# Tree Farm Licence 57 – Management Plan #2

## Information Package

Version 2.1

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Project 988-2

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# 1 Introduction

Iisaak Forest Resources Ltd., the holder of Tree Farm Licence (TFL) 57 is commencing the Management Plan #2 Process. As part of the management plan 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. An area-based approach to harvest regulation is utilized for this TFL, made possible by the *Tree Farm Licence Area-based Allowable Annual Cut Trial Program Regulation.* With an area-based AAC, the area of land that can be harvested annually is defined rather than the amount of volume. This information package has been prepared to support the timber supply analysis and describes the information that is material to the analysis including data inputs and assumptions.

The results of the analysis are an important part of the annual allowable cut determination process and aim to document future harvest flows that will not restrict future options in the TFL. **The results presented here do not define a new AAC – they are intended only to provide insight into the likely future timber supply of the TFL 57.** The final harvest level decision will be made by the Deputy Chief Forester.

# 2 Modelling Approach

In simplest terms, the harvest flow of an area based AAC is the Effective THLB area divided by rotation length, where rotation length is the actual expected age at harvest (as opposed to minimum harvest age often referenced in volume based approaches). With a wide range of species and productivity potentials as well as variable retention levels, more than one rotation length is required. Stands will be grouped into analysis units based on species and productivity class as well as retention level. A specific rotation length is calculated for each grouping. This analysis will verify that the calculated non-declining harvest flow (ha/yr) can be achieved given the current cover constraints and age class distribution.

The following outlines the high-level approach for determining the recommended area-based AAC:

1. Determine the timber harvesting land base using spatially explicit information where possible.
2. Stratify the stands within the THLB by species groups (Leading and Secondary) and productivity (based on managed site index classes) into groups referred to as Analysis Units.
3. Determine minimum harvest ages/rotation lengths based on 10 years prior to the **desired** merchantability criteria (distinct from minimum merchantability criteria) of future regenerated stands. Use managed stand yields generated from TIPSY to incorporate genetic worth of improved seed, managed stands site index and adjustment factors due to variable retention
4. Summarize the land base area by Analysis Unit.
5. Divide the area of each analysis unit by the rotation length to obtain a maximum rate of harvest for each analysis unit (ha/yr).
6. Create a timber supply model that incorporates the maximum harvest rates calculated above as well as all other timber supply cover constraints (watershed rate of cuts, scenic areas, old growth requirements (i.e. terrain class IV).

7. Apply the calculated analysis unit maximum cut rates as constraints.
8. Run the model with an even flow harvest request equal to the sum of the harvest rates calculated for each analysis unit.
9. Analyse the model outputs, run sensitivities and report on harvest flow outcomes.

## 2.1 Model

Forest Planning Studio (FPS) version 6.0.2.0 will be used to complete the timber supply analysis. This model has been used previously in the timber supply analysis of other units, for example: TFL 14 (MP#9, 2008), TFL 56 (MP#3, 2001), the Lillooet TSA (TSR 3, 2005), and the Golden TSA (TSR4, 2009).

FPS was developed by Dr. John Nelson at the University of British Columbia (UBC) and is a spatially explicit forest estate simulation model. All events in the model are directly linked to stand level polygons or harvest units and thus allow tracking of individual stand attributes and spatial relationships through time. Each polygon belongs to a specific stand type (Analysis Unit) and has attributes such as age, harvest system, and land base status (THLB or Non THLB). Results are typically aggregated for reporting at higher levels (i.e. harvest flow for entire unit).

A wide range of constraints can be modeled on the land base: harvest exclusion, spatial adjacency/maximum cutblock size, maximum disturbance/young seral, minimum mature/old seral, and equivalent clearcut area (ECA) limits. Constraints are applied to groups of polygons (cliques) and harvest is restricted if a constraint is not satisfied. A single polygon can belong to many overlapping cliques and each of them must be satisfied in order to allow harvest of the polygon. Where a mature or old cover constraint is not met, harvesting may still occur if there are any eligible stands remaining after the oldest stands are reserved to meet the constraint.

Harvest is implemented using a set of priorities to queue stands for harvest. In each period, the model harvests the highest priority eligible stands until it reaches the harvest target or exhausts the list of opportunities. Harvest can be implemented in single years, multiple year periods or a combination of these. Where periods are used, the midpoint of the period is typically used as the point where harvest opportunity is evaluated because it is a good balance between the start of the period (pessimistic) and the end of the period (optimistic).

