

Revelstoke Timber Supply Area – TSA 27

Vegetation Resources Inventory Strategic Inventory Plan

Nona Phillips Forestry Consulting
November 28, 2007

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Acknowledgements

This planning process was initiated by Dieter Offermann of Downie Street Sawmills Ltd. It has been supported by both industry and government Stakeholders including:

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Executive Summary

The Ministry of Forests & Range (MFR) is soon to launch the process for Timber Supply Review 4 (TSR4) in the Revelstoke Timber Supply Area (TSA). In the current 'Rationale for Allowable Annual Cut (AAC) Determination' the Chief Forester listed a series of recommended tasks to be undertaken prior to the development of a subsequent data package. Through the Vegetation Resources Inventory (VRI) Strategic Inventory Planning (VSIP) process, the Stakeholder group in this TSA is investigating inventory options to provide new and pertinent information, both for TSR and operational planning purposes. This document provides a record of the decision-making process that has been completed.

The initial step in the preparation of a Strategic Inventory Plan for the Revelstoke TSA was to bring together the identified Stakeholders in this management unit at a meeting in Revelstoke on October 16, 2007. This meeting's agenda was designed to:

1. provide a background on the Vegetation Resources Inventory process
2. discuss client data needs in the TSA identified by previous planning processes and brought forward by the Stakeholders
3. investigate support that can be provided through the Vegetation Resources Inventory

Prior to this meeting, the Stakeholders were sent an 'issues paper', outlining the main features of a Strategic Inventory Plan, to provide some background to the discussions that would occur on October 16.

The meeting started with a 'primer' of the current Vegetation Resource Inventory process in British Columbia, presented by Ministry of Forests & Range inventory staff. This foundation allowed us to narrow the focus from the inventory's broad goals to localize its application.

The licensees commented that they have greater concerns about short-term timber supply related issues than mid to long term. They have a strong interest in obtaining improved information to reduce uncertainties in the areas of:

1. Inventory volume for all species in unmanaged stands.
2. Merchantability.
3. Site productivity.

This Strategic Plan for the Revelstoke TSA includes decision-making on the following:

1. Undertaking a Vegetation Resources Inventory investment is appropriate for the TSA.
2. The Stakeholder group's consensus was that the current VRI mapping is acceptable and a Phase 1 photo interpretation project is not recommended for this TSA at this time.

3. The VRI components to be undertaken will include Phase 2 ground sampling with Net Volume Adjustment Factor (NVAF) destructive sampling.
4. The Phase 2 ground sampling will follow the Timber-emphasis (TE) Protocol. Although there is local interest in ecological data, the random sampling approach and the VRI Ecology sampling objectives do not well support the Biogeoclimatic (BEC) localization project that is planned in 2008. A closer analysis of the coarse woody debris data that is randomly collected at each sample needs to be made before the project commits to collecting it.
5. The target population for sampling. Samples will be selected from the Vegetated Treed (VT) landbase. The operable component of this landbase greater than 30 years will be pre-stratified and 100 samples will be chosen from this component of the landbase. An additional 25 samples will be selected from the inoperable component of the Vegetated Treed Land Base. Exclusions from the landbase will include private land, parks and protected areas.
6. Sampling strata for ground sampling work have been suggested in this plan, but can be reassessed during the development of the Project implementation Plan (VPIP).
7. An enhanced number of trees will be included in the Net Volume Adjustment Factor destructive sampling project, to address interest in Hemlock and Cedar.
8. The licensees will work with the MFR Inventory Branch staff to obtain written support for a variance to the Standard NVAF ground sampling for the collection of additional data related to merchantability at the Project Implementation planning stage.
9. Monitoring has been recognized as part of the VRI process. Since many of its objectives serve to support issues in the medium to long term, a decision regarding initiating a monitoring program will be deferred.
10. This project is on a tight timeline to have data available to the Chief Forester to consider prior to his final decision-making regarding TSR4. Good Project Management will be important so that the Analysis & Adjustment of the current Photo Interpreted Inventory that follows the Phase 2 field work occurs as soon as possible after all of the field data is collected.

The follow up requirement in the VRI planning process, a VRI Project Implementation Plan for Ground Sampling and NVAF, should follow the VSIP's approval and sign-off. The VPIP will provide details and final decisions regarding the undertaking of the Revelstoke TSA VRI project including a GIS exercise identifying the sampling population, strata for the ground sampling and the NVAF, the sample lists (polygons and UTM locations of plot 'cluster' for each sample), roles and responsibilities, implementation steps and fine-tuning of project costs.

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1. Introduction

1.1 Background

The Vegetation Resources Inventory (VRI) in the province of British Columbia is a 'broad' inventory designed to support, among other things, the Timber Supply Review (TSR) process. The constraints on the forest in the Revelstoke Timber Supply Area (TSA) are identified in the current Timber Supply Review. There is uncertainty concerning several issues affecting the short-term timber supply of the TSA. One in particular, the Chief Forester's reference to undertaking a Phase II vegetation inventory prior to the next determination to address volume estimates in existing stands,¹ is a key element that has caused the MFR to encourage local Stakeholders to initiate this investigation of a vegetation resources inventory project.

Undertaking a Vegetation Resources Inventory project requires starting with a formalized planning component. Often supported by a contracted VRI specialist, this VRI Strategic Inventory Planning (VSIP) process requires local Stakeholders' involvement in making decisions on project direction and indirectly leading it. While the process does follow a kind of 'template', it should be unique and relevant to the management unit and its clients.

The Vegetation Resources Inventory Strategic Inventory Plan builds the Business Case for a VRI project as it details the existing inventory and identifies forest management issues in a management unit and evaluates the effectiveness of the 'phases' of the VRI to address these issues. During the strategic planning phase, the potential of various components of the inventory may be recognized and selected to provide data to support specific information gaps and management decisions. The VSIP provides direction for the next step in the VRI planning process, the development of the more detailed and operational Project Implementation Plan (VIP).

Nona Phillips Forestry Consulting has prepared this plan in consultation with the Revelstoke TSA Stakeholders. Included in the Stakeholders' group are the following:

- Downie Street Sawmills Ltd., Revelstoke
- Bell Pole Canada Inc., Revelstoke
- Joe Kozek Sawmills Ltd., Revelstoke
- BC Timber Sales, Okanagan-Columbia Business Area
- Ministry of Forests and Range (MFR)
 - – Forest Analysis & Inventory Branch
 - – Southern Interior Forest Region
 - – Columbia Forest District

This VSIP is the product of an initial 'Issues paper' provided prior to the Stakeholders' Meeting, input received during the Stakeholders meeting held in Revelstoke on October

¹ Page 64, Revelstoke Timber Supply Area Rationale for Allowable Annual Cut (AAC) Determination, effective September 1, 2005, Jim Snetsinger Chief Forester

16, 2007, subsequent comments from the Stakeholders initiated by the meeting and edits to 'draft' editions of this plan.

