KALUM TIMBER SUPPLY AREA

Vegetation Resources Inventory Project Implementation Plan for Ground Sampling

PREPARED BY:
LM FOREST RESOURCE SOLUTIONS LTD.

MARCH, 2007

EXECUTIVE SUMMARY

This VRI Ground Sampling Project Implementation Plan (VPIP) has been developed by LM Forest Resource Solutions Ltd. for VRI Phase I and Phase II activities in the Kalum TSA. The purpose of this VPIP is to summarize identified VRI needs and provide details for air photo acquisition and implementation of timber emphasis ground sampling and net volume adjustment factoring (NVAF) in terms of geographic area, scheduling, priorities, and sample location, estimated costs by year, and roles and responsibilities. This document may be used by the District Land Base Investment Program (LBIP) steering committee to assist in long term inventory planning.

It is expected that photos will be obtained for the entire TSA excluding any large adjacent parks or protected areas. Interpretation is expected to be deferred until a future inventory update. The recommended target population for ground sampling is the Vegetated Treed (VT) component of the operable landbase within the Kalum TSA. Sample polygons should be stratified into mature (> 120 years of age) and immature ($\leq$120 years). Selection within these strata should be using probability proportional to size with replacement (PPSWR) sampling. Phase II ground sampling for all species will require 42 timber emphases ground samples; eight in mature stands and 34 in immature stands. Mature polygons will be stratified into two strata based on forest type - specifically, hemlock leading and other leading. Immature polygons will also be stratified based on forest type and three sub-strata - hemlock leading, pine leading and other leading sub-stratified by age class. Two age classes are recommended - stands 31-80 years and stands 81-120 years. This approach will result in six sub-strata for immature sample polygons.

NVAF sampling should also be conducted within the immature component of the landbase. Thirty NVAF trees (18 hemlock, five pine, and seven other) from 13 immature ground clusters is estimated to be required to achieve an overall sampling error of $\pm$ 10 % for all species. The total cost of the VRI inventory is estimated to be about $445,000 for phase I photo acquisition, 42 phase II ground sample clusters, and 30 NVAF trees. This cost includes administration, installation of the VRI sample clusters, NVAF sampling, helicopter access, quality assurance, statistical analysis, and inventory file adjustment.

Forest Analysis and Inventory Branch, BC Timber Sales, and West Fraser Mills Ltd. must approve this plan prior to implementation. As well, it is recommended that the plan be reviewed by other stakeholders to ensure it meets their business needs.

Table of Contents

LIST OF TABLES

1. INTRODUCTION

1.1 Vegetation Resources Inventory Overview

A Vegetation Resources Inventory (VRI) is designed to answer two questions:

1. Where is the resource located?
2. How much of a given vegetation resource (for example, timber or coarse woody debris) is within an inventory unit?

The VRI is carried out in two phases. Phase I (photo interpretation) involves estimating vegetation polygon characteristics from existing information, aerial photography, and other sources. In Phase II (ground sampling) tree and stand attributes are measured in sample clusters established randomly within the target population. Phase II also includes stem analysis to assess decay and taper in individual trees (net volume adjustment factor measurements - NVAF). Information on population attributes acquired from Phase II measurements is used to statistically adjust all polygons in the photo interpreted database.

1.2 Background

This Vegetation Resources Inventory (VRI) Project Implementation Plan (VPIP) was prepared by LM Forest Resource Solutions and is based on the Kalum TSA VRI Strategic Inventory Plan (VSIP) finalized in February 2007. The VSIP outlined VRI activities and products needed to address forest management and inventory issues in the Kalum Timber Supply Area (TSA), as identified by stakeholders. It is expected that funding for this initiative will come from the Focused Funding component of the Forest Investment Account (FIA).

1.3 Document Objectives

This document provides stakeholders with the operational detail needed to complete VRI work that will meet their business needs. The VPIP restates the need for a VRI and provides implementation details such as target population, sample intensity, plot locations, maps, scheduling, estimated costs, and roles and responsibilities.

1.4 Landbase

The Kalum TSA, centered on the community of Terrace, lies within the Northern Interior Forest Region and is administered from the Kalum Forest District office in Terrace. The TSA is bordered by the Nass, Kispiox, North Coast and Bulkley TSAs, as well as two Tree Farm Licenses (TFL 1 and TFL 41). Adjacent to the TSA are several parks, including the Nisga’a Memorial Lava Bed

Provincial Park, the Lakelse Lake Provincial Park, the Exchamsiks River Provincial Park and the Gitnadoix River Recreation Area.

According to the Chief Forester's Rationale for Allowable Annual Cut Determination for the Kalum TSA produced in 2000, there are 539,319 hectares in the TSA of which 36,213 hectares, or approximately 6.7 percent, are not managed directly by the British Columbia Forest Service (BCFS) including parks, ecological reserves, private land and various special use permit areas. An additional 305,698 hectares, or approximately 57 percent, are non-productive areas which include rock, swamp, alpine areas and water bodies. Productive forest land managed by BCFS totals 197,408 hectares and comprises roughly 37 percent of the total area. Other reductions to the productive forest land base mean that only 98,256 hectares or approximately 50 percent of the productive forest land is considered to be available for timber harvesting.

2. SAMPLING PLAN

The sampling plan includes inventory objectives, target population, sample size and selection, and the VRI tools to be used.

2.1 Inventory Objectives

Phase I

The objective with photo acquisition is to produce an updated VRI with more accurate attribute information and polygon delineation. Normally the VRI Phase I product is a spatial database consisting of unadjusted photo-interpreted estimates. The information and the aerial photos themselves are used in addressing a variety of forest management issues both within the timber harvest land base and outside it (OGMA delineation for example). Because of perceived budget limitations, timber supply review timelines, and uncertainties regarding the quality of linework in the existing inventory, it has been recommended that photo interpretation be deferred until a future inventory. It is expected, however, that air photo acquisition and scanning would be completed under this initiative and so this VPIP addresses this aspect.

Phase II

The overriding objective is to improve the statistical validity of timber age, height, volume, and site index estimates in all stands as well as decay estimates in young stands within the target population. Improved knowledge of immature timber types will lead to a better understanding of the mid to long term timber supply. Specific sampling objectives include:

- ensure that sufficient sampling is completed to achieve an overall sampling error for timber volume, for all strata combined, of ± 10% (95% probability).

- achieve a sampling error for decay estimates from NVAF sampling for immature stands, all species combined, of less than 10% (95% probability).