The purpose of this analysis is to examine both the short- and long-term timber harvesting opportunities in the TFL. The dominant scenario presented in this report is the base case or current management scenario. Modeling was completed for 500 years for each scenario but only the first 250 years are presented in the report because the harvest level remains constant after that time.

## 2.2 Data Sources

Table 1 describes the spatial data and sources used for this analysis.

***Table 1 Spatial data sources***

| Spatial Data | Source |
|---|---|
| Base: Road Network | Iisaak: master_roads_july2_2006 |
| Ownership: Tree Farm Licences | LRDW: FADM_TFL |
| Ownership: Schedule A | LRDW: FADM_TFL_SCHED_A |
| Ownership: Parks and Protected Areas | LRDW: TA_PARK_ECORES_PA_SVW |
| Ownership: National Parks | LRDW: CLAB_NATIONAL_PARKS |
| Resource: Watershed Sub-Basins | Iisaak: watershed_sub_basins |
| Resource: Watershed Planning Units | Iisaak: ws_planning_units |
| Resource: Visual / Scenic Areas | LRDW: REC_VISUAL_LANDSCAPE_INVENTORY |
| Resource: Terrain | Iisaak: Terrain_Unit |
| Resource: Clayoquot Watershed Reserves | GEO BC FTP: reserves |
| Forest: Biogeoclimatic Ecosystems | LRDW: BEC_BIOGEOCLIMATIC_POLY |
| Forest: Vegetation Resource Inventory | LRDW: VEG_COMP_LYR_R1_POLY (projected to 1/1/2012) |
| Forest: Economic Operability (theme) | IIsaak: tfl57_oper |
| Forest: Provincial Site Productivity | BC GOV FTP: Site_Prod_BC |
| Forest: RESULTS openings | LRDW: WHSE_FOREST_VEGETATION_RSLT_OPENING_SVW |
| Forest: RESULTS Forest Cover | LRDW: WHSE_FOREST_VEGETATION_RSLT_FOREST_COVER_INV_SVW |
| Forest: RESULTS Reserves | LRDW: RSLT_FOREST_COVER_RESERVE_SVW |
| Forest: Forest Tenure Cut blocks | LRDW: FTN_C_B_PL.shp |

# 3 Base Case Assumptions

This analysis will focus on a single forest management scenario that reflects current management practices in the TFL. It is therefore guided by existing land use designations and current legislation including the Forest and Range Practices Act (FRPA) and the Clayoquot Land Use Decision. In addition to the current management or "Base Case" scenario, an assessment of how results might be affected by uncertainties will completed using a number of sensitivity analyses. Together, the sensitivity analyses and the Base Case will form a foundation for determining future timber harvest levels. This section covers the assumptions used to define the base case scenario.

## 3.1 Land Base Assumptions

Landbase assumptions define the crown forest land base (CFLB) and timber harvesting land base (THLB). The THLB is designated to support timber harvesting while the CFLB is identified as the broader land base that can contribute toward meeting non-timber objectives (i.e., biodiversity).

The land base assumptions used in this project are a combination of those used for MP#1 and reserves established through watershed planning from the Clayoquot Land Use Order.

Table 2 summarizes the netdown criteria and assumptions used to define the land base.

***Table 2 Land base assumptions – Base Case***

| Netdown Criteria | Assumption |
|---|---|
| Non-Forest and Non-Productive | Excluded all areas that have not been logged and the CFLB identified in the VRI is "N" (where BCLCS is NP and SI <5m). |
| Existing Roads, Trails and Landings | Excluded all areas buffered on road segments. Iisaak staff indicate that mainlines average 10-12m in width while spurs and operational roads average 8-10m. The available road network is unclassified so an average road buffer of 10 m (5m each side) was used for this analysis. |
| Parks | Provincial Parks and protected areas were removed from the Crown Forest Land Base. |
| Hydro-riparian Reserves | These areas were accounted for and excluded from the THLB using the Clayoquot Sound Watershed Management Plan Reserve Network. |
| Physically Inoperable (Class V Terrain) | |
| Protected Areas (provincial) | |
| Protected Areas (National) | |
| Marbled Murrelet | |
| Recreation and Tourism Values | |
| Sensitive Soils/Floodplain | |
| Red- and Blue-plant and animal species | |
| Non-Merchantable | Deciduous-leading stands are not utilized and therefore were removed. |
| Uneconomic | Operability was reviewed and updated in 2009. Areas considered uneconomic (margin <-10 $/m³) were removed (not including areas previously logged). |
| Low Productivity | Inventory Site Index <8 |
| Meares Island | Excluded from harvest through existing court injunction. |
| Future Roads, Trails, and Landings | Future roads were considered by applying a 5% aspatial reduction to the THLB. |
| Stand Level Retention | This includes permanent retention over and above watershed reserves and varies depending on site level conditions but averages 40%. See Section 3.3.1. |