1.2 Vegetation Resources Inventory Overview

In 1991, the Forest Resources Commission recommended “that the Government of British Columbia undertake a commitment to complete inventories for all renewable forest resource values using standardized compatible systems”.

The Vegetation Resources Inventory is one of a number of inventories that were developed in the 1990's in the province. The VRI has been the 'standard' for forest cover (FC) inventory in British Columbia since 1996. The Resources Information Standards Committee (RISC) has evolved as the group who oversees the requisite protocols required to complete an inventory program.

As stated on the Ministry of Forest and Range's website for the Vegetation Resources Inventory², the VRI was designed to answer two questions:

1. Where is the resource located?
2. How much of a given vegetation resource is within an inventory unit?

Among the strengths of the VRI are its statistically accurate procedures, its re-introduction of a ground sampling phase to adjust the photo interpreted population and its multi-option approach to address inventory related questions in a specific management unit.

Critical to deciding the direction for a VRI project, this planning process recognizes that it is important for Stakeholders to have some understanding of this inventory, through an overview. The Vegetation Resources Inventory has several components that may be undertaken in combination or in some cases individually, including:

1. Phase 1 or Photo Interpretation

The Photo Interpretation phase involves estimating vegetation polygon characteristics from aerial photographs.

The key steps involve:

- Delineating the vegetated and non-vegetated land base into polygons based on similar vegetation characteristics
- Field calibration for the photo interpreters
- Attribute estimation, incorporating historical data, field calibration data and the skills of the photo interpreters
- Digital capture of attribute and graphic information to produce VRI maps

² <http://www.for.gov.bc.ca/hts/vri/index.html>

2. Phase 2 or Ground Sampling activities

The ground sampling phase provides the information necessary to determine how much of a given attribute is within the inventory area.

There are two parts to this phase.

- i) Establishment of 'cluster' samples randomly across the project area. The data collected at the cluster samples may include the measurement of timber and/or ecology attributes. Net close utilization volume is obtained by call grading and net factoring trees, and breakage loss factors.
- ii) Destructive sampling following the protocols established in the Net Volume Adjustment Factor (NVAF) process is used to correct for errors in the estimation of net tree volume. The NVAF work provides an adjustment factor that is used during sample compilation to produce unbiased estimates of net close utilization tree volume and adjust the net factor volumes from the plot establishment activity.

3. Analysis and Adjustment

- Data analysis is the process of screening, preparing, and comparing compiled ground sample data to the Phase 1 inventory data, to determine the relationships between these data.
- Attribute adjustment is the process of applying the relationship between photo estimation data and ground sampling data to the initial estimates in the photo interpreted database.

4. Monitoring plots

Monitoring is not considered part of the Vegetation Resources Inventory "toolkit" but may be included in a project to track changes on the landbase. The permanent plot design of the National Forest Inventory (NFI) – British Columbia Standard allows for repeated measurement of forest attributes over time, at defined locations. The following are features of this work:

- cross between a VRI and a Growth & Yield (G&Y) Permanent Sample Plot (PSP) creates a permanent, remeasurable design that is a statistically based system of monitoring and reporting
- RISC Procedures exist that determine the methodology for data collection
- projects often include collecting full VRI ground sampling data, including timber and ecology
- intention is to monitor change over a long term at intervals of 5 to 10 years
- address mid to long term issues i.e. projects often target managed stands in younger age classes

1.3 Vegetation Resources Inventory Overriding Principles

To ensure consistent and effective implementation of the inventory the following principles guide projects across the province:

- Strategic and Project Implementation Plans are produced to provide background on the VRI process, identify the project area and tailor the inventory to the specific business needs of the management unit as identified by the Stakeholders. While a management unit requires only one VRI Strategic Inventory Plan, a separate Project Implementation Plan is required for Phase I Photo Interpretation and Phase II Ground Sampling activities (where they are prescribed on a unit). Project Implementation plans identify specifics for undertaking a VRI project including timelines, roles and responsibilities, and deliverables. Together these plans form a critical part of the record for Vegetation Resources Inventory projects and they have high value in both the short and long term. If diligently written, they archive the initiation of the process. The VPIP should be a guideline and reference for the operational project.
- Implementation will follow the standards and procedures established by the Resources Information Standards Committee that are available at the website:
<http://ilmbwww.gov.bc.ca/risc/pubs/teveg/index.htm>

1.4 Vegetation Resources Inventory Planning

The VRI planning process is a requirement of both the Ministry of Forests & Range and the Forest Investment Account (FIA) and approval is required by the MFR prior to undertaking a VRI project. This is to ensure that there is a need for an inventory project and that the activities proposed address issues identified in the TSA.

The overall planning process is as follows:

- Identify stakeholders and consult with them throughout the project. Initially, a meeting is held with the stakeholders to describe the process and identify issues specific to the management unit. This client group should be kept informed throughout the planning process and be provided with the opportunity for input regarding critical decisions.
- A VRI Strategic Inventory Plan is developed that may support a recommendation to undertake VRI activities addressing stakeholder needs. As needed, specific VRI tools to support the collection of data or products to resolve issues will be identified.
- As directed through the approved VSIP, a VRI Project Implementation Plan will be prepared, providing details for each prescribed activity (Phase I photo interpretation and/or Phase 2 ground sampling). The ground sampling VPIP includes Net Volume Adjustment Factor sampling, analysis and adjustment and monitoring activities as well as details on the ground samples.

Approved VRI Strategic and Project Implementation Plans are time-sensitive documents, with a 'life' of 5 years prior to their requirement for review previous to undertaking a project under their direction. They are posted on the Vegetation Resources Inventory web-site:

http://www.for.gov.bc.ca/hts/vri/reports&pub/vri_vripub.html#top

1.5 Funding

This project is being funded by the Licensee component of the Stakeholder group, utilizing money from their Forest Investment Account allocation, administered by PriceWaterhouseCoopers (PWC). Any inventory projects that develop as a result of this planning will be funded through the FIA process, subject to approval from the Ministry of Forests & Range.

An approximate cost of the type of project under consideration has been developed as part of this planning process, utilizing historic costs from similar projects on similar landscapes. Both weather (short snow-free period at elevation) and funding are factors when establishing the timeframe for a project for this TSA.

