

100 Mile House Timber Supply Area – TSA 23

Vegetation Resources Inventory Project Implementation Plan Including Volume Audit Sampling and Air Calls

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Executive Summary

This Vegetation Resources Inventory (VRI) Project Implementation Plan (VPIP) is the planning document that will be used as a guide for VRI Volume Audit (VA) and Air Calls sampling projects in the 100 Mile House Timber Supply Area (TSA). The area of interest is the entire 100 Mile House TSA. The details recorded in this plan regarding these two activities include:

- an outline of the land base including the netting down process;
- documentation of the sample selection;
- a listing of all sample locations; and
- confirmation of the sampling protocols for each planned VRI activity.

This Project Implementation Plan has been prepared following the documents:

- *Vegetation Resources Inventory Sample Selection Procedures for Ground Sampling v4.0 DRAFT*
- *VRI Guidelines for Preparing a Project Implementation Plan for Ground Sampling and Net Volume Adjustment Factor Sampling (Version 3.1)*
- *Streamlining VRI Ground Sampling - Volume Audit Sampling*

The Volume Audit and the Air Call samples were selected from the Vegetated Treed (VT) land base. The VA samples were selected from the population greater than 50 years while the Air Calls were selected from the VT area greater than 30 years. The following exclusions occurred to net down the VT land base during the sample selection process for each activity:

- private land, parks, and federal lands including Indian Reserves and Military Reserve.

The Volume Audit ground sample selection has been completed based on an initial stratification of the population by leading species representation. The strata are:

- Stratum 1: Douglas fir
- Stratum 2: Spruce-Balsam
- Stratum 3: Pine
- Stratum 4: Other

The VA strata have been further stratified into three (3) sub-strata, based on basal area. The VA sample list is made up of seventy (70) initial samples and thirty (30) alternates.

A separate sample selection process was completed for a set of one hundred (100) Air Calls. There was no stratification of this population.

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1.0 Introduction

The Vegetation Resources Inventory (VRI) is the standard for forest cover inventory in the province of British Columbia (BC). It follows a set of procedures with associated standards, administered by the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO or 'the Ministry'). The VRI was designed to answer two questions: "Where is the resource located?" and "How much of given vegetation resource is within an inventory unit?"¹

The VRI is a photo based, 2-phase program. Phase 1 involves photo interpretation, delineating polygons of homogenous land cover types and providing estimates of the vegetation attributes for each polygon. Phase 2 includes ground sampling activities. The Volume Audit (VA) activity samples a random subset of polygons to verify the confidence in the accuracy of the Phase I volumes as well as some of the other key vegetation attributes. It provides detailed information on tree size and condition.

This project follows the delivery of a VRI Phase 1 re-inventory in this TSA. This Project Implementation Plan (VPIP) has been prepared to outline the details of a Volume Audit sampling project for the entire 100 Mile House Timber Supply Area (TSA). Additionally, this plan identifies the location of a set of Air Call samples to be completed.

1.1 Document Objectives

The objectives of preparing this Project Implementation Plan are two-fold. This document provides a record of the decisions made to develop the Volume Audit and Air Calls sample lists. It also serves as a guide for those undertaking these projects.

Specific details provided in this VPIP include the identification of:

- decisions made in the development of the sampling population and sample lists;
- the sampling population;
- sample lists for the Volume Audit and Air Calls activities;
- VRI data collection methodology for the VA and Air Call sampling; and
- deliverables for each project.

1.2 Project Land base²

The 100 Mile House TSA is located in south central British Columbia. It is administered from the Ministry of Forests, Lands and Natural Resource Operations' office in 100 Mile House. The TSA boundary coincides with the 100 Mile House Forest District Boundary,

¹ From the MFLNRO, Forest Analysis & Inventory Branch, Vegetation Resources Inventory website – Overview - <http://www.for.gov.bc.ca/hts/vri/intro/overview.html>

² Text adapted from the 100 Mile House TSA Rationale for Allowable Annual Cut (AAC) Determination – Nov7/13.

which is part of the Cariboo Region. It covers approximately 1.23 million hectares and is bounded by the Williams Lake TSA to the north and northwest, the Fraser River to the west, Kamloops TSA to the south, and the Cariboo Mountains and Wells Gray Provincial Park and Tree Farm License (TFL) 18 to the east.

100 Mile House is the largest Municipality and therefore major services centre in the TSA. Other communities encompassed within the TSA are: Clinton, 108 Mile Ranch, Lac la Hache, Forest Grove, 70 Mile House, Lone Butte and Bridge Lake.

Table 1 shows the land base distribution in the entire TSA.

Table 1: 100 Mile TSA Land base Summary

| Land Classification | Area (ha) | % of TSA Area |
|----------------------------|------------------|----------------------|
| Total TSA Area | 1,235,978 | 100 |
| Net-downs | 175,113 | 14.17% |
| Parks | 53,264 | 4.31% |
| Private | 116,451 | 9.42% |
| Federal | 5,398 | 0.44% |
| Net Area | 1,060,865 | 85.83% |
| Non Vegetated | 53,363.00 | 4.32% |
| Vegetated | 1,007,502.00 | 81.51% |
| Non-Treed | 129,363.00 | 10.47% |
| Treed | 878,139.00 | 71.05% |

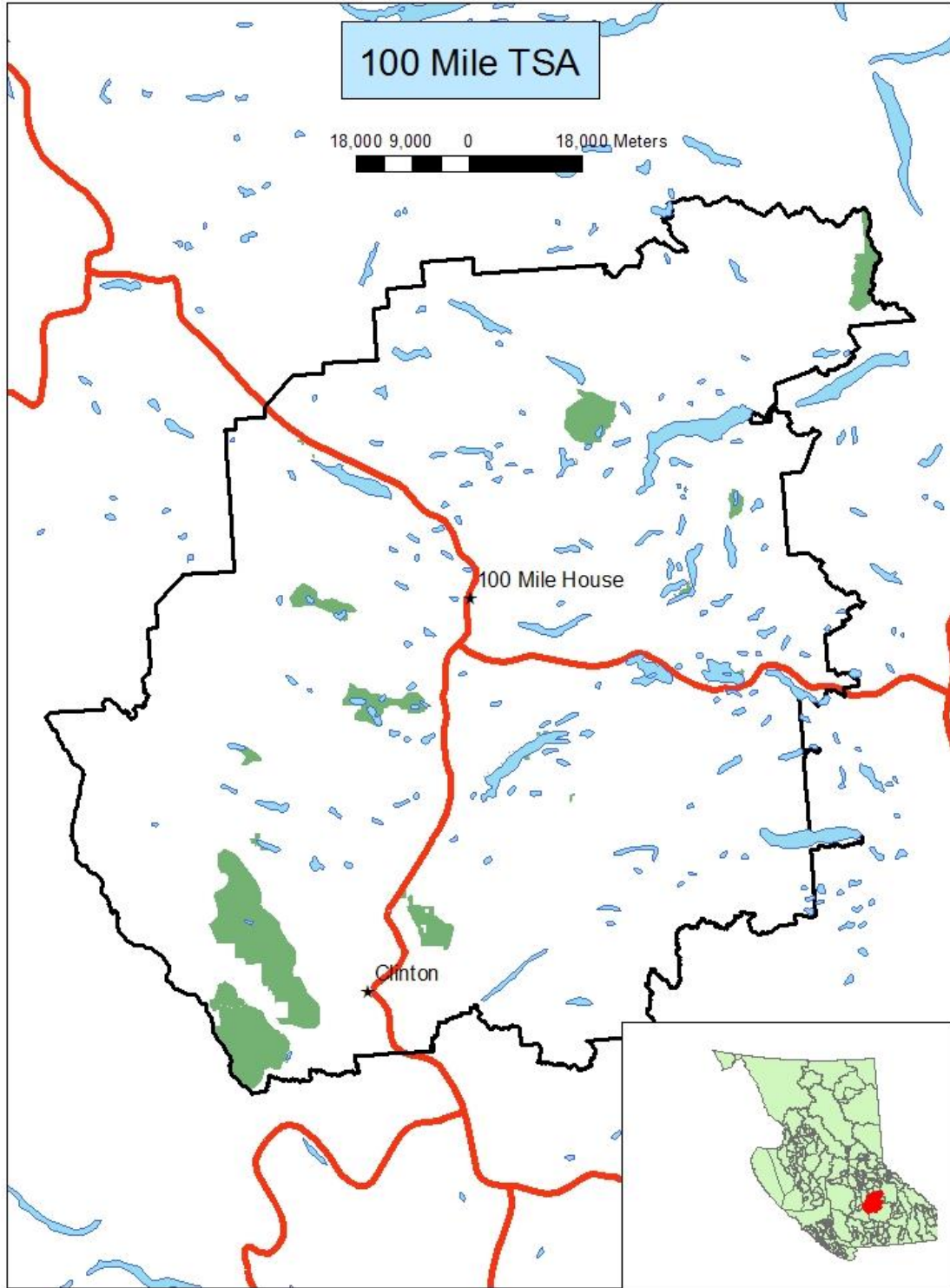
The 100 Mile House TSA has varied topography. It consists primarily of undulating plateau with the Fraser River valley forming much of the western boundary and includes the lowest elevations in the TSA. The southwestern part includes areas of higher relief, the largely calcareous Marble and Pavilion ranges. Along the north eastern edge of the TSA the area rises steeply to form the Quesnel Highlands and the most westerly portions of the Cariboo Mountains.³

The southwestern part of the TSA along the Fraser River has a hot, dry climate, while the Cariboo Mountains to the northeast produce a wet climate. There are eighteen biogeoclimatic subzones/variants in the TSA with the single largest unit being Interior Douglas-fir dry cool variant 3 (IDFdk3). The previous inventory showed lodgepole pine as the dominant tree species in the TSA at 49%, and that 60% of the pine volume in the TSA was over 80 years old. This was prior to the Mountain Pine Beetle (MPB) epidemic of the last decade. This mature pine was particularly susceptible to the pine epidemic, as was shown by the results of the recent Phase I project. Table 2 summaries of the current inventory show the dominant tree species in the TSA are Douglas fir and spruce. Other tree species present include lodgepole pine, subalpine fir (balsam), western red cedar, western hemlock and various deciduous species.