Data obtained in this initiative will be used in conjunction with Phase II data obtained in 2005 to achieve maximum precision. It is hoped that this information will be acquired in a timely manner so that it will be available for the next timber supply analysis. If target sampling errors are not achieved, there are two available options: a) secure funding for a second year of sampling to make up the number of samples required to achieve the target sampling error, or b) use the information in the next timber supply analysis anyway, recognizing that it is the best available information and that its reliability may be lower than usual.

2.2 Target Population

In preparing the existing database for sample selection, database attributes were projected to 2004 because sampling in the Kalum 2004 VRI was projected to 2004 and this inventory builds on that work. The target population for Phase I work is the entire TSA (539,319 ha), while for Phase II work it includes only vegetated treed stands greater than 30 years of age in the operable landbase (77,775 ha). Within the target population there are two subpopulations - mature stands (>120 years of age) and immature stands (31 to 120 years of age) (table 1).

Table 1. Area by species and age class in within the target population for ground sampling.

AREA (Ha) SUMMARIES FOR SPECIES AND AGE CLASS FOR THE KALUM TSA
(VEGETATED, TREED, OPERABLE, >30 YEARS)

IMMATURE (AGES 31 TO 120)				MATURE (AGES 121+)			
SPECIES	**COUNT**	**AREA (ha)**	**% of IMMATURE**	**SPECIES**	**COUNT**	**AREA (ha)**	**% of MATURE**
HW	972	17249	59.46	HW	2801	33454	68.60
PL	218	4179	14.41	HM	706	6470	13.27
AC	202	1768	6.10	BA	255	3034	6.22
DR	155	1602	5.52	H	228	2610	5.35
BA	72	1323	4.56	CW	110	885	1.81
AT	51	812	2.80	AC	90	755	1.55
EP	50	523	1.80	SS	91	678	1.39
S	39	507	1.75	S	55	325	0.67
H	53	504	1.74	PL	51	306	0.63
SX	6	196	0.68	B	6	113	0.23
CW	9	160	0.55	EP	2	51	0.10
SS	8	86	0.30	YC	10	36	0.07
HM	11	73	0.25	SW	2	30	0.06
B	5	14	0.05	SX	2	20	0.04
SW	3	12	0.04				
TOTAL		**29009**	**100.00**	**TOTAL**		**48767**	**100.00**

Mature and immature stands have been stratified on an area-weighted basis by leading species (table 2). Immature stands were further stratified on the basis of age (31 to 80 years of age and 81

to 120 years of age). In stands that are greater than 120 years of age (mature) hemlock species dominate on about 87 percent of the area and other species dominate on eight percent. In immature stands within the target population, hemlock dominates on about 61 percent of the area, pine on 14 percent, deciduous on 16 percent, and other species dominate on 9 percent of the area.

Table 2. Area by stratum in the vegetated treed portion of the operable landbase greater than 30 years old.

	Stratum	**Area (Ha)**	Percent
Mature (63% of population)	Hemlock	42,533	87
	Other	6,233	13
	Total	48,767	100
Immature (37% of population)	Hemlock	17,827	61
	Pine	4,179	14
	Other	7,003	25
	Total	29,009	100

2.3 Sample Size

To meet inventory objectives, a minimum sample size of 42 VRI ground clusters was recommended based on a coefficient of variation of 48% and an existing sample of 50 mature ground clusters from 2005 (t^2 x CV^2/SE^2). Eight clusters were recommended for the mature (seven from hemlock types and one from other types) and the remaining 34 ground clusters were recommended for immature types (21 from hemlock types, five from pine, and eight from other types). Because of the small sample size, and the fact that sampling in 2005 was not done this way, no substrata for age were defined for mature. The breakdown for immature clusters by age class is shown in table three.

With respect to NVAF sampling, sample size has been based conservatively on a weighted average coefficient of variation for mature trees (from NVAF sampling in 2005) of 30%. Sampling errors in 2005 with 50 samples varied between 8% and 9.5% for all species. It is expected that the CV for immature stands will be less than that observed in mature stands. Recommended sample size is shown in table 3. No dead trees have been recommended for sampling.

Table 3. Recommended sample size for immature ground clusters and NVAF trees.

Immature Ground Clusters		Stands 31-80 yrs	Stands 81-120 yrs
hemlock	21	15	6
pine	5	3	1
other	8	6	2
Total	34	24	10
Immature NVAF Trees			
hemlock	18	13	5
pine	5	4	1
other	7	5	2
Total Trees	30	22	8

2.4 Sample Selection

Sample polygons were chosen from each of the strata defined above using the most current inventory database, GIS tools, and the probability proportional to size with replacement method. It was recommended that the 30 NVAF trees be selected from 13 of the 34 ground clusters. Thirteen polygons were chosen to so that more than one tree could be sampled in a polygon and to ensure enough NVAF samples per stratum. A higher number could also be chosen as long as the distribution by species and age class does not change. The final sample population was compared to the target population to ensure a representative sample had been selected (Appendix D). Further detail on the sample selection process can be found in Appendix B and a list of recommended sample polygons is provided in Appendix C. Note that three times as many sample polygons were selected as required to allow for substitution if necessary. Selected polygons were also ranked so that any substitutions would be done without bias.

2.5 Sample Type

Phase II ground samples will be timber emphasis clusters established in accordance with the most recent version of the *VRI Ground Sampling Procedures Manual*, and the document *Vegetation Resources Inventory Data Collection Standards for VRI Ground Sampling*. NVAF work will include call grading, net factoring and scaling and will be conducted in accordance with the most recent version of the *Net Volume Adjustment Factor Sampling Standards and Procedures*. These manuals are currently available at: http://www.for.gov.bc.ca/hts/vri/standards/index.html#sampleselection. In each of the polygons in which NVAF clusters are established, two to three auxiliary plots are also recommended. The auxiliary plots are to enhance net factoring, call grading and scaling, increasing the certainty of data collected.

2.6 Measurements

Ground sampling involves collecting tree attribute data on a representative sample of stands using accepted VRI procedures. Certified crews will gather data following the current VRI Ground Sampling Procedures Manual recording data on VRI Card Types 1-3 (CH Header, CP Compass, CL Cluster Layout), and 8-11 (TD Tree Details, TL Tree Loss Indicators, TS Small Tree, Stump and Site Tree Data, TA Auxiliary Tree Card). Note that all call grading and net factoring enhancement data is recorded on the FS 505M Auxiliary Plot Card (TA) 11. GPS coordinates will be collected at a suitable tie point, as well as for each integrated plot center.

NVAF sampling involves detailed stem analysis of sample trees to assess hidden decay and possible taper equation bias, 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 existing net factoring and taper equations). The results of the NVAF analysis are used to adjust the inventory database estimates of net tree volume. Net timber volume will be gross volume minus stumps, tops, decay, waste, and breakage. Decay and waste are estimated using NVAF call grading/net factoring. Breakage is estimated using existing loss factors, which were produced in 1976 using the best science of the day. The scaling will be done to help establish a correlation between VRI net factoring and actual scaled volume.

