INVERMERE TIMBER SUPPLY AREA VEGETATION RESOURCES INVENTORY PHASE II PROJECT IMPLEMENTATION PLAN VERSION 3.1

Prepared for

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On Behalf Of

Forest Licencees in the
Invermere Timber Supply Area

Project: TEM-005

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Timberline
Natural Resource Group

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1. INTRODUCTION

1.1 VRI BACKGROUND

The Vegetation Resources Inventory (VRI) is the Ministry of Forests and Range (MoFR) forest inventory standard on public lands in BC. Where possible, forest licencees must use the VRI standard in their data package when preparing the submission for Timber Supply Review (TSR).

The VRI is a four-step process (Figure 1):

1. Phase I (unadjusted inventory data) – Polygon attributes are estimated for the target population[1], generally using photo-interpretation.
2. Phase II (ground sample data) – Measurements are taken from randomly located ground samples for the target population.
3. Net Volume Adjustment Factor (NVAF) sampling – Random trees are selected for stem-analysis studies to develop adjustment ratios that correct taper and decay estimation bias.
4. Adjustment Phase – The Phase I estimates are adjusted using the NVAF-corrected Phase II ground samples to provide an adjusted unbiased estimate of forest inventory attributes. The final product is an adjusted VRI database.

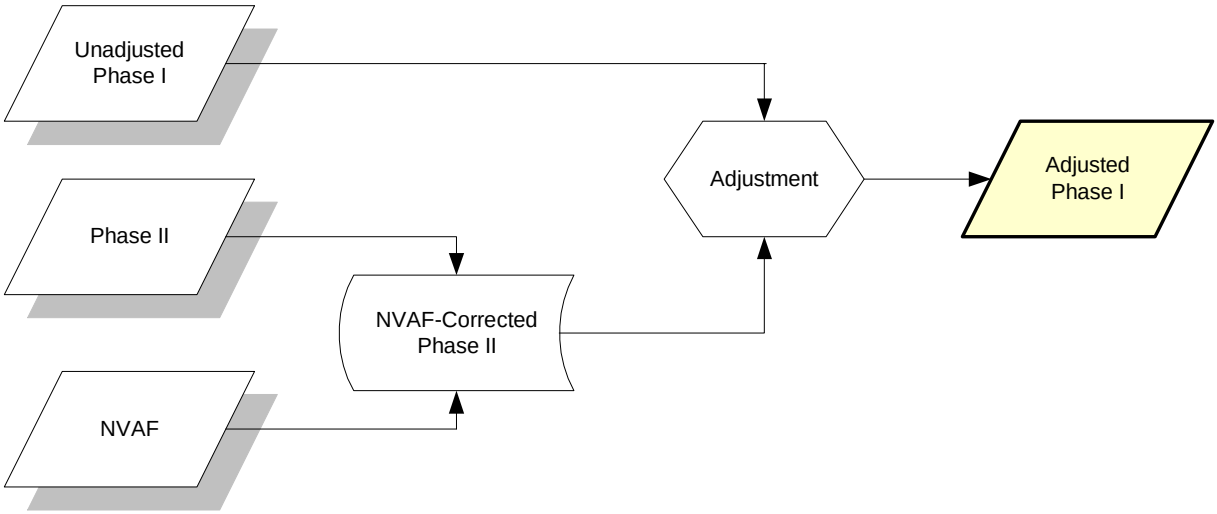

Figure 1. VRI flow-chart.

The Invermere stakeholders assessed the need to complete Phase I and decided that the current forest cover inventory suited their information needs. The next step is to develop a VRI project implementation plan (VPIP) to guide implementation of the proposed Phase II and NVAF field sampling projects in the Invermere TSA.

[1] VRI technical terms are explained in Appendix I.

1.2 INVERMERE TSA INVENTORY BACKGROUND

The most recent photo-interpreted inventory for the Invermere TSA was completed in 1995 using the standards at the time. The forest Inventory Planning (FIP) lines and attributes were rolled over to the VRI format in 2000. The inventory is missing VRI attributes that were not included in the FIP database. Legacy attributes from the FIP database are still available; however they are not in the VRI. The disturbance update is current to September 2003.

An inventory audit was completed on the original inventory in 1993.[2] The audit samples were recompiled in 1996 to correspond to the stratification of the current inventory. Due to new stratification, the recompilation must be viewed with some caution, as some of the strata do not have an adequate number of plots.

1.3 VPIP OBJECTIVES

The objective of this VPIP is to:

1. *Develop the Phase II sampling methods to address Invermere TSA stakeholders inventory issues.*
2. *Present the proposed NVAF program.*
3. *Outline the strategy for Phase II implementation and the proposed budget and timelines.*

The intent is that MoFR will review and approve the proposed Phase II sampling program. The Invermere TSA licencees will update this VPIP once the Phase II sampling is complete.

1.4 TERMS OF REFERENCE

This VPIP was prepared for Marcie Belcher, *RFT* of Tembec Industries Inc. and the Invermere TSA licencees. The document was prepared by Hugh Carter, *MSc, RFT* (project manager/analyst). This document will be approved by MoFR prior to sampling.

1.5 INVERMERE TSA LAND BASE

The Invermere TSA is located within the Southern Interior Forest Region – Rocky Mountain District (Figure 2). The Rocky Mountain Forest District is situated in the southeast corner of BC and was created in 2003 by amalgamating the former Invermere and Cranbrook Forest Districts. The Invermere TSA covers approximately 1.12 million ha, of which approximately 480,000 ha (43%) are Vegetated Treed (VT) (Table 1).

Table 1. Invermere TSA net down.

Land Classification	*Area*	*% of TSA*
Total Area[3]	1,119,460	
Parks	196,350	18%
Non-Parks	923,110	82%
Non-crown land	95,477	9%
Crown Land	827,633	74%
Non-vegetated	254,008	23%
Vegetated	573,624	51%
Non-treed	92,463	8%
Treed	481,161	43%

[2] BC Ministry of Forests Inventory Branch. Invermere TSA Inventory Audit Revised November 1996. Unpublished Report, no date. 5 p.

[3] Data used was obtained from the LRDW received January 2007, the difference between the TSA total area in the VSIP and TSR 3 report was accounted for in park land.

The Invermere TSA is located in the interior dry-belt of the province and contains six biogeoclimatic (BGC) zones. The BGC zones, in order of relative proportion within the THLB are: Montane Spruce (MS), Englemann Spruce-Subalpine Fir (ESSF), Interior Douglas-fir (IDF), Interior Cedar-Hemlock (ICH), Ponderosa Pine (PP), and Alpine Tundra (AT). Lodgepole pine (Pl) and Douglas-fir (Fd) are the main species on the TSA, while Interior Spruce (Sx), Western Larch (Lw), and subalpine fir (Bl) are also important. Minor species include ponderosa pine, western hemlock, western redcedar, whitebark pine, cottonwood, aspen, and birch. The age distribution is relatively uniform across all age classes.