³ From Large Scale Biogeoclimatic Mapping of the 100 Mile House TSA – 2008, Ray Coupe.

Figure 1 provides an overview map of the TSA.

Figure 1. Overview map of the 100 Mile House TSA



1.3 State of the Inventory

During the 2008/09 fiscal year, a VRI Strategic Planning exercise (VSIP) was undertaken co-operatively between the local stakeholders and the Ministry staff. This work was funded under the Forest Investment Account (FIA) and followed the Ministry Standards. A Business Case was developed that concluded that it was timely to undertake a new VRI for the 100 Mile House TSA including both Phase 1 and Phase 2 activities. Timing the photography to reflect the land base following the MPB epidemic was recognized to be an important aspect to the timelines for this project.

As a follow-up to the Strategic Planning process, a Project Implementation Plan was prepared to outline the Phase 1 photo acquisition and photo interpretation. The photos were flown in 2011. The Phase 1 project was delivered to the Ministry in early 2014.

The inventory files used for this project's sample selection reflect the following updates:

- harvest and reforestation updates current to 2014
- ages projected to 2014

2.0 Ground Sampling Plan

2.1 Sampling objectives

The investigation of the 100 Mile House TSA inventory was driven, in part, by the fact that it was one of the older inventories in the province. During the 2009 planning processes for this TSA, a series of studies assessing the state of the inventory in the TSA were identified and analyzed. The following are excerpts from the VSIP document that provide direction from the Chief Forester regarding issues with the inventory that a VRI project could help to resolve:

- During the Timber Supply Review 2 (TSR2), uncertainty regarding existing stand volumes caused the Chief Forester to conclude that there is a need to “complete a Vegetation Resource Inventory for the Timber Supply Area (TSA); in particular, to improve the forest cover attributes.”⁴
- More recently, the Mountain Pine Beetle (MPB) epidemic has devastated the forests of the former Cariboo Forest Region, including 100 Mile House TSA. The Ministry of Forests & Range completed TSR3 locally in 2006 to create an action plan in response to the infestation. In the ‘Rationale for Allowable Annual Cut (AAC) Determination’, the results of the (2001-2003) VRI Phase II project were discussed and applied in the analysis. The Chief Forester has recommended that “after the MPB epidemic has subsided” the TSA should be re-inventoried. “The inventory needs to identify what has survived the epidemic so that volume forecasts can be more accurately determined.”⁵

⁴ Page 34 of 2002 AAC Rationale

⁵ P42 of 2006 Rationale

The VRI Strategic Inventory Planning (VSIP) process concluded that a Vegetation Resources Inventory Phase 1 followed by Phase 2 project needed to be implemented in this TSA. From a review of the existing VSIP and VPIP and the most recent (2013) Annual Allowable Cut determination for the TSA, a number of information requirements were hoped to be supported by continuing the ongoing 100 Mile House TSA VRI activities:

1. Mid-term timber supply including the potential contribution of deciduous leading stands.
2. Uneven-aged stands e.g. Douglas fir and their ability to contribute to the mid-term timber supply.
3. Errors in Inventory Attribution – Confirmation that new photo interpretation has resulted in an improvement, for planning purposes.
4. Site Index – Improved height estimates so site index would better estimate local growth rates.
5. Merchantability and ‘shelf life’ in the dead standing pine.
6. Biodiversity/habitat management attributes collected in the VRI.
7. Mortality in Young Stands (less than 60 years) due to MPB.

With the Phase 1 project delivered, this plan outlines the undertaking of a Volume Audit sampling project to verify the accuracy of volumes and other key attributes in this re-inventory. It will provide a statistically valid analysis of the volumes in the mature population. A sampling error of 15% (net volume) is the target set for the Volume Audit population.

Additionally, a supplementary Air Call sampling project will be undertaken, to review the overall attribute calls on a set of randomly selected polygons.

2.2 Target Population

The two activities outlined in this plan will occur on the Vegetated Treed (VT) land base. Netdowns from the VT land base include area in private land, parks and federal lands including military reserves and Indian reserves. Community Forests and Woodlots have been retained.

Based on the VT land base, the target populations for each activity differ as follows:

1. Volume Audit sampling will occur in stands aged 51 years and older.
2. The Air Calls project population includes stands aged 31 years and older.

Tables 2 and 3 provide land base figures for the Volume Audit population.⁶ Figures in Table 2 have formed the basis for the decisions regarding the stratification of the population for VA sampling.

Table 2: Species Distribution – Volume Audit Population - Vegetated Treed Land base, Ages 51+

| Species | Area | % |
|----------------|----------------|---------------|
| FD | 370,211 | 51.7% |
| SX | 151,091 | 21.1% |
| P | 112,178 | 15.6% |
| AT | 49,850 | 7.0% |
| B | 29,122 | 4.1% |
| CW | 3,058 | 0.4% |
| EP | 1,039 | 0.1% |
| Total | 716,549 | 100.0% |

Table 3: Age class Distribution, All Species – Volume Audit Population, Ages 51+

| Age Class | Area | % |
|------------------|----------------|-------------|
| 3 | 28,267 | 4% |
| 4 | 86,364 | 12% |
| 5 | 122,662 | 17% |
| 6 | 113,602 | 16% |
| 7 | 123,286 | 17% |
| 8 | 215,736 | 30% |
| 9 | 26,632 | 4% |
| Total | 716,549 | 100% |

In summary, in the 100 Mile House TSA, the land base in the Volume Audit population is 716,549 hectares while the Air Calls population encompasses a total area of 770,593 hectares.

2.3 Sample Size

For the 100 Mile House TSA VPIP preparation, the contract *Schedule A* stated that a total of 70 ground samples would be established in the Volume Audit population. The sample list includes the original 70 samples selected plus an additional 30 Volume Audit samples, to be available as alternates if required.

⁶ Numbers related to identifying the sampling population are the result of analytical work completed by Nona Phillips Forestry Consulting, using current data files provided by the Ministry. All work has followed the *VRI Sample Selection Standard* and has been documented in a Sample Selection Report provided to the government.

The Air Calls sampling project population was determined using the same methodology as the Volume Audit population. A total of 100 samples were selected.

2.4 Strata

2.4.1 100 Mile House TSA - Air Call Population

There was no pre-stratification of the Air Call population in the sample selection process.

2.4.2 100 Mile House TSA -- Volume Audit Population

The Volume Audit population has been stratified based on species distribution. An analysis of Table 2 resulted in four species groupings as follows:

- Stratum 1: Douglas fir
- Stratum 2: Spruce-Balsam
- Stratum 3: Pine
- Stratum 4: Other

Each stratum was further divided into 3 sub-strata with roughly equal numbers of polygons, based on Basal Area. Table 4 below describes the criteria used for sub-stratification of the population into basal area classes. Appendix C discusses how the strata and Basal area class sub-stratum are defined and how samples were distributed among them.

Table 4: Criteria for Sub-stratification of Volume Audit Population

| Strata | # of polygons | Div by 3 | Sub-Strata | Target polygon range | BA | Actual # of Polygons |
|--------|---------------|----------|------------|----------------------|-------|----------------------|
| Fd | 21787 | 7263 | 1 | 0-7263 | 0-14 | 6967 |
| | | | 2 | 7264-14526 | 15-25 | 7984 |
| | | | 3 | 1452+ | 26+ | 6837 |
| Sp-Bal | 15112 | 5037 | 1 | 0-5037 | 0-15 | 5487 |
| | | | 2 | 5038-10074 | 16-30 | 5650 |
| | | | 3 | 10075+ | 31+ | 3975 |
| Pine | 8276 | 2759 | 1 | 0-2759 | 0-10 | 3683 |
| | | | 2 | 2760-5518 | 11-20 | 2476 |
| | | | 3 | 5519+ | 21+ | 2117 |
| Other | 5779 | 1926 | 1 | 0-1926 | 0-15 | 1987 |
| | | | 2 | 1927-3852 | 16-30 | 2289 |
| | | | 3 | 3853+ | 31+ | 1503 |

Table 5 shows the distribution of samples in the Volume Audit population.

