



Morice & Lakes Innovative Forest Practices Agreement

# Determination of a Method to Realize the Incremental Volume Gain from Harvesting with Low Stumps in the Morice and Lakes Timber Supply Areas

*Prepared by:*

*Timberline Forest Inventory Consultants Ltd.  
Prince George, B.C.*



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## Executive Summary

The Babine Enhanced Forest Management Pilot Project (EFMPP) Improved Utilization activity identified that Babine Forest Product's current harvesting practices resulted in an achieved stump height that is consistently lower than the required 30 cm. It was determined that low stump harvesting increased Babine's annual harvest by about 2%, or about 10,000 cubic metres.

The Morice & Lakes Innovative Forest Practices Agreement (IFPA) undertook this project to determine if all IFPA harvesters were consistently achieving harvest with low stumps, and to determine if the IFPA proponents were undertaking any special activities to enable harvest with low stumps. If the results indicated all IFPA proponents consistently achieved harvest with low stumps, then the project was to identify a process that would enable IFPA licensees to achieve a gain in volume.

The project has confirmed that all IFPA harvesting consistently achieves low stump heights, and has identified a variety of procedures undertaken by licensees that promote and enable harvest with low stumps. Stump heights reported from the brief non-statistical sample were lower overall than those reported by the Babine EFMPP activity. The project identified that long butting of trees will reduce the volume gain and quantified the proportion of net down to be 11% in the Morice Timber Supply Area (TSA) and 13% in the Lakes TSA.

The project has identified and recommended a relatively cost effective and efficient means of determining achieved stump height on a TSA basis. Two means of determination of volume gain attributable to harvest with low stumps are identified, one for use at the cutting permit level, the other at the TSA level.

A simple and effective means has been recommended by which licensees can receive the volume gain from low stump harvesting. An addition to the cutting permit document is proposed, which will enable identification of the volume attributable to low stumps and will consider such volume as not contributing to cut control.

Given that the recommendations are implemented now, there will be data available for consideration at the next Timber Supply Review (TSR), which may lead to including the gain from low stump harvesting in the TSA annual harvest.

It is anticipated that a net increase of about 2% in harvested volume will result from implementation of the recommendations. In the Lakes TSA this additional volume is not significant at this time, given the current increase in harvest to address mountain pine beetle salvage priorities. However, this small increase will help to offset the upcoming post-salvage downfall in harvest levels.

## Background

The forest licensees and Ministry of Forests programs responsible for nearly all of the harvest in the Morice and Lakes TSAs are listed below.

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- Lakes TSA
  - Babine Forest Products Co. (BFP).
  - Decker Lake Forest Products (this licence is managed by BFP).
  - West Fraser Mills Co. (WFM).
  - L&M Lumber Co. (L&M).
  - Canadian Forest Products Co. Ltd. (CFP), Houston Division.
  - Lakes District Small Business Forest Enterprise Program (SBFEP).
- Morice TSA
  - Canadian Forest Products Co. Ltd., Houston Division.
  - Houston Forest Products Co., (HFP)
  - Morice District SBFEP

Most of the timber harvested is milled in sawmills owned by the Morice & Lakes forest license holders.

Babine Forest Products Company is one of the participants in the Morice & Lakes Innovative Forest Practices Agreement (IFPA). Babine sponsored an Enhanced Forest Management Pilot Program (EFMPP) on their traditional operating areas, including Decker Lake's operations, within the Lakes TSA. The Babine EFMPP was rolled into the Morice & Lakes IFPA. Improved utilization was one of the Babine EFMPP activities. Thirty centimetres is the utilization level used for stump height in determination of all Timber Supply Review (TSR) allowable annual rates of harvest and operational cruises. The Babine harvest operations achieved a stump height of 15.4 centimetres. As a result of the low stump height a gain of about 2% in Babine's annual harvest was determined by this Babine EFMPP activity.

The potential for increase in the annual harvest through use of improved utilization fits within the following goals of the Morice & Lakes IFPA:

- To advance the goal of enhanced forest productivity as measured by percentage gain in realized mean annual increment.
- To increase the benefit to the province and local communities derived from the forest in terms of employment and revenue.
- To pilot innovative practices that will have utility in other TSAs and promote information transfer.

This project was initiated by the IFPA in September 2001 to confirm that harvest and sawmill practices undertaken by licensees in the two TSA's are similar to Babine's operations, and to identify a procedure to realize the volume gain attendant to harvest with low stumps.

A sub-committee was established to review results and provide direction to the project. The sub-committee works with the IFPA Forest Productivity Advisory

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Committee and reports to the IFPA Technical Committee. The sub-committee members are as follows:

- Larry McCulloch RPF, Lang & McCulloch Forest Management Services Ltd, M&L IFPA Secretary and Co-ordinator;
- John Illes RPF, Zone Forester Major Tenures, Lakes Forest District;
- Cyril Thacker RPF, Operations Forester, (replaced Garth Ehalt RPF), Houston Forest Products Ltd; and
- John Fuller RPF, Manager, Timberline Forest Inventory Consultants Ltd., Prince George.

