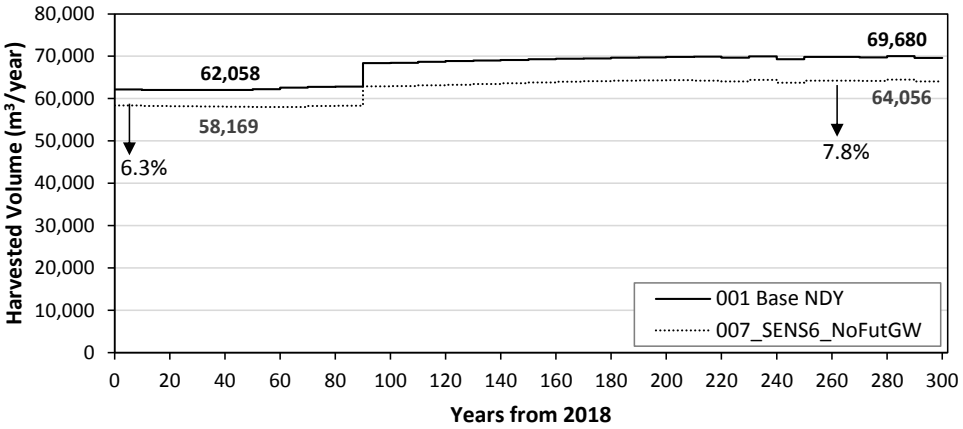


***Figure 17 No Genetic Worth – Comparing Harvest Flows with the Base Case***

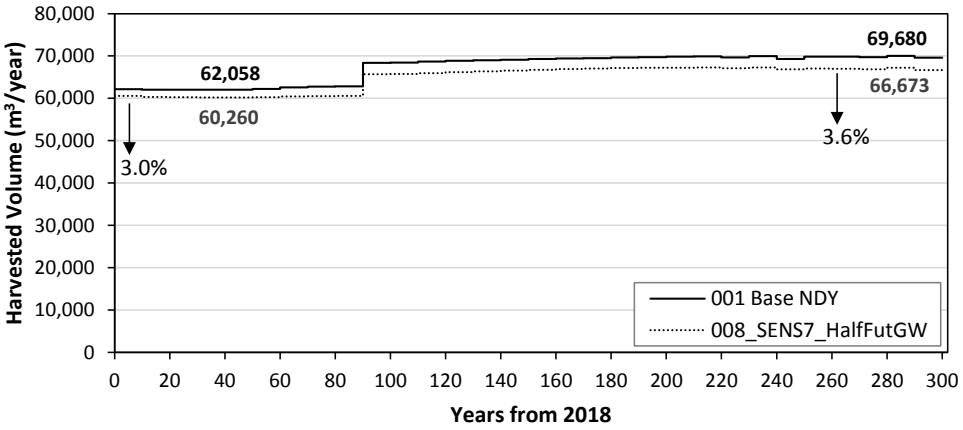


***Figure 18 Half the Genetic Worth – Comparing Harvest Flows with the Base Case***

## 5.7 PROPOSED HARVEST RATE

While the short-term harvest level for the Base Case NDY supports a potential AAC increase of 38% or 17,000 m³ (45,000 m³ to 62,000 m³), the District of Mission would prefer to adopt a more prudent harvest level that considers the following factors, which were not implemented in the Base Case NDY.

1) The Mission Interpretive Forest Site (REC 106116) was established on September 14, 2011, under Section 56 of the Forest and Range Practices Act, with the following objectives: maintain the quality of the experience of forest recreation activities, and maintain or enhance, where practicable, the forest interpretive qualities of the site. As forest management remains the highest priority, this interpretive site is intended to demonstrate how a working community forest can be integrated with enhanced and safe multi-user recreational infrastructure and educational opportunities. Accordingly, this could constrain timber harvesting within the site.