2. Business Considerations

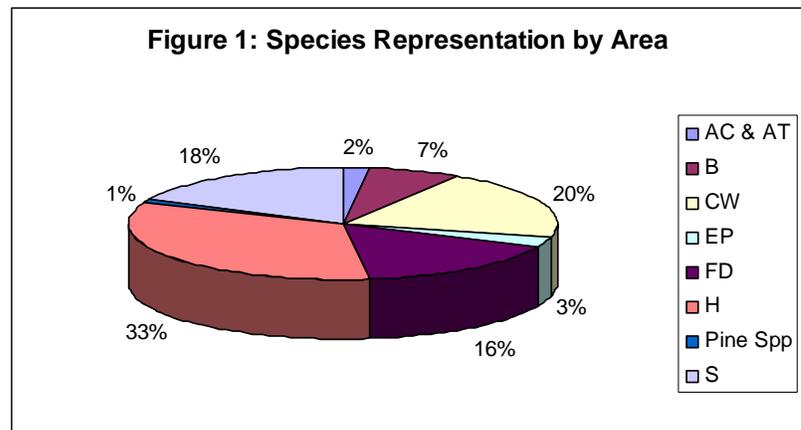
2.1 Landbase

2.1.1 Current Landbase (adapted from the Revelstoke TSA Allowable Annual Cut (AAC) Rationale – September 1, 2005)

The Revelstoke TSA is located in the eastern portion of the Southern Interior Forest Region. It is bordered by Golden to the east, Robson Valley to the north, Kamloops to the west and TFL23 to the south. It comprises approximately 549,420 hectares of the Columbia Forest District which is administered from Ministry of Forest and Range office in Revelstoke. Revelstoke is the largest community in the TSA (8,049 residents³). Figure 2 is an overview map of the area.

The terrain is quite rugged and mountainous. About 41 percent of the total TSA area is considered forested land managed by the Ministry of Forests & Range. The area defined as the Timber Harvesting Land Base (THLB) is approximately 78,000 hectares or 35 percent of the productive forest land base, following area exclusions for factors such as poor operability, environmental sensitivity and unmerchantable forest types.

There are three biogeoclimatic zones in the TSA including Alpine Tundra (At), Engelman Spruce-Subalpine Fir (ESSF) and Interior Cedar-Hemlock (ICH). The main commercial tree species include western hemlock, Engelmann spruce, western red cedar, subalpine fir (balsam) and Douglas-fir. Over 50% of the stands are greater than 140 years of age.



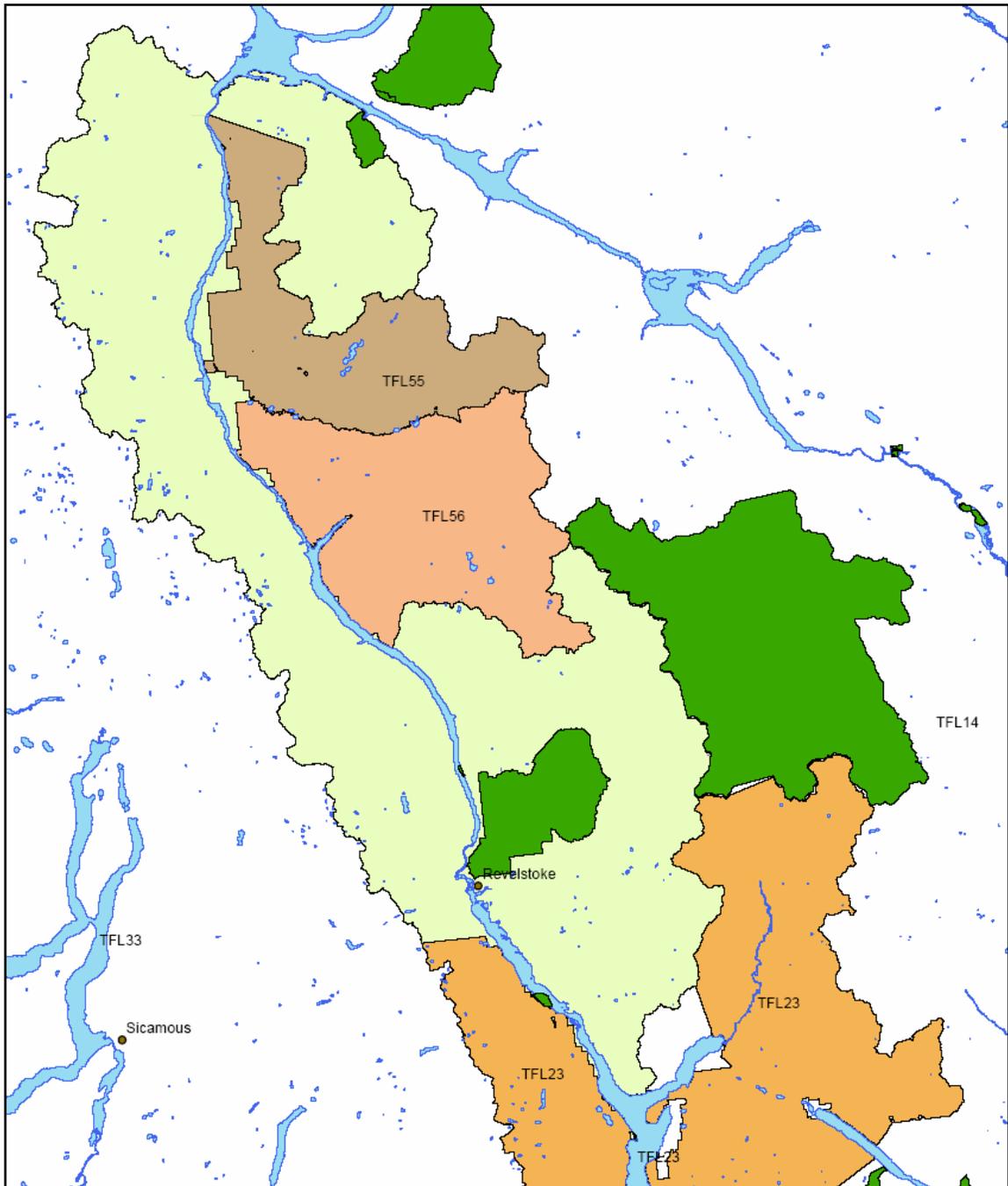
There are no First Nation communities in the TSA but the following assert territorial interests in the area:

- Ktunaxa Nation Council
- Akisq'nuk First Nation
- Shuswap Indian Band
- Shuswap Nation Tribal Council
- Adams Lake Indian Band
- Little Shuswap Indian Band

³ 1996 census on City of Revelstoke website – Community profile, Population characteristics, <http://www.cityofrevelstoke.com>

- Neskonlith Indian Band
- Simpcw First Nation
- Splotsin First Nation
- Okanagan Nation Alliance
- Okanagan Indian Band
- Lower Similkameen Indian Band