Table 5: Volume Audit population - Distribution of Ground Samples

| Stratum | Population Area | % of Area | No of Samples | # of Hectares Represented by each plot | Replacement Samples |
|----------------|------------------------|------------------|----------------------|---|----------------------------|
| Fd | 370,211 | 51.7% | 36 | 10,284 | 15 |
| Sp & Balsam | 180,213 | 25.2% | 18 | 10,012 | 7 |
| Pine | 112,178 | 15.7% | 11 | 10,198 | 5 |
| Other | 53,947 | 7.5% | 5 | 10,789 | 3 |
| Total | 716,549 | 100.0% | 70 | 10,236 | 30 |

Table 6 shows the division of the Volume Audit population stratum into sub-strata based on 3 Basal Area classes.

Table 6: Volume Audit Population – Sample Distribution by Sub-Strata

| Strata | Sub-strata | Area | % | Samples | Replacements |
|--------------------|-------------------|----------------|-------------|----------------|---------------------|
| Douglas Fir | 1 | 111,329 | 30% | 11 | 5 |
| | 2 | 130,773 | 35% | 13 | 5 |
| | 3 | 128,108 | 35% | 12 | 5 |
| Total | | 370,210 | 100% | 36 | 15 |
| Spruce & Balsam | 1 | 51,682 | 29% | 5 | 2 |
| | 2 | 69,876 | 39% | 7 | 3 |
| | 3 | 58,654 | 33% | 6 | 2 |
| Total | | 180,212 | 100% | 18 | 7 |
| Pine | 1 | 47,159 | 42% | 5 | 2 |
| | 2 | 35,831 | 32% | 3 | 2 |
| | 3 | 29,189 | 26% | 3 | 1 |
| Total | | 112,179 | 100% | 11 | 5 |
| Other | 1 | 14,089 | 26% | 1 | 1 |
| | 2 | 20,096 | 37% | 2 | 1 |
| | 3 | 19,762 | 37% | 2 | 1 |
| Total | | 53,947 | 100% | 5 | 3 |
| Grand Total | | 716,548 | | 70 | 30 |

2.5 Sample Selection – Ground Sampling (including Air Calls)

The initial step in preparing this plan was to define the land base for the two sampling populations. Appendix C outlines the sample selection process used for both activities. It details the identification of the population areas, development of the strata and sub-strata for the Volume Audit population, and the distribution of the VA samples.

For the Volume Audit sampling, the list contains the initial samples and replacement samples available in the event that some of the initial samples are rejected in the field. In 100 Mile House TSA, there are 70 initial samples and 30 replacement samples in the Volume Audit population.

For the Volume Audit population, sample polygons were selected according to procedures outlined in *Vegetation Resources Inventory –Draft Version 4.0 - Sample Selection Procedures for Ground Sampling* - Section 3.0. That is by “probability proportional to size with replacement” (PPSWR). Sample points were located randomly within the sample polygon using ARCMAP 10 GIS techniques and random numbers generated by Excel. Sample locations were reviewed against recent Landsat imagery. The original sample ‘70’ in strata ‘Other’, sub-strata ‘3’ fell within recent cutover and was replaced by a contingency sample in the same sub-strata.

The Volume Audit samples are numbered 1 to 70. The alternates included in the list are numbered 71 to 100. Where there is a need to replace a sample in the field, the replacement should be from the same stratum or strata and sub-stratum.

Also in the 100 Mile House TSA Air Call samples were identified. The population for Air Call samples was not stratified and only polygons were selected for sampling. (That is, specific locations were not identified within the sample polygons.) The Air Calls sample **polygons** were selected in the same manner used for the VA sample polygons, using the PPSWR method. One hundred (100) polygons were selected and are numbered 101 to 200. Sample locations were not identified within the polygons.

The sample lists for each activity are provided in Appendix A.

2.6 Sample Establishment Methodology

The ground samples established for the 100 Mile House TSA in the Volume Audit population will be completed by certified VRI Timber samplers following ‘Timber Emphasis’ procedures. Coarse Woody Debris (CWD) data will not be collected at each sample.

The Air Call sampling will follow a procedure similar to the protocol listed in the most current edition of the Ministry Standards *Air and Ground Calibration – VRI Field Calibration Procedures for Photo Interpretation*. Again the work will be completed by certified personnel, in this case the samplers will be certified VRI Photo Interpreters. Final decisions on methodology and delivery will be outlined in the bidding process and contract with the Ministry.

3.0 Project Implementation

3.1 Sample Packages

Sample packages will be prepared following Ministry direction for all samples selected in this 100 Mile House TSA Project Implementation Plan for Volume Audit and Air Calls. They will include tools that support the field crews in their efforts to navigate to, and establish each sample in the correct location.

3.2 Standards

The current edition of the appropriate Ministry Standard will be followed to complete this project for each sampling activity. The Standards relevant to this project are listed in this document, following the Bibliography. When the project is initiated, the participants should access the Forest Analysis and Inventory Branch website to confirm that they are using the latest version of each Standard.

3.3 Sample List

A complete sample list for the VA sampling and the Air Call sampling is provided in Appendix A. A description of how samples were distributed across their population is included in Appendix C.

3.4 Project Files

The original population files used to determine the selection will be provided to, and kept on file by, Forest Analysis and Inventory Branch staff.

3.5 Project Analysis

Statistical analysis projects will be conducted on all of the data collected. Other sampling occurring in the area may be used in the analysis projects as well.

Bibliography

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4. Ministry of Forests, Lands and Natural Resource Operations. Streamlining VRI Ground Sampling -Volume Audit Sampling. 2011.
5. BC Ministry of Forests, Resources Inventory Branch. 100 Mile House TSA Inventory Audit Report. 1996.
6. Nona Phillips Forestry Consulting. Vegetation Resources Inventory Project Implementation Plan for 100 Mile House TSA. March 30, 2009.
7. Nona Phillips Forestry Consulting. Vegetation Resources Inventory Strategic Inventory Plan for 100 Mile House TSA. January 16, 2009.
8. Nona Phillips Forestry Consulting. Cranbrook TSA, TFL18, Mackenzie TSA, TFL53, Kootenay Lake, Morice and Williams Lake TSA Vegetation Resources Inventory Project Implementation Plans. February 2011 (Cranbrook), March 2011 (TFL18), June 2011 (Mackenzie), July 2011 (TFL53), July 2011 and March, 2012 (Kootenay Lake), March 2012 (Morice), March 2013 (Williams Lake), March 2014 (Prince George).
9. Various. Personal Communication with Ministry of Forests, Lands & Natural Resource Operations staff members Chris Mulvihill and Matt Makar regarding issues related to the preparation of the 100 Mile House TSA VPIP.

VRI Standards & Procedures

The list of VRI Standards and Procedures that have been followed in the preparation of this plan and project to date and that must be followed to complete the 100 Mile House TSA VRI ground sampling projects is provided below. The most current edition should be used when this project is undertaken. They will be found at the VRI website:

<http://www.for.gov.bc.ca/hts/VRI/>

Planning and Sample Selection:

Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Ground Sampling and Net Volume Adjustment Factor Sampling Version 3.1, March 2010

VRI Phase 2 Post-Project Documentation and Deliverables, June, 2007
Vegetation Resources Inventory Sample Selection Procedures for Ground Sampling
DRAFT Version 4.0 May 2011

Ground Sampling, Vegetation Resources Inventory (VRI):

Vegetation Resources Inventory Ground Sampling Procedures Version 4.9.1, June 2012

Ground Sampling Procedures' Appendices Version 4.6, March 2010

Vegetation Resources Inventory Ground Sampling Quality Assurance Procedures and Standards for VRI Ground Sampling Version 3.1, March 2008

Vegetation Resources Inventory Ground Sampling Data Collection Procedures for Inaccessible Samples Version 1.0, March 2003

VRI – Data Analysis

VRI Sample Data Analysis Procedures and Standards. Version 1.0, June 2011

Photo Interpretation

Air and Ground Calibration – VRI Field Calibration Procedures for Photo Interpretation.
Version 1.4, April 2014

Appendix A

Sample Lists for 100 Mile House TSA Ground Samples

1. Volume Audit Samples
2. Air Calls Samples

The following are sample lists for each of the two populations. Only the Volume Audit list contains initial samples for data collection and alternate samples in the event that some of the initial samples need to be replaced during the data collection phase.

For the Volume Audit population (ages 51+) there are 70 initial samples and 30 alternate samples. The initial samples are number 1 to 70. The alternates are numbered 71 to 100.

For the Air Calls (ages 31+) there are 100 samples. These are numbered 101 to 200.

Each of the sample shapefiles include all of the data fields from the originally supplied VRI database.

In the Volume Audit population, samples can be rejected at the field sampling stage if they are in an unsafe location or in a cutover. When replacing samples they must be from the same stratum and sub-stratum (basal area class). The project manager must be consulted if samples are rejected.

Below is a description of the strata, for reference.