The sub-committee provided direction and information throughout the project. This was especially valuable in this current period of great changes in government organization. The consultant's reports to the sub-committee summarized periodic findings and results of activities and presented recommendations for future action. The sub-committee reviewed and revised the consultant's reports and contributed ideas and knowledge and assisted in the formulation of subsequent activities.

## **Objectives**

The project objectives are as follows:

1. Confirm that the harvest and sawmill practices that impact on stump height are consistently applied throughout the two TSAs.
2. Identify a practical procedure to determine achieved stump height on an ongoing basis.
3. Identify a process to determine the volume gain attendant to achieved stump height of less than 30 centimetres.
4. Identify a procedure whereby TSA licensees will attain the gain in volume from harvesting with low stumps.

## **Methodology**

The methods used to achieve the four objectives are described in the following sections.

### **Confirmation of consistent harvest and sawmill practices that result in low stumps in the Morice and Lakes TSAs**

A brief non-statistical field study was undertaken to assess the consistency of harvest operations undertaken within the Morice & Lakes IFPA in regards to achieving low stumps. The operations staff of forest licencees and the

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Ministry of Forest's Small Business Forest Enterprise Program (SBFEP) each nominated one winter harvest and one summer harvest block deemed to be representative in terms of timber profile and harvest conditions. Stump height data was collected at four samples randomly located within each block. BFP and Decker Lake were excluded from this study as stump height had previously been established for their operations in the Babine EFMPP.

In addition to this field sampling for stump height, interviews were held with forest licensee operations staff to determine the special activities undertaken at the time of harvest or in the sawmilling process that would support harvest methods that result in lower stumps. Visits were made to the sawmills that had incorporated specialized equipment to address the problems associated with harvesting with low stumps. Gaps in information were identified through this process, and procedures to obtain the missing data were proposed by the consultant and reviewed by the sub-committee.

**Identify a practical procedure to determine achieved stump height on an ongoing basis**

The Babine EFMPP activity recommended a procedure to determine a statistically valid stump height. The procedure was designed to be applied in conjunction with residue and waste surveys, as this survey process provides a random and representative sample, and undertaking both data collections together offers significant cost savings.

Interviews were held with the appropriate M&L IFPA licensee planning and operations staff and the SBFEP, tenures, and Forest Practices Code enforcement staff. The objectives of the project were reviewed and staff was solicited for input.

**Identify a process to determine the volume gain attendant to achieved stump height of less than 30 centimetres**

Several cruise compilation programs can use variable stump utilization levels, and can be employed to determine the gain attendant to harvest with low stumps on a cutting permit.

The procedure to quantify the gain attendant to low stumps employed by the Babine EFMPP activity was to compare the cruise compilation volumes based on the conventional 30 cm stump height from nine representative cutting permits to the volumes derived using the achieved stump height of 15.4 cm. The proportional gain was applied to the annual harvest determined for Babine's EFMPP area.

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The MOF is currently developing version 7 of the Variable Density Yield Program (VDYP) that will enable the use of variable stump heights.

**Identify a procedure whereby TSA licensees will attain the gain in volume from harvesting with low stumps**

As well as interviews with licensee and MOF staff, a review of relevant acts and policies was undertaken to determine the processes that might be employed to enable the award of the gain in volume attendant to low stumps to the licensees.

**Results**

The results of the project are described below by objective.

**Confirmation of consistent harvest and sawmill practices that result in low stumps in the Morice and Lakes TSAs**

The brief study undertaken to determine if harvest activities undertaken by the M&L IFPA licensees were consistent in achieving low stump heights showed that all licencees’ harvesting consistently resulted in a stump height significantly less than the mandatory 30 cm. The results reinforced the findings of the Babine EFMPP study and are shown in Table 1.

**Table 1. Summary of Achieved Stump Height (cm) by Licencee/SBFEP, by Season and by TSA**

<u>Season of Harvest</u>	<u>CFP</u>	<u>HFP</u>	<u>Morice SBFEP</u>	<u>WFM</u>	<u>L&amp;M</u>	<u>Lakes SBFEP</u>	<u>All Lic/SBFEP</u>
Summer	11.2	11.6	10.7	13.1	7.8	9.5	10.1
Winter	13.1	17.2	11.5	9.8	8.1	18.8	12.3
S+W	12.5	13.9	11.1	11.3	7.9	12.8	11.1
		<b>Summary Morice TSA</b>			<b>Summary Lakes TSA</b>		
Summer		11.1			9.2		
Winter		13.5			11.3		
<b>S+W</b>		<b>12.3</b>			<b>10.0</b>		

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The results of this brief study indicate an achieved stump height of 12.3 cm for the Morice TSA licensees and 10.0 cm for the Lakes TSA licensees, excluding BFP and Decker Lake. It is logical that the stump height reported for the Lakes TSA is lower than the Morice, as the area of operations sampled is in the southern portion of the TSA where smaller pine is the major species harvested. The drier climate in this area also provides less snow than is found elsewhere in either TSA, which contributes to low stump height.

The sample results for West Fraser Mills (WFM) demonstrate a seasonal variation that is not observed in the other licensee/SBFEP samples. The winter harvest stump height is shorter than the summer harvest stump height by 3.2 cm. This difference has been reported to be largely due to special protective shielding used on the harvest equipment in the summer harvest operations, as well as low snow depths at the time of winter harvest. Operator skill and rocky terrain are also contributing factors.