No WPV sampling is planned at this time.

3. IMPLEMENTATION

3.1 Timelines

Finite funding and a re-inventory scheduled for 2008 mean that every effort must be made to ensure that the project unfolds in an expeditious manner. The VSIP outlines seven categories of potential work to be completed:

1. air photo acquisition,
2. ground calls and air photo interpretation,
3. map preparation,
4. database preparation,
5. Phase II ground sampling,
6. Phase II NVAF sampling, and
7. Phase II data analysis and database adjustment.

Although Phase II field work would ideally follow air photo acquisition and interpretation tasks so that Phase II samples can be selected from an updated database and newly delineated polygons, funding limitations mean that interpretation needs to be deferred until some future date. As a result,

it is recommended that air photo acquisition, ground sampling, and NVAF sampling be completed before interpretation. This will mean that analysis and adjustment stemming from the phase II work will need to be repeated once photo interpretation is completed. The additional cost associated with this should not be more than ~$15,000. Recommended timelines for all tasks, assuming the acquisition of air photos and phase II work begins in 2007, and that interpretation occurs subsequent to this, is shown in the gantt chart below.

Table 4. VRI timelines assuming photo interpretation is deferred.

	2007 Su	2007 Wi	2008 Su	2008 Wi	2009 Su	2009 Wi
Photo acquisition						
Phase II Gd Sampling						
Phase II NVAF						
Analysis and Adjustm						
Adjusted Dbase						

Note that it is assumed that weather conditions will require that photo acquisition is completed over two consecutive summers. It is recommended that tendering begin immediately following approval of this plan.

3.2 Sample Packages

Field sampling packages supplied with this VPIP include an overview map showing sample polygon locations, a 1:20,000 scale map for each group of samples showing access, a 1:10,000 map of each sample polygon showing polygon boundaries and sample cluster location. Maps were provided for both rank one and rank two stands. It is expected that with the addition of a copy of this VPIP, these packages will be sufficient to implement the contract without too much further preparation on the part of the implementing agency.

3.3 Project Support

It is expected that the MOF will provide the sample package described above, aluminum stakes, aerial photos if required, and field cards to the contract crews. Provision of other equipment such as GPS will be the responsibility of the contract crews.

The Forest Analysis and Inventory Branch will provide mentoring to the contractor. A regional Forest Analysis Inventory representative will be present at the onset of the fieldwork to provide

training and support for the first 1 to 3 days of ground sampling. Further mentoring for the NVAF portion of the contract should be provided by an expert cruiser and certified faller.

3.4 Fieldwork

Fieldwork will be completed using VRI measurement protocols and VRI certified crews (timber emphasis). The VRI Card Types 1-3 and 8-11 should be completed to address timber emphasis issues using the most up to data VRI Ground Sampling manual.

3.5 Quality Assurance

Ground sampling quality assurance is the responsibility of stakeholders. Forest Analysis Inventory representative may provide guidance in the performance of quality assurance activities. The VRI quality assurance standards typically require inspection of at least 10% of the samples. The field crews are responsible for the quality control of their own work.

NVAF quality assurance will likely be conducted by an independent contractor.

3.6 Data Compilation, Analysis, and Adjustment

It is expected that data will be compiled by a contractor and entered into TIMVEG. Error-free data will then be provided to ILBM and archived in the land and resources data warehouse (LRDW). The implementing agency is also responsible for the statistical analysis and database adjustment and a separate contractor will likely be needed for these tasks.

3.7 Roles and Responsibilities

The three major stakeholder groups in the Kalum TSA are the forest licensees, the Ministry of Forests Analysis and Inventory Branch, and the Integrated Land Management Bureau. Roles and responsibilities of each in the VRI process are summarized below.

Licensees:

- Identify funding sources and relative priorities.
- Approve the VPIP products.
- Manage implementation of the VPIP.
- Submit plans to the FIA fund manager (Price Waterhouse Coopers) for funding approval
- Submit plans to Forest Analysis and Inventory Branch for technical review.

- Submit all FIA funded products, including digital and analog data, maps, and QA reports to the MoF Northern Interior Region.

Forest Analysis and Inventory Branch

- Develop standards and make them available to Licensee and inventory contractors.
- Develop yield models used in the inventory and timber supply analysis process.
- Provide technical advice and support.
- Review and approve plans to ensure the products will meet MoF business needs.
- Undertake inventory audits as required and report them to stakeholders.

Integrated Land Management Bureau

- Develop data archiving standards and make them available to inventory proponents.
- Maintain the Land and Resource Data Warehouse.
- Upload all inventory information to the LRDW.
- Ensure inventory users have appropriate access to the data warehouse.

3.8 Approximate Costs

Estimated sample sizes and costs for completion of air photo acquisition, ground sampling and NVAF are listed in Table 5. The total cost is estimated to be about $445,000.00. An effort should be made early in the project to determine whether the estimated budget is appropriate or whether it needs to be adjusted. The most variable factors are the bid price per sample and the number of samples that require helicopter access. If the stakeholders have the means to conduct phase I photo interpretation of the productive landbase (197,408 ha) subsequent to, or concurrent with the activities outlined in this PIP, costs would likely be in the range of an additional $178,000 to $217,000.

Table 5. Potential costs for VRI activities in the Kalum TSA[1]

VRI Project Component	Unit Cost	Total Cost
Photo acquisition[2]	$0.27/ha.	$148,500
Scanning, AT, and Diap Viewer Sets	$0.20/ha.	$110,000
Orthophotos	$0.07	$38,500
Total Photography Costs[1]		**$297,000**
NVAF (30 trees)	$600/tree	$18,000
NVAF heli cost (3 polygons)	$2,100/polygon	$6,300
NVAF QA audit (3 polygons, 1 heli)	$600/tree +heli costs	$3,900
Compilation and analysis		$5,000
Sub total		**$33,200**
Ground Samples - 42 clusters	$1500/cluster	$63,000
Ground Samples - heli cost (15 clusters)	$2,100/cluster	$31,500

Ground Samples QA Audit (4 clusters, 1 heli)	$8,100
Compilation, analysis and adjustment	$12,000
Sub total	**$114,600**
Total Phase II Costs	**$147,800**
All VRI Projects	**$444,800**

[1] The Kalum TSA is 539,319 ha but it is assumed that photography will be required for ~ 550,00 ha in order to capture the entire landbase.