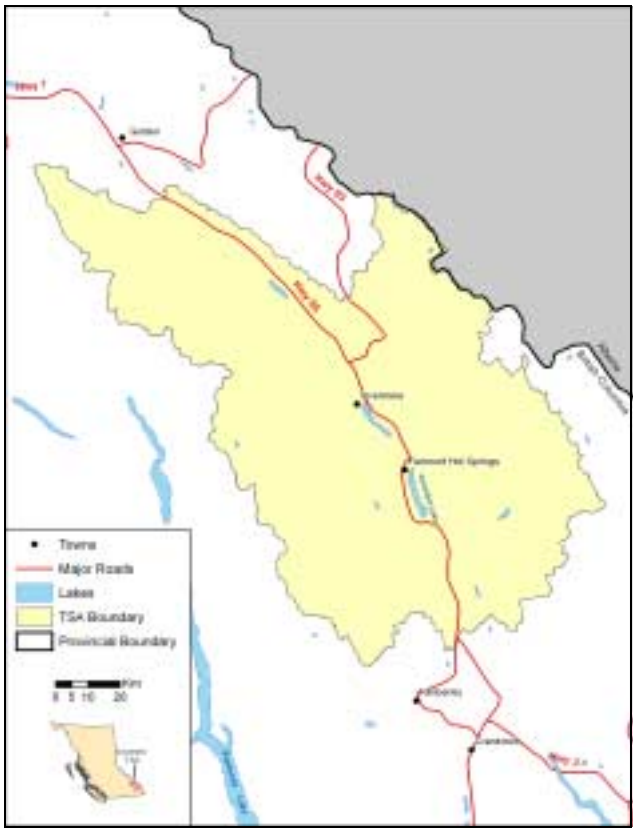

Figure 2. Map of the Invermere TSA.

2. STRATEGIC PLAN

2.1 PROJECT OVERVIEW

The overall goal of the project is to complete the VRI Phase II and NVAF programs in the 2007/08 fiscal year. A first batch of Phase II plots will be established in the early summer of 2007, and include measurement of all NVAF enhanced plots. Preliminary compilations will be completed soon after, and the VPIP will be updated to include the sample plan for the NVAF program. NVAF destructive sampling will run concurrently with the establishment of additional plots in the late summer. Data compilation, analysis, statistical adjustment, and reporting is intended to be completed before March 31, 2008.

2.2 GOALS & OBJECTIVES

The goal of this project is to provide the Provincial Chief Forester with the necessary confidence in the Invermere TSA forest inventory to support the Invermere TSA Timber Supply Review (TSR). The Invermere licencees' project objectives are to:

1. *Develop statistically unbiased volume estimates for stands at least 30 years old in the Invermere TSA vegetated treed (VT) land base.*
2. *Collect coarse woody debris information in all Phase II plots to support landscape level biodiversity objectives.*
3. *Collect site series information to get improved information on landscape level biodiversity.*[4]

2.3 TARGET POPULATION

The target population for this project was defined as the VT land base, 30 years and older in 2007 (that is, stands established before 1978). The target population represents approximately 464,667 ha (42% of the total Invermere TSA) (Table 2). The Invermere TSA includes all forest cover polygons that are inside the TSA boundaries.

Table 2. Invermere TSA VRI Phase II target population.[5]

Land Class	Area (ha)	% TSA
Total TSA	1,119,460	
Vegetated Treed	481,161	43%
Stands < 30 years	16,494	1%
Target Population	464,667	42%
Operable	240,907	22%
Inoperable	223,760	20%

2.4 STRATIFICATION

Stratification of the target population improves sampling efficiency by grouping similar sub-populations that might exist within a general population. Concentrating sampling efforts in the operable land base provides the stakeholders with information in this area and it reduces the expense of sampling in areas of poor access, which consequently reduces the risk of working in an unsafe environment.[6] Although

[4] The collection of this data will be collected for use by the Invermere stakeholders as it will be collected by non-eco-certified field samplers. Appendix IV gives a rationale for the inclusion of non-standard data.

[5] Data used was obtained from the LRDW received January 2007, the difference between the TSA total area in the VSIP and TSR 3 report was accounted for in park land.

[6] When using the operable area as a qualifier for strata it is important that the operable lines be stable. Marcie Belcher from Tembec confirmed that the operable lines are relatively stable for the Invermere TSA.

concentrating sampling efforts in the operable area has benefits, the approach runs the risk of missing information on vegetation attributes throughout the TSA. Collecting information outside of the operable area is important to ensure that vegetation attributes are accounted for on the entire land base.

Strata were created based on similarity of sub-populations, strata areas large enough to install a minimum of 15 plots, ability to provide information in the areas of high activity,[7] while still gathering information outside of the operable area to provide vegetation data over the entire land base. Using the above criteria, the target population of the Invermere TSA was stratified based on leading species (specifically Pine, Douglas Fir, and Spruce) and operability classification. The strata were defined as follows:

1. Pine leading polygons in the operable area.
2. Spruce leading polygons in the operable area.
3. Douglas fir leading polygons in the operable area.
4. Other – Any areas in the VT > 30, not in strata 1- 3.

This strata separation scheme groups the main leading species in areas of high activity, and addresses landscape level diversity, while reducing sampling cost and safety risks.

Table 3. Target population stratification.

Stratum	Sub-Stratum	Area (ha)	% Stratum	% Target
Pine Leading in Operable area	30 – 80 yrs	28,913	34	6
	81 – 140 yrs	41,340	48	9
	141+ yrs	15,327	18	3
	Total	*85,580*	*100*	*18*
Spruce Leading In Operable area	30 – 80 yrs	5,288	15	1
	81 – 140 yrs	5,768	16	1
	141+ yrs	24,268	69	5
	Total	*35,324*	*100*	*7*
Douglas Fir Leading in Operable area	30 – 80 yrs	13,865	19	3
	81 – 140 yrs	34,665	48	7
	141+ yrs	23,729	33	5
	Total	*72,259*	*100*	*15*
Other – Any areas in the VT > 30, not in strata 1- 3.	30 – 80 yrs	46,521	17	10
	81 – 140 yrs	77,648	29	17
	141+ yrs	147,333	54	32
	Total	*271,502*	*100*	*59*

Inventory adjustment ratios will be computed at the stratum level.[8] Each stratum was subdivided into sub-strata to ensure a representative distribution of samples within each stratum. The sub-strata in all strata were based on age class. Sub-stratification is for spatial distribution of plots only. No adjustment ratios will be applied at the sub-strata level.

2.5 PHASE II SAMPLING

2.5.1 Overview

Phase II plot installation will be completed in the 2007 field season by VRI-certified timber emphasis cruisers. The choice of field samplers will be determined early in the fiscal year following a competitive bid process. The goal is to complete all field work (Phase II and NVAF) before the end of the 2007 field season; however this will depend upon availability of FIA funding and field crews throughout the field season.

[7] Also, reducing sampling expense and safety risk.

[8] Upon examination of the final data, some post stratification may be necessary and is a possibility when compiling the data. Decisions regarding appropriate strata for adjustment should be open for discussion.

2.5.2 Sampling Objectives

The sampling objective is to install a sufficient number of plots to achieve an overall average net merchantable volume minimum sampling error of ±10% (at a 95% confidence level) for use in the TSR. The 1996 inventory audit information produced a coefficient of variation (CV) of 44%.[9] If 10% is added, resulting in a CV of 55%, 120 samples should be sufficient to achieve the target sampling error. If the coefficient of variation is larger than 55%, more plots will be required to achieve the sampling objective.

2.5.3 Sample Size

A batch of 120 plots was selected from the target population and will be installed in the four strata (Table 4, Appendix III). A ratio of 85:15 operable area plots versus total area plots was used for distribution.[10] Sample size for the strata in operable areas was allocated proportionally to the area of each stratum and the plots were distributed based on the area of each sub-stratum. Each plot, in the operable area, therefore represents approximately 1900 ha.

Table 4. Phase II sample size by stratum.