PGTSA Volume Audit Population Strata Definition

| Strata | Leading Species |
|--------|-----------------|
| 1 | Douglas fir |
| 2 | Spruce-Balsam |
| 3 | Pine |
| 4 | Other |

100 Mile VA Sample List

| Samp | Typ | Sub_Strat | UTM Zone | E | N | Map | POLYGON_NU | BA | Stems/ha | Sp | Sp % | Ht | Age |
|------|-----|------------|----------|--------|---------|---------|-----------------|----|----------|-----|------|----|-----|
| 1 | I | DOUG FIR 1 | 10 | 606537 | 5684349 | 092P033 | 092P03337216845 | 5 | 125 | FDI | 50 | 22 | 72 |
| 2 | I | DOUG FIR 1 | 10 | 573959 | 5708688 | 092P051 | 092P05140000378 | 5 | 45 | FDI | 100 | 28 | 202 |
| 3 | I | DOUG FIR 1 | 10 | 560235 | 5678351 | 092O030 | 092O03066982106 | 10 | 550 | FDI | 100 | 18 | 203 |
| 4 | I | DOUG FIR 1 | 10 | 598354 | 5712536 | 092P053 | 092P05382263212 | 10 | 200 | FDI | 100 | 19 | 123 |
| 5 | I | DOUG FIR 1 | 10 | 620569 | 5746717 | 092P084 | 092P08403233896 | 10 | 200 | FDI | 60 | 20 | 73 |
| 6 | I | DOUG FIR 1 | 10 | 611580 | 5682928 | 092P024 | 092P02467536215 | 10 | 300 | FDI | 50 | 19 | 62 |
| 7 | I | DOUG FIR 1 | 10 | 580381 | 5750664 | 092P091 | 092P09167625244 | 5 | 156 | FDI | 100 | 23 | 144 |
| 8 | I | DOUG FIR 1 | 10 | 604325 | 5677239 | 092P023 | 092P02325682555 | 1 | 25 | FDI | 100 | 16 | 83 |
| 9 | I | DOUG FIR 1 | 10 | 632754 | 5686407 | 092P035 | 092P03588868860 | 5 | 75 | FDI | 100 | 26 | 143 |
| 10 | I | DOUG FIR 1 | 10 | 638678 | 5652615 | 092P005 | 092P00533848886 | 5 | 100 | FDI | 90 | 25 | 142 |
| 11 | I | DOUG FIR 1 | 10 | 588089 | 5734408 | 092P072 | 092P07215065752 | 12 | 200 | FD | 85 | 24 | 228 |
| 12 | I | DOUG FIR 2 | 10 | 609772 | 5678202 | 092P023 | 092P02357573313 | 25 | 250 | FDI | 100 | 34 | 253 |
| 13 | I | DOUG FIR 2 | 10 | 578907 | 5709675 | 092P051 | 092P05168420997 | 15 | 225 | FDI | 100 | 20 | 137 |
| 14 | I | DOUG FIR 2 | 10 | 570830 | 5671087 | 092P011 | 092P01129798137 | 15 | 250 | FDI | 100 | 26 | 253 |
| 15 | I | DOUG FIR 2 | 10 | 565418 | 5691739 | 092O040 | 092O04093860156 | 15 | 600 | FDI | 90 | 15 | 102 |
| 16 | I | DOUG FIR 2 | 10 | 556682 | 5693418 | 092O040 | 092O04041341097 | 15 | 150 | FDI | 100 | 27 | 262 |
| 17 | I | DOUG FIR 2 | 10 | 594892 | 5745829 | 092P082 | 092P08251852590 | 15 | 450 | FD | 85 | 20 | 118 |
| 18 | I | DOUG FIR 2 | 10 | 638126 | 5732530 | 092P075 | 092P07510165999 | 20 | 300 | FDI | 90 | 25 | 123 |
| 19 | I | DOUG FIR 2 | 10 | 591973 | 5733939 | 092P072 | 092P07240655358 | 25 | 400 | FD | 65 | 24 | 188 |
| 20 | I | DOUG FIR 2 | 10 | 636028 | 5742938 | 092P085 | 092P08596391826 | 25 | 550 | FDI | 65 | 23 | 93 |
| 21 | I | DOUG FIR 2 | 10 | 627734 | 5725051 | 092P065 | 092P06552791438 | 15 | 400 | FDI | 95 | 15 | 73 |
| 22 | I | DOUG FIR 2 | 10 | 598939 | 5737542 | 092P073 | 092P07379007740 | 20 | 250 | FDI | 100 | 28 | 163 |
| 23 | I | DOUG FIR 2 | 10 | 644118 | 5717247 | 092P056 | 092P05653167473 | 15 | 250 | FDI | 70 | 26 | 183 |
| 24 | I | DOUG FIR 2 | 10 | 600100 | 5697443 | 092P043 | 092P04396534339 | 15 | 450 | FDI | 80 | 22 | 113 |
| 25 | I | DOUG FIR 3 | 10 | 619351 | 5700408 | 092P044 | 092P04409536611 | 30 | 250 | FDI | 100 | 35 | 253 |
| 26 | I | DOUG FIR 3 | 10 | 634513 | 5674017 | 092P025 | 092P02501001600 | 35 | 875 | FDI | 85 | 22 | 73 |
| 27 | I | DOUG FIR 3 | 10 | 586544 | 5650391 | 092I092 | 092I09227716333 | 30 | 450 | FDI | 90 | 26 | 162 |
| 28 | I | DOUG FIR 3 | 10 | 597011 | 5695475 | 092P042 | 092P04279413362 | 35 | 350 | FDI | 75 | 32 | 182 |
| 29 | I | DOUG FIR 3 | 10 | 610099 | 5743166 | 092P083 | 092P08341681402 | 35 | 500 | FDI | 60 | 27 | 143 |

| | | | | | | | | | | | | | |
|----|---|------------|----|--------|---------|---------|-----------------|----|------|-----|-----|----|-----|
| 30 | I | DOUG FIR 3 | 10 | 569333 | 5664247 | 092O020 | 092O02022164222 | 30 | 1200 | FDI | 100 | 16 | 133 |
| 31 | I | DOUG FIR 3 | 10 | 620338 | 5743722 | 092P084 | 092P08403382012 | 30 | 400 | FDI | 85 | 34 | 153 |
| 32 | I | DOUG FIR 3 | 10 | 650276 | 5670521 | 092P016 | 092P01697049737 | 40 | 530 | FDI | 70 | 31 | 202 |
| 33 | I | DOUG FIR 3 | 10 | 598578 | 5669382 | 092P013 | 092P01395907672 | 35 | 725 | FDI | 100 | 24 | 132 |
| 34 | I | DOUG FIR 3 | 10 | 637503 | 5675988 | 092P025 | 092P02521652633 | 30 | 475 | FDI | 70 | 28 | 143 |
| 35 | I | DOUG FIR 3 | 10 | 621562 | 5728147 | 092P064 | 092P06414572907 | 40 | 900 | FDI | 100 | 21 | 93 |
| 36 | I | DOUG FIR 3 | 10 | 623573 | 5765115 | 093A005 | 093A00516374811 | 30 | 500 | FDI | 50 | 25 | 103 |
| 37 | I | SPR&Bal 1 | 10 | 671781 | 5706419 | 092P048 | 092P04813851582 | 15 | 200 | SE | 40 | 25 | 122 |
| 38 | I | SPR&Bal 1 | 10 | 661996 | 5684321 | 092P027 | 092P02762458166 | 15 | 350 | SX | 75 | 23 | 92 |
| 39 | I | SPR&Bal 1 | 10 | 666354 | 5756135 | 092P098 | 092P09872540482 | 10 | 250 | SX | 50 | 22 | 83 |
| 40 | I | SPR&Bal 1 | 10 | 670037 | 5773906 | 093A008 | 093A00886031082 | 10 | 300 | BL | 100 | 18 | 242 |
| 41 | I | SPR&Bal 1 | 10 | 680473 | 5776555 | 093A019 | 093A01947402991 | 5 | 200 | BL | 100 | 16 | 162 |
| 42 | I | SPR&Bal 2 | 10 | 659763 | 5685921 | 092P037 | 092P03748879094 | 20 | 250 | SX | 75 | 32 | 162 |
| 43 | I | SPR&Bal 2 | 10 | 657041 | 5690046 | 092P037 | 092P03733401627 | 20 | 575 | SX | 50 | 21 | 72 |
| 44 | I | SPR&Bal 2 | 10 | 664993 | 5757096 | 092P098 | 092P09861851040 | 20 | 300 | SX | 60 | 28 | 93 |
| 45 | I | SPR&Bal 2 | 10 | 625455 | 5757721 | 092P095 | 092P09530460522 | 25 | 200 | SX | 65 | 32 | 153 |
| 46 | I | SPR&Bal 2 | 10 | 614916 | 5711214 | 092P054 | 092P05479172834 | 25 | 600 | SX | 100 | 22 | 123 |
| 47 | I | SPR&Bal 2 | 10 | 653108 | 5696226 | 092P037 | 092P03708045062 | 25 | 700 | SX | 85 | 22 | 107 |
| 48 | I | SPR&Bal 2 | 10 | 657081 | 5675027 | 092P027 | 092P02735542678 | 30 | 635 | SX | 70 | 24 | 122 |
| 49 | I | SPR&Bal 3 | 10 | 655650 | 5678894 | 092P027 | 092P02727574648 | 45 | 635 | SX | 80 | 30 | 142 |
| 50 | I | SPR&Bal 3 | 10 | 672848 | 5710177 | 092P058 | 092P05819923649 | 35 | 450 | SE | 90 | 28 | 133 |
| 51 | I | SPR&Bal 3 | 10 | 668225 | 5762264 | 092P098 | 092P09879624299 | 50 | 400 | SX | 50 | 34 | 163 |
| 52 | I | SPR&Bal 3 | 10 | 653768 | 5770711 | 093A007 | 093A00792288850 | 35 | 750 | SX | 80 | 22 | 112 |
| 53 | I | SPR&Bal 3 | 10 | 598189 | 5711041 | 092P053 | 092P05381742334 | 35 | 500 | SX | 60 | 26 | 143 |
| 54 | I | SPR&Bal 3 | 10 | 656910 | 5696159 | 092P037 | 092P03730434994 | 45 | 650 | SX | 60 | 31 | 142 |
| 55 | I | PINE 1 | 10 | 586355 | 5694436 | 092P032 | 092P03216032270 | 10 | 350 | PLI | 65 | 16 | 92 |
| 56 | I | PINE 1 | 10 | 597869 | 5692188 | 092P033 | 092P03384371145 | 5 | 200 | PLI | 60 | 17 | 92 |
| 57 | I | PINE 1 | 10 | 617925 | 5676945 | 092P024 | 092P02404432998 | 5 | 400 | PLI | 80 | 13 | 53 |
| 58 | I | PINE 1 | 10 | 637837 | 5665363 | 092P015 | 092P01525326294 | 5 | 250 | PLI | 60 | 16 | 62 |
| 59 | I | PINE 1 | 10 | 625939 | 5661081 | 092P004 | 092P00456673610 | 8 | 1333 | PLI | 100 | 11 | 80 |
| 60 | I | PINE 2 | 10 | 598792 | 5683485 | 092P023 | 092P02393456163 | 15 | 700 | PLI | 95 | 18 | 71 |
| 61 | I | PINE 2 | 10 | 589132 | 5684606 | 092P032 | 092P03234856560 | 20 | 550 | PLI | 75 | 17 | 82 |
| 62 | I | PINE 2 | 10 | 584237 | 5717153 | 092P052 | 092P05298035454 | 20 | 450 | PLI | 40 | 22 | 122 |

