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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April 21, 2014

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 base[2]

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%

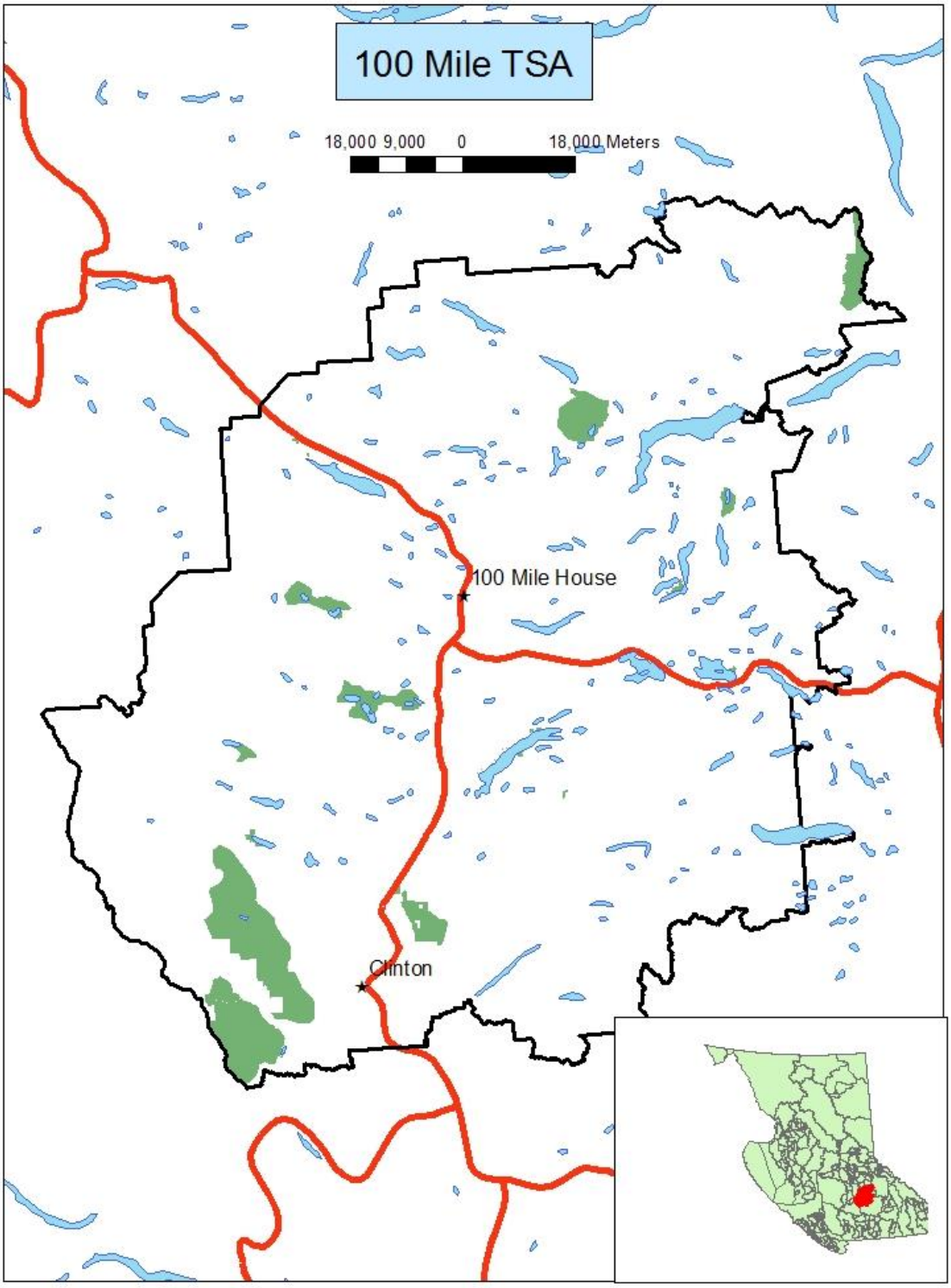
The 100 Mile House TSA has varied topography. It consists primarily of undulating plateau with the Fraser River valley forming much of the western boundary and includes the lowest elevations in the TSA. The southwestern part includes areas of higher relief, the largely calcareous Marble and Pavilion 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 <u>not</u> 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

1. British Columbia Ministry of Forests, Lands & Natural Resource Operations, Timber Supply Branch. 100 Mile House TSA - Rationale for Allowable Annual Cut (AAC) Determination – Diane Nicholls, Deputy Chief Forester. November 7, 2013. Victoria, B.C.

2. BC Ministry of Forests, Lands and Natural Resource Operations website for VRI - www.for.gov.bc.ca/hts/VRI/

3. Ministry of Forests, Lands and Natural Resource Operations. A Framework for Implementing Young Stand Growth Monitoring in British Columbia. 2012.

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.