Figure 2. Revelstoke TSA



Tables 1&2. Land Base of the Revelstoke TSA

Total Crown Managed Vegetated Treed (VT) Land (Includes Inoperable)

SPECIES	Area (hectares)	percent
B	73825	33
H	61381	28
S	38087	17
CW	25269	11
FD	19522	9
AC & AT	2958	1
EP	2360	1
Pine SPP	1240	0
LW	34	0
	224676	100

Total Vegetated Treed in Operable Area, greater than 30 years

SPECIES	Area (hectares)	Percent
H	22807	33
CW	13872	20
S	12273	18
FD	11505	16
B	4886	7
EP	2182	3
AC & AT	1745	2
Pine Spp.	737	1
LW	37	0
	70044	100

2.1.2 Potential Addition to the Project Landbase

The area north of the boundary between the Arrow Boundary and Columbia Forest Districts, commonly known as the 'Shelter Bay Block' is a British Columbia Timber Sales (BCTS) operating area with the exception of three Timber Licenses held by Pope & Talbot (P&T) in Tree Farm License (TFL) 23. It has been proposed that these licenses be reverted from Schedule "A" lands to Schedule "B" Crown lands and these areas would be added to BCTS's Shelter Bay Block. BCTS planning staff has asked that this block be considered as part of the landbase for the Revelstoke TSA VRI project.

This tenure change is at the consultation stage and the exact area is not clear at this time. While the Stakeholders are aware of this situation, it was decided to keep the VRI planning process moving forward based on the

current landbase of the Revelstoke TSA used during the timber supply review.

The request will be reassessed at the time of writing the Project Implementation Plan. At this future date, the following will need to be considered prior to making a decision:

1. Timing on finalization of decisions on allocation of this block. Except for the Schedule 'A' lands discussed above, they are Crown lands and will continue to be such regardless of who operates them.
2. Which BCTS business area will be responsible for this block? For example, if this is being managed from the north i.e. as part of the Okanagan-Columbia Business Area, BCTS staff feels that it makes sense to include it with the Revelstoke TSA. If it is managed from the South i.e. Kootenay Business Area, a different decision may be more suitable. There is no plan at present to transfer the area out of the Okanagan-Columbia Business Area.
3. Since this block was part of TFL23 for previous inventory work, from an inventory perspective, its issues potentially may be dissimilar to the Revelstoke TSA issues. Based on an assessment of the inventory by MFR inventory specialists, it needs to be determined whether this unit fits with the rest of the Revelstoke TSA or would best be integrated in another unit for an inventory exercise or whether a unique project would be most suitable. BCTS staff sees this as an opportunity to begin the integration of TFL23 into the Revelstoke TSA inventory. They are looking to avoid continual data integration problems once the TFL transfer is made. They are concerned that it may be years before the TFL23 landbase would be eligible for funding on its own.
4. Whether any concerns exist in the Ministry of Forests & Range or PriceWaterhouseCoopers regarding including this management unit in the Revelstoke TSA project. FIA funding has strict guidelines on spending within management unit boundaries, so it may be critical to know whether the Shelter Bay block is seen as part of the Revelstoke TSA management unit or not. Also, the MFR usually wants VRI planning processes to concentrate on a singular management unit, attached to its unique Timber Supply Review process. So a decision will require input from the appropriate Timber Supply staff.
5. The Stakeholders at the October 16 meeting expressed concerns that any indecision regarding adding the new area could result in missed deadlines for undertaking this project and ultimately the data availability for TSR 4.

2.2 Forest Cover Inventory History

The Ministry of Forests completed a forest cover reinventory of the TSA in 1996, based on aerial photos from 1991 and 1992. The most current update year for the VRI files for the Revelstoke TSA is February 2004. In 2001 the forest cover inventory was converted to VRI format through a 'rollover' process. This eliminated some of the FC1 details e.g. Environmentally Sensitive Areas.⁴

2.3 Inventory Audit

A significant inventory initiative that occurred in most Crown managed tenures in British Columbia between 1992 and 1999 was the Inventory Audit program. The inventory audit methodology was developed to provide a statistical description of the forest inventory's volume. To achieve this goal, statistical analysis techniques were developed to examine the accuracy of forest polygon attributes and the total standing volume in a timber supply area.⁵

An inventory audit was undertaken in the Revelstoke TSA in 1994 on the older forest inventory. The results of this audit do not appear on the MFR website for Inventory audits. It was noted in the AAC rationale that the inventory audit data was restratified in 2002 based on the new VRI polygons⁶. The data from this effort was then recompiled and is available from the MFR in the report 'Revelstoke TSA – Documentation of Inventory Audit Restratified Analysis'.

The analysis of the audit data for this TSA shows that in stands greater than 60 years of age on the operable land base, there is no statistically significant difference between the average volume for the audit and the inventory. The audit results do suggest that the volumes derived in the audit were 8 to 10 percent lower than those calculated using the inventory attributes.

While the analysis results may not be statistically significant in the audit report, in the AAC rationale the Chief Forester voices a concern about the volumes in existing stands. Based on various factors that he outlines, he concludes that there is uncertainty and the data is inconclusive. Due to the potential impact that this volume issue has on the short term timber supply, this uncertainty needs resolution.

⁴ The ESA's are still available for use i.e. for analysis purposes. Personal Communication, Jeff Stone at the VRI VSIP Stakeholders' Meeting, October 16, 2007.

⁵ Resource Inventory Branch, Inventory Audit Sampling Standards & Procedures 1998.
http://www.for.gov.bc.ca/hts/vri/audits/audit_manuals/auditsp.pdf

⁶ The inventory audit data has actually been restratified twice, based on the new FC1 polygons. (personal communication, Chris Mulvihill, September 13, 2007)

2.4 Site productivity

No local site productivity studies have been conducted on this TSA.⁷

Two studies conducted provincially by the Ministry of Forests' Research Branch on site index adjustments for old-growth stands are discussed in the AAC Rationale. Results of these studies show that Province-wide, productivity has a trend to be under-estimated for the majority of sites occupied by old growth stands. This 'opportunity' can have an uplift effect in the medium to long term.

Stands older than 140 years comprise over 50% of the THLB in this TSA. In the AAC rationale the Chief Forester discusses the potential of site productivity to affect the timber supply. It is concluded that this is another data gap in the timber supply analysis.⁸

2.5 Forest Management and Inventory Issues

The following set of issues was discussed and identified as relevant locally at the October 16, 2007 Stakeholders' meeting.