| | | | | | | | | | | | | | |
|----|---|------------|----|--------|---------|---------|-----------------|----|------|-----|-----|----|-----|
| 63 | I | PINE 3 | 10 | 632967 | 5663875 | 092P015 | 092P01597185432 | 35 | 1200 | PLI | 60 | 17 | 62 |
| 64 | I | PINE 3 | 10 | 653071 | 5699932 | 092P047 | 092P04706327248 | 25 | 350 | PLI | 50 | 25 | 112 |
| 65 | I | PINE 3 | 10 | 632044 | 5761842 | 092P095 | 092P09567343170 | 25 | 450 | PLI | 50 | 18 | 113 |
| 66 | I | OTHER 1 | 10 | 645543 | 5694956 | 092P036 | 092P03663184107 | 15 | 150 | AT | 75 | 32 | 142 |
| 67 | I | OTHER 2 | 10 | 610784 | 5708290 | 092P053 | 092P05355550985 | 20 | 450 | AT | 85 | 20 | 83 |
| 68 | I | OTHER 2 | 10 | 592834 | 5670761 | 092P012 | 092P01259918513 | 20 | 450 | AT | 80 | 24 | 128 |
| 69 | I | OTHER 3 | 10 | 660503 | 5679982 | 092P027 | 092P02755075473 | 45 | 635 | AT | 60 | 30 | 142 |
| 70 | I | OTHER 3 | 10 | 668501 | 5693346 | 092P038 | 092P03897013683 | 35 | 625 | AT | 65 | 28 | 142 |
| 71 | R | DOUG FIR 1 | 10 | 654611 | 5737318 | 092P077 | 092P07706389260 | 10 | 240 | FDI | 60 | 23 | 73 |
| 72 | R | DOUG FIR 1 | 10 | 613753 | 5689139 | 092P034 | 092P03477929720 | 5 | 250 | FDI | 100 | 16 | 72 |
| 73 | R | DOUG FIR 1 | 10 | 592144 | 5728625 | 092P072 | 092P07242052623 | 5 | 100 | FD | 95 | 18 | 118 |
| 74 | R | DOUG FIR 1 | 10 | 605082 | 5680809 | 092P023 | 092P02329444672 | 5 | 250 | FDI | 70 | 16 | 73 |
| 75 | R | DOUG FIR 1 | 10 | 620243 | 5668136 | 092P014 | 092P01417507402 | 5 | 60 | FDI | 100 | 29 | 162 |
| 76 | R | DOUG FIR 2 | 10 | 648840 | 5740475 | 092P076 | 092P07672301090 | 25 | 400 | FDI | 60 | 28 | 113 |
| 77 | R | DOUG FIR 2 | 10 | 656182 | 5732041 | 092P077 | 092P07716506065 | 15 | 325 | FDI | 100 | 23 | 93 |
| 78 | R | DOUG FIR 2 | 10 | 590465 | 5736108 | 092P072 | 092P07233426890 | 20 | 507 | FD | 80 | 20 | 72 |
| 79 | R | DOUG FIR 2 | 10 | 634168 | 5707269 | 092P055 | 092P05593760994 | 25 | 600 | FDI | 60 | 25 | 143 |
| 80 | R | DOUG FIR 2 | 10 | 598501 | 5718236 | 092P063 | 092P06380536683 | 25 | 750 | FDI | 100 | 26 | 153 |
| 81 | R | DOUG FIR 3 | 10 | 638078 | 5691379 | 092P035 | 092P03520351708 | 45 | 725 | FDI | 90 | 27 | 162 |
| 82 | R | DOUG FIR 3 | 10 | 598877 | 5655558 | 092P003 | 092P00399289529 | 35 | 600 | FDI | 60 | 26 | 152 |
| 83 | R | DOUG FIR 3 | 10 | 653772 | 5750175 | 092P087 | 092P08796486830 | 30 | 800 | FDI | 60 | 18 | 63 |
| 84 | R | DOUG FIR 3 | 10 | 678833 | 5761999 | 092P099 | 092P09940844573 | 35 | 650 | FDI | 50 | 26 | 103 |
| 85 | R | DOUG FIR 3 | 10 | 664130 | 5762544 | 092P097 | 092P09755254305 | 35 | 375 | FDI | 40 | 33 | 243 |
| 86 | R | SPR&Bal 1 | 10 | 657585 | 5770944 | 093A007 | 093A00715078993 | 15 | 600 | BL | 90 | 16 | 162 |
| 87 | R | SPR&Bal 1 | 10 | 596759 | 5675867 | 092P022 | 092P02281421548 | 10 | 400 | SX | 60 | 17 | 73 |
| 88 | R | SPR&Bal 2 | 10 | 654397 | 5764472 | 093A007 | 093A00797385212 | 30 | 750 | SE | 50 | 21 | 112 |
| 89 | R | SPR&Bal 2 | 10 | 639170 | 5766740 | 093A006 | 093A00607736147 | 30 | 650 | BL | 40 | 20 | 142 |
| 90 | R | SPR&Bal 2 | 10 | 654093 | 5703138 | 092P047 | 092P04710889090 | 25 | 400 | SX | 85 | 24 | 92 |
| 91 | R | SPR&Bal 3 | 10 | 642792 | 5691573 | 092P036 | 092P03648771821 | 35 | 495 | SX | 100 | 30 | 142 |
| 92 | R | SPR&Bal 3 | 10 | 647625 | 5767673 | 093A006 | 093A00660886415 | 40 | 425 | SE | 90 | 30 | 201 |
| 93 | R | PINE 1 | 10 | 661657 | 5738111 | 092P077 | 092P07746679813 | 0 | 585 | PLI | 80 | 25 | 111 |
| 94 | R | PINE 1 | 10 | 606459 | 5687155 | 092P033 | 092P03335118449 | 2 | 150 | PLI | 85 | 14 | 72 |
| 95 | R | PINE 2 | 10 | 597597 | 5672127 | 092P012 | 092P01286959316 | 15 | 800 | PLI | 65 | 14 | 88 |

| | | | | | | | | | | | | | |
|-----|---|---------|----|--------|---------|---------|-----------------|----|-----|-----|----|----|-----|
| 96 | R | PINE 2 | 10 | 622842 | 5762142 | 092P094 | 092P09414682943 | 20 | 400 | PLI | 80 | 20 | 53 |
| 97 | R | PINE 3 | 10 | 615936 | 5753028 | 092P094 | 092P09471057347 | 35 | 750 | PLI | 85 | 24 | 133 |
| 98 | R | OTHER 1 | 10 | 620684 | 5678226 | 092P024 | 092P02421453565 | 10 | 425 | AT | 65 | 17 | 53 |
| 99 | R | OTHER 2 | 10 | 664866 | 5704020 | 092P047 | 092P04775649766 | 30 | 400 | AT | 75 | 25 | 102 |
| 100 | R | OTHER 3 | 10 | 656173 | 5718121 | 092P057 | 092P05719177927 | 40 | 450 | AT | 50 | 28 | 123 |