Table 3 provides a summary of the land base area by netdown category. TFL 57 is approximately 87,140 ha in total. For the analysis, this area was expanded to include portions of provincial parks that are adjacent to the TFL as they contribute to forest cover constraints such as seral stage distribution. Therefore, the total area under assessment for this analysis is approximately 109,676 ha. Of this area, approximately 82.3% is within the Crown Forested Land Base (CFLB) and 16.6% is considered to be Timber Harvesting Land Base (THLB).

### *Table 3 Land Base Area Summary – Base Case*

| | Total | Schedule A | Schedule B | Total Effective Area (ha) | Percent of Total Area | Percent of CFLB |
|---|---|---|---|---|---|---|
| Total Area | **87,143** | **17,827** | **69,316** | **87,143** | **100.0%** | |
| less: | | | | | 0.0% | |
| Non-Forest / Non-Productive | 9,106 | 205 | 8,901 | 9,106 | 10.4% | |
| Existing Roads, Trails, and Landings | 936 | 288 | 6,481 | 6,769 | 7.8% | |
| Crown Forest Land Base | | **17,333** | **53,934** | **71,267** | **81.8%** | **100.0%** |
| less: | | | | | 0.0% | |
| Parks | 22,376 | | 92 | 92 | 0.1% | 0.1% |
| Clayoquot Protected Reserve Network | | | | | | |
| Hydro-riparian reserves | 21,561 | 3,348 | 11,402 | 14,750 | 16.9% | 20.7% |
| Terrain Stability | 11,112 | 288 | 6,481 | 6,769 | 7.8% | 9.5% |
| Marbled murrelet | 7,356 | 160 | 3,881 | 4,041 | 4.6% | 5.7% |
| Recreation / tourism | 3,876 | 158 | 285 | 443 | 0.5% | 0.6% |
| Sensitive soils | 10,035 | 298 | 2,793 | 3,091 | 3.5% | 4.3% |
| Floodplains | 1,604 | 49 | 168 | 217 | 0.2% | 0.3% |
| Non-Veg / scrub-herb | 223 | 5 | 4 | 9 | 0.0% | 0.0% |
| Red and Blue listed | 3,152 | 62 | 76 | 139 | 0.2% | 0.2% |
| Non-Merchantable (Deciduous-Leading) | 2,453 | 241 | 401 | 642 | 0.7% | 0.9% |
| Uneconomic | 44,911 | 2,642 | 17,932 | 20,575 | 23.6% | 28.9% |
| Low Productivity | 16,792 | 54 | 1,147 | 1,200 | 1.4% | 1.7% |
| Meares Island | 3,534 | 3,471 | 35 | 3,506 | 4.0% | 4.9% |
| **Timber Harvesting Land Base** | | **6,499** | **15,298** | **21,797** | **25.0%** | **30.6%** |
| Less aspatial netdowns: | | | | | | |
| Permanent Stand Level Retention (@40%) | | 2,600 | 6,119 | 8,719 | 10.0% | 12.2% |
| **Effective Timber Harvesting Land Base** | | **3,899** | **9,179** | **13,078** | **15.0%** | **18.4%** |
| Less future aspatial netdowns: | | | | | | |
| Future Roads, Trails, and Landings (@5%) | | 195 | 459 | 654 | 0.8% | 0.9% |
| **Future Timber Harvesting Land Base** | | **3,704** | **8,720** | **12,425** | **14.3%** | **17.4%** |