TSA Issue	VRI Effectiveness			Remarks
	Photo-Interpreted Estimates	Ground sampling & NVAF	Monitoring	
1. Current Volumes – Discrepancy between actual & projected volumes	Moderate	High	High	New Phase I can provide more accurate attributes for VDYP to use in deriving volumes. Ground sampling will provide good data on actual volumes. The data can then be used to adjust the database.
2. Volume of dead wood. -Chief Forester identified his need to consider dead wood volumes in TSR determinations since 2006	Low	High	Moderate	To date, the Chief has used the inventory audit on other TSAs. Ground sampling & NVAF would be effective to provide good information on dead potential volumes..
3. Errors in inventory attributes: species, species composition, age, height - Errors in stand ages is of particular concern in this TSA	Moderate	Moderate		Phase I and Ground sampling may improve polygon values and reduce errors in attributes. Further analysis by age and species could also identify trends within the inventory.
4. Site index in both managed and unmanaged stands:	Moderate	Moderate	Moderate	VRI does provide data on attributes that affect Site Index i.e. age & height. Phase

⁷ Page 24, AAC Rationale for Revelstoke TSA

⁸The Licensee Stakeholders are utilizing FIA funds to support an Accuracy Assessment for the Predictive Ecosystem Mapping (PEM) in the Revelstoke TSA to be completed in 2008/09. The Chief Forester has established an accuracy standard of 65% that all PEM projects must attain to be accepted for use in Timber Supply Review base case analysis. If this mapping achieves this 65%, it will be an important tool to link sites to site index predictions.

-Concern that current SI may underestimate growth rates -Need better estimates in immature stands. -SI adjustments for species				I can provide better estimates of height for use in determining Site Index. Ground Sampling looks at these attributes and can provide data for Site Index. Monitoring can provide data, over time and is better suited to targetting young managed stands if interest is in capturing data on potential of the TSA. Other inventories i.e. PEM with SI work i.e. SIBEC may be better method
5. Landscape-level biodiversity -Age class information seen to be important for this issue on this TSA.	Moderate	Moderate	Moderate	Photo interpretation and Ground sampling may provide better information to support this issue.
6. Problem Forest Types - Identification	Moderate	High		New Phase I can verify/improve the estimates in these stands if the PFT is pre-defined. The attempt to better define PFT is based on the need but limited by the ability to identify merchantability criteria. The NVAF destructive sampling in target species, accompanied by log scaling may help to improve the objectivity in the approach to PFTs.
7. Decay, waste, and breakage	Low	High		NVAF data will provide information on decay and waste. This data could be used to provide information to verify the current loss factors and adjust the photo-estimated inventory. Breakage is not part of the VRI system.
8. Implications of managing for species at risk i.e. caribou -VRI attributes are important here	Moderate	Low to Moderate		New Phase I can provide finer delineation and specific attributes for non-forest areas. Ground sampling will show general incidence of lichens for caribou (TSA level overview), but not spatial extent. Both Phase I and Phase II may improve forest cover attributes to provide support for this issue.
9. Cutblock adjacency and green-up	Low	Low	Moderate	Monitoring can provide information on whether or not regenerated stands are meeting expected green-up and fill in an information gap on how managed stands are progressing.

In summary, the following information of particular interest to the Stakeholder group could be derived from the completion of VRI activities:

- Provide improved data for stand attributes and overall inventory volume
- Provide good information on dead wood volume
- Improve accuracy of species-specific volumes in Cedar and Hemlock
- Improve knowledge regarding merchantability by providing an estimate of grade from standing timber and information on 'sawable' volume
- Provide an opportunity to post-stratify the population by developing attributes that allow better definition of "Problem Forest Types" (PFT)
- Improve current site index information

2.6 VRI Activities and Products

2.6.1 VRI Photo Interpretation (Phase 1)

If Phase I is a selected VRI activity, a new photo interpreted inventory would be completed over the entire TSA, excluding Parks and large tracts of Private Land.

The most current photos for this TSA are from 2002-2003 photography. They are considered out-of date for a new Phase I that would start in 2008/09⁹. Therefore, the first step for a VRI Phase I project would be flying the entire TSA. The earliest that the photo interpretation could start would be in 2008/09.

The trend in photo interpretation is softcopy technology. Softcopy refers to the project being done using digital air photos, on a computer screen. After the TSA is flown, the scanning of the photos, aerial triangulation and digital model building would have to occur before the project could begin.

Delineation could occur once the photo preparation is complete, and based on expected timelines, could be bid out before the end of next fiscal year. Delineation is the process of dividing up the area into homogeneous polygons. A decision on average polygon size or the desired number of polygons per mapsheet would be part of the Request for Proposal (RFP) to qualified contractors.

Fieldwork would follow in the 2009 field season. The fieldwork is a mixture of ground and air calibration points completed throughout the project area. The point is to improve the ability of the contractor to interpret the photos in the

⁹ The Phase I VPIP standards state "As a guideline, the maximum age of the photographs is five years from the date of the start of attribute estimation. Acceptance of older photographs to fill in small information gaps must be reviewed in consultation with the MoFR."

office. The amount of fieldwork completed would be specified in the Request for Proposal (RFP) and is determined by the budget. Attribute estimation follows the fieldwork.

The timeframe for a new Phase I in the Revelstoke TSA would be dependent on the finalization of the photo materials and the availability of funding and contractors to work within the schedule developed in the VRI VPIP. At best, once the photo work is available, a new Phase I could take 2 to 3 years.

Prior to undertaking new photo work for the purposes of a new Phase I inventory, the most important consideration becomes whether there is a business need for this new inventory, beyond the desire for new photos. A new Phase I inventory will give an up-to-date snapshot of the forest. There is an assumption that “new is better” and “better means more accurate”. One of the major objectives for doing a phase I inventory is to get better volumes of timber in the study area. When looking for greater accuracy of the other attributes in the polygon descriptions, there is some chance of improvements overall, but no guarantee.

2.6.2 VRI Ground Sampling (Phase II)

The VRI Ground Sampling phase requires a completed photo interpreted inventory – either new or existing. It involves establishment of ‘cluster’ ground samples and the completion of Net Volume Adjustment Factoring destructive sampling. It must be followed up by the statistical analysis and adjustment of the photo interpreted database.

Prior to undertaking a Phase 2 Ground Sampling program, there are three initial decisions that must be made by the Stakeholders.

1. Decisions on the overall project design, with Stakeholder input: This includes deciding the sampling population, the sample strata and working out the number of samples that will be completed in the project.
2. Selecting activities to be completed in the project from the “ground sampling toolkit”:¹⁰ Optional plot types in Phase 2 VRI sampling include:
 - O - Full VRI – includes timber and ecology data collection. Coarse Woody Debris (CWD) and Succession are included as part of the ecological data.
 - Q - Timber Emphasis – tree information only is collected.
 - D - Timber Emphasis plus Coarse woody debris data.
 - T – Timber Emphasis plus Succession information.