2) While significant recreational infrastructure improvements have occurred, planning work continues to evolve under the Stave West Leadership team. Information gathering is underway with local user groups to fill gaps in currently unknown recreation values to guide further improvements in forest interpretation and additional trail-related infrastructure. The District of Mission believes that increasing the AAC in advance of the

completion of planning work in the interpretive forest could potentially affect the recreational opportunities and user expectations.

3) Swiss needle cast and overall effects on the timber harvest from climate change (e.g., periods of severe drought) were contemplated in this analysis but no specific assumptions were implemented with the lack of reliable and localized data. While the Region is presently monitoring Swiss needle cast in various weather stations throughout the TFL, specific information was not yet available to reflect its long-term effect on harvest levels.

This conservative approach is intended to provide the District of Mission with some flexibility to adjust to these potential pressures on the timber harvest and to reduce its financial risk by stabilizing revenue and staffing capacity while the uncertainties above are worked out.

A sensitivity analysis was conducted to examine the harvest flow impacts of setting the initial harvest rate at 56,602 m³/year (55,000 m³/year allocated to the District of Mission plus 1,602 m³/year allocated to BC Timber Sales). Results showed that this proposed harvest rate (8.8% less than the Base Case NDY [run 001]) was maintained over 6 decades (Figure 19). The harvest rate then increased 10.2% to the long-term harvest level, three decades earlier than the Base Case NDY level.

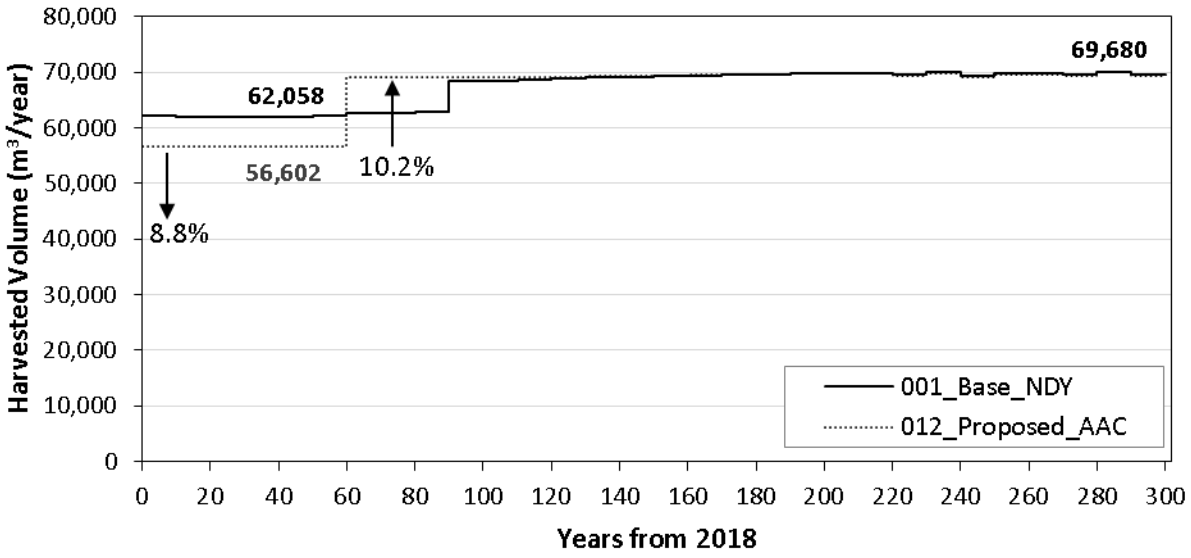


***Figure 19 Proposed Harvest Level – Comparing Harvest Flows with the Base Case***

# 6 Differences from the Previous Timber Supply Analysis

The last timber supply analysis for TFL 26 was completed in 2001 (District of Mission, 2009) resulting in an AAC established at 45,000 m³. The same 2001 analysis was subsequently used in 2010 to inform a second determination that maintained the current AAC at 45,000 m³. Compared to the 2001 analysis, our Base Case harvest rate was approximately 44% higher in the short- and mid-term, and 39-46% higher in the long-term (Figure 20). The main reasons contributing to this increase include the use of LiDAR-enhanced forest inventory, implementing provincial site productivity estimates for managed stands, and a slight increase in landbase (169 ha FMLB and 81 ha THLB) that resulted from recent boundary transactions. Use of the LiDAR-enhanced forest inventory significantly increased the initial growing stock (section 5.2), which allowed the forest estate model to

start at a higher harvest level. This higher harvest level could then be maintained because existing managed stand yield curves were developed with SI estimates that were ~2.2 m higher than the current inventory. In the long-term, an even higher harvest rate was possible because of the growth increases due to genetic gains.