** Aspatial netdowns are applied in the model but are not reflected in the GIS dataset areas.*
***Approximately 22,520 ha of adjacent parks (Clayoquot Arm Park, Clayoquot Plateau Park, Dawley Passage Park, Flores Island Park, Gibson Marine, Park, Kennedy Lake Park, Kennedy River Bog Park, Strathcona Park, Sydney Inlet Park, and Tranquil Creek Park) of which 13,120 ha is forested was included in the analysis to contribute towards non-timber constraints. The 92 ha of effective area of park removed in the netdown table is a result of discrepancies with the spatial park boundaries and the TFL boundary originating in the data obtained from the LRDW.*

By comparison, this THLB is 5,088 ha (18.9%) less the reported THLB in MP1 (26,885 ha). Major differences in areas between MP1 and this analysis are due to updated Clayoquot Sound Watershed reserves and updated economic operability (2008).

## 3.2 Non-Timber Management Assumptions

This section describes how non-timber values were addressed in the model and how forest management occurs. Table 4 summarizes the management criteria and assumptions used for the Base Case run. Area requests for constraints were prorated according to total and effective harvest areas.

***Table 4 Non-Timber management assumptions –base case***

<table>
<tr><th>Criteria</th><th>Assumption</th></tr>
<tr><td>Watershed Rate of Harvest</td><td>Within each identified watersheds (1st Order, 2nd Order, 3rd Order) either a 5% per 5 year period or a 10% per 10 year periods constraint will be applied to the productive forest landbase as follows:
<table>
<tr><th>Watershed Type</th><th>Limit Applied</th></tr>
<tr><td>Any Watershed > 500 ha (1st, 2nd, 3rd Order)</td><td>No more than 5% per 5 year period</td></tr>
<tr><td>Primary >=200 and<500</td><td>No more than 10% per 10 year period</td></tr>
<tr><td>Any Watershed > 500 ha (1st, 2nd, 3rd Order) and >=200 and <500 where cut has exceed 20% in last ten years</td><td>No harvest until watershed conforms to specified rate-of-cut</td></tr>
<tr><td>Any Watershed that has < 30% THLB to total area ratio or is <200 ha in size</td><td>No constraint applied (flagged as RULE_APPLY='n' in W5 layer)</td></tr>
</table>
If a watershed overlaps a Park, the limits will be adjusted in recognition that harvesting will not be occurring within the Park.</td></tr>
<tr><td>Scenic Areas / Visuals</td><td>This analysis used visually effective green-up (VEG) heights as cover constraints to model the maintenance of visual values. Clayoquot Sound visual classes were used to model visual quality objectives and are shown in the table below. These criteria were applied to CFLB areas within each visual polygon. This approach is unchanged from MP1.
<table>
<tr><th>VQO</th><th>% Maximum alteration</th><th>VEG height (m)</th><th>Crown Forested Area (ha)</th><th>Timber Harvesting Land Base Area (ha)</th></tr>
<tr><td>Small Scale Alteration</td><td>35</td><td>6</td><td>16,698</td><td>3,920</td></tr>
<tr><td>Minimal Alteration</td><td>30</td><td>7</td><td>10,256</td><td>2,447</td></tr>
<tr><td>Natural Appearing</td><td>25</td><td>8</td><td>8,760</td><td>2,745</td></tr>
</table>
Modeled age to achieve the minimum VEG height requirements were derived for each visual polygon using SiteTools Batch v3.3.</td></tr>
<tr><td>Recreation</td><td>Recreation resources are primarily accounted for through land base deductions for other values, in particular the marine shore reserve and hydroriparian reserves. There are also designated recreation reserves around large lakes. Within the recreation management zone, a maximum disturbance limit of 35% <6m applied to the productive forest will be implemented.</td></tr>
<tr><td>Mature + Old Seral stage distribution (Landscape Level Biodiversity)</td><td>Minimum 40% > 140 years applied to the CFLB portion of each watershed at all watershed order levels (1st, 2nd, 3rd).</td></tr>
<tr><td>Stand Level biodiversity</td><td>Stand level biodiversity is dealt with by implementing variable retention (40% on average).</td></tr>
<tr><td>Cultural Heritage</td><td>Cultural heritage values are assessed on a stand level basis. Specific protection measures are considered within stand level retention assumptions described above.</td></tr>
</table>

## 3.3 Timber Management Assumptions

This section describes the criteria and considerations used to model timber harvesting activities. Table 5 summarizes the harvest assumptions applied.