The results from both TSAs are lower than the 15.4 cm mean stump height determined for the BFP and Decker Lake operations in the Babine EFMPP. There are two possible reasons that explain this difference. Firstly, the Babine EFMPP study was implemented over a three-year term that captured variations in annual snow depth. (The winter harvest blocks sampled in this project were harvested during the 2000/2001 winter, which did not produce deep snows.) Secondly, the BFP operating area is located in the northern half of the Lakes TSA where snow depths are always greater.

Interviews with licensees, ministry staff and harvesting contractor staff indicate that these consistent low stump heights are attributable to several complimentary activities as described in point form below.

1. The forest licensees wish to harvest the maximum economically useable volume from the forest and direct their harvesting contractors in this manner.
2. The harvest contractors maximize volume harvested per hectare as they are usually remunerated on the basis of the volume they deliver to the sawmill.
3. The most commonly employed harvest system is termed roadside harvest. In this system a feller/buncher cuts the trees and piles them in bunches. The skill of these equipment operators enables them to consistently achieve stump height less than 30 cm.
4. Grapple-skidders move the bunches of trees to the roadside. The efficiency of this phase of the harvest operation is improved greatly by consistently low stump height.
5. The MOF traditionally employs residue and waste assessment programs, which identify volume where the forest licence utilization

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standards are not met. Reductions in licensees' allowable annual harvest results and a penalty may be imposed when such volumes are deemed excessive.

These five factors provide incentives for harvesting with low stumps. The brief study measured a total of 1,355 stumps. Only 26 stumps of this total number -- less than 2% -- were over 30 cm. The brief report describing the findings in full, *Summary of Stump Height Samples Established in October 2001* (Appendix I), was circulated to the IFPA membership.

***Licensee activities that promote and enable harvest with low stumps***

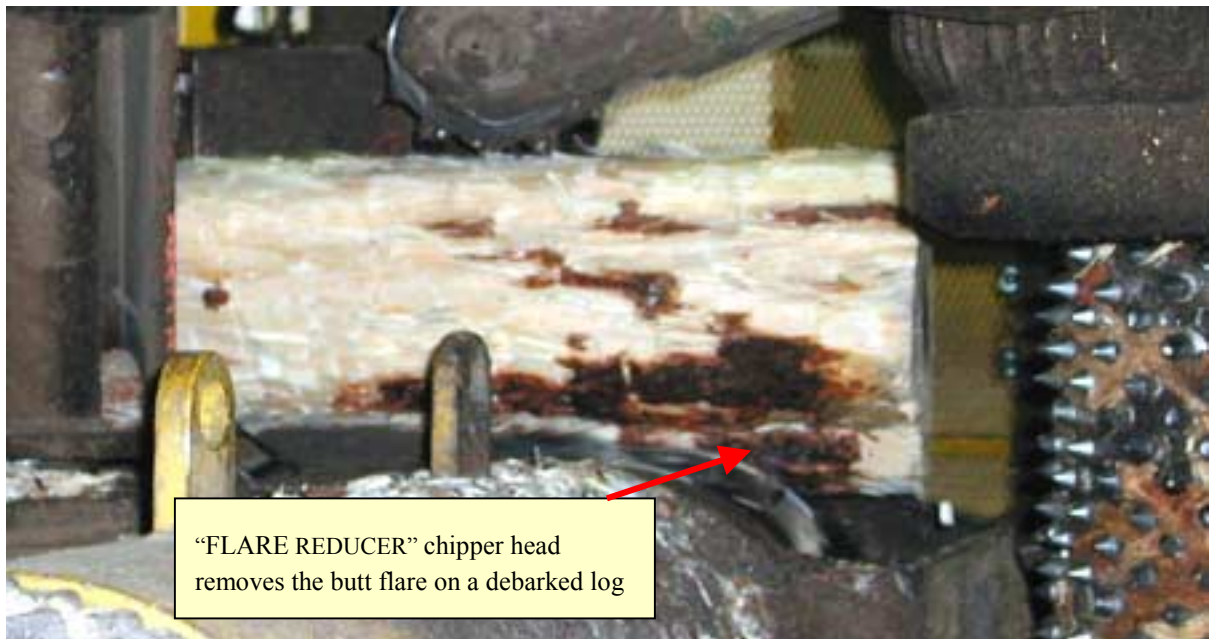
The interviews and mill tours indicate that licensees deal with the problems presented by low stump harvesting in several different ways. These procedures reflect the resource profile that is provided by their traditional operating areas.

The most common problem associated with low stump harvesting is flare on the butt end of a log. This flared section causes difficulty in processing the log at a sawmill. The butt end may be too large in diameter to fit into the debarker, or may have a butt flare projection termed a "horn" that interferes with the alignment of the log with saws. Some mills require that flare be reduced in the harvesting operation, either by long butting for excessive flare, or by longitudinally cutting the flared section off of the log. Several sawmills have installed specialized equipment to deal with butt flare or they utilize existing equipment to address butt flare problems.

All forest licensees have standards that apply to harvest contracts that require long butting of excessive flare and other defects in the field.