¹⁰ A complete listing can be found on page 30 of the VRI Ground Sampling Procedures.

3. Net Volume Adjustment Factor Sampling

NVAF sampling involves detailed stem analysis of sample trees, calculation of actual net volume, and calculation of the ratio between actual net volume and estimated net volume (where estimated net volume is obtained from net factoring and taper equations). Net Volume Adjustment Factor destructive sampling has been recognized as a mandatory component of a VRI Phase 2 project. The NVAF data provides an adjustment factor that is used during sample compilation to produce unbiased estimates of net merchantable tree volume.

Net Volume Adjustment Factor sampling requires these actions:

- Step 1 – Based on the sample list developed for ground sampling, prior to fieldwork, a sub-set of the ground samples is selected to ‘enhance’ to provide a tree list for the NVAF sampling.¹¹
- Step 2 - Sample trees are selected from this sub-set of the ground samples, following the age-class, strata, diameter and geographic distribution considerations.
- Step 3 – The sample trees selected in Step 2 are felled and sectioned to measure actual net volume.

At the VPIP stage, the Stakeholders would like the following additional work to be investigated to provide data for their information needs regarding merchantability, including:

1. A measurement of unmerchantable sound wood by the NVAF sampler using scaling conventions to determine the volume of sawable wood for each sample tree.
2. An estimate of the VRI and/or Interior log grades by the NVAF sampler for the felled tree.
3. A scale of each sample tree by a licensed scaler.

2.7 Follow up Activities

2.7.1 Ground Sampling Analysis and Inventory Attribute Adjustment

The inventory will be adjusted to the current MFR standards for the following attributes:

- Height
- Age
- Stems/hectare
- Basal Area (BA)
- Volume at 5 different utilization levels

¹¹ The selection of the NVAF samples and the trees to be destructively sampled is made in an unbiased manner according to the NVAF standards.

The findings of the NVAF work will be incorporated into this adjustment. Ideally that data collected will be of a large enough sampling size to reach decisions by species or species group.

For both the ground sampling and the NVAF work, in addition to the standard procedure's analysis, there should be analysis completed related to any additional data collected. For 'tree data' this could include dead tree volume, interior log grading and the scaling procedure on the NVAF.

It should be noted that if any supplementary data is collected beyond the VRI 'standard' procedures, cost recovery would be at the licensee's expense for both the data collection and compilation.

2.7.2 Monitoring

Many TFLs and some TSAs have undertaken long term monitoring projects based on various business needs. Their goal is to monitor the changes and trends of the timber and non-timber resources over time. Often these monitoring plots are established in Post-Harvest Regenerated (PHR) stands. Their primary objective is to assess whether these stands are growing as predicted, and whether they will produce volumes according to existing models. A secondary objective is to monitor the site index of these stands.

Other opportunities where monitoring may answer questions regarding forest management are included in the table in Section 2.5. The focus of monitoring projects is to answer questions about uncertainty in forest management.

To conduct an effective monitoring program for a TSA, there must be clearly defined objectives. This would include:

- What is to be monitored?
- Why is it being monitored?
- What is going to be done with the data?

It is possible to keep the option open of initiating a monitoring project on a management unit during the VRI planning process. The Stakeholders can delay any decisions on developing a monitoring program, incorporating it at the Project Implementation planning stage or later through an amendment to the VPIP.

3 Inventory Plan

3.1 Overview

This section takes the theoretical discussions on the Vegetation Resources Inventory outlined in Sections 1.2, 2.6 and 2.7 and provides direction to a VRI project in the Revelstoke TSA.

3.2 Phase I - Photo Interpretation

In the September, 2005 Timber Supply Review rationale, the Chief Forester did not identify any issues with the Revelstoke TSA inventory that would suggest the value of new photo interpretation of the land base.

The Forest Management and Inventory Issues list in Section 2.5 represents concerns of the local users regarding the current inventory and puts these in context of how a new photo interpretation inventory will perform in relation to filling information gaps.

The consensus of the group at the Stakeholders' meeting was that at this time, there are no significant factors that would cause them to conclude that their ability to manage the Revelstoke TSA either for daily forest management activities or from a Timber Supply review perspective would benefit by undertaking a full VRI Phase I photo interpretation project at this time.

3.3 Phase II Ground Sampling

The results of the recompiled inventory audit suggested that there was no significant difference in the volume when comparing the audit data to the inventory. Despite the fact that there is no significant difference, there is evidence that the volume could be overestimated by as much as 8 to 10%. The logical 'first step' suggested by the Chief was to undertake a Phase II inventory as this work could address this issue.

The VDYP7 yield model will be coming on line in the next year. It will produce different volumes than VDYP6, the current yield model. The VDYP 7 volume for every polygon in the TSA will be different than the current volume. Key factors in this model are basal area and height. Ground sampling will provide validation of the volume estimates produced by VDYP7.

3.3.1 Inventory Objectives

The objective of VRI ground sampling is to attain statistically valid timber volumes in the live and dead timber. A sample error objective of +/- 10% for overall inventory volumes, 95% probability will be targeted in a project.

3.3.2 Target Population

The target population for sampling was discussed at the Stakeholders' Meeting. The Ministry inventory staff pointed out that in many other projects, the Vegetated Treed¹² landbase is often selected.

Following Stakeholder input, the population suggested for sampling includes:

- 80 % of samples in the Operable Vegetated Treed landbase. Exclusions will include private land, parks, and protected areas. Only that portion with >10% Crown Closure and over 30 years old will be sampled.
- 20% of samples located in the Inoperable Vegetated Treed landbase. This area may need further definition. For example, it may be prudent to limit sampling to an elevation line i.e. 1750 m.

It was felt that the inoperable landbase should not be excluded from the project since it may represent potential opportunities, either for harvesting or wildlife habitat.

3.3.3 Sample Size

Typically, 100 samples are required for a management unit. During the Project Implementation Plan development, to obtain an estimate of the coefficient of variation (CV), the Guidelines for the Preparation of a VPIP recommends using the CV from the inventory audit, increased by an additional 10% to account for differences in the sampling methodology. Since the audit for this TSA was on a previous inventory, the minimum standard sample size for ground sampling of 100 was used as the basis for discussion at the Stakeholder meeting. It was suggested that, in the interests of straight-forward project analysis, these 100 samples could be weighted according to pre-determined strata in the operable landbase.

The 'inoperable' landbase is largely valued for its contribution to non-timber values i.e. habitat. As mentioned in Section 3.3.2., the Stakeholders thought that this part of the Revelstoke TSA should be investigated during this project to provide some tangible information on the nature of this forest. At this stage

¹² B.C. Land Cover Classification Scheme

in the planning process, including 25 samples randomly located in the inoperable landbase, in a single stratum was suggested. An elevation line for this activity would likely need to be incorporated when considering this population.