***Table 5 Timber management assumptions –base case***

| Criteria | Assumption |
|---|---|
| Silvicultural Systems | Variable Retention is applied to all harvesting on the TFL. Retention may be dispersed, aggregate, or a combination of both and ranges from 15% (clearcut with retention) to 70% (partial cut). Operationally, these are implemented as a mixture of patch cuts and various forms of dispersed retention (See Section 3.3.1). |
| Variable Retention Levels | Reductions were applied by dealing with the effect of leave trees on the growth of the trees growing in the remaining areas resulting from the variable retention silviculture system implemented on the TFL by applying an aspatial reduction of 40% and by incorporating variable retention assumptions in the development of yield curves to support rotation length determinations (Section 3.4). |
| Harvest Rule | A Relative Oldest first Harvest Rule was implemented. This harvest rule chooses stands furthest away from their minimum harvest age. |
| Harvest Flow Objectives | Maintain a non-declining harvest flow from the present to the long-term harvest level for the TFL. |

### 3.3.1 Silviculture systems

All blocks employ a variable retention silviculture system. This system provides for permanent retention of forest structures such as large trees, snags, logs and downed wood from the original stands. Retention may be dispersed, aggregate, or a combination of both. Operationally, variable retention is largely implemented as mixture of clearcut with reserves, patch cuts, and narrow strips.

The amount of retention varies based on a site specific assessment and sensitivities. This is required to calculate a level of harvest reflecting the average operational harvest practices and ensure the recommended sustainable harvest reflect these practices. A review of harvest performance indicated that on average, 40% of harvest areas are retained with 66% of that attributed to aggregated retention and 33% attributed to dispersed retention. These retention levels are over and above all other spatial netdowns.

Regeneration of harvested areas is supplemented with planting on all harvest openings however natural ingress of hemlock dominates hemlock leading stands. Dwarf mistletoes are monitored and stand level prescriptions are adjusted depending on the prevalence of them within stands.

## 3.4 Rotation Lengths

This section highlights the information that was considered in deriving the rotation lengths. Yield curves describe changes in tree and stand attributes over time (e.g. merchantable yield, mean annual increment, height, tree diameters, etc.). Developing yield curves for volume based cut determinations is typically a rigorous process where the yield of existing natural, existing managed, and future managed stands are estimated using permanent sample plots and various forms of stand projection models. For the purpose of this analysis, yield curves were developed only for future managed stands to support rotation length determination.

Table 6 summarizes the details for key criteria, and where needed a more detailed explanation follows below.

***Table 6 Rotation Length assumptions – base case***

| Criteria | Assumptions |
|---|---|
| Analysis Units | All stands were stratified for the purpose of assigning yields. Stands were grouped by species type and managed stand site index. See 3.4.1 and for further details on how this was done. |
| Desired Merchantability criteria | Based on the achievement of maximum mean annual increment (also known as culmination mean annual increment- CMAI) |
| Stand Projection Model | TIPSY 4.3 future managed yield development |
| Existing Inventory | Provincially maintained forest cover was utilized. |
| Regeneration Methods | Both natural and artificial regeneration methods were employed to both existing and future managed stands. |
| Regeneration Delay | A regeneration delay of 2 years was used for planted stands while natural stands had a regeneration delay of 3 years. |
| Variable Retention | Variable retention silviculture systems are utilized throughout the entire TFL. Growth reductions of regenerated stands were accounted for by using functionality built into TIPSY (Variable Reduction Adjustment Factors – VRAF). See Section 3.4.4 for further details. |
| Site Productivity | Provincially maintained SIBEC was utilized. See section 3.4.5 |
| Genetic Gains | Genetic worth assumptions were applied: Fd 6.4%, Cw 18.4%, Yc 20.0% (see section 3.4.6). Gains for existing managed stands were not applied. |

### 3.4.1 Analysis Unit Characteristics

Stands were grouped into analysis units (AU) to reduce the complexity and volume of information in the model and for assigning potential treatments and transitions to yield curves following harvest. Criteria used to group stands are provided in Table 7.