The following photograph shows a device installed in HFP's sawmill called a flare reducer.

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**Figure 1. Flare on the butt of a debarked log being removed by "Flare Reducer" in HFP's sawmill**

The flare on a debarked log is removed by a chipper head to enable correct orientation for sawing to lumber. The equipment can remove up to 15 cm of butt flare on one quadrant of a log.

### ***Variance for Snow Depth***

When unseasonably deep snows occur, licensees can apply to the district manager for a variance from the normal stump height utilization standard. The interviews with licensee and MOF staff identified that this procedure had not been employed at all in the Lakes Forest District, and was only rarely employed in the Morice Forest District. It was determined that variance from normal stump height requirements was not a factor to be considered in the determination of achieved stump height and volume gain in the M&L IFPA.

### ***Multi-purpose post harvest sampling***

The opportunity to combine other types of post harvest sampling with stump height data collection was discussed with licensee and MOF staff. It is anticipated that there may be incentive to survey for certification purposes as well as collection of data for forest management purposes. In addition to the residue and waste assessments the types of surveys that may be candidates for aggregation with stump height sampling include coarse woody debris, site degradation and assessment of potential for natural regeneration. All

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those interviewed thought there could be opportunity for multi-purpose sampling. However, the sub-committee felt that making recommendations on specific aggregated sampling was beyond the scope of this project.

**Long Butting**

Long butting in the harvesting operations was one significant factor that was identified through the interview process. This was not recognized as a consideration in the Babine EFMPP.



**Figure 2 Processor at a Babine Forest Products roadside harvest operation long butting for excessive flare.**

Trees are long butted usually to remove butt rot, or mechanical defects such as shatter, or to remove excessive flare at the butt of the tree. Figure 2 shows a processor at a roadside landing long butting a tree for excessive flare. Any tree that is long butted will not contribute to the volume gain from harvesting with low stumps.

A field study to derive the proportion of trees that are long butted was undertaken, and determined that overall 12% of the trees are long butted in the M&L IFPA. The statistical analysis of the study resulted in an overall standard error of 7.8% for both TSAs. The study determined that the proportion of trees long butted in the Morice TSA is 11%, with a standard

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error of 10.03%, and in the Lakes TSA the proportion long butted is 13%, with a standard error of 11.7%. A standard error of 10% or less is normally required for most inventory procedures, and less than 15 % has been deemed acceptable for some uses. Acquisition of additional data, should it be required, is relatively easy.

A brief report describing the long butt sample procedures and findings is located in Appendix II. It is proposed that the procedures employed to determine volume attributable to harvest with low stumps reduce the TSA volume gains by these respective proportions.

**Identify a practical procedure to determine achieved stump height on an ongoing basis**

The Babine EFMPP activity estimated that sufficient stump heights would be collected in 75 residue and waste samples to derive a statistically valid estimate of achieved stump height. A sample size of 100 plots was recommended to account for variability and operational changes to sampling plans. The Babine EFMPP activity report containing the recommended methodology for stump height data collection, *Improved Utilization, Final Report 1999-2000* can be found at the following website:  
[www.babineefmpp.com](http://www.babineefmpp.com).

Where the MOF requires residue and waste assessments to be completed within a TSA, the stump height data can be collected simultaneously in a very cost-effective manner.

Staff at the Morice Forest District have developed an innovative procedure for annual residue and waste assessment that offers additional savings in time and expense. The process is called the Multi-year Aggregate Method. Simply put, the procedure uses residue and waste data collected over several years instead of the conventional practice of using only the current year's data to provide a statistically valid sample. This enables a very significant reduction in the number of samples collected annually. The document describing the process is contained in Appendix III. The procedure is under review by Prince Rupert Forest Region staff and head office staff in Victoria. The procedure has been successfully applied for several years in the Morice Forest District and is regarded as an effective alternative to conventional residue and waste assessments by the MOF and forest licensees.

Collection of stump height data in conjunction with the Morice Forest District Multi-Year Aggregate Method will reduce costs and provide a statistically valid estimate of achieved stump height. Morice staff report that about 80 to 90 residue and waste assessment plots are established annually in the Morice TSA using the method. If stump height data was collected on 33

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of these plots that were deemed representative, then over a term of three years sufficient stump height data would exist to provide a statistically valid estimate of achieved stump height in the TSA.

**Identify a process to determine the volume gain attendant to achieved stump height of less than 30 centimetres**

There are two methods of determination of volume gain from harvest of low stumps. The first uses VDYP and is best for determination of gain on a TSA basis. The second uses a cruise compilation program and is best for determination of volume gain on a cutting permit.

The MOF is currently developing VDYP Version 7 that enables use of different utilization levels for stump height in the determination of volume. Using the new VDYP Version 7, the increase in the annual rate of harvest due to achieved low stump height can be determined from the TSA inventory files. This procedure is the best method to determine the volume gain from harvest with low stumps on a TSA basis, and would be the basis of any award of increase in TSA allowable annual rate through the TSR process.

The use of achieved stump height in the cutting permit cruise compilation process will enable determination of the volume gain for individual cutting permits.

The use of representative cutting permits to determine the proportional gain on a TSA basis will work, and provides an alternative method until VDYP Version 7 is available.