100 Mile Air Call Sample List

| Sample | Mapsheet | POLYGON_NU | AREA | BA | Stems/ha | Lead Spp | Sp% | AGE | Ht |
|--------|----------|-----------------|-------|----|----------|----------|-----|-----|----|
| 101 | 092P096 | 092P09673591521 | 4.91 | 35 | 350 | FDI | 100 | 203 | 34 |
| 102 | 092P084 | 092P08456196175 | 10.16 | 40 | 650 | FDI | 50 | 163 | 30 |
| 103 | 092P075 | 092P07536844838 | 39.22 | 35 | 600 | FDI | 90 | 133 | 27 |
| 104 | 092P065 | 092P06581812201 | 5.45 | 25 | 450 | SX | 50 | 93 | 24 |
| 105 | 092P086 | 092P08679142716 | 7.84 | 10 | 150 | FDI | 70 | 203 | 30 |
| 106 | 092P036 | 092P03697861384 | 56.73 | 50 | 675 | FDI | 75 | 142 | 31 |
| 107 | 092P035 | 092P03591818513 | 11.38 | 40 | 700 | FDI | 95 | 142 | 27 |
| 108 | 092P084 | 092P08446683809 | 3.52 | 1 | 50 | SX | 100 | 73 | 16 |
| 109 | 092P014 | 092P01401170539 | 2.99 | 20 | 725 | AT | 90 | 63 | 18 |
| 110 | 092P045 | 092P04587984988 | 24.17 | 15 | 500 | FDI | 60 | 72 | 18 |
| 111 | 092P003 | 092P00333773445 | 13.80 | 10 | 150 | FDI | 100 | 122 | 16 |
| 112 | 093A019 | 093A01944823478 | 8.74 | 20 | 500 | BL | 95 | 222 | 21 |
| 113 | 092P017 | 092P01733100354 | 4.85 | 40 | 600 | AT | 55 | 142 | 29 |
| 114 | 092P082 | 092P08218360422 | 44.27 | 5 | 100 | FD | 100 | 248 | 26 |
| 115 | 092P005 | 092P00586462058 | 34.04 | 45 | 450 | SX | 100 | 141 | 30 |
| 116 | 092P044 | 092P04401358786 | 11.72 | 30 | 750 | FDI | 60 | 83 | 23 |
| 117 | 092P051 | 092P05124923491 | 34.38 | 2 | 1200 | PLI | 70 | 32 | 4 |
| 118 | 092P063 | 092P06332507126 | 2.87 | 1 | 150 | SX | 100 | 53 | 9 |
| 119 | 092P051 | 092P05175534164 | 41.40 | 10 | 350 | FDI | 85 | 82 | 15 |
| 120 | 092P002 | 092P00225176529 | 3.17 | 10 | 1000 | FDI | 100 | 32 | 7 |
| 121 | 092P006 | 092P00666258905 | 7.17 | 20 | 350 | FDI | 100 | 122 | 17 |
| 122 | 092P057 | 092P05779486977 | 5.53 | 25 | 450 | SX | 60 | 102 | 25 |
| 123 | 092P033 | 092P03397883067 | 2.35 | 25 | 300 | SX | 60 | 142 | 26 |
| 124 | 092P083 | 092P08303305823 | 9.94 | 5 | 2000 | FDI | 60 | 48 | 8 |

| | | | | | | | | | |
|-----|---------|-----------------|--------|----|------|-----|-----|-----|----|
| 125 | 092P021 | 092P02132160099 | 6.67 | 20 | 850 | FDI | 90 | 83 | 16 |
| 126 | 092P077 | 092P07735135919 | 16.49 | 10 | 200 | AT | 60 | 93 | 25 |
| 127 | 092P062 | 092P06233510465 | 21.09 | 15 | 400 | PL | 65 | 128 | 20 |
| 128 | 092P072 | 092P07247513070 | 15.01 | 27 | 400 | FD | 75 | 158 | 25 |
| 129 | 093A006 | 093A00699646428 | 9.32 | 30 | 450 | SE | 80 | 131 | 28 |
| 130 | 092P032 | 092P03221452559 | 1.92 | 10 | 550 | FDI | 90 | 72 | 15 |
| 131 | 092P085 | 092P08579342760 | 0.63 | 15 | 175 | AT | 70 | 93 | 26 |
| 132 | 092P022 | 092P02254762246 | 7.62 | 25 | 550 | AT | 85 | 113 | 25 |
| 133 | 092P076 | 092P07612227071 | 8.89 | 45 | 440 | FDI | 50 | 203 | 36 |
| 134 | 092P016 | 092P01609920292 | 16.02 | 3 | 225 | PLI | 85 | 52 | 13 |
| 135 | 092P062 | 092P06215032285 | 0.06 | 10 | 1250 | PL | 95 | 33 | 10 |
| 136 | 092P084 | 092P08493780673 | 1.05 | 10 | 400 | FDI | 60 | 53 | 14 |
| 137 | 092P061 | 092P06123548884 | 3.17 | 12 | 300 | FD | 95 | 118 | 20 |
| 138 | 092P052 | 092P05231860269 | 13.34 | 20 | 450 | SX | 85 | 132 | 26 |
| 139 | 092P013 | 092P01330904287 | 11.20 | 45 | 725 | FDI | 85 | 142 | 29 |
| 140 | 092P055 | 092P05505713903 | 38.85 | 15 | 528 | AT | 80 | 74 | 17 |
| 141 | 092P051 | 092P05114883621 | 21.22 | 20 | 175 | FDI | 80 | 182 | 28 |
| 142 | 092P061 | 092P06187846641 | 8.00 | 15 | 650 | PL | 45 | 73 | 17 |
| 143 | 092P014 | 092P01499838970 | 140.34 | 20 | 700 | FDI | 80 | 81 | 22 |
| 144 | 093A006 | 093A00656646048 | 5.94 | 10 | 900 | BL | 60 | 42 | 12 |
| 145 | 092P013 | 092P01310718892 | 398.08 | 10 | 100 | FDI | 100 | 143 | 23 |
| 146 | 092P052 | 092P05219912742 | 40.82 | 30 | 600 | PLI | 70 | 92 | 20 |
| 147 | 092P064 | 092P06452492387 | 8.92 | 35 | 500 | AT | 50 | 103 | 28 |
| 148 | 092P012 | 092P01256265833 | 5.35 | 15 | 250 | FDI | 75 | 242 | 27 |
| 149 | 092P073 | 092P07379714530 | 4.02 | 15 | 500 | FDI | 60 | 53 | 15 |
| 150 | 093A006 | 093A00606750433 | 8.13 | 12 | 200 | BL | 60 | 162 | 18 |
| 151 | 092P041 | 092P04129803052 | 51.24 | 30 | 675 | FDI | 95 | 122 | 21 |
| 152 | 092P066 | 092P06658383356 | 10.00 | 15 | 400 | FDI | 90 | 103 | 19 |
| 153 | 092P065 | 092P06579398557 | 16.28 | 30 | 450 | FDI | 80 | 163 | 28 |
| 154 | 092P002 | 092P00268338751 | 8.84 | 35 | 400 | FDI | 60 | 202 | 30 |
| 155 | 092P052 | 092P05228543582 | 3.23 | 25 | 325 | SX | 80 | 162 | 28 |
| 156 | 092P045 | 092P04500677338 | 3.85 | 40 | 400 | FDI | 80 | 162 | 35 |
| 157 | 092P056 | 092P05692368199 | 2.55 | 25 | 1000 | SX | 85 | 83 | 15 |

| | | | | | | | | | |
|-----|---------|-----------------|-------|----|------|-----|-----|-----|----|
| 158 | 092P063 | 092P06334698016 | 10.82 | 10 | 1000 | FDI | 75 | 33 | 11 |
| 159 | 092P046 | 092P04636330788 | 3.12 | 35 | 450 | FDI | 60 | 123 | 26 |
| 160 | 093A005 | 093A00521577108 | 4.22 | 5 | 100 | SX | 80 | 112 | 28 |
| 161 | 092P057 | 092P05756785550 | 10.60 | 20 | 350 | SX | 40 | 122 | 25 |
| 162 | 092P035 | 092P03581512305 | 6.93 | 35 | 700 | SX | 50 | 127 | 24 |
| 163 | 092O050 | 092O05010235409 | 8.49 | 20 | 225 | FDI | 100 | 202 | 20 |
| 164 | 092P086 | 092P08669633492 | 13.85 | 25 | 800 | EP | 60 | 53 | 14 |
| 165 | 093A019 | 093A01955814950 | 3.34 | 10 | 400 | BL | 100 | 122 | 18 |
| 166 | 092P044 | 092P04486427777 | 0.79 | 5 | 550 | PLI | 100 | 43 | 12 |
| 167 | 092P005 | 092P00589422798 | 9.24 | 4 | 342 | PLI | 100 | 139 | 14 |
| 168 | 092P023 | 092P02336080818 | 0.01 | 10 | 400 | FDI | 70 | 93 | 18 |
| 169 | 093A008 | 093A00826781498 | 11.08 | 5 | 100 | BL | 100 | 152 | 16 |
| 170 | 092P075 | 092P07580288786 | 14.71 | 20 | 600 | FDI | 60 | 53 | 23 |
| 171 | 092P031 | 092P03154127894 | 3.39 | 10 | 800 | PLI | 40 | 42 | 8 |
| 172 | 092P051 | 092P05152462142 | 8.18 | 30 | 600 | PLI | 85 | 122 | 20 |
| 173 | 092P022 | 092P02229150823 | 10.23 | 25 | 500 | FDI | 55 | 253 | 25 |
| 174 | 092P035 | 092P03513538946 | 2.60 | 10 | 300 | FDI | 60 | 87 | 21 |
| 175 | 092P028 | 092P02898067757 | 36.49 | 40 | 800 | AT | 75 | 112 | 24 |
| 176 | 092P012 | 092P01290326554 | 4.05 | 20 | 125 | FDI | 100 | 302 | 32 |
| 177 | 093A008 | 093A00815490831 | 9.34 | 15 | 250 | SE | 60 | 202 | 28 |
| 178 | 093A019 | 093A01948594818 | 58.62 | 15 | 350 | BL | 90 | 162 | 22 |
| 179 | 092P041 | 092P04158823525 | 15.15 | 35 | 400 | FDI | 85 | 112 | 26 |
| 180 | 092P015 | 092P01570737396 | 8.62 | 10 | 325 | FDI | 100 | 72 | 21 |
| 181 | 092P035 | 092P03590060132 | 9.45 | 35 | 900 | FDI | 100 | 122 | 19 |
| 182 | 092P034 | 092P03401821157 | 4.11 | 20 | 350 | SX | 60 | 152 | 26 |
| 183 | 092P065 | 092P06579447992 | 29.13 | 20 | 400 | PLI | 40 | 113 | 25 |
| 184 | 092P085 | 092P08538442565 | 64.15 | 25 | 650 | FDI | 60 | 73 | 20 |
| 185 | 092P012 | 092P01283528109 | 71.43 | 10 | 75 | FDI | 100 | 338 | 28 |
| 186 | 093A006 | 093A00632309552 | 33.29 | 5 | 200 | BL | 90 | 202 | 12 |
| 187 | 092P066 | 092P06652813751 | 73.81 | 30 | 400 | FDI | 80 | 183 | 30 |
| 188 | 092P052 | 092P05244709471 | 5.70 | 8 | 400 | SX | 90 | 62 | 12 |
| 189 | 093A005 | 093A00517314008 | 22.39 | 30 | 500 | FDI | 40 | 103 | 25 |
| 190 | 092P057 | 092P05775884379 | 9.98 | 45 | 450 | SX | 80 | 132 | 32 |