4. APPROVAL

I have read and concur with the Kalum TSA VRI Project Implementation Plan, dated March 30th, 2007. 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. Any major modifications to this plan will need to be reviewed and approved by the signatories.

_____

BC Timber Sales, Skeena Business Area

_____

West Fraser Timber Ltd.

_____

Coast Tsimshian Resources Limited Partnership

_____

Manager
Vegetation Resource Inventory; Forest Analysis & Inventory Branch

Note that approval of the plan by a separate funding agency may also be required.

APPENDIX A – GLOSSARY OF TERMS[1]

District-wide VRI

This is synonymous with provincial VRI; see Provincial VRI.

Ground Sampling

Ground sampling is the field measurement of timber, ecology, range, and/or coarse woody debris values at one or more locations within each sample polygon. Sample polygons are selected proportional to their area from a sorted list. To accommodate a wide variety of resources, various types and sizes of sampling units (e.g., fixed and variable plots, transects) are used to make the measurements.

Inventory Unit

An inventory unit is the target population from which the samples are chosen. For the provincial VRI, the inventory unit is the Forest District, which includes the timber harvesting landbase, parks, recreational areas, private, and federal lands. For management inventories, the inventory unit is a subset of the provincial VRI inventory unit that focuses on a geographic area or specific attribute set, depending upon sampling objectives.

Landcover Classification

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

Management VRI

Management VRI are specialized inventories that provide detailed information required for specific resource management, i.e., day-to-day forest management. One or more VRI sampling procedures may be used for management inventories. Management inventories may focus on specific resource types (e.g., timber, range, ecology), geographic areas (e.g., landscape unit, TFL), attribute sets (e.g., Douglas-fir leading stands, age class 4+). They may use one or more of the following tools (e.g., photo-interpretation, ground sampling, NVAF sampling).

[1] Source: Ft Nelson TSA VRI Ground Sample and Monitoring Project Implementation Plan

National Forest Inventory (NFI)

The NFI provides information on Canada's resources across all provinces and allows the Federal Government a consistent framework for reporting on Canada's inventory. The inventory unit for the NFI is the entire country, although it is implemented province-by-province.

Net Volume Adjustment Factor (NVAF) Sampling

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

Photo-Interpretation

Photo-interpretation involves subjective delineation of polygons and photo estimation of attributes for all polygons in an inventory unit. Medium scale aerial photographs (1:15,000) are most often used in photo-interpretation. However, if existing photo-based inventory is acceptable, the database can be translated into VRI format and upgraded to include the additional VRI attributes.

Post-Stratification

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

Pre-Stratification

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

PPSWR (Probability Proportional to Size With Replacement)

This is a sample selection method in which samples (polygons) are selected with probability proportional to their size. That is, the larger polygons have a higher chance of being included in the sample.

Provincial VRI

The provincial VRI provides baseline data for provincial inventory reporting, monitoring, and research. All sampling procedures from the VRI toolbox are used for this inventory at the Forest District level. The databases generated from each District inventory will be compiled to create the provincial VRI database. The provincial VRI has also been referred to in the past as the District VRI.

Resource-Specific Interpretations

Resource-Specific Interpretations (RSI) use the Resource Inventory Committee (RIC) standard VRI baseline data products (provincial VRI or management inventory), in combination with other data sets and analysis (outside of that required to produce VRI), to produce information to address specific-resource management issues (e.g., TSR review, important ecosystems, important habitats). These interpretations include ecosystem interpretations and habitat interpretations.

Retrofit

Retrofitting is the process of translating and upgrading an existing photo-based inventory to VRI standards. If the polygon linework and attributes are of acceptable quality, the existing FIP (Forest Inventory Planning) databases are translated to VIF (Vegetation Inventory Files) databases and the additional attributes required by the VRI are re-estimated from aerial photographs.

Sample Size

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

Statistical Analysis

Statistical analysis is the process of adjusting the values of the photo-interpretation variables using ground sampling observations. For each sampled polygon, ground observations are compared to photo-estimated values to develop an adjustment factor. This factor is then applied to all polygons in the photo interpretation database to produce the final adjusted database.

Sub-unit

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

Target Precision

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

Vegetation Resources Inventory (VRI)

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

- *Photo-interpretation*: the delineation of polygons from aerial photography and the estimation of resource attributes.
- *Ground sampling*: the establishment of plot clusters in selected polygons to measure timber, ecological, and/or range attributes.
- *NVAF Sampling*: stem analysis sampling of individual trees for net volume adjustment.
- *WPV Sampling*: intensive sampling of selected polygons to determine the error between the estimated attribute values and the "true" attribute values.
- *Statistical Adjustment*: the adjustment of the photo-interpreted estimates for all polygons in an inventory unit or management unit using the values measured during ground sampling.

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

Within Polygon Variation Sampling

WPV sampling provides information for expressing the true individual polygon error, assessed as the difference between the adjusted polygon value and the "true" value for that polygon. The "true" value for the polygon is an estimate derived from a small sample of polygons that are intensively sampled on the ground.

APPENDIX B - SAMPLE SELECTION PROCESS

This appendix explains the GIS process used in preparing the data and determing the ground sample polygons, cluster locations and NVAF polygons, as well as archiving specifics. Analysis was performed by GIS analyst Suzanne Gunn. The software used for the analysis included ArcView 9.2 and Microsoft Excel.

Base Population Preparation

Base data included the most recent rank 1 forest cover tables with associated polygons, clipped to the TSA boundary, and a newly revised operability layer, dated February 2007. Base data was acquired from Ralph Lenardt and Meg Hoole of the GIS Department, Kalum Forest District, Terrace, and was delivered in the form of ArcGIS shapefiles via the MOF FTP site.

The base population was prepared from an overlay of the operable areas and the forest cover dataset and then a selection of the vegetated-treed stands. Prior to and following the overlay, every effort was made to reduce the number of gaps (or sliver polygons) in the resultant dataset. The age field for the resultant population was projected to 2007. (As this VPIP builds on previous sampling in the Kalum in 2004, the three year difference was noted as changing stands that cover 0.14% of the total area from immature to mature.) The resultant dataset was then coded by strata as identified in Section 2.2 of this document and was thus ready for sample polygon selection. The polygons were listed in a random order, by stratum.

Quality Assurance: The population list was checked prior to sample selection using queries to determine the completeness of the selected base from the source data. Queries on crown closure, species, and operability were performed and visual checks on overlays of the resultant data with the source data were also performed.

Ground Sample Polygon Selection

To prepare the data for the probability proportional to size with replacement selection process (PPSWR), the individual polygon areas were accumulated from first to last polygon and stored in a new field in the database. This procedure was repeated for each stratum.