**Identify a procedure whereby TSA licensees will attain the gain in volume from harvesting with low stumps.**

The existing forest acts and policies provide for several means by which the licenses can receive recognition for the gain in volume attendant to harvest with low stumps. Three options were identified and are listed below with some comments:

1. Revision of Licence Utilization Specifications.
  - a. The regional manager, in consultation with the district manager and the forest licensees, may revise the utilization specifications. This would mean changing stump height from the current standard of 30 cm to an average achieved stump height on each TSA. The district manager can modify TSL utilization specifications in a similar manner. The TSR determination of annual harvest would be greater than harvest based on 30 cm stump height, and the TSA licensees would presumably share in the increase.

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- b. The residue and waste assessment procedure would negate a significant portion of the gain, as stumps that exceed the new utilization stump height would contribute to a volume deficit that would be applied in the cut control process.
  2. Employ the Residue and Waste Assessment Process to Determine the Volume Gain Attendant to Low Stumps.
    - a. At present the residue & waste process only quantifies the volume of stumps over 30 cm in height for cut control billing purposes.
    - b. The procedure could be modified to determine the volume attendant to stumps less than 30 cm in height. In this circumstance the residue and waste survey could actually determine that a credit to cut control was merited.
    - c. This process would require two measurements and a calculation for each sample stump. Deemed much more time consuming and expensive than alternative methods, this procedure will not work in the Lakes TSA where the residue and waste program is discontinued for beetle salvage cutting permits.
  3. Addition to the Cutting Permit Document.
    - a. This procedure considers the portion of the tree below 30 cm as available for optional utilization. It can be enacted by the district manager and would apply to all cutting permits issued in the district.
    - b. The cutting permit would include the additional :*“Upon submission of a survey that meets the satisfaction of the district manager, the volume of that portion of the tree utilized below the required stump height will not contribute to cut control.”*
    - c. The licensees would be required to identify the achieved stump height and the attendant gain in volume.
    - d. This process is simple and can be implemented almost at once with the support and participation of M&L IFPA members.

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- e. If employed in the period until the next TSR this procedure will provide data for consideration when the TSA annual rate of harvest is determined.

## **Discussion**

Several significant changes in policy and organization occurred throughout the term of the project that have bearing on the procedures and processes recommended, and more changes that are likely to impact on the recommendations of this project are anticipated in the next several months.

The following list describes several issues under review at present that may have a bearing on the realization of volume from shorter stumps. The procedures recommended by this project should be reviewed in light of new government and ministry policy and may require revision.

- Morice Forest District Multi-Year Aggregate Methodology is under review by regional and branch staff of the MOF.
- The utilization specifications may be altered or removed in revisions to forest licence and timber sale licence specifications.
- The SBFEP is under review, and may be significantly revised. The issue is that the SBFEP is responsible for a significant portion of the TSA annual harvest and should participate in determination of volume gain from low stump harvesting.

The brief study on current harvest practice indicates that the achieved stump height across both the Morice and Lakes TSAs is consistent and is lower than the stump height determined in the Babine EFMPP. It has been identified that licensees are currently undertaking activities in harvesting and sawmilling that enables effective harvesting with low stumps. It has been identified that long butting will reduce the gain by 11 to 13%. We consider that the TSA-specific results for the proportion of long-butted trees obtained through this study are adequate for the purposes of providing a net down to the volume gain from low stump harvesting. If the recommendations of this study are implemented and concerns are raised about data having standard error in excess to 10%, it will be easy and relatively inexpensive to add additional samples to the existing data.

It is anticipated that a net gain of 2% in the TSA annual cut will result from harvest with low stumps.

The project recommends a method by which the licensees can obtain the benefit from harvest that achieves stump height less than 30 cm. This procedure will be applied on a cutting permit basis and will require licensees and SBFEP to participate in the collection of stump height data in order to quantify the gains.

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Given the current salvage harvest situation in the Lakes TSA, where the annual rate of harvest has been doubled, the question is raised, “Why bother with this relatively small increase in annual harvest at this time?” There are two potential benefits of starting to document achieved stump height and the attendant gain in volume now. One is to help to offset the upcoming downfall in rate of harvest that will be implemented after the salvage programs are completed, and the second is that consideration can be given to including the volume gain attendant to harvesting with low stumps at the next TSRs, if there is supporting data.

## **Recommendations**

The project has identified several alternative procedures to address the objectives. The table in Appendix IV briefly describes the alternative procedures for each objective, and lists the pros and cons of each with a relative recommendation.

Where residue and waste surveys are implemented, which is currently the situation in the Morice TSA, stump heights should be collected for a total of 75 to 100 residue and waste samples. The residue and waste sample design procedures provide representative and unbiased sampling. Residue and waste samples selected for stump height data collection must be representative of the annual harvest taking into consideration the variables of season, licensee and geographic location.

Cutting permit cruise compilations and /or Version 7 of VDYP should be used to determine the gain in volume from low stump height. The volume gain should be reduced by the TSA specific proportion of long butted trees. These procedures should be undertaken annually.

The benefit of the net gain attendant to low stumps should be recognized by licensees through use of achieved stump height in the cruise compilations of cutting permits. This gain should be identified as volume that does not contribute to cut control.