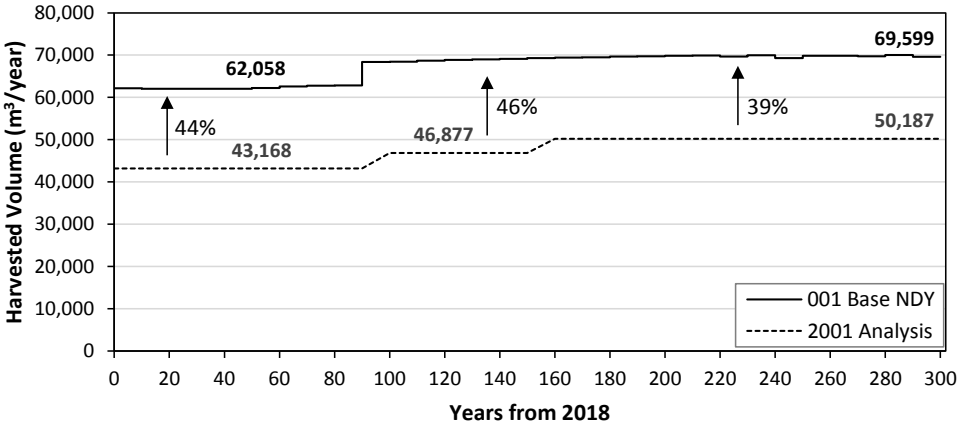


***Figure 20 Base Case – Comparing Harvested Volume with Previous Analysis***

Several input datasets and assumptions were changed since the previous timber supply analysis that was completed in 2001. While these differences were detailed in the Information package document (Forsite Consultants Ltd., 2019), a list of the significant changes is provided below:

- Relatively small net change to TFL boundary resulting from an exchange of area to the adjacent First Nation Woodland Licence N2Z for four parcels of land situated within the District of Mission but outside of TFL 26.
- Use of spatial OGMAs and a network of spatially defined long-term reserves to meet landscape- and stand-level biodiversity requirements.
- Use of LiDAR-enhanced forest inventory to develop yields for existing natural stands.
- Use of provincial managed SI estimates and RESULTS data to develop yields for managed stands.
- Use of TEM to identify non-forested areas in addition to VRI, to identify marginal sites (replaced ESA), and to stratify analysis units.
- Improved stream network, classification, and riparian retention based on LiDAR data.
- Stand level retention levels developed from past harvest history, additional retention added for VQO Partial Retention and Retention.
- Different analysis units and regeneration assumptions for managed stands, including the use of silviculture eras for managed stands and species composition changes to overcome FD-related health issues (Swiss needle cast and root disease).
- Use of VDYP 7.30a for natural stand volume projections rather than version 6.4.
- Use of TIPSY version 4.4 for managed stand volume projections rather than version 2.1e.
- Use of PATCHWORKS™ model rather than FSOS.
- Spatially explicit modeling for green-up and adjacency objectives.

In summary, the gross TFL area increased by 81 ha (0.7%), the FMLB increased by 169 ha (1.7%), and the future THLB decreased by 53 ha (0.8%). The THLB growing stock increased from ~2.65 million m³ reported in 2001 to 2.912 million m³ (+9.9%), using the LiDAR-enhanced forest inventory to develop yields for existing natural stands.