Random numbers were generated for each stratum, ranging in size from 0 to the total area of the stratum and numbering as many as there are allocated samples for each stratum, including spares.

These random numbers were then used to identify the selected polygons by choosing, for each random number, the polygon where the random number was larger than the accumulated total area corresponding to the polygon immediately preceding it, and the random number was smaller than or equal to its accumulated area. The database field 'chosen' was calculated to equal the number of times each polygon was chosen using this process. This process was repeated for each stratum.

Where *x-number* of sample polygons were required for a stratum, the first *x-number* of polygons chosen were ranked as a priority and the remaining polygons were ranked as spares. The database field 'rank' was coded as a 1 or a 2 accordingly. Selected polygons were extracted to their own dataset.

Quality Assurance: The distribution of selected polygons across the sample base was investigated, determined to be accurate, and reported in Appendix D of this report.

Cluster Location Selection

A standard 100m dot grid (also used for the 2004 VPIP) was used for cluster selection. Points from the grid that fell within the selected polygons were selected out to produce the base selection point dataset. These points were randomly numbered for each polygon. For each selected polygon, random numbers were generated for as many times as the polygon had been selected for sampling. These generated random numbers were used to choose the cluster location(s) within the polygon by selecting the dot whose randomly assigned number was equal to the generated random number. This procedure was repeated for each selected polygon. Selected cluster locations were extracted to their own dataset and UTM coordinates were generated for each record. An overlay was performed to populate the cluster location point dataset with the polygon information from the selected polygon dataset (mapsheet, polygon number and rank).

Guidance for the above procedures was obtained from the "Vegetation Resource Inventory Sample Selection Procedures for Ground Sampling", MSRM, December 2002.

Quality Assurance: Results were output to a table where each polygon was checked to ensure a sufficient number of cluster locations, and each cluster was checked for sufficient attributes for identification. The process ensured that clusters were located in areas defined as operable by the new operability layer.

NVAF Polygon Selection

NVAF polygon selection from the list of VRI ground sample polygons was by systematic selection with a random start to minimize the lack of selection common to small random samples. The selected polygons were sorted by leading species and percent species. A selection interval was determined by dividing the number of VRI polygons by the number of required NVAF samples. A random start number was selected between 1 and the selection interval. This start number identified the first NVAF polygon chosen, and the derived interval was used to select following NVAF polygons down the list of sorted VRI polygons until the required number of NVAF samples was reached. This process was repeated for each immature stratum.

Guidance for this process was obtained from "Net Volume Adjustment Factor Sampling Standards and Procedures, Version 4.1", MOF, March 2006

Quality Assurance: Results were exported to a table and checked for completeness by stratum.

Archiving

All data and documents relevant to this project have been archived to a CD labeled DKMVPIP07 Source data, the base population data and the resultant selected polygons have been archived to this CD under the 'datasets' folder. Notes accrued during the sampling process as well as e-mails and correspondence have been archived under the 'notes' folder. The final sample lists and notes pertaining to their use have been archived under the 'samples' folder. Access and overview maps have been archived under the 'maps' folder. A copy of the GIS report (Appendix B of this document) has been archived under 'reports'.

Archiving has been performed according to the "Vegetation Resource Inventory Sample Selection Procedures for Ground Sampling", MSRM, December 2002.

APPENDIX C - LIST OF SAMPLE POLYGONS

The following ground sample polygon list reflects the sample strategy described in the main body of this plan. The mature subpopulation is stratified by species group. The immature subpopulation is also stratified by species group but is further sub-stratified by age class (31-80 yrs and 81-120 yrs). The result is two mature strata and six immature strata.

Mature (> 120 yrs.)

- Hemlock leading,
- Other (than hemlock) leading.

Immature (< 120 yrs.)

- Hemlock leading, 31-80 yrs.,
- Hemlock leading, 81-120 yrs.,
- Pine leading, 31-80 yrs.,
- Pine leading 81-120 yrs.,
- Other leading 31-80 yrs.,
- Other leading 81-120 yrs.

Each sub-stratum contains **3 times** the planned number of sample polygons, bringing the total list to 126, although only 42 samples are planned for ground sampling. The extra sample polygons have been included for the following reasons:

- A polygon may be need to be dropped if unsafe conditions or extremely poor access exists. If either of these conditions exist, one must follow these standards: http://www.for.gov.bc.ca/hts/vri/standards/index.html#vri
  If a plot is dropped in accordance with these standards, the project administrator should be notified immediately.
- Samples falling in completely inoperable polygons will be removed from the population (The assessment of an inoperable polygon will not be made by the field crews while in the field. All samples will be assessed in the office for operability using the stated slope standards. Every reasonable effort will be made to sample operable polygons as planned).
- A polygon may have been disturbed since the last projection and not have the intended attributes (e.g. the stand has been logged and is therefore, by definition not VT and outside the population of interest).
- The stakeholders may wish to expand on this research at a future date.

Highlighted portions represent the planned sample polygon list. Where a polygon was selected twice for sampling, two records exist, one for each cluster location. Polygons chosen for NVAF sampling are entered in bold text (immature strata only).

Table 6: Ground Sample Polygons with Cluster Locations and NVAF Sample Polygons

Mature, >120 years, Hemlock Leading

MAPSHEET	POLYGON	LEADING SPECIES	SPECIES %	AGE	TIMES SELECTED	UTM EASTING (ZONE 9)	UTM NORTHING (ZONE 9)	PRIORITY
103I037	164	HW	80	319	1	522961	6023535	1
103I058	89	HW	50	301	1	530616	6048520	2
103I067	246	HW	50	319	1	525233	6057211	3
103P007	178	HW	70	319	1	517814	6099495	4
103P007	91	HW	83	318	1	517628	6101492	5
103P007	155	HW	50	319	1	523691	6105059	6
103P017	116	HW	100	319	1	521576	6109980	7
103H086	198	HW	67	318	1	512193	5968147	8
103H096	67	HW	50	268	1	508474	5973100	9
103I008	167	HW	70	285	1	526275	5985787	10
103I039	210	HM	80	331	1	549383	6022156	11
103I038	188	HW	50	241	1	531698	6025511	12
103I047	563	HW	70	269	1	525146	6031046	13
103I057	166	HW	60	304	1	515603	6043268	14
103I060	19	HW	80	319	1	553597	6047897	15
103I059	80	HW	50	319	1	544598	6049718	16
103I068	223	HW	80	319	1	535602	6056151	17
103I067	14	HW	60	299	1	516761	6060759	18
103I080	14	H	60	331	1	553323	6070740	19
103I087	257	HW	80	211	1	517615	6073626	21
103I089	192	H	60	275	1	543596	6075537	22