Stratum	Sub-Stratum	Area (ha)	No. Plots	Sampling Weight (ha)
Pine Leading in Operable area	30 – 80 yrs	28,913	15	1,927
	81 – 140 yrs	41,340	22	1,879
	141+ yrs	15,327	8	1,916
	Total	*85,580*	*45*	*1,902*
Spruce Leading In Operable area	30 – 80 yrs	5,288	3	1,763
	81 – 140 yrs	5,768	3	1,923
	141+ yrs	24,268	12	2,022
	Total	*35,324*	*18*	*1,962*
Douglas fir Leading in Operable area	30 – 80 yrs	13,865	7	1,981
	81 – 140 yrs	34,665	19	1,824
	141+ yrs	23,729	13	1,825
	Total	*72,259*	*39*	*1,853*
Other – Any areas in the VT > 30, not in strata 1- 3.	30 – 80 yrs	46,521	3	15,507
	81 – 140 yrs	77,648	5	15,530
	141+ yrs	147,333	10	14,733
	Total	*271,502*	*18*	*15,083*

The sample size in the "Other" stratum was allocated based on area occupied by each sub-stratum, and therefore each plot represents approximately 15,100ha.

The sample and target population were compared by height class, age class, and volume class and are provided in Appendix III.

2.6 NET VOLUME ADJUSTMENT FACTOR SAMPLING

2.6.1 Overview

The Invermere TSA licencees will implement a NVAF program whereby the 2007 Phase II field data will be used to develop a NVAF tree matrix from which the trees for destructive sampling will be selected. A sub-sample of the VRI Phase II plots must be selected for NVAF-enhancement to build the NVAF tree matrix.

[9] The 1995 inventory information was used for the CV calculation.

[10] Ratio was determined through conversation with Sam Otukol, February 2007.

Thirty (30) (or one plot for every three trees being sampled) VRI Phase II plots (10 immature and 20 mature)[11] are typically selected to be NVAF-enhanced. For this project forty-five (45) (20 immature and 25 mature) plots will be NVAF enhanced in attempt to address the perceived issue with small pine taper. This will provide a larger pool of trees to select the destructively sampled trees from when the NVAF selection is completed. The VRI Phase II plots were sorted by stratum and sub-stratum within each maturity class and plots were selected using a systematic sampling design with a random start. Net factoring and call grading will be completed on all auxiliary plots for the NVAF-enhanced plots.

The NVAF sample size and species distribution of the NVAF field program will be determined following review of the field data. This VPIP will be updated after the Phase II program is complete with details of the proposed NVAF program and will be approved by MoFR prior to NVAF implementation. Destructive sampling will be completed in the 2008 field season by NVAF-certified cruisers.

[11] Stands 120 years old or younger (2007 age) were considered immature, and mature otherwise.

3. IMPLEMENTATION PLAN

3.1 SAMPLE SELECTION

Sample polygons were selected using probability proportional to size with replacement (PPSWR). Each polygon in the sampling frame was listed only once and size was the total area of the polygon. The sample points within the sample polygons were selected from the provincial 100 m grid in a Geographic Information System (GIS) using the simple random sampling (SRS) method.

3.2 SAMPLE PACKAGES

Field sample packages include at a minimum[12]:

1. An ortho-photo[13] (1:5,000) showing plot location and its Global Positioning System (GPS) points.
2. An ortho-photo (1:10,000) showing plot location and access.
3. A forest cover map (1:10,000) showing target polygon and plot locations with roads, contours and water features.
4. Access maps using ortho-photos (1:20,000) showing polygon and plot location.
5. Overview map (approx 1:100,000) for general polygon location.

3.3 PHASE II SAMPLING

3.3.1 Field Crews

Fieldwork is scheduled to begin early in the 2007 field season.[14] A project pre-work meeting will be held on the first day and sampling should begin immediately thereafter. All plots will be installed at the random locations selected by the GIS. If a plot location is unsafe or is no longer part of the target population (due to harvesting or fire), the Invermere TSA licencees and MoFR representatives will try to locate an alternate location. If an alternate location cannot be found, the plot will be dropped.

3.3.2 VRI Measurements

The project priority is to measure timber attributes and coarse woody debris at each plot. Data will be collected to provincial VRI ground sampling standards.[15] Additional attributes beyond VRI requirements will be measured (Section 3.3.3). Certified crews will gather the data using VRI Card Types 1, 2, 3, 6, 7, 8, 9, 10, and 11.

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[12] Sample packages may also include laser copied stereo pairs of photos and an access plan.

[13] This assumes that the orthophotos are of usable quality. If orthos are found to be unacceptable for use, document photos will need to be pin pricked which will require additional costs.

[14] The stakeholders may complete an access evaluation prior to putting the field work contract out to tender.

[15] VRI ground sampling procedures are available: http://srmwww.gov.bc.ca/risc/pubs/teveg/vri_gs_2k4/vri_gs_2k4.pdf. Some changes to the sampling procedures may be approved prior to the 2007/2008 field season. Any new changes will be incorporated into the VPIP if work has not started prior to their approval.

3.3.3 Non-Standard VRI Data

The Invermere licencees will collect additional, non-standard, VRI data to supplement the information normally provided by the VRI Phase II sampling. The value of the additional measurements will be assessed during the tendering of field crews, and a separate quote for these activities will be requested. The TSA stakeholders recognize that these additional measurements will not be included as a part of the FIA Land base – VRI budget. Additional measurements will include (Appendix IV contains rationales and utility of measuring these values):

1. Collecting species and diameter data on dead standing trees in the auxiliary plots.
2. Record site series attributes such as soil moisture and nutrient regime.[16]
3. Measure the distance from the sample point to the tree in the auxiliary plots.[17]

3.3.4 Core Counting

Tree ages from sample cores will be counted by the field contractor completing the plot. Ages will be counted in the lab using a microscope and entered into the MoFR data entry program, TIMVEG.

3.3.5 Data Entry

Standard VRI field data will be entered into the MoFR data entry program TIMVEG. Validation reports will be generated for each plot to ensure data integrity. All standard VRI data will be provided to the MoFR to be included in the provincial VRI database. Non-standard data will also be provided to the MoFR in a digital format.

All tree cores will be counted in the lab by the field contractor and included in TIMVEG. GPS data will be post-processed by the field contractors, entered into TIMVEG, and delivered with the data at the end of the project.

3.3.6 Pre-work and Quality Assurance

All field crews should attend a pre-work session with the client and auditor to review the plot methods and ensure that all questions are resolved at the beginning of the project. The Invermere TSA licencees will hire a third party auditor to audit a minimum of 10% [18] of all plots following the *VRI Ground Sampling Quality Assurance Standards*.[19] Auditing will be done by batch, and failed plots may result in a failed batch. Crews may be required to revisit failed plots at their own expense.[20]

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16 These measurements will be taken by the timber certified field samplers and not eco-certified samplers.

17 This has been completed on several inventories throughout BC and at minimal cost. Costs have been quoted as $0-10 extra/plot.

18 A minimum of 10% of all Phase II plots will be audited; however, going beyond this minimum should be left to the discretion of the auditor. This has been done on many land bases in past VRI projects.

19 Minimum standards for VRI sampling are located at: http://srmwww.gov.bc.ca/risc/PUBS/TEVEG/VRIQA/VRI_Ground_Sampling_2K2/QA Standards for VRI-02.pdf

20 The requirement to revisit plots will be explicitly outlined in the contract between the TSA stakeholders and the field contractor.

3.3.7 Plot Supplies

Supplies such as aluminum stakes, field maps, field equipment, photos, plot cards, handheld data recorders, GPS units, and other required equipment will be supplied by the field contract crews. The MoFR will supply VRI tags for each sample.