The next timber supply review may consider the information that has been gathered by this procedure and may award an increase in the TSA rate of harvest to reflect the gain from harvesting with low stumps.

### ***Morice TSA***

Collection of stump height data in the Morice TSA is recommended to be undertaken in conjunction with the residue and waste program employing the Morice Multi-Year Aggregate Methodology. This process will provide accurate results with reduced cost. Applying this process will reduce the

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annual stump height data collection to about 33 samples per year. The data for successive years will be aggregated.

It is anticipated that the data from year one and two will provide estimates of achieved stump height that are accurate enough for the purposes of determining volume gain. If these initial estimates of stump height are deemed inaccurate, then more stump height data will need to be collected in the first year. This data set will provide the statistically valid estimate of achieved stump height, given that about 75 to 100 samples are required, after three years.

The achieved stump height will be used in cutting permit cruise compilations to determine the gain in volume attributable to harvesting with low stumps. The resulting volume will be reduced by 11% to account for long butting. The net gain will be applied pro-rata to the active cutting permits where the gain will be identified as volume that does not contribute to cut control.

The achieved stump height should be used in VDYP Version 7 and applied to the TSA inventory file to determine the gain in volume attendant to low stumps on a TSA basis. Applying the TSA-specific reduction for long butting will derive the net gain.

### ***Lakes TSA***

It is recommended that licensees in the Lakes TSA implement a process similar to that recommended for the Morice TSA. In the absence of residue and waste assessments the Multi-Year Aggregate residue and waste sample design methodology should be employed for the stump height samples. A reduction of 13% should be applied to the volume gain to account for the proportion of long-butted trees.



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# **Appendix I**

## **Summary of Stump Height Samples**

### **Established in October 2001**

DETERMINATION OF A METHOD TO REALIZE THE INCREMENTAL VOLUME GAIN FROM HARVESTING WITH LOW STUMPS IN THE  
MORICE AND LAKES TIMBER SUPPLY AREAS

**Nov 09/01**

The Morice and Lakes IFPA is undertaking a project to determine a method to realize the incremental gain in harvested volume attendant to achieved stump height below 30 cm. . A sub-committee, established to recommend a process, works with the IFPA Forest Productivity Advisory Committee and reports to the IFPA Technical Committee. The following brief report was submitted to the sub-committee upon completion of an interim step within in the project.

**Summary of Stump Height Samples Established in October 2001**

**Objective**

The purpose of this sampling program is to confirm that existing harvest practices within the Morice and Lakes IFPA may achieve reduced stump height, to quantify existing stump height from a small sample, to identify where opportunities for improving stump height exists, and to provide assurance to the IFPA that future work on stump height is worthwhile.

**Method**

The IFPA participants-- with the exception of Babine Forest Products Co., where achieved stump height has been quantified in the Babine EFMPP -- each nominated two representative harvest blocks for sampling, one summer harvest and one winter harvest. Four plots were located in each block. The Residue and Waste Assessment sample design methodology was employed to ensure random plot location. Twelve blocks were sampled, and 48 plots were located. The Residue and Waste Assessment plot measurement procedures were used. The field program was supervised and implemented by the same technician who undertook most of the sampling in the Babine EFMPP project. The field work was completed October 15 to 19, 2001. Data were collated in a Microsoft Access database.

**Results**

Field crews observed that the plots were representative of the average condition of the harvest blocks or sampled portions of blocks in terms of species, stump height, terrain and harvest method. Information about the sampled blocks is tabled below.



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**Stump Height Sample Program**  
**Harvest Block Information**

Lic/SBFEP	TSLic/CP Block	No. of Plots	Season of Harvest	Felling Hand or Machine	Harvest System	BGC SZ-Var	Comments
L&M	192-41	4	W	M	Roadside	SBS dk	
L&M	192-79	4	S	M	Roadside	SBS dk	
WFM	L31-137A	4	S	M	Roadside	SBS dk	
WFM	514-160	4	W	M	Roadside	SBS dk	Sel harv of PI
HFP	082-1	4	S	M	Roadside	SBS mc	
HFP	087-1	4	W	M	Roadside	SBS mc	see Note #1
CFP	266-2	4	S	M	Roadside	SBS mc2	
CFP	589-2	4	W	M	Roadside	SBS mc2	
Lakes SBFEP	A 65843-SB4	4	W	M	Convent	SBS mc2	
Lakes SBFEP	A 54712	4	S	M	Roadside	SBS mc2	
Morice SBFEP	A 52022 Blk- E	4	S	M	Roadside	SBS mc2	
Morice SBFEP	A 64973	4	W	M	Roadside	SBS mc2	
	total	48					

Note #1 - HFP 087-1 no samples were established within old harvesting of brood patches.

The mean stump height determined from the data collected in the 48 plots is summarized in the following table. The data has been aggregated to provide summer and winter results for each TSA, as well as each licensee/SBFEP and all licensees. The seasonal stump heights have been averaged to indicate an approximation of the average annual stump height.