Mature, >120 years, Other Species Leading

MAPSHEET	POLYGON	LEADING SPECIES	SPECIES %	AGE	TIMES SELECTED	UTM EASTING (ZONE 9)	UTM NORTHING (ZONE 9)	PRIORITY
103P007	41	BA	50	319	1	515325	6103799	1
103I047	353	SS	80	219	1	518526	6031164	2
103I078	131	BA	50	291	1	533333	6069385	3

Immature, 31-80 years, Hemlock Leading

MAPSHEET	POLYGON	LEADING SPECIES	SPECIES %	AGE	TIMES SELECTED	UTM EASTING (ZONE 9)	UTM NORTHING (ZONE 9)	PRIORITY
103I037	1057	HW	80	34	1	523896	6018061	1
103I038	**2933**	**HW**	**50**	**34**	**1**	**530710**	**6020457**	**2**
103I037	70	HW	67	31	1	520721	6024341	3
103I037	99	HW	50	32	1	521613	6024580	4
103I048	572	HW	50	31	1	527612	6029647	5
103I047	676	HW	60	41	1	520499	6034255	6
103I047	322	HW	40	33	1	520377	6034751	7
103I047	39	HW	50	44	1	516805	6038608	8
103I056	**296**	**HW**	**50**	**31**	**1**	**511818**	**6042706**	**9**
103I057	225	HW	60	39	1	518571	6044197	10
103I058	**160**	**HW**	**70**	**59**	**1**	**530852**	**6045322**	**11**
103I057	**97**	**HW**	**60**	**44**	**1**	**519765**	**6046754**	**12**
103I057	262	HW	50	40	1	525040	6049986	13
103I067	467	HW	70	32	1	523568	6053933	14
103I067	**55**	**HW**	**40**	**59**	**1**	**517249**	**6056369**	**15**
103I035	86	HW	45	51	1	491098	6025583	16
103I045	231	HW	60	31	1	495121	6029965	17
103I007	308	HW	80	34	1	518198	5987146	18
103I008	70	HW	85	34	2	527905	5989866	19
103I008	70	HW	85	34	2	529268	5990826	20
103I008	49	HW	85	34	1	529730	5991748	21
103I008	59	HW	80	34	2	527720	5991862	22
103I008	59	HW	80	34	2	527635	5993863	23
103I037	983	HW	65	35	2	523023	6019728	24
103I037	1052	HW	85	34	1	524011	6020071	25
103I037	983	HW	65	35	2	523276	6020842	26
103I039	17	HW	70	34	1	540326	6027684	27
103I047	84	HW	40	36	1	518709	6031573	28
103I048	560	HW	50	38	1	529123	6031817	29
103I048	442	HW	90	79	1	535122	6032173	30
103I047	402	HW	60	31	2	520459	6032850	31
103I047	402	HW	60	31	2	520716	6033864	32
103I047	331	HW	40	34	1	521544	6035603	33
103I047	255	HW	30	79	1	522625	6038456	34
103I056	250	HW	70	34	1	509551	6041807	35
103I057	275	HW	60	36	2	517258	6039730	36
103I057	275	HW	60	36	2	517226	6042836	37
103I058	524	HW	60	35	1	536758	6043169	38
103I057	182	HW	60	39	1	518920	6045415	39
103I067	370	HW	50	37	1	524801	6050878	40
103I068	417	HW	50	33	1	527598	6055809	41
103I069	597	HW	70	37	1	539718	6056025	42
103I067	422	HW	76	34	1	523149	6056722	43
103I079	532	HW	70	37	1	548310	6068421	44
103I087	340	HW	70	61	1	515703	6076150	45

Immature, 81-120 years, Hemlock Leading

MAPSHEET	POLYGON	LEADING SPECIES	SPECIES %	AGE	TIMES SELECTED	UTM EASTING (ZONE 9)	UTM NORTHING (ZONE 9)	PRIORITY
103I038	2880	HW	85	115	1	530646	6021958	1
103I048	165	HW	50	99	1	528697	6032400	2
103I048	47	HW	40	99	1	528833	6038620	3
103I067	**196**	**HW**	**70**	**109**	**1**	**521599**	**6055452**	**4**
103I077	166	HW	90	119	1	515475	6062709	5
103I077	**10**	**HW**	**90**	**111**	**1**	**515221**	**6071018**	**6**
103I048	229	HW	100	91	1	526990	6030122	7
103I048	445	HW	70	101	1	535901	6032707	8
103I047	368	HW	100	101	1	521495	6034398	9
103I047	375	HW	80	91	1	522078	6034824	10
103I048	143	HW	60	101	1	530357	6035779	11
103I048	44	HW	75	87	1	528271	6037694	12
103I058	2074	HW	50	115	1	536067	6049956	13
103I068	2065	HW	55	120	1	536221	6051065	14
103I067	299	HW	60	99	1	521874	6051354	15
103I069	12	HW	40	99	1	538806	6058593	16
103I089	218	HW	70	93	1	539634	6076771	17
103I087	135	HW	40	101	1	515552	6077347	18

Immature, 31-80 years, Pine Leading

MAPSHEET	POLY	LEADING SPECIES	SPECIES %	AGE	TIMES SELECTED	UTM EASTING (ZONE 9)	UTM NORTHING (ZONE 9)	PRIORITY
103I077	**64**	**PL**	**90**	**79**	**1**	**515488**	**6067120**	**1**
103I058	**34**	**PL**	**70**	**79**	**1**	**526360**	**6047236**	**2**
103I058	**57**	**PL**	**90**	**74**	**1**	**528048**	**6047608**	**3**
103I057	**208**	**PL**	**90**	**33**	**1**	**523565**	**6049322**	**4**
103I059	**14**	**PL**	**80**	**59**	**1**	**539303**	**6049292**	**5**
103I077	**320**	**PL**	**30**	**43**	**1**	**512984**	**6064708**	**6**
103I047	**199**	**PL**	**80**	**49**	**1**	**520562**	**6037466**	**7**
103I077	**338**	**PL**	**100**	**69**	**1**	**513674**	**6062632**	**8**
103I058	**157**	**PL**	**70**	**69**	**2**	**530448**	**6045405**	**9**
103I058	**157**	**PL**	**70**	**69**	**2**	**530048**	**6045388**	**10**
103I068	**294**	**PL**	**70**	**74**	**1**	**537455**	**6055027**	**11**
103I069	**565**	**PL**	**50**	**39**	**1**	**540976**	**6057082**	**12**