***Table 7 Criteria used to group stands into analysis units***

| Existing Stand Type |
|---|
| **Existing Natural Stands (100 series)**<br>➢ Species Groups: Fir, Cedar/Cypress, Hemlock/Balsam/Spruce<br>➢ Site Classes: (Managed Site Index): Good ( >23m); Medium (≥20m & <=23m); Poor (<20m) |

A detailed list of AUs and TIPSY inputs for future managed stands is provided in Appendix 1.

### 3.4.2 Rotation Length Merchantability Criteria

Within the timber supply model, stands were considered eligible for harvesting once they achieved their defined rotation length. For this analysis, rotation lengths were defined by the following criterion:

- 10 Years prior to the age at which stands achieve the maximum or culmination mean annual increment (CMAI).

This criterion aligned better with desired merchantability criteria while providing some flexibility for the model.

### 3.4.3 Regeneration Delays

A regeneration delay of 2 years was used for this analysis.

### 3.4.4 Variable Retention Impacts

Variable retention impacts on rotation lengths were incorporated using the TIPSY built-in variable retention functionality. Operational practices on the TFL indicate that on average, 40% of stands are retained 75% of which is within the harvest opening. The remaining 25% of retention is typically located in areas adjacent to the harvest opening. Of the within-block retention, 2/3 is attributed to aggregate retention and 1/3% attributed to dispersed retention. Table 8 provides additional detail of the variable retention assumptions used in TIPSY.

***Table 8 Variable Retention TIPSY Inputs***

| Input Variable | Description |
|---|---|
| Residual Stand top height at entry | Residual stand height was entered as the **THLB area weighted average height** of stands >60 years old from forest cover inventory for each AU. |
| Crown Cover retained | Variable retention is employed and as such the level of retention from block to block varies. On average, total stand level retention is 40% with ¾ of that retention considered within the block. Therefore, **30%** crown cover retention was input into TIPSY as this represents the type of retention that increases the overall edge length (and hence reducing light transmission to regenerating trees). |
| Relative proportion of aggregate and dispersed | **33% aggregate** retention (10% of the 30% total retention), **67% dispersed** (20% of the total retention). |
| Average aggregate Group Size | A an average groups size of **1.5 ha** was utilized |
| Average crown area (for dispersed retention portion) | The default TISPY value of **40 m²** was used as there is currently no information on the average crown area of leave trees (varies by block and stand conditions). |

### 3.4.5 Managed Site Index assignments

Managed stand site index reflects the potential productive capacity of a stand. Since rotation lengths are dependant only on expected productivity of future management stands, only managed stand site indices were utilized to generate yield curves for the purpose of determining rotation lengths.

Site index for managed stands was calculated as area-weighted averages from provincial site productivity estimates[1]. The distribution of natural and managed stand site indices across the THLB is shown in Figure 1. The area-weighted average site index of the THLB for natural stands is 16.5 m. After the THLB is converted into managed stands the average site index increases to 21.8 m.

[1] FLNR Provincial Site Productivity Layer, TEM/PEM-SIBEC and Biophysical Analysis, V3.3, July 30, 2012. Clover Point Consulting