3.4 NET VOLUME ADJUSTMENT FACTOR SAMPLING

Upon completion of the first batch of Phase II plots (including the forty-five NVAF enhanced plots), all trees in the NVAF enhanced plots with a diameter at breast height 12.5 cm or larger will be included in the sampling frame to develop the tree matrix.[22] The expected tree matrix will be stratified into six strata:

1. Dead trees
2. Immature trees
3. Mature – Lodgepole pine (Pl)
4. Mature – Douglas Fir (Fd)
5. Mature – Spruce (Sx)
6. Mature – Other

Table 5. Expected NVAF sample size distribution. [a]

		Total Merch Vol (m^3) [b]		No. Trees	
Stratum	Spp	% Total	% Group	Trees	% Group
Dead [c]	Pl	34.2	34.2	4	40.0
	Fd	23.0	23.0	2	20.0
	Sx	28.4	28.4	3	30.0
	Other	14.4	14.4	1	10.0
	Total	***100***	***100***	***10***[21]	***100***
Immature	Pl	20.2	59.8	31	72.0
	Fd	6.8	20.1	6	14.0
	Sx	2.4	7.1	2	5.0
	Other	4.4	13.0	4	9.0
	Total	***33.8***	***100***	***43***	***100***
Mature-Pl	Pl	14.0	21.1	20	30.0
Mature-Fd	Fd	16.2	24.5	15	22.0
Mature-Sx	Sx	26.0	39.3	23	34.0
Mature-Other	Other	10.0	15.1	9	13.0
	Total	***66.2***	***100***	***67***	***100***
Total	***Total***	***100***	***100***	***120***	***100***

[a] Distributions are based on the inventory data. This is the expected distribution and will most likely change once the ground data is assessed.
[b] Total merch volumes were calculated using VDYP 6.
[c] The inventory does not differentiate between live and dead volume. The distributions of dead volumes are based on the inventory volume.

For this project, one hundred and twenty (120) trees will be selected following the NVAF tree selection standard methodology (Table 5). One objective of this NVAF program is to obtain a larger sample of pine to help address taper issues related to the small pine population. In Table 5 it can be seen that the Immature (Pl) and Mature-Pl strata have proportionally more sample trees based on the additional 15 plots enhanced (10 Immature and 5 mature). This resulted in 66% of the additional 20 trees (13 trees) being sampled in the Immature (Pl) stratum and the remainder (7 trees) being sampled in the Mature-Pl stratum. The sample size within each stratum will be assigned in consultation with the MOFR, based on estimates of net merchantable volume and expert knowledge about the variability within the stratum. An NVAF-certified crew will be hired to complete the destructive sampling by the end of the 2008 field season.

[21] Based on an email provided by Will Smith (Feb. 8, 2007) suggesting that the sample size requirements for live and dead trees will change to 10 dead and 90 live for the 2007/2008 fiscal year.

[22] The final NVAF strata allocations will be based on proportions of volume using the first batch of plots (a minimum of 40 samples including the 30 NVAF enhanced plots).

The NVAF program will follow MoFR VRI standards and involve five steps:[23]

1. Create a tree matrix using data from the enhanced Phase II plots.
2. Select sample trees from the tree matrix.
3. Complete stem analysis of the sample trees.
4. Complete a third-party audit of the sample trees.
5. Analyze the data to develop net volume adjustment factors.

The Invermere TSA licencees will hire a third party auditor to audit approximately[24] 10% of all plots following the NVAF quality assurance standards.[25]

3.5 STATISTICAL ADJUSTMENT

3.5.1 Data Compilation, Analysis and Adjustment

The Invermere TSA licencees will use the MoFR SAS compiler to compile all Phase II plots and NVAF trees. The licencees will complete the analysis and statistical adjustment of the Phase I data to MoFR standards at the conclusion of the field program. The analysis will:

- Use the MoFR Fraser adjustment method (or equivalent).
- Calculate ground sample average volumes and inventory volumes for the Invermere TSA.
- Adjust inventory height and age.
- Generate new *VDYP* volumes using the adjusted heights and ages.
- Adjust new volume estimates using the ratio of means method.
- Compute sampling errors for the Invermere TSA.

[23] NVAF sampling standards can be found at: http://srmwww.gov.bc.ca/risc/pubs/teveg/nvaf2k2/nvaf 02.pdf

[24] A minimum of 10% of all NVAF sampled trees will be audited.

[25] The NVAF quality assurance standards are described in the NVAF sampling standards, chapter 10.

4. SCHEDULE

4.1 2007-2008 TIMELINES

The Invermere TSA licencees will seek approval of the VPIP by the MoFR before the end of the 2006/2007 fiscal year. Upon approval of the VPIP the sample packages will be created. The next step is to solicit bids from consultants with VRI-certified field personnel to install the Phase II plots.

Sampling will begin early in the field season, immediately following the pre-work meeting. Crews will be audited at the start of the project and as the auditor deems necessary throughout the project. Data will be entered into TIMVEG and non-standard data entered into a database or spreadsheet.

The goal is to have the first batch of a minimum of 40 plots completed by mid summer (including all NVAF enhanced plots), and all Phase II plots installed before August 31, 2007. Upon completion of the first batch of plots, the NVAF tree matrix, sample size, and VPIP update will be completed. The NVAF program (destructive sampling and data entry) will be completed before October 1, 2007. Data compilation, inventory adjustment, and reporting will be completed by March 31, 2008.

	2007												2008		
Activities	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1. Complete VPIP															
2. Select sample locations															
3. Submit VPIP to MoFR															
4. Hire field staff															
5. Mentor field crews															
6. Field sampling															
7. Field QA															
8. NVAF sample plan															
9. Submit NVAF plan to MoFR															
10. NVAF destructive sampling															
11. NVAF audit															
12. Compilation, analysis, & report															

Figure 3. Proposed 2006/07 implementation schedule.

Stakeholders Field Crew VRI Mentor Auditor
NVAF Crew NVAF Auditor

4.2 PROPOSED BUDGET

The proposed Phase II program should cost approximately $253,000, including audit, helicopter costs and the statistical adjustment. The proposed NVAF costs and the final program will be updated once this program is defined at the conclusion of the Phase II program.

Table 6. Proposed Phase II and NVAF program cost.

Phase	Cost	%
Field Sampling[a]	$180,000	48
Helicopter	$35,000	9
Field Audit	$18,000	5
Statistical Adjustment & Report	$20,000	5
Sub-total	*$253,000*	*67*
NVAF Sampling	$90,000	24
Helicopter	$18,000	5
Field Audit	$9,000	2
NVAF Analysis	$5,000	1
Sub-total	*$122,000*	*33*
Total	*$375,000*	*100*

[a] These costs are based on a field crew rate of $1,500/day.

4.3 ROLES & RESPONSIBILITIES

Invermere TSA Licencees

- Develop and update VPIP (as necessary).
- Coordinate project activities.
- Select sample polygons and locations within polygons.
- Prepare sample packages.
- Check data after initial compilation.
- Validate and compile data.
- Provide data to MoFR.
- Complete statistical adjustment and submit to MoFR for review.
- Complete final report and submit to MoFR for review.

Phase II Field Contractors

- Complete field sampling.
- Enter the standard data (incl. full cores and GPS of plot locations) into TIMVEG and non-standard data into database or spreadsheet and submit to the licensees.
- Complete internal quality control and submit data to the licensees at the conclusion of field sampling.

NVAF Field Contractor

- Complete destructive sampling.
- Enter the sample data and provide to the licensees.

VRI Phase II Auditor

- Third party check-cruiser will audit a minimum of 10% of the Phase II samples.

NVAF Auditor

- NVAF-certified auditor will audit a minimum of 10% of the NVAF sample trees.