Immature, 81-120 years, Pine Leading

MAPSHEET	POLYGON	LEADING SPECIES	SPECIES %	AGE	TIMES SELECTED	UTM EASTING (ZONE 9)	UTM NORTHING (ZONE 9)	PRIORITY
103I048	**176**	**PL**	**95**	**91**	**1**	**531371**	**6035521**	**1**
103I086	2033	PL	100	104	1	511430	6079978	2
103I058	59	PL	60	91	1	528461	6047325	3

Immature, 31-80 years, Other Species Leading

MAPSHEET	POLYGON	LEADING SPECIES	SPECIES %	AGE	TIMES SELECTED	UTM EASTING (ZONE 9)	UTM NORTHING (ZONE 9)	PRIORITY
103I037	1055	DR	40	31	1	524741	6019401	1
103I037	1060	DR	50	31	1	525529	6019735	2
103I038	150	DR	70	39	1	531033	6026986	3
103I086	**128**	**DR**	**60**	**39**	**1**	**512719**	**6075622**	**4**
103I086	**2055**	**EP**	**25**	**70**	**1**	**510868**	**6079051**	**5**
103I067	485	S	50	31	1	521542	6054448	6
103I034	387	AC	100	61	1	474905	6017474	7
103I034	607	DR	100	41	1	476938	6019165	8
103I034	303	BA	60	43	1	482369	6021101	9
103I045	248	S	50	33	1	496009	6030303	10
103I046	488	AC	100	59	1	511222	6030852	11
103I046	464	DR	70	39	1	512620	6033318	12
103I046	466	AC	70	34	1	512916	6033430	13
103I047	72	AC	70	34	1	513016	6033435	14
103I007	21	DR	75	41	1	522894	5994563	15
103I047	477	CW	40	32	1	522228	6031322	16
103I047	142	AC	80	39	1	515762	6034855	17
103I057	547	DR	80	39	1	517616	6040748	18

Immature, 81-120 years, Other Species Leading

MAPSHEET	POLYGON	LEADING SPECIES	SPECIES %	AGE	TIMES SELECTED	UTM EASTING (ZONE 9)	UTM NORTHING (ZONE 9)	PRIORITY
103I058	114	DR	40	89	1	528477	6044620	1
103I058	**2098**	**EP**	**30**	**100**	**1**	**534060**	**6047665**	**2**
103I045	117	AC	100	109	1	491719	6034531	3
103I069	71	AT	80	119	1	542993	6061478	4
103I089	42	EP	70	95	1	545126	6074901	5
103I089	181	EP	50	95	1	544105	6075359	6

APPENDIX D – COMPARATIVE ANALYSIS OF THE POPULATION AND THE SAMPLE POLYGONS SELECTED

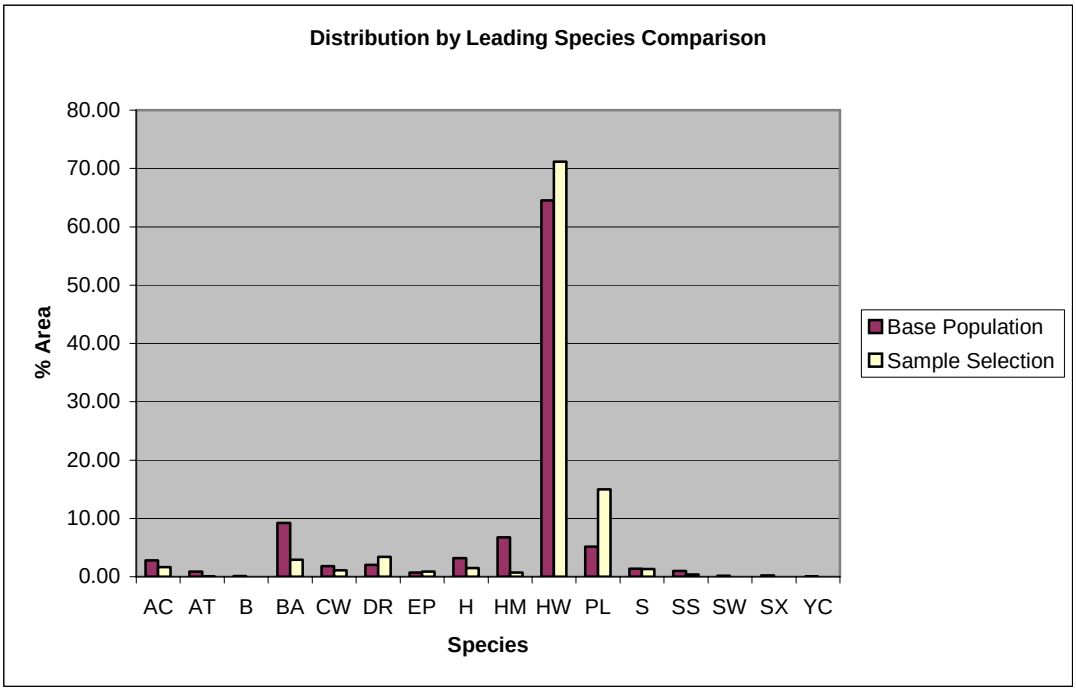
The following tables compare the distribution of samples selected to the population distribution (percent area). Charts are included for a better visual representation of distribution. Relationships are depicted for the distribution of samples by leading species and projected age class (projected to 2007). They reveal a strong co-relation between the two populations and indicate that the sample selection was effective.

Table 7: Distribution by Age Class, Projected to 2007

BASE POPULATION				SAMPLE POLYGONS			
AGE CLASS	**COUNT**	**SUM AREA (Ha)**	**% AREA**	**AGE CLASS**	**COUNT**	**SUM AREA (Ha)**	**% AREA**
1	358	6473.84	6.63	2	45	2516.84	48.51
2	1403	26566.78	27.21	3	13	370.07	7.13
3	281	4117.27	4.22	4	12	787.81	15.19
4	224	3099.26	3.17	5	14	427.40	8.24
5	358	5673.93	5.81	6	13	251.34	4.84
6	245	2925.55	3.00	8	3	44.82	0.86
7	155	1187.67	1.22	9	21	789.69	15.22
8	949	9522.23	9.75			**5187.98**	
9	2966	38056.77					
		97623.31					