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**Summary of Achieved Stump Height (cm) by TSA and by Licence/SBFEP**

(Standard deviation shown in brackets)

<u>Season of Harvest</u>	<u>CFP</u>	<u>HFP</u>	<u>Morice SBFEP</u>	<u>WFM</u>	<u>L&amp;M</u>	<u>Lakes SBFEP</u>	<u>All Lic/SBFEP</u>
Summer	11.16 (5.67)	11.57 (8.64)	10.67 (8.54)	13.06 (6.24)	7.81 (3.67)	9.52 (9.15)	10.08 (7.23)
Winter	13.12 (8.71)	17.19 (8.40)	11.53 (7.66)	9.83 (5.13)	8.13 (4.62)	18.81 (12.87)	12.29 (8.44)
S+W	12.47 (7.88)	13.89 (8.96)	11.06 (8.15)	11.34 (5.88)	7.93 (4.03)	12.81 (11.48)	11.09 (7.88)
		<b>Summary Morice TSA</b>			<b>Summary Lakes TSA</b>		
Summer		11.07 (8.12)			9.17 (6.17)		
Winter		13.46 (8.50)			11.29 (12.55)		
S+W		12.27 (8.39)			10.02 (9.32)		

**Discussion**

This small sample of stump height achieved by the licencees and SBFEP harvest operations indicates that all harvesting within the IFPA yields reduced stump height. The results are consistent with the findings of the Babine EFMPP for stump height, that harvesting operations are achieving stump heights significantly less than 30 cm . The preliminary indications based on these findings are that the reduced stump height in the IFPA may be shorter than the achieved stump height of 15.4 cm determined in the Babine EFMPP. However, snow depths have reportedly been exceptionally low in the most of the operating areas in the last two winters. Winter mean stump height of 18.1 cm was 7 cm higher than the summer mean stump height of 11.1 cm in the Babine EFMPP study.

The sample results for WFM demonstrate a seasonal variation that is not observed in the other licencee/SBFEP samples. The winter harvest stump height is shorter than the summer harvest stump height by 3.2 cm . This difference has been reported to be largely due to special protective shielding used on the harvest equipment in the summer harvest operations, as well as low snow depths at the time of winter harvest. Operator skill and rocky terrain are also contributing factors.

Determination of stump height will require a larger sample to achieve greater confidence in the results, and the determination of volume gain will require

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weighting for summer and winter harvest. Overall there only appears to be some small opportunity to further reduce stump heights.

The total number of stumps included in the samples and the number of stumps that exceed the current utilization specification of 30 cm are tabled below. It is noteworthy that only 2% of all stump heights exceed the utilization specification of 30 cm.

CP	BLK	Total No. of Stumps	Season Of Harvest	No. of Stumps > 30 cm
192	41	128	W	0
192	79	225	S	0
266	2	64	S	1
514	160	81	W	0
589	2	130	W	3
82	1	121	S	2
87	1	85	W	6
A52022	Blk-E	169	S	2
A54712		75	S	4
A64973		142	W	2
A65843	SB4	49	W	5
L31	137A	72	S	1
<b>Totals:</b>		<b>1355</b>		<b>26</b>

The results provide assurance to the IFPA that the determination of a process to derive achieved stump height and the attendant volume gain is worthwhile.



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## **Appendix II**

# **Procedure to Sample Log Decks to Identify the Proportion of Trees that are Long Butted**



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Mar 13, 2002

Results of the Sampling of Log Decks to Identify the Proportion of Trees  
that are Long Butted

Prepared for Stump Height Project Sub-Committee

Morice & Lakes IFPA

Background:

The M&L IFPA has initiated a process to identify the gain in volume from harvesting stumps with an achieved height of less than 30 cm. It has been noted that a proportion of all trees are long butted in the field. This proportion is thought to be significant and any long butting of the tree will reduce the gain in volume. Long butting of trees is normally carried out by processors to remove excessive butt rot, or less frequently for removal of shatter or flare. Processors utilize a chainsaw in long butting, and this leaves a relatively smooth cut face on the butt of the tree. Most standing trees are harvested by feller/bunchers that normally utilize a power-head cutting device that leaves a rough surface on the butt. These two devices each create a different surface that is easily distinguishable, as shown in the following photograph. We propose to locate samples in mill yard log decks to quantify the proportion of stems that are long butted. Mill yard staff will be consulted prior to establishing these samples to ensure that only trees from the M&L IFPA are sampled, and that only loads from contractors who utilize power-head feller/bunchers as opposed to chain saw cutting-head feller/bunchers are included in our samples. The sub-committee has made the assumption that randomly located samples will provide a representative sample of the proportion of harvested trees that are long butted.

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**Eric Hannula of BFP points out the difference in butt face between feller/buncher cuts and processor cuts.**

Methodology:

Ten randomly located samples were proposed for log decks in each of the 4 mill yards that process logs from the Lakes TSA, and 20 samples were planned for each of the two Houston mill yards which primarily mill logs from the Morice TSA. Many mills store their logs in different decks that are stratified by age or quality. The samples were proposed to be located proportionally within each stratum. Sample locations at 50-metre intervals within the decks were proposed to ensure unbiased sampling. The samples are 3 metres by 3 metres in area. All stems in the sample were tallied to 5 cm diameter classes at the butt. A height pole was used to assist in determination of in and out stems at the top of the plot. The pith was the determination point for inclusion of borderline stems. Processor-cut butt faces (i.e. the long butts), were identified within each sample. The proportion of long-butted stems was determined by 5 cm butt diameter classes and for all diameter classes.