MoFR

- Review and approve the VPIP.
- Review and approve the final analysis & the statistical attribute adjustment.
- Be the custodian of the VRI standard and non-standard sample & population data.
- Audit the VRI process to ensure that VPIP commitments and MoFR standards were met.

4.4 MoFR Deliverables

The deliverables for the MoFR upon completion of the ground sampling program include:

1. The VPIP.
2. A digital copy of the Phase 1 target population map.
3. A digital copy of the Phase 1 target population data.
4. The Phase 1 data used to determine adjustment factors.
5. Sample list modifications (if any).
6. The sample packages.
7. The plot cards.
8. The validated TIMVEG ground sampling field data.
9. The NVAF destructive sampling data in a digital format accepted by the MOFR.
10. Corrected GPS data.
11. A copy of the quality assurance report.
12. An interim analysis memo.
13. A final analysis and adjustment report.

5. SIGN-OFF SHEET

I have read and concur that the Invermere TSA VRI Phase II Project Implementation Plan dated January 2008 meets current VRI standards and business needs and considerations. It is understood that this is an agreement-in-principle and does not commit the signatories to completing the inventory activities outlined within the plan.

_____ _____

Tembec Industries Inc. (lead proponent) Date

_____ _____

Jon Vivian, RPF Date
Manager Vegetation Resources Inventory
Forest Analysis and Inventory Branch
Ministry of Forests and Range

APPENDIX I – GLOSSARY OF TERMS

Ground Sampling

VRI ground sampling (Phase II) is the field measurement of timber, ecology, range, and/or coarse woody debris values at one or more locations within each sample polygon. To accommodate the wide variety of resources, various types and sizes of sampling units (e.g., fixed and variable plots, transects) are used to make the measurements.

Landcover Classification

The BC Landcover Classification Scheme (BCLCS) was designed specifically to meet the requirements of the VRI, in addition to providing general information useful for "global vegetation accounting" and "integrated resource management." The BCLCS is hierarchical and reflects the current state of the landcover (e.g., presence or absence of vegetation, type and density of vegetation) and such fixed characteristics as landscape position (i.e., wetland, upland, alpine). There are two main classes of polygons: Vegetated and Non-Vegetated.

Net Volume Adjustment Factor (NVAF) Sampling

NVAF sampling provides factors to adjust net tree volume estimated from net factoring and taper equations. The adjustment accounts for hidden decay and possible taper equation bias. NVAF sampling involves detailed stem analysis of sample trees, calculation of actual net volume, and calculation of the ratio between actual net volume and estimated net volume (where estimate net volume is obtained from net factoring and taper equations).

Photo-Interpretation (Phase I)

Photo-interpretation (Phase I) involves the subjective delineation of polygons and the photo estimation of attributes for all polygons in an inventory unit. Medium scale aerial photographs (1:15,000) are most often used in the photo-interpreted estimates inventory.

Post-Stratification

Post-stratification involves the division of an inventory unit into mutually exclusive sub-populations (strata) *after* ground sampling has been completed. Samples that fall in each post-stratum are analyzed separately and the results are applied to the corresponding population post-strata.

Pre-Stratification

Pre-stratification involves the division of an inventory unit into mutually exclusive sub-populations (strata) *before* ground sampling to provide estimates for specific areas, or to increase the confidence in the overall estimates by considering the special characteristics of each stratum.

Sample Size

The sample size for an inventory is the minimum number of ground samples to be established in an inventory unit to meet specified target precision or cost.

Statistical Adjustment

Statistical adjustment (or analysis) is the process of adjusting the values of the photo-interpreted estimates variables using the ground sampling observations. For each sampled polygon, the ground observations

are compared to the photo-estimated values to develop an adjustment factor. This factor is then applied to all polygons in the photo-interpreted estimates database to produce the final adjusted database.

Sub-unit

The term sub-unit describes the inventory unit of a management inventory (i.e., the management inventory target population is a subset of the provincial VRI inventory unit). A sub-unit may be defined by a specific geographic area (e.g., operable land base) or stand type (e.g., problem forest types) within the Forest District.

Target Population

The target population is the unit from which the samples are chosen. For management inventories, the inventory unit is a TSA, TFL or other geographic area or specific attribute set, depending upon the sampling objectives.

Target Precision

Target precision expresses the amount of variation in key attributes (e.g., timber volume) desired in the final results. The target precision, usually expressed as the coefficient of variation (CV), is used to calculate the minimum sample size for subsequent ground sampling.

Vegetation Resources Inventory (VRI)

The VRI is an improved vegetation inventory process for assessing the quantity and quality of BC's vegetation resources. The VRI process is designed to include a flexible set of sampling procedures for collecting vegetation resource information. The VRI is essentially a toolbox of procedures, which include:

- BC Landcover classification scheme (BCLCS).
- *Photo-interpreted estimates (Phase I)*: the delineation of polygons from aerial photography and the estimation of resource attributes.
- *Ground sampling (Phase II)*: the establishment of plot clusters in selected polygons to measure timber, ecological, and/or range attributes. The data are used for the adjustment of the photo-interpreted estimates for all polygons in an inventory unit or management unit.
- *NVAF Sampling*: Stem analysis sampling of individual trees for net volume adjustment.
- *Change Monitoring Inventory (CMI)*

The VRI can be deployed over the entire province (provincial VRI) measuring timber and non-timber resources, or over a large management unit (management VRI) measuring selected resources in specific portions of the land base. The VRI sampling process produces spatial and non-spatial databases that can be used in multiple resource management applications including timber, ecosystem, and wildlife habitat management.

APPENDIX II – VRI PHASE II PLOT LIST

Table 7. Invermere TSA Phase II plots. Shading indicates NVAF enhanced plots.