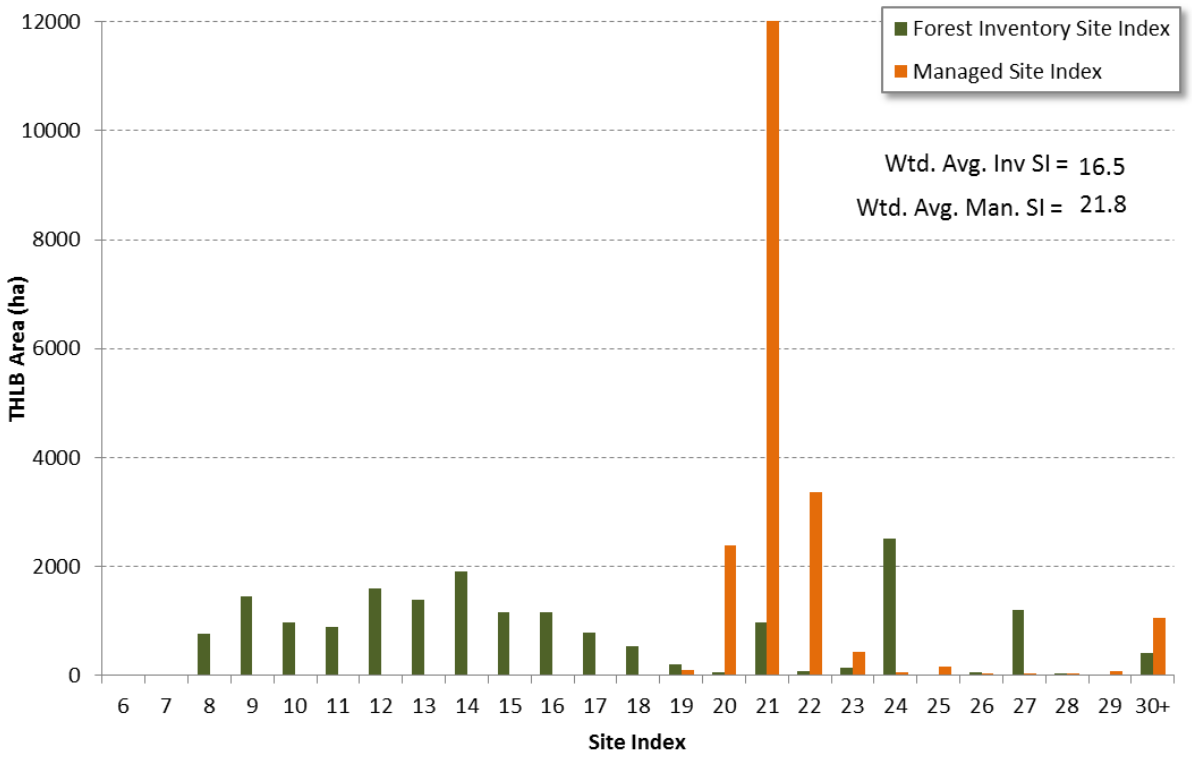


***Figure 1 Distribution of natural and managed stand site indices over the THLB***

### 3.4.6 Select Seed Use / Genetic Gains

The *Chief Foresters Standards for Seed Use* requires that seed or vegetative material with a genetic worth of 5% or greater is available, it must be used for post-harvest stand establishment.

Genetic gain assumptions for future managed stands were derived from a review of both current (recent seed use and genetic gain practices estimated over the past 5 years) and future (near to short term) projected estimates of seed use and genetic gain over the next 10 years. Forecasted seed production and genetic gain estimates were identified for all seed planning units (SPU) within the TFL.

The production forecast of class A seed projected over the next 10 years was used to weight the estimated gains achievable (based on orchard capacity and current seed use behaviour) for each SPU years relative to demand (based on total SPU seed use –all seed users). To provide average species gains for the TFL, the production-weighted gains were applied. There was no need to area-weight the SPU gains by the proportion that falls within the TFL as all SPUs cover 100% of the TFL (within their elevation bands). The seedling need assigned for each SPU is assumed to account for the needs in the TFL 57.

Table 9 summarizes the information used to calculate the anticipated genetic gains for future managed stands.

***Table 9 Genetic gain for future managed stands***

| Seed Planning Unit | SPU Need (million) | SPU Production Forecast (million) | SPU Weighted Gain (2012-2021) | SPU Production Weighted Gain [(1)] |
|---|---|---|---|---|
| Coastal Douglas fir Maritime Low | 13.1 | 4.9 | 17 | **6.4** |
| Coastal Western Redcedar Maritime Low | 5.9 | 5.7 | 19 | **18.4** |
| Yellow Cypress all | 0.9 | 0.7 | 26 | **20.0** |
| Sitka Spruce Maritime Low | 1.5 | 6.2 | 90[(2)] | **N/A** |

*(1) Estimated gain weighted by the proportion of the annual seedling need and the annual production forecast over 10 years*

*(2) Although some genetic gain in stem volume growth is reported, reported genetic worth is for weevil resistance. Therefore, no gain was applied for Sitka Spruce.*

*Source: Forest Genetics Council of BC 2012/13 species plans*

## 3.5 Natural Disturbance Assumptions

Natural disturbance assumptions define the extent and frequency of natural disturbances across the land base. For this analysis, a constant area was disturbed annually in each Watershed/NDT combination. The amount of disturbance in each Watershed/NDT combination was based on the BEC zones present and their associated natural disturbance intervals and old seral definitions as outlined in the Biodiversity Guidebook[2] and Table 10 below.