| | | | | | | | | | |
|-----|---------|-----------------|-------|----|-----|-----|-----|-----|----|
| 191 | 092P092 | 092P09293816965 | 1.85 | 16 | 800 | FD | 80 | 33 | 11 |
| 192 | 092I091 | 092I09101874078 | 4.31 | 20 | 700 | PLI | 40 | 102 | 15 |
| 193 | 092P083 | 092P08324640643 | 3.63 | 5 | 150 | FDI | 100 | 123 | 22 |
| 194 | 092P051 | 092P05116111203 | 9.15 | 25 | 750 | FDI | 80 | 92 | 18 |
| 195 | 092P026 | 092P02638796467 | 53.82 | 3 | 35 | FDI | 100 | 237 | 32 |
| 196 | 092P023 | 092P02338905479 | 2.89 | 10 | 500 | FDI | 100 | 83 | 16 |
| 197 | 092P056 | 092P05678668110 | 4.11 | 25 | 600 | SX | 55 | 83 | 23 |
| 198 | 092P085 | 092P08554463316 | 13.91 | 20 | 300 | SX | 50 | 73 | 26 |
| 199 | 092P045 | 092P04519724804 | 1.47 | 25 | 200 | FDI | 80 | 92 | 25 |
| 200 | 093A006 | 093A00600230122 | 37.87 | 5 | 200 | BL | 70 | 122 | 15 |

Appendix B

Comparison of the Sample Characteristics to the Population

The following tables show how the sample distribution compares to the population distribution for age class, height class, leading species, and (for Volume Audit only) strata. Sample and populations compare quite closely.

Table 1: Volume Audit Age Class Comparison

| Age Class | Area | % | Samples | % |
|--------------|----------------|-------------|-----------|-------------|
| 3 | 28,267 | 4% | 1 | 1% |
| 4 | 86,364 | 12% | 10 | 14% |
| 5 | 122,662 | 17% | 10 | 14% |
| 6 | 113,602 | 16% | 8 | 11% |
| 7 | 123,286 | 17% | 11 | 16% |
| 8 | 215,736 | 30% | 26 | 37% |
| 9 | 26,632 | 4% | 4 | 6% |
| Total | 716,549 | 100% | 70 | 100% |

Table 2: Volume Audit Height Class Comparison

| Height Class | Population Area | Population % | Samples | Sample % |
|--------------|-----------------|--------------|-----------|-------------|
| 1 | 1346 | 3% | | 0% |
| 2 | 15947 | 31% | 18 | 26% |
| 3 | 26860 | 53% | 40 | 57% |
| 4 | 6660 | 13% | 12 | 17% |
| 5 | 139 | 0% | | 0% |
| 8 | 1 | 0% | | 0% |
| Total | 50953 | 100% | 70 | 100% |

Table 3: Volume Audit Species Comparison

| Species | Area | % | Samples | % |
|---------|--------|-------|---------|-----|
| FD | 370211 | 51.7% | 36 | 51% |
| SX | 151091 | 21.1% | 16 | 23% |
| PL | 111965 | 15.6% | 11 | 16% |
| AT | 49850 | 7.0% | 5 | 7% |

| | | | | |
|--------------|---------------|---------------|-----------|-------------|
| BL | 29106 | 4.1% | 2 | 3% |
| CW | 3058 | 0.4% | | 0% |
| EP | 1039 | 0.1% | | 0% |
| PY | 146 | 0.0% | | 0% |
| PA | 67 | 0.0% | | 0% |
| BA | 16 | 0.0% | | 0% |
| Total | 716549 | 100.0% | 70 | 100% |

Table 4: Volume Audit Strata Comparison

| Stratum | Population Area | % of Area | No of Samples | % of Samples |
|--------------|-----------------|-------------|---------------|--------------|
| FD | 370,211 | 52% | 36 | 51% |
| Sp & Balsam | 180,213 | 25% | 18 | 26% |
| Pine | 112,178 | 16% | 11 | 16% |
| Other | 53,947 | 7% | 5 | 7% |
| Total | 716,549 | 100% | 70 | 100% |

Table 5: Air Call Age Class Comparison

| Age Class | Population Area | % | Samples | % |
|--------------|-----------------|-------------|------------|-------------|
| 2 | 33,530 | 4% | 5 | 5% |
| 3 | 48,781 | 6% | 10 | 10% |
| 4 | 86,364 | 11% | 10 | 10% |
| 5 | 122,662 | 16% | 15 | 15% |
| 6 | 113,602 | 15% | 11 | 11% |
| 7 | 123,286 | 16% | 17 | 17% |
| 8 | 215,736 | 28% | 29 | 29% |
| 9 | 26,632 | 3% | 3 | 3% |
| Total | 770,593 | 100% | 100 | 100% |

Table 6: Air Call Height Class Comparison

| Ht Class | Population Area | % | Samples | % |
|--------------|-----------------|-------------|------------|-------------|
| 1 | 47,280 | 6% | 6 | 6% |
| 2 | 224,685 | 29% | 32 | 32% |
| 3 | 381,690 | 50% | 48 | 48% |
| 4 | 114,596 | 15% | 14 | 14% |
| 5 | 2,342 | 0% | | 0% |
| 8 | 1 | 0% | | 0% |
| Total | 770,593 | 100% | 100 | 100% |

Table 7: Air Call Species Comparison

| Species | Population Area | % | Samples | % |
|----------------|------------------------|-------------|----------------|-------------|
| FD | 388,794 | 50% | 52 | 52% |
| SX | 157,822 | 20% | 19 | 19% |
| PA | 136,703 | 18% | 12 | 12% |
| AT | 52,498 | 7% | 8 | 8% |
| B | 30,217 | 4% | 8 | 8% |
| CW | 3,151 | 0% | | 0% |
| EP | 1,408 | 0% | 1 | 1% |
| Total | 770,593 | 100% | 100 | 100% |

Appendix C

Sample Selection Process and Methodology for 100 Mile House TSA

Sampling Process and Methodology for 100 Mile House TSA

1) Data assembly Process

All the shapefile data was obtained from Chris Mulvihill, the project coordinator with Ministry of Forests, Lands & Natural Resource Operations ('the Ministry'). This included VRI data in the VRIMS format clipped to the outside TSA boundary. Matt Makar provided an Access Query database to extract Rank 1 Layer data from the VRIMS data.

Exclusions:

The following process was undertaken to net down the land base.

- Created Shapefiles for all the removals. Selected for Private (code 40), Parks (codes 51, 63, and 67), IR (code 52). Called this Landbase_exclusions.
- Dissolved the above file to make the erase from the land base more efficient and called it Landbase_Exclusions_Dissolved.
- Erased the Netdown_dissolve shape from the TSA Boundary file. Created a new shapefile called TSA_Net.
- Clipped the VRI Shapefile to TSA_Net. Call this VRI_net_prelim.
- Conducted a "Repair Geometry" on the file.
- Added a new field for each called New_Area and calculated the field.
- Eliminated polygons less than .01ha and created a new file (called this VRI_Poly_Net).

The table below is a summary of the area of the TSA.