Table 8 Distribution by Leading Species

BASE POPULATION				SAMPLE POLYGONS			
SPECIES	**COUNT**	**SUM AREA (Ha)**	**% AREA**	**SPECIES**	**COUNT**	**SUM AREA (Ha)**	**% AREA**
AC	299	2719.33	2.79	AC	6	83.62	1.63
AT	53	871.42	0.89	AT	1	2.83	0.06
B	11	126.83	0.13	BA	3	149.82	2.92
BA	486	8999.37	9.22	CW	1	56.60	1.10
CW	154	1743.63	1.79	DR	9	173.72	3.38
DR	215	2000.62	2.05	EP	4	45.42	0.88
EP	65	700.50	0.72	H	2	76.72	1.49
H	275	3114.38	3.19	HM	1	35.81	0.70
HM	654	6579.55	6.74	HW	76	3654.26	71.17
HW	4181	62978.49	64.51	PL	12	767.87	14.95
PL	301	5027.90	5.15	S	2	68.64	1.34
S	121	1352.38	1.39	SS	1	19.57	0.38
SS	98	985.58	1.01			**5134.89**	
SW	8	146.36	0.15				
SX	10	240.79	0.25				
YC	8	36.19	0.04				
		97623.31					



APPENDIX E – OPERABLE LANDBASE CRITERIA

November 20, 2003

Kalum TSA, TFL 1 & 41 Operability - Slope Parameters for Primary Harvest Code

Primary Codes	FIZ A	FIZ J
G (Ground-based)	≤ 30% slope	≤ 40% slope
C (Cable)	> 30 ≤ 80% slope	> 40 ≤ 80% slope
A (Aerial)	> 80 ≤ 90% slope	> 80 ≤ 90% slope
I (Inoperable)	> 90% slope	> 90% slope

Kalum TSA, TFL 1, TFL 41 - Stand Quality Code Parameters and description

Mature = Age Class 5 – 9
Immature = Age class ≤ 4 (≤ 80 years)
Minimum Harvest Age = Age at which 250m3/ha is achieved as per G&Y table having a height of 22m and dbh of 25 cm

G, M, P, L sites are as per the Kalum TSR: Good sites: SI ≥ 26 Medium sites: SI ≥ 15, <26 Poor sites: SI ≥ 10, < 15 Low sites: SI < 10. SI will be applied (also allow for the opportunity to run the model using the GMPL site class values as well)

FIZ A	FIZ J
S – Coniferous Sawlog stands i.e. primarily of sawlog grade (licencee best estimate)	
• Coniferous leading stands, all species, age class ≤ 5 to 7, height class ≥ 3; site class G or M; Net merchantable volume at minimum harvest age ≥ 300 m3/ha • Spruce, Pine, Balsam, or Cedar leading stands; age class 8 or 9, height class ≥ 4; Site class G or M; Net merchantable volume ≥ 300 m3/ha • Hemlock leading stands; age class 9, height class ≥ 4; Site class G and M; Net merchantable volume ≥ 300 m3/ha; ≥20% Spruce, Pine, Balsam, or Cedar • Hemlock leading stands; age class 8, height class ≥ 4; Site class G and M; Net merchantable volume ≥ 300 m3/ha • All immature coniferous leading stands; Net merchantable volume at minimum harvest age ≥ 300 m3/ha	• Coniferous leading stands, all species, age class 5 to 7, height class ≥ 3; site class G, M or P; Net merchantable volume at minimum harvest age ≥ 250 m3/ha • Spruce, Pine, Balsam, and Cedar leading stands; age class 8 or 9, height class ≥ 3; Site class G or M; Net merchantable volume ≥ 250 m3/ha • Hemlock leading stands; age class 9, height class ≥ 3; Site class G or M; Net merchantable volume ≥ 250 m3/ha; ≥20% Spruce, Pine, Balsam, and Cedar • Hemlock leading stands; age class 8, height class ≥ 3; Site class G; Net merchantable volume ≥ 250 m3/ha • All immature coniferous leading stands with height class ≥ 3; Net merchantable volume at minimum harvest age ≥ 250 m3/ha • All immature coniferous leading stands with height class < 3 that have resulted from previous logging/catastrophic events where silviculture activities have taken place; Net merchantable volume at minimum harvest age ≥ 250 m3/ha •
M – Marginal Coniferous Sawlog stands i.e. stands that are not "sawlog", but not poor enough to be designated as "pulplog"	

• Hemlock leading stands; age class 9, height class ≥ 4; Site class G and M; Net merchantable volume ≥ 300m3/ha; <20% Spruce, Pine, Balsam, or Cedar • Hemlock leading stands; age class 8 or 9, height class = 3; Site class G and M; Net merchantable volume ≥ 300 m3/ha • Spruce, Pine, Balsam, and Cedar leading stands, age class 8 or 9; height class = 3; site class G and M; Net merchantable volume ≥ 300 m3/ha. • **ADDED:** Deciduous leading stands with greater that 50% of the stand volume comprised of deciduous species, and with ≥ 30 % Spruce and/or Cedar content. •	• Hemlock leading stands; age class 9, height class ≥ 3; Site class G or M; Net merchantable volume ≥ 250 m3/ha; <20% Spruce, Pine, Balsam, and Cedar • Hemlock leading stands; age class 8, height class ≥ 3; Site class M; Net merchantable volume ≥ 250 m3/ha • Spruce, Pine, Balsam, and Cedar leading stands, age class 8 or 9; height class ≥ 3; site class P; Net merchantable volume ≥ 250 m3/ha. • Deciduous leading stands with greater that 50% of the stand volume comprised of deciduous species, and with ≥ 30 % Spruce and/or Cedar content.
P – Coniferous Pulplog stands i.e. primarily of Pulplog grade (licencee best estimate)	
• Coniferous leading stands; age class 8 or 9, height class ≥ 3; Site class P; Net merchantable volume ≥ 300 m3/ha	• Hemlock leading stands; age class 8 or 9, height class ≥ 3; Site class P; Net merchantable volume ≥ 250 m3/ha
D- Deciduous leading stands	
• All stands having greater than 50% of the stand volume comprised of deciduous species and < 30 % Spruce and/or Cedar content.	• All stands having greater than 50% of the stand volume comprised of deciduous species and < 30 % Spruce and/or Cedar content.
L – Low sites	
• Conifer leading stands, age class 4 and greater, stocking classes 2,3, and 4 • Mature coniferous stands with a height class of 2 or less; • Stands with volumes of ≤ 300 m3 at minimum harvest age age > 140 years; • Site productivity “L” or site indices of less than 10 at 50 years.	• Conifer leading stands, age class 4 and greater, stocking classes 2,3, and 4 • Mature coniferous stands with a height class of 2 or less; • Stands with volumes of ≤ 250 m3 at minimum harvest age age > 140 years; • Site productivity “L” or site indices of less than 10 at 50 years.
T- Density problems	
• Coniferous leading stands, **age class 5 and greater**, stocking classes 2, 3,and 4; • Immature stands resulting from catastrophic events that have had no silviculture treatments.	• Coniferous leading stands, **age class 5 and greater**, stocking classes 2, 3,and 4; • Immature stands resulting from catastrophic events that have had no silviculture treatments.