Plot No	NVAF	Stratum	Sub Stratum	Feature ID	Area (ha)	Oper	LdgSpp	Ht (m)	Age (yrs)	Vol (m^3/ha)	UTM		
											Zone	East.	North
1		1	1	18523C1D488ED7B24DE091B76445DC4A	42.8	IN	PY	20	69	100	11	588971.1	5524928.4
2	Y	1	1	2877E4C646474CF0C58C6F989D304648	28.4	IN	PL	20	64	200	11	564014.6	5577907.0
3		1	1	30653CB641A5F6B6C86BC48CB42EB2D4	13.6	IN	PL	15	76	100	11	594495.5	5535688.9
4		1	1	43E4C2D840B228E11CD9C9A8BB5C3B1A	19.2	IN	PL	10	33	0	11	602279.9	5578589.1
5		1	1	488BB043499552284A3090A756573CE9	55.4	IN	PL	20	76	200	11	566689.3	5577560.9
6	Y	1	1	4BBD066E4F046C52618B08A0B80E678D	38.1	IN	PL	25	77	200	11	601109.3	5590528.0
7		1	1	5333EFA843AB30C91831F8A09D798F72	34.7	IN	PL	15	66	100	11	609176.7	5541736.7
8		1	1	6E2E64CC41F91040B34962B88FEF92DD	26.4	IN	PL	15	47	0	11	611671.5	5565583.7
9		1	1	6FC1B69A4AEF3B1F6879E1898BD6B8FC	8.5	IN	PL	20	56	200	11	597272.4	5618433.4
10	Y	1	1	72449B29450ABA0E4AC7BBBA79BD1213	435.2	IN	PL	15	64	100	11	567912.0	5582338.3
11		1	1	AE2E715A412DE70D0CCB199625FB5DC2	15.1	IN	PL	15	46	100	11	588841.3	5601589.8
12		1	1	E4D5E11945C5842EF7D79EA0DCBA7A55	9.4	IN	PL	25	76	200	11	548187.7	5640203.8
13		1	1	E85111964365048F5E95BA8D53791C6F	63.0	IN	PL	20	73	200	11	583618.0	5534885.1
14	Y	1	1	F1DD64634DE26149A03B5B91955A6B15	203.1	IN	PL	25	74	200	11	591670.8	5618756.4
15		1	1	F27D1A2A4D8063D893A7D580F9D4680F	52.1	IN	PL	20	71	200	11	599155.1	5575468.9
16		1	2	0123EA044E8A33AF327FC6AEC9F41E9C	16.0	IN	PL	20	135	200	11	627004.6	5559560.8
17	Y	1	2	02BFB4EE495C288CF97E73AE4960E10C	145.8	IN	PL	20	89	200	11	622658.2	5574934.1
18	Y	1	2	02D0DE1F409DA312247E15B2B15B557C	24.3	IN	PL	25	129	300	11	577343.2	5538517.7
19		1	2	18AF763642F2F51824EC1E9ECC391E93	16.7	IN	PL	25	134	300	11	617775.7	5549782.9
20		1	2	2C01B10F457DA922FB4A8BBFAEECD5B3	8.6	IN	PL	25	86	300	11	582156.8	5543028.8
21	Y	1	2	38DD00154219B24C2595F887ADDEB799	108.4	IN	PL	25	85	200	11	600457.4	5586280.5
22		1	2	3B5C7F0049AF25BE5C85F9AF8E072AC2	20.3	IN	PL	25	108	300	11	583123.7	5617344.5
23	Y	1	2	44697A8446DB914FC3B9108FFA9912D1	55.5	IN	PL	25	85	200	11	580993.9	5527070.6
24		1	2	45AD1A494E6369FF705712A68C295BBE	11.1	IN	PL	25	136	300	11	625146.5	5552248.4
25		1	2	45DCB4DA43B1951DFCDE51A4A9E0642E	30.4	IN	PL	25	97	400	11	545063.1	5600402.6
26	Y	1	2	490A60DB4597AE01C1ED05BBBB2DFC01	10.8	IN	PL	25	123	300	11	542468.4	5611517.8
27		1	2	562EBABF4B670B531DCAF89370177CFE	38.0	IN	PL	30	116	400	11	533759.5	5634608.3
28		1	2	A4F6FDD44A1CCA6E5C8914844CF661B3	241.6	IN	PL	30	98	300	11	578335.3	5530636.8
29	Y	1	2	B1BAFD834B2868892A5907A045011387	21.6	IN	PL	20	86	200	11	553630.6	5604333.1

Plot No	NVAF	Stratum	Sub Stratum	Feature ID	Area (ha)	Oper	LdgSpp	Ht (m)	Age (yrs)	Vol (m^3/ha)	UTM		
											Zone	East.	North
30		1	2	B73ED0344279D4EA328581A9886AD96A	6.3	IN	PL	15	109	100	11	628744.7	5572933.5
31		1	2	C20318BE45C975D1822DE2981E665ACA	35.3	IN	PL	20	85	200	11	599201.0	5590574.1
32	Y	1	2	C3E5E51D42AEDFA968F07792FA1BC05F	45.5	IN	PL	20	105	200	11	616376.0	5597916.3
33		1	2	C98DEECA42FC71608C57B196FC187A32	92.5	IN	PL	20	84	200	11	570369.0	5543750.7
34		1	2	CAC49FEB496CF83BC5C3D1998B9A13E6	71.4	IN	PL	20	86	200	11	567027.1	5558381.5
35	Y	1	2	D4EDCED245EAA01687FD64BC49F8A64B	48.5	IN	PL	20	93	200	11	600808.3	5589761.1
36	Y	1	2	E216D0C8437972429AD7C2BE5D16C347	2.3	IN	PL	20	126	200	11	539633.3	5627804.1
37	Y	1	2	E8AF782C4978CF7A2BF5A189EAF15090	48.8	IN	PY	20	88	100	11	587470.3	5516465.9
38		1	3	4FCFDD2E498A4ABC4F77E6B22E8DEFE1	23.7	IN	PL	25	142	300	11	605272.5	5579913.2
39		1	3	709181F64A981793F8AD64807C2E5F59	21.3	IN	PL	25	196	300	11	599235.8	5563673.4
40	Y	1	3	711AD0E8488DE3F188009685C79616E3	24.0	IN	PL	25	146	200	11	610967.5	5560941.1
41	Y	1	3	BCBE10D6464DF8D3DD46FC8CDFE62EFA	60.9	IN	PA	20	216	200	11	572965.7	5542810.2
42		1	3	BDFC63B94B5A3EB7043DEAA59AE63749	12.6	IN	PL	25	146	300	11	620821.7	5556940.5
43	Y	1	3	D1E621914E5F62C9BEE42CBE8589B568	11.5	IN	PL	20	265	200	11	566572.8	5573547.1
44		1	3	DDA18FFE4BFAEFB11651879F0CBDCE74	19.6	IN	PL	20	212	300	11	599212.3	5617073.3
45		1	3	E278EE1E4E19998571612AB74EF19236	9.9	IN	PL	20	216	200	11	564959.9	5558749.7
46	Y	2	1	797AA64347B351DC48564E8D9AB7D6A5	21.3	IN	SE	20	75	200	11	591953.5	5615495.0
47	Y	2	1	D9D2A7254E76D8ADFF239E8B642183E1	23.0	IN	SE	5	32	0	11	608981.4	5562710.0
48		2	1	F1DFABF14C98C30836686D888CA01B62	31.0	IN	SE	20	66	100	11	589652.0	5530175.9
49		2	2	6CAEF2984601AF3FECB27C8237474F7E	24.5	IN	SE	30	86	300	11	568721.9	5577700.7
50	Y	2	2	9AE717E84413345AF669FA882130ED0D	10.0	IN	SE	20	126	100	11	565737.0	5586548.3
51		2	2	D1581A84483D81DBC8F16DB11FC0891F	54.1	IN	SE	20	86	100	11	526019.3	5623816.5
52		2	3	1C7228B74F55787208CF8A84009DAE1C	18.3	IN	SE	35	235	400	11	615553.6	5597015.5
53	Y	2	3	4F114D2245E1F692FFFAE18856AA935D	130.2	IN	SE	35	332	400	11	608595.8	5583007.6
54		2	3	544688AC49298E48824F3D9ED2537D68	16.4	IN	SE	30	276	300	11	615283.3	5594934.6
55		2	3	7705A2DE4FBB986858509A861474E738	1.4	IN	SE	25	166	300	11	586360.4	5552150.7
56		2	3	7DECBB3D41EF5CD85FD93D925D542A0F	35.7	IN	SE	30	143	400	11	553590.6	5612600.1
57	Y	2	3	A70A8635483843F8DC948D97E0A1FE4B	33.4	IN	SE	30	145	300	11	612001.5	5577427.4
58		2	3	AF52C7E04A54973E8FF3078191FF77C4	10.1	IN	SE	25	216	200	11	621171.2	5587519.5
59	Y	2	3	B8B8D24E40096CFE28033F9CE7B649A0	18.1	IN	SE	30	196	300	11	529091.4	5575771.0
60		2	3	C68F637A485CC4001D094190AD2C3F2E	33.5	IN	SE	30	216	400	11	594897.2	5608664.2
61		2	3	D89ED22548A06DBC3F4F1AA1C262EB68	23.9	IN	SE	25	216	300	11	617692.0	5565405.6