Based on sampling in the operable and inoperable landbase, the project would comprise 125 samples in total.

3.3.4 Sample Selection

The sample selection will follow the Provincial VRI standard. The selection of sample polygons is based on stratified sampling using the Probability Proportional to Size with Replacement (PPSWR) sampling method.

The operable population will be pre-stratified into a number of strata. Following the lead of previous planning tables, these strata will be based on species or species groupings that are significant in terms of the population and the Stakeholder's identified interests. Table 3 shows the distribution of the 100 samples among the strata based on their area representation in the operable landbase. It will be 'fine tuned' and completed in greater detail i.e. the number of hectares represented by each sample, during the preparation of the VPIP.

From a statistical viewpoint, a stratum must be of sufficient size to derive adequate sample numbers to allow discussion and conclusions by individual stratum, in the analysis. This is generally understood to be a minimum of 15 samples in a stratum.¹³ Otherwise, the conclusions will be much more general and therefore may not provide some of the species-specific answers sought in the project.

¹³ Personal communication, MFR statistician, Sam Otukol.

Table 3¹⁴: Distribution of Samples in the Operable Landbase

Stratum	Population Area (ha)	Planned number of samples	Number of hectares represented by each sample
Hemlock	33% Area	33	
Cedar	20% Area	20	
Spruce-Balsam	25% Area	25	
Fd-P	17% Area	17	
Other spp ¹⁵	5% Area	5	
	Total Area	100	

3.3.5 Net Volume Adjustment Factor Sampling

The NVAF sample tree target is 100 trees to meet the Standard, 90 live and 10 dead. At the Stakeholders' meeting, there was recognition and support for the opportunity to utilize the NVAF project to look at local species issues. Major interest was expressed in cedar and hemlock net merchantable volumes. Adjacent management units (TFL 23 and Golden) have found that an increased sample size is required to address unique issues related to these species in the wetbelt. The proposed sample size for this project is 140 trees.

NVAF sample trees can be used to create statistical adjustments of loss factors and taper equations. The Southern Interior Forest Region and Forest Analysis & Inventory Branch staff will provide guidance during the VRI planning process to ensure appropriate decisions are made regarding sampling strata, sample size and the live/dead ratio in this TSA. The Planning and Sampling Contractors representing the Licensees will work with the MFR to develop the NVAF ground sampling plan for the TSA. An example of this breakdown for NVAF might be:

Table 4 NVAF Stratum Sample Size

Species group	Number of trees
Dead – All species	10
Live – Cedar	30
Live – Hemlock	45
Live - Spruce-Douglas Fir	20
Live – Balsam	20
Live – PI – other Minor spp.	15
Total	140

¹⁴ The actual number of samples and the number of hectares represented by each sample will not be known until after the ground sampling has been completed. A revised table will be provided in the final analysis documentation.

¹⁵ 'other spp' may be combined with another appropriate stratum as it is too small to stand on its own

The additions to the NVAF destructive sampling work referenced in Section 2.6.2 have been proposed by the licensee Stakeholders due to their concern that just having improved decay and waste information alone is not sufficient to their needs. Knowing that there is rot in a log is only part of the equation. These activities have been proposed to provide estimates of log merchantability and log grades based on both the VRI and Interior log grades. This additional work would provide critical data for the TSA regarding the remaining 'sawable volume' – or what you can make from that log. Approval of these activities will be pursued at the Project Implementation Planning stage through a variance to the Standard.

3.3.6 Monitoring Plots

The Stakeholders recognize that Monitoring is a good investment, contributing more in the long term. They indicated that this is a low priority for a planned VRI activity during this initial planning cycle.

Following the Stakeholder meeting, the licensees did identify the following monitoring issue:

Uncertainty in timber volumes in post harvest regenerated stands i.e. less than 30 years. Trends have been noted such as an underestimation of volumes in the ICH.

Undertaking a monitoring project on this TSA could be investigated through an amendment to the Project Implementation Plan.

3.3.7 Implementation

All phases of a ground sampling program could be completed in a 2 year time frame, dependent on sufficient funding and availability of certified crews. Timing is critical to the successful execution of a VRI ground sampling project.

3.4 VPIP Project Implementation Plan

If VRI work is to be undertaken, following the completion of the VSIP, the next step is the planning process to develop the VPIP. Using the direction of the VSIP, with input from the Stakeholders, the VPIP will specify the operational details for the inventory.

3.5 Roles and Responsibilities

This section of the VSIP outlines organizational roles and responsibilities in the development of a VRI project.

Licensees (including BC Timber Sales):

- Initiate inventory projects through FIA funding process to support planning of VRI inventories.
 - Prepare requisite plans for inventory work. VSIP to establish the overall VRI strategy. VPIP prior to undertaking a VRI project.
 - Inform other Stakeholders of the planning process and involve them in the project i.e. MFR and other key government agencies.
 - Submit Strategic and Project Implementation plans to the appropriate MFR Forest Analysis & Inventory Branch staff for their support, review and sign off.
 - Sign off final approved edition of project plan(s).
 - Apply to Price-Waterhouse Coopers for approval of project funding based on approved Plans.
 - Complete the RISC inventory activities following the appropriate Standards and Procedures outlined in the Implementation Plan.
 - Submit data from completed projects to the MFR/Provincial Data Warehouse (as appropriate).
- MFR – Forest Analysis & Inventory Branch, Inventory Section
- Provide mentoring and advice regarding the Vegetation Resources Inventory methodology.
 - Coordinate plan review within the MFR.
 - Sign off final approved edition of project plan(s).
 - Provide expertise to projects as they are ongoing.
 - Facilitate the acceptance of the data as is appropriate.

All Stakeholders will be important in their provision of input and possibly some operational support such as GIS and local knowledge for crew work.

All Stakeholders should be included in a final information session when the work is complete.

3.6 Costs

Table 5. Estimated sample sizes and costs for VRI Phase II activities in the Revelstoke TSA

VRI Activity	Sample Size	Unit Cost	Total Cost
<u>GROUND SAMPLING</u>			
Contract administration & materials-2 years			\$20,000
VSIP and VIP preparation -includes Sampling plans development and package preparation			\$30,000
Timber Emphasis Plots – timber data collection	125	\$1,500/sample	\$187,500
NVAF destructive sampling ¹⁶	140	\$800/tree	\$112,000
Helicopter access-estimate			\$40,000
Mentoring VRI and NVAF			\$6,000
Quality Assurance-Timber emphasis plots			\$12,000
Quality Assurance-NVAF			\$10,000
Final Compilation/analysis and inventory file adjustment			\$20,000
Total Phase II			\$437,500

Table 6. Sample size and estimated funding breakdown for VRI Monitoring project

<u>MONITORING</u>			
Contract Administration – includes GIS work			\$6,000
Sample Establishment	25	\$2,500/sample	\$62,500
Helicopter Access			\$5,000
Mentoring	1 crew	\$1,000	\$1,000
Quality Assurance		\$3000	\$3,000
Total Monitoring			\$77,500

¹⁶ This cost per tree does not include the additional measurements listed in Section 2.6.2. While this work may be supported by the MFR inventory Branch staff through a variance from the Standard, it is beyond the funding scope of regular FIA activities for a VRI Phase II NVAF ground sampling project.