Table 1: 100 Mile TSA Land base Summary

| Land Classification | Area (ha) | % of Proj Area |
|----------------------------|------------------|-----------------------|
| Total TSA Area | 1,235,978 | 100 |
| Net-downs | 175,113 | 14.17% |
| Parks | 53,264 | 4.31% |
| Private | 116,451 | 9.42% |
| Federal | 5,398 | 0.44% |
| Net Area | 1,060,865 | 85.83% |
| Non Vegetated | 53,363.00 | 4.32% |
| Vegetated | 1,007,502.00 | 81.51% |
| Non-Treed | 129,363.00 | 10.47% |
| Treed | 878,139.00 | 71.05% |

- Extracted Rank 1 Layer data from the VRIMS using Matt Makar’s Access Query. Exported this new file to Excel (provided more reliable results when joining to the shape than the Access format).
- Created a new shapefile class of the VRI data by joining the Excel tables to the VRI_Poly_Net file exporting the data (called this 100 Mile_VRI_Net)
- Created a new field called Proj_Ht and calculated.
- Created new fields for height class and Age Class and calculated.

2) Creation of Population Shapefiles

- From 100 Mile_VRI_net selected for VT and Projec_age≥51 and create a new file (call it 100 Mile_VA). The total area of the volume audit population is 716,549 ha or 82% of the VT.
- Selected for VT>30 and called this Air_Call_Pop. The total area of the air call population is 770,593 ha or 88% of the VT.

3) Sample Selection for the Volume Audit Population

3.1 Stratification

In order to make decisions about stratification, a summary by leading species was run. This provided the leading species distribution shown below.

Table 2: Species Distribution for Volume Audit

| Species | Area | % |
|----------------|---------------|---------------|
| FD | 370211 | 51.7% |
| SX | 151091 | 21.1% |
| PL | 111965 | 15.6% |
| AT | 49850 | 7.0% |
| BL | 29106 | 4.1% |
| CW | 3058 | 0.4% |
| EP | 1039 | 0.1% |
| PY | 146 | 0.0% |
| PA | 67 | 0.0% |
| BA | 16 | 0.0% |
| Total | 716549 | 100.0% |

Table 3: Age Class Summary for Volume Audit

| Age Class | Area | % |
|--------------|----------------|-------------|
| 3 | 28,267 | 4% |
| 4 | 86,364 | 12% |
| 5 | 122,662 | 17% |
| 6 | 113,602 | 16% |
| 7 | 123,286 | 17% |
| 8 | 215,736 | 30% |
| 9 | 26,632 | 4% |
| Total | 716,549 | 100% |

Based on this information, the Ministry staff identified the following strata for the 100 Mile TSA VA ground sampling project.

Table 4: Volume Audit population Strata Definition

| Strata | Leading Species |
|--------|-----------------|
| 1 | Douglas Fir |
| 2 | Spruce & Balsam |
| 3 | Pine |
| 4 | Other |

Shapefiles were created for each stratum.

The number of samples for the Volume Audit population was specified by the Ministry in the Contract Schedule A document. They specified that there would be 70 initial samples and 30 replacements in the Volume Audit population.

Table 5: Distribution of Ground Samples - Volume Audit Population

| Stratum | Population Area | % of Area | No of Samples | # of Hectares Represented by each plot | Replacement Samples |
|--------------|-----------------|---------------|---------------|--|---------------------|
| FD | 370,211 | 51.7% | 36 | 10,284 | 15 |
| Sp & Balsam | 180,213 | 25.2% | 18 | 10,012 | 7 |
| Pine | 112,178 | 15.7% | 11 | 10,198 | 5 |
| Other | 53,947 | 7.5% | 5 | 10,789 | 3 |
| Total | 716,549 | 100.0% | 70 | 10,236 | 30 |

3.2) Sub-stratification

For the Volume Audit population sub-stratification was carried out the same way for all 4 strata. The process is described below.

- Exported the attribute table from each of the stratum shapefiles

- In these new worksheets, sorted data by BA
- Determined the number of polygons in each stratum
- Divided total number of polygons by 3 to determine the number of polygons (approx) that should be in each sub-stratum.
- Used the “number of polygons per sub-strata” figure determined above in the table sorted by BA to find the BA figure that would be used to divide the sub-strata.

The table below shows the criteria defining the sub-strata.

Table 6: Criteria for Sub-stratification of Volume Audit Population

| Strata | # of Polygons | Div by 3 | Sub Strat | Target Polygon Range | BA | Actual no of Polygons |
|----------|---------------|----------|-----------|----------------------|-------|-----------------------|
| FD | 21787 | 7263 | 1 | 0-7263 | 0-14 | 6967 |
| | | | 2 | 7264-14526 | 15-25 | 7984 |
| | | | 3 | 1452+ | 26+ | 6837 |
| Sp & Bal | 15112 | 5037 | 1 | 0-5037 | 0-15 | 5487 |
| | | | 2 | 5038-10074 | 16-30 | 5650 |
| | | | 3 | 10075+ | 31+ | 3975 |
| Pine | 8276 | 2759 | 1 | 0-2759 | 0-10 | 3683 |
| | | | 2 | 2760-5518 | 11-20 | 2476 |
| | | | 3 | 5519+ | 21+ | 2117 |
| Other | 5779 | 1926 | 1 | 0-1926 | 0-15 | 1987 |
| | | | 2 | 1927-3852 | 16-30 | 2289 |
| | | | 3 | 3853+ | 31+ | 1503 |

Sample distribution in the Volume Audit population was based on area representation of the sub-strata. The table below shows this distribution.

Table 7: Distribution of Samples in VA Sub-strata

| Strata | Sub-strata | Area | % | Samples | Replacements |
|-----------------|------------|---------|------|---------|--------------|
| Douglas Fir | 1 | 111,329 | 30% | 11 | 5 |
| | 2 | 130,773 | 35% | 13 | 5 |
| | 3 | 128,108 | 35% | 12 | 5 |
| Total | | 370,210 | 100% | 36 | 15 |
| Spruce & Balsam | 1 | 51,682 | 29% | 5 | 2 |
| | 2 | 69,876 | 39% | 7 | 3 |

| | | | | | |
|-------------|---|---------|------|----|----|
| | 3 | 58,654 | 33% | 6 | 2 |
| Total | | 180,212 | 100% | 18 | 7 |
| Pine | 1 | 47,159 | 42% | 5 | 2 |
| | 2 | 35,831 | 32% | 3 | 2 |
| | 3 | 29,189 | 26% | 3 | 1 |
| Total | | 112,179 | 100% | 11 | 5 |
| Other | 1 | 14,089 | 26% | 1 | 1 |
| | 2 | 20,096 | 37% | 2 | 1 |
| | 3 | 19,762 | 37% | 2 | 1 |
| Total | | 53,947 | 100% | 5 | 3 |
| Grand Total | | 716,548 | | 70 | 30 |

3.3 Sample Polygon Selection

Volume audit samples were chosen using the probability proportional to size with replacement technique (PPSWR).

- An Excel random number spreadsheet was obtained from the Ministry that creates random numbers from a “seed”. Random numbers between 0 and the total area of each sub-stratum were produced for samples and replacement samples in each of the sub-stratum. As well, one extra random number per stratum was produced for a contingency sample in the event that a sample was eliminated during the sample location stage.
- Accumulated area tables were produced for each of the sub-stratum. This was done by selecting for the sub-strata criteria in the strata shapefiles and exporting the table.
- Two new columns were added to the accumulated area table for recording the samples that were chosen (I for initial, R for replacement and C for contingency) and sample number. The accumulated volume table was then sorted by I/R and then by sample number. All other rows were deleted (saved as Samp list full – sub-stratum). Another table was created from this with just mapsheet, polygon, selection, and area columns (called Samp list part-sub-strat). Using the random numbers generated for each sub-stratum, polygons were selected. A polygon was selected from the accumulated area table if the random number was larger than the accumulated area of the polygon immediately preceding it and less than or equal to its accumulated area.
- Initial Sample Polygons were selected first followed by replacement sample polygons then by contingency samples.

Initial sample numbers were numbered 1 to 70 and alternate samples were numbered 71-100.

3.4 Location of Samples within Polygons

For each population, samples were located within selected polygons using an Arcmap 10.1 GIS program as follows:

- A new shapefile was created for samples with the following fields:

| FID_1 | Sample_no | Strata | Sub-strat | X | Y |
|-------|-----------|--------|-----------|---|---|
| | | | | | |

*FID_1 is to link with the Objectid field in the immature VRI shapefile for joining these two files later on.

- The population, 100m grid (obtained from the Ministry), and Landsat shapefiles were displayed on an Arcview map.
- Sample polygons were displayed using the selection tool in the population attribute table.
- For each polygon to be sampled, random numbers were generated (with a range between 1 and the total number of dots in the polygon) for each selected polygon using “=Randbetween(1,X)” function in an Excel spreadsheet. The random numbers were recorded in a new column in this spreadsheet.
- The sample was located at the location of the randomly selected dot.
- The location was then checked against the Landsat image to see if any samples fell in a recent cutover. No samples fell in recent cutover.
- After sample location was complete for a population, UTM coordinates were calculated then the sample shapefile was joined to the population VRI shapefile so that all veg information would be included in the sample file.

4) Air Call Samples

Selected sample polygons as described in **Sample Polygon Selection** above. The sample numbers will be 101-200.