Plot No	NVAF	Stratum	Sub Stratum	Feature ID	Area (ha)	Oper	LdgSpp	Ht (m)	Age (yrs)	Vol (m^3/ha)	UTM		
											Zone	East.	North
62	Y	2	3	F1D5EC2D488A7D63441FA6B2D9EC4D56	15.2	IN	SE	35	266	400	11	563686.4	5553577.4
63		2	3	F49C27164DB93122594F67896DB9B2B4	27.2	IN	SE	30	216	300	11	591371.9	5604788.4
64	Y	3	1	6EA66FC94657264449977D97E43F0BED	16.9	IN	FD	15	76	0	11	593664.8	5535494.7
65		3	1	A14DC34B45489CBD7DD2FE932CA907D6	11.2	IN	FD	15	56	0	11	576327.5	5563320.3
66		3	1	B205088C4C06814160FC2D8B3BA06824	28.4	IN	FD	20	80	100	11	599200.4	5585133.9
67		3	1	CC70CC8845E0806B43623B9BD679E4C3	49.4	IN	FD	20	64	100	11	592984.5	5535683.6
68	Y	3	1	D5E999384161887EBDE7CF888A126026	18.2	IN	FD	10	33	0	11	603871.9	5551287.9
69		3	1	D87B4C084D9DFDEF8406489776886FDB	13.8	IN	FD	20	76	100	11	538763.8	5652305.4
70		3	1	FD45DD4E4D65FF0C931786847D0F6695	59.0	IN	FD	20	68	100	11	595924.4	5528858.3
71		3	2	04DEBCFC4ADF41F6C081D8A2E5FF4F32	48.6	IN	FD	25	126	200	11	595366.5	5573442.2
72		3	2	1E616FB24B229DA48CC68F9210CF77FA	18.0	IN	FD	25	99	200	11	584295.9	5526139
73		3	2	2856C363469F4022FD2674906B86DBDB	21.5	IN	FD	20	125	200	11	615284.0	5556955.6
74		3	2	3690CD144D253FD3304C568E8283AFB0	46.7	IN	FD	30	102	300	11	544085.0	5600629.7
75	Y	3	2	3827DED84F21EDBDE102C99FC6D83136	12.8	IN	FD	30	126	400	11	534337.5	5655497.0
76	Y	3	2	41359A37480900B6E074EAB630D62DEC	18.3	IN	FD	20	116	100	11	555559.2	5609121.5
77		3	2	45DA420641883DD37031D3AD7770E6A8	27.2	IN	FD	20	86	100	11	566755.6	5558618.0
78		3	2	57A8C63249C97537C328D6A14C1D2AD4	21.6	IN	FD	25	124	200	11	574830.3	5594538.7
79		3	2	606D7ADD455A6CF2C6384F9CEEBBF407	21.4	IN	FD	20	116	100	11	573456.2	5552816.0
80	Y	3	2	6D61ADFE4BC65338DE0C3491957202B3	9.9	IN	FD	25	126	200	11	555100.0	5614924.0
81		3	2	6EA234DE420157D1D2D391A89EFB469F	17.0	IN	FD	20	136	100	11	548979.3	5603422.9
82		3	2	70382D41464078F622EEB6A1C490366F	40.6	IN	FD	25	87	200	11	598571.8	5543819.2
83	Y	3	2	749CFEBE4D084160B1770395F21E41D8	37.5	IN	FD	20	136	200	11	583750.6	5569307.9
84		3	2	818FD98949F2F715C64085B4A6298039	4.9	IN	FD	15	91	100	11	556632.4	5619764.2
85	Y	3	2	90645ED141F6E7761DD7B4A272BD176B	1.5	IN	FD	20	86	0	11	595354.7	5552393.7
86	Y	3	2	BB0944C9468D79A9F2E84AA6242FF193	5.8	IN	FD	25	117	200	11	594067.5	5571193.3
87		3	2	BC8ADB8844A9A804544E8F9FE7C2D7DE	22.4	IN	FD	25	116	200	11	561915.8	5626336.6
88		3	2	DA97CB304B7CCEA6A5AE588FD5F0767D	13.8	IN	FD	20	101	100	11	582449.6	5580254.3
89	Y	3	2	DC48270044EF8FCCD23A099A3B858270	28.2	IN	FD	10	121	0	11	588895.6	5559274.2
90	Y	3	3	08FF915148C1068F450E31B400B0D4B3	17.3	IN	FD	25	196	300	11	583071.4	5583497.9
91		3	3	3E3758DF4F7FB001F359419EDBA43C9C	22.9	IN	FD	30	162	300	11	603159.6	5583814.2
92	Y	3	3	54E8E029425FB7226C85D3BFCBBF80E5	14.9	IN	FD	25	166	200	11	611528.0	5576884.5
93		3	3	6B4C285041AD9BAD67423799DDE66471	37.3	IN	FD	20	146	100	11	559387.1	5614571.4

Plot No	NVAF	Stratum	Sub Stratum	Feature ID	Area (ha)	Oper	LdgSpp	Ht (m)	Age (yrs)	Vol (m^3/ha)	UTM		
											Zone	East.	North
94		3	3	7FCD40564F4DA1B2C30449A2F2EF7EFD	14.1	IN	FD	25	216	200	11	555221.5	5632240.6
95	Y	3	3	88FD0AD643AD1502A7D12DB456EBB316	5.6	IN	FD	30	216	300	11	550043.9	5585152.5
96		3	3	91DA6ED74107241EBA0D04A4A502D3BE	1.5	IN	FD	30	146	200	11	558870.7	5614084.0
97	Y	3	3	AB11A444475EF3016D5A5FBD09E466A3	11.4	IN	FD	20	146	200	11	599122.4	5565904.0
98		3	3	B4A31C584EEA5423B5DC0DAB3826A99F	27.4	IN	FD	40	315	400	11	606735.4	5574887.8
99	Y	3	3	C61B2FC347FAC30AABF3E4BBABBFF59C	24.9	IN	FD	25	176	300	11	577265.3	5593115.2
100		3	3	C7E23305408FBA1B6293959BC7F15D65	40.1	IN	FD	15	199	0	11	598316.1	5524017.3
101		3	3	E09D914F471D671FD26BACA3C43805C6	41.0	IN	FD	30	193	300	11	591096.5	5593338.0
102		3	3	F6F6614C43FFC5E722C48581B751F849	39.6	IN	FD	25	202	200	11	615930.8	5554957.9
103	Y	4	1	612374EF4FD65340F27CD4B1FEFA50FD	8.5	IN	BL	15	66	100	11	549123.9	5608441.7
104	Y	4	1	67C03B644159B3081E1EFBBB861742C7	34.7	OUT	PL	15	76	100	11	571350.6	5538891.3
105		4	1	A0219F224FF3A916B1D01B98155FB5FF	8.3	OUT	SE	15	51	100	11	529825.2	5604887.8
106		4	2	06BF4DF34C990947B4C06D94A5D4DBA7	4.5	OUT	PL	20	86	200	11	621890.5	5577552.5
107		4	2	188FD6D642B2A702D95B028203537AC4	10.9	OUT	PL	20	104	200	11	543492.2	5585898.1
108	Y	4	2	1B522AA744136925A7BF51A4294F961B	11.2	OUT	PL	15	126	100	11	599076.7	5556241.1
109		4	2	22F343B24EA982C42B087583763F46DC	8.7	OUT	SE	20	93	100	11	550773.4	5543265.5
110		4	2	7E6DC52B4B83934C687DD08F96DD1B0F	25.4	OUT	AT	20	105	100	11	594658.7	5627036.3
111	Y	4	3	1CB2086D468318B6478CD0A7037257E1	6.4	OUT	BL	30	216	200	11	592162.8	5612444.8
112	Y	4	3	5E9529F349B9730220A26DA20F1A78ED	32.6	OUT	SE	25	183	200	11	567882.0	5519105.9
113		4	3	6570CCE144EA23A2DD7B4BB886E4BE87	17.1	OUT	SE	25	196	200	11	552379.0	5595427.9
114		4	3	6687F84947F249F266BCDDA617D853C6	55.8	OUT	BL	20	192	100	11	552699.3	5541808.4
115	Y	4	3	7009B2FF421C5D20C876A98EF2FE6F2D	26.4	OUT	SE	10	219	0	11	616579.6	5535940.7
116		4	3	717CC4A6470E4BE23FECD284CDCC08A6	15.1	IN	LW	30	166	200	11	597353.7	5595750.6
117		4	3	A06A6A964DA264A48489CE8EC70704CB	3.3	OUT	SE	20	166	100	11	530214.6	5660262.2
118		4	3	A871F1B145F5F947F0C9DA88EAE61B7D	8.1	OUT	FD	30	194	300	11	600444.2	5552035.1
119	Y	4	3	BA16425E4D4582EDC11D0BA47572FE29	2.6	OUT	LA	20	216	100	11	605038.7	5595962.6
120		4	3	D60DEC0C46C798292905879BCE0646DB	7.4	OUT	PA	10	219	0	11	606954.1	5525411.8