***Table 10 Annual natural disturbance limits in the forested non-THLB by BEC Zone/NDT***

| BEC Zone | NDT | Disturbance Interval (yrs) | "OLD" Defn (yrs) | % Area ≥ OLD* | Effective Rotation Age (yrs)* | Contributing Non-THLB Area (ha) | Annual Area Disturbed (ha)(area/rot age) |
|---|---|---|---|---|---|---|---|
| CWH | 1 | 200 | ≥250 | 37% | 395 | 64,950 | 164 |
| MH | 1 | 125 | ≥350 | 49% | 490 | 3,599 | 7 |
| Grand Total | | | | | | **68,862** | **171** |

** % area old = exp (-[old age / disturbance interval]), Effective rotation age = old age / (1 – % area old)*

To reduce the number of modelled zones required, modelling disturbance was simplified to BEC zone/NDT combinations for applying annual disturbances. Stands were randomly selected to account for these natural disturbance areas. Ages were then adjusted in each period according to the effective rotation age so that all stands within each unit were turned over once throughout the effective rotation. This process continued throughout the planning horizon and avoided seral requirements because disturbance was selected randomly; independent of modeled harvest priority.

Across the NHLB, approximately 171 ha (0.25%) is disturbed each year, resulting in an average disturbance turn-over of the non-THLB approximately every 400 years (range is 395 to 490 years).

[2] BC Ministry of Forests and BC Ministry of Environment, Lands and Parks 1995

### 3.6 Modelling Assumptions

General assumptions were incorporated into the model to improve its efficiency or to produce results that are spatially more realistic. Table 11 summarizes the modelling assumptions employed in this analysis.

***Table 11 Modelling assumptions***

| Criteria | Assumption |
|---|---|
| Minimum Polygon Size | Resultant polygons less than 0.25 ha in size were minimized by conducting a GIS eliminate process. |
| Maximum Polygon Size | Resultant Polygons larger than 25 ha in size were split to avoid large spikes in the area harvested per period. |
| Planning Horizon | A 200 year planning horizon was applied reported in 10-year increments (i.e., 20 periods). 2013 was used as the initial modelling year. |

## 4 Sensitivity Analyses

Sensitivity analysis is commonly performed to provide a perspective on the impacts to timber supply of uncertainty in the data or assumptions. They are key component of any Timber Supply. Sensitivity analyses help to frame the potential impacts of uncertainty by analyzing scenarios that are more pessimistic and more optimistic than the base case. The sensitivities planned for TFL 57 are described in Table 12.

***Table 12 Planned Sensitivities***

| Sensitivity | Description |
|---|---|
| Rotation Ages +/- | Change the rotation length by -10 years and +10 years |
| Economic Operability @ $-10/m³ allowing exclusion of previous harvest history | Keep the economic operability margin set to $-10/m³ but allow previously logged blocks to be kicked out of the THLB. |
| Economic Operability @ $-15/m³ | Set the threshold for economic operability to $-15/m³ |
| Economic Operability @ $-20/m³ | Set the threshold for economic operability to $-20/m³ |
| Economic Operability @ $-25/m³ | Set the threshold for economic operability to $-25/m³ |

# *Appendix 1.* ***Analysis Unit Details***

## Future Managed Stand Analysis Units

| Analysis Unit # | Analysis Unit Name | Regen Species and Weightings | Managed Site Index Range | Establishment Density (stems/ha) | Regeneration Method | Wtd. Avg. Managed Site Index | THLB Area (Ha) | Rotation Length (yrs) |
|---|---|---|---|---|---|---|---|---|
| 101 | Fir Good-Good | Fd70Hw30 | ALL | 1000 | Plant | 34.5 | 985.3 | 68 |
| 102 | Cedar-Cypress-Good | Cw60Hw40 | ALL | 1000 | Plant | 21.0 | 13,774.8 | 89 |
| 103 | Hemlock/Balsam/Spruce-Good | Hw70Ba30 | ≥23 | 4000 | Natural | 25.9 | 600.1 | 93 |
| 104 | Hemlock/Balsam/Spruce-Medium | Hw70Ba30 | ≥20 & <23 | 4000 | Natural | 21.3 | 5,938.8 | 116 |
| 105 | Hemlock/Balsam/Spruce-Poor | Hw70Ba30 | <20 | 4000 | Natural | 19.0 | 498.3 | 119 |