Table 7. Estimated funding breakdown by year, based on timing of VRI activities

Year	Activity	Costs
Preliminary Year	VRI Planning - Strategic & Project Implementation Plans & package preparation	\$30,000
Preliminary Preparation		\$30,000
Year 1-VRI Sampling	Contract Administration	\$10,000
	Ground sampling – timber emphasis	\$187,500
	Mentoring & QA	\$16,000
	Helicopter	\$30,000
Year 1 total		243,500
Year 2 - NVAF & Analysis	Contract Administration	\$10,000
	NVAF with scaler	\$112,000
	Mentoring and QA	\$12,000
	Helicopter	\$10,000
	Analysis & Adjustment	\$20,000
Year 2 total		\$164,000
Grand Total		\$437,500

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10. Phillips, Nona. March, 2007. Robson Valley TSA Vegetation Resources Inventory Strategic Inventory Plan.
11. Timberline Forest Inventory Consultants. March 31, 2005. A User's Guide to the Vegetation Resources Inventory. FIA/ Tolko Industries Limited.
12. Various. Personal Communication with Stakeholders including Dieter Offermann, Colin Pike, Rein Kahlke, Kevin Lavelle, Chris Mulvihill, Will Smith, Gary Johansen and Laurence Bowdige regarding issues related to the preparing of this VSIP.

The most recent edition of the **Vegetation Resources Inventory Standards and Procedures** will be followed for the completing this project. They are located at the website:

<http://ilmbwww.gov.bc.ca/risc/pubs/teveg/index.htm>

The following is a list of the critical Standards and Procedures for a VRI project:

Ground Sampling:

Strategic Inventory Planning (VSIP), January 2005

Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Ground Sampling and Net Volume Adjustment Factor Sampling Version 3.0, May 2007

Vegetation Resources Inventory Sample Selection Procedures for Ground Sampling Version 3.3, December 2002

Vegetation Resources Inventory Sample Selection Procedures for Ground Sampling Version 3.3 Errata No. 1, April 2005

Vegetation Resources Inventory Ground Sampling Procedures Version 4.7, July 2007

Vegetation Resources Inventory Ground Sampling Procedures Version 4.7 Addendum, July 2007

Ground Sampling Procedure Appendices Version 4.5, March 2004

Vegetation Resources Inventory Quality Assurance Procedures for VRI Ground Sampling Version 3.0, March 2004

Vegetation Resources Inventory Data Collection Standards for VRI Ground Sampling Version 2.1, March 2006

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

Net Volume Adjustment Factor Sampling Standards and Procedures Version 4.2, June 2007

Net Volume Adjustment Factor Sampling Standards and Procedures Version 4.2, Addendum, April 2007

VRI – Analysis and Adjustment

Vegetation Resources Inventory Procedures and Standards for Data Analysis Attribute Adjustment and Implementation of Adjustment in a Corporate Database Version 2.0, March 2004

Monitoring

National Forest Inventory BC Change Monitoring Procedures for Provincial and National Reporting Version 1.4, March 2005

Change Monitoring Inventory Ground Sampling Quality Assurance Procedures Version 1.1, March 2002

Change Monitoring Inventory Ground Sampling Quality Assurance Standards Version 2.1, May 2007

Photo Interpretation

Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Photo Interpretation, Version 2.1, June 2007

Vegetation Resources Inventory Photo Interpretation Procedures Version 2.4, March 2002

Vegetation Resources Inventory Photo Interpretation Standards and Quality Assurance Procedures, Version 3.0, April 2006

Vegetation Resources Inventory Air Call Data Collection Procedures and Standards, Version 2.1, June 2007

Vegetation Resources Inventory Ground Call Data Collection Procedures and Standards Version 3.1, June 2007

Appendix A

Attendance at Stakeholders' Meeting

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**Attendance at Stakeholders' Meeting
October 16, 2007
Columbia Forest District, Revelstoke**

Meeting initiated and lead by Nona Phillips, Inventory Contractor

Participant	Affiliation
Dieter Offermann	Operations Forester, Downie Timber Ltd
Colin Pike	Forestry Supervisor - Stewardship, Bell Pole Canada Inc. & Joe Kozek Sawmills Ltd.
Gary Johansen	MFR, Planning, Forest Analysis & Inventory Branch, Victoria
Will Smith	MFR, NVAF - Forest Analysis & Inventory Branch, Victoria
Chris Mulvihill	MFR, VRI Inventory-Phase I & II, Southern Interior Forest Region, Nelson
Jeff Stone	MFR, Timber Supply Planner, Southern Interior Forest Region, Kamloops
Kevin Lavelle	MFR, Stewardship Officer, Columbia Forest District, Revelstoke
John Cruikshank	MFR, Stewardship Forester, Columbia Forest District, Revelstoke
Cory Legebokow	MoE, Ecosystem Officer, Kootenay Ecosystem Section, Revelstoke

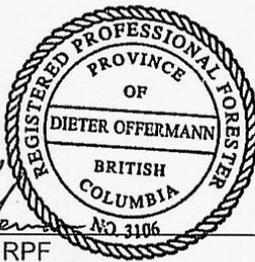
Appendix B

VSIP Approval Signature Page

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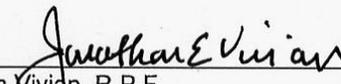
**Revelstoke Timber Supply Area Vegetation Resources Inventory
Strategic Inventory Plan Approval**

The Revelstoke TSA Vegetation Resources Inventory Strategic Inventory Plan was prepared in consultation with MOFR staff. I have read and concur that this plan, dated November 28, 2007, meets current VRI standards, business needs and considerations. It is understood that this is an agreement-in-principle and does not commit the signatories to completing the inventory activities outlined within the plan.

Dieter Offermann, RPF
Downie Street Sawmills Ltd. (Lead proponent)

December 6, 2007
Date



Jon Vivian, R.P.F.
Manager
Vegetation Resource Inventory
Forest Analysis and Inventory Branch
Ministry of Forests and Range

Date