* IN = sample is within the operable area, OUT = sample is outside of the operable area.

APPENDIX III – TARGET AND SAMPLE COMPARISONS

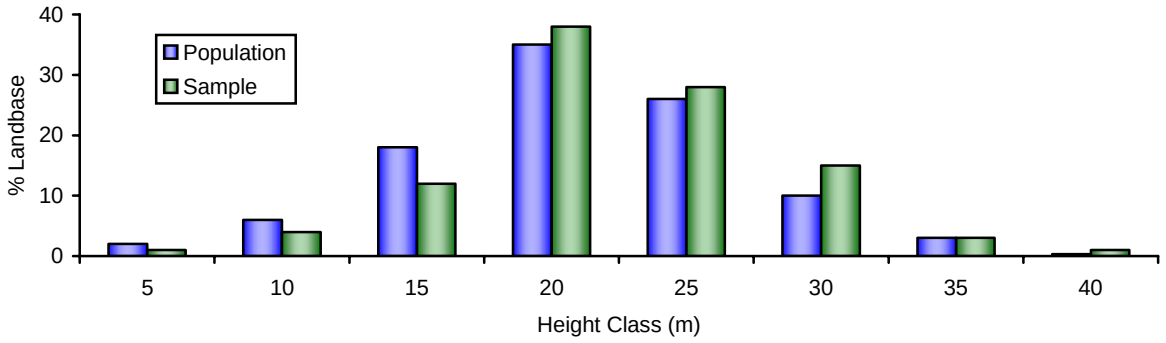

Figure 4. Target and sample population comparison by height class.

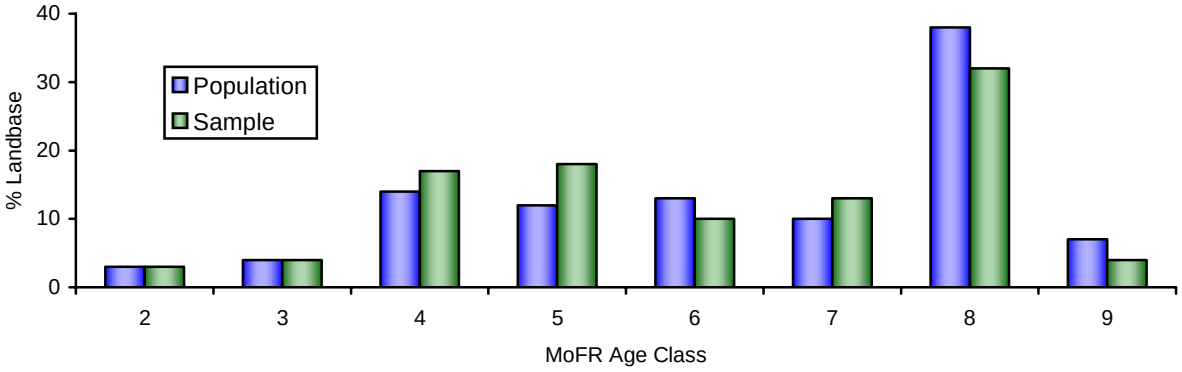

Figure 5. Target and sample population comparison by age class.

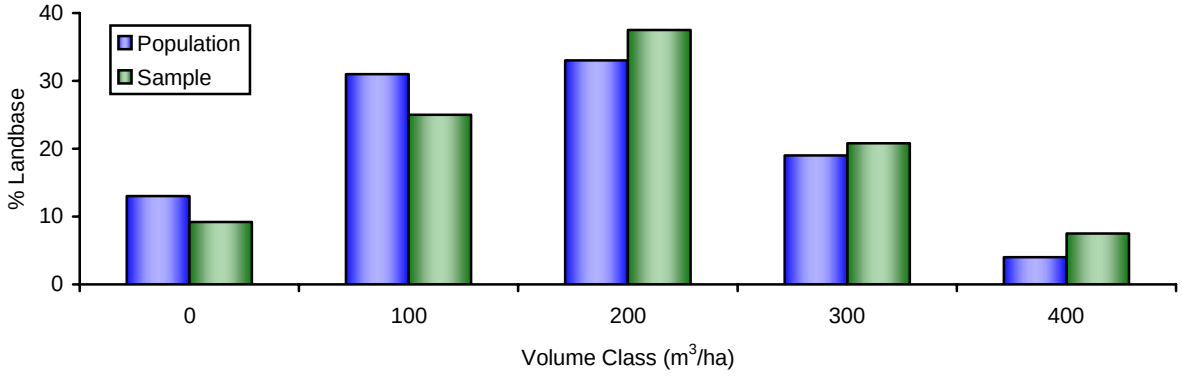

Figure 6. Target and sample population comparison by volume class.

APPENDIX IV – ADDITIONS TO STANDARD VRI METHODS

In order to provide data that better meets the Invermere TSA licencees' inventory needs, additional field data is being collected beyond provincial VRI standards. The additions to current VRI methods include:

- Tallying all dead standing trees in all plots.
- Collect soil moisture and nutrient regime information.
- Recording the distance plot centre-tree on auxiliary plots.

Tally dead standing trees in auxiliary plots

In order to determine the amount of deadwood occurring on the TSA (regardless of cause of death), we propose tallying the species and diameter of dead standing trees in all plots. With this information the TSA stakeholders will be able to assess the need for further studies related to deadwood and cause of death. This information can also be used for TSR to help assess unsalvageable losses.

Collect soil moisture and nutrient regime information

These attributes can be collected under the current VRI standards; however this requires a VRI eco-certified field sampler. In order to get site series information at a reduced cost, we propose that timber emphasis samplers collect information on soil moisture and nutrient regime based on indicator species at IPC. This data could be useful for broad strategic planning for wildlife habitat, site productivity, and species selection.

Record the distance plot centre-tree on auxiliary plots

Tree distances are only recorded on the Integrated Plot Centre (IPC). We propose recording this attribute on all auxiliary plots to increase the information on tree distances. These distance measurements could facilitate the remeasurement of the entire VRI cluster which could then be used to assess changes in the land base for future TSR's. The cost of completing this measurement has historically been $0-10/plot. This minimal cost is easily justified considering the potential gains in the future.