# 7 Discussion and Recommendation

The Base Case scenario harvests 62,000 m³/year for 90 years and then increases to the long-term level of 69,500 m³/year. A number of sensitivity analyses were completed to assess the impacts of potential uncertainty in data and modelling assumptions. The results from these model runs were summarized in Table 3. While significant, differences in harvest flow resulted from changes to the forest inventory, MHAs, and future genetic worth, they are considered appropriate. In discussing difference between model runs, it is important to recognize the heuristic nature of the forest estate model, which responds to any changes that occur throughout the entire planning horizon and across the land base; it continually adjusted the solution to improve the overall objective function.

The harvest flows were particularly sensitive to changes in THLB area and to changes in yield estimates. Applying larger riparian buffers (i.e., Fraser TSR buffer widths) or excluding stands that never reached a volume of 475 m³/ha decreased the available THLB by 60 ha and 351 ha, respectively. With this relatively constrained land base, any decrease in THLB was likely to have a negative influence on the harvest flow. With a relatively small decrease in THLB (e.g., 60 ha or 0.9%), the harvest flow eventually recovered in the long-term by scheduling these stands to overlap with other constraints like visual objectives. However, the model could not overcome the initial negative impact on the harvest flow associated with relatively large decreases in THLB (e.g., 351 ha or 5.2%). In fact, harvest rates were slightly worse in the mid- and long-term, possibly because most of the areas removed from the THLB did not overlap with other constraints like visual objectives.

Significant negative impacts on the harvest flow were demonstrated by using the standard vegetation inventory to develop natural stand yields – rather than the LiDAR-Enhanced Forest Inventory used to develop the Base Case – and by adjusting the genetic worth of future stands. While applying the standard vegetation inventory reduced the short-term harvest level by 6.2%, the impact diminished over time and finally disappeared in the long-term as natural stands transitioned to managed stands. In contrast, lowering the genetic worth reduced future yields and average stand heights, which resulted in a negative impact throughout the entire planning horizon. While the long-term harvest level was clearly reduced due to the lower yields, short- and mid-term harvest levels were affected by the reduction in stand heights that delayed stands from achieving certain non-timber objectives (e.g., ECA, VQO) that rippled into earlier periods.

Changes to align MHAs with the Fraser TSR had a minor negative impact on the harvest rates. As discussed in section 5.4, these changes did not affect existing older stands, which contributed prominently to the short- and mid-term harvest levels. Meanwhile, the higher minimum volume criterion was advantageous for future yields where a slightly higher harvest flow was possible.

Including treatment options for fertilization was expected to result in a higher harvest flow over the mid-term that could possibly help in transitioning to a long-term harvest rate sooner. As discussed in section 5.5, the heuristic model only treated a selection of stands within the narrow window set to fertilize and harvest. These treatments did not deliver higher volumes since harvesting was preferred on older stands with higher volumes (presumably) that improved the harvest flow without violating VQOs. These changes were sufficient to alter the Base Case harvest schedule that resulted in a very slightly lower harvest flow.

While the Base Case NDY suggests the initial harvest rate could be increased by as much as 38% of the current AAC, the District of Mission would prefer to adopt a more prudent harvest level that considers factors that were

not specifically included in the analysis (i.e., Mission Interpretive Forest Site, recreational infrastructure, forest health, and climate change). Based on the information provided above that examines both timber and non-timber values, the District of Mission recommends a harvest rate of 56,602 m³/year over the next management plan period.

# 8 References

BC Ministry of Forests and BC Ministry of Environment, Lands and Parks. (1995). *Biodiversity Guidebook.* Victoria: BC Ministry of Forests, Lands and Natural Resource Operations.

District of Mission. (2009). *Information Related to a New AAC Determination for Mission TFL 26. Version November 18, 2009.* Mission, BC: District of Mission.

Forsite Consultants Ltd. (2019). *Tree Farm Licence 26 - Management Plan #10 Timber Supply Analysis Information Package v1.2.* Mission, BC: District of Mission.

Ministry of Forests, Lands, and Natural Resource Operations. (2013). *Fraser Timber Supply Area, Timber Supply Review Data Package, October 2013.* Victoria, BC: Ministry of Forests, Lands, and Natural Resource Operations.