The mills involved in this study include the following four mills that process stems from the Lakes TSA:

1. L&M Lumber Ltd, Vanderhoof
2. West Fraser Mills Ltd, Fraser Lake
3. Babine Forest Products Co Ltd., Burns Lake
4. Decker Lake Sawmill, BFP subsidiary, Burns Lake



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And, the following two mills that process the stems primarily from the Morice TSA:

1. Houston Forest Products, Houston
2. Canadian Forest Products Ltd at Houston.

Results:

Plots were established in the mill yards of the six mills. Only five plots were established in the Decker Lake mill yard. There were two reasons for this. The mill yard had very few decked logs at the time, and the Decker samples contained a significantly larger number of logs due to the small piece size than the other mill samples. The five plots provided a similar sample size to the other Lakes TSA mill samples.

The L&M mill yard decks contained highway loads and many of the trees had been bucked for highway haul. It was not always possible to differentiate between long-butted butts and the bucked butt end of the top logs. To compensate for inclusion of the butt ends of top logs in the L&M sample, an arbitrary factor of 38% was applied to the two butt diameter classes that contained top logs, 15.1 to 20 cm and 20.1 to 25 cm.

Sampling results summarized on the attached spreadsheet are listed by mill and by butt diameter class. The proportion of long-butted trees overall was 12 percent. The average is 13 % for the four Lakes TSA mills, BFP, Decker FP, WFM and L&M. In the Morice TSA, the average for CFP and HFP is 11%.

A statistical analysis was undertaken on the sample data (see the attached). The standard error of the proportion of trees long butted for the two TSAs was determined as 7.8%. The standard error for the Lakes TSA was determined as 11.72% and the Morice TSA standard error was determined as 10.03 %. The convention for acceptable standard error for inventory data is 10% or less; however, exceptions have been made to 15% or less in certain instances. We feel that the estimates of the proportion of long-butted trees are adequate for the purpose of netting down the estimated gain in volume from low stump harvesting. Should it be determined that a standard error of 10% or less must be achieved, it is a simple and relatively cheap procedure to collect additional samples and include these with the current data.



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March 13/02

**Proportion of Harvested Trees that are Long Butted**

**TALLY OF ALL STEMS**

**5cm Butt Diameter Classes**

	10.1-15	15.1-20	20.1-25	25.1-30	30.1-35	35.1-40	40.1-45	45.1-50	50.1-55	55.1-60	60.1-65	65.1-70	Total
<b>L&amp;M</b>	17	213	229	162	61	17	5	0	0	0	0	0	<b>704</b>
<b>WFM</b>	0	36	148	278	235	70	36	25	7	1	0	0	<b>836</b>
<b>BFP</b>	1	7	32	147	174	112	93	70	29	12	5	3	<b>685</b>
<b>Decker Lake (1)</b>	62	165	113	79	48	32	26	13	9	2	3	2	<b>554</b>
<b>Total Lakes TSA</b>	<b>80</b>	<b>421</b>	<b>522</b>	<b>666</b>	<b>518</b>	<b>231</b>	<b>160</b>	<b>108</b>	<b>45</b>	<b>15</b>	<b>8</b>	<b>5</b>	<b>2779</b>
<b>HFP</b>	5	106	191	349	298	158	146	110	47	22	9	5	<b>1446</b>
<b>CFP</b>	3	39	123	370	378	140	118	93	34	12	7	6	<b>1323</b>
<b>Total Morice TSA</b>	<b>8</b>	<b>145</b>	<b>314</b>	<b>719</b>	<b>676</b>	<b>298</b>	<b>264</b>	<b>203</b>	<b>81</b>	<b>34</b>	<b>16</b>	<b>11</b>	<b>2769</b>
<b>Total All Mills</b>	<b>88</b>	<b>566</b>	<b>836</b>	<b>1385</b>	<b>1194</b>	<b>529</b>	<b>424</b>	<b>311</b>	<b>126</b>	<b>49</b>	<b>24</b>	<b>16</b>	<b>5548</b>

**TALLY OF LONG BUTTED STEMS**

	10.1-15	15.1-20	20.1-25	25.1-30	30.1-35	35.1-40	40.1-45	45.1-50	50.1-55	55.1-60	60.1-65	65.1-70	Total
<b>L&amp;M (2)</b>	0	9	38	22	10	0	0	0	0	0	0	0	<b>79</b>
<b>WFM</b>	0	0	9	36	31	4	5	0	1	0	0	0	<b>86</b>
<b>BFP</b>	0	1	5	30	25	26	16	13	2	1	1	0	<b>120</b>
<b>Decker Lake</b>	0	7	11	18	13	11	6	1	0	0	0	0	<b>67</b>
<b>Total Lakes TSA</b>	<b>0</b>	<b>17</b>	<b>63</b>	<b>106</b>	<b>79</b>	<b>41</b>	<b>27</b>	<b>14</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>352</b>
<b>HFP</b>	0	3	15	32	42	18	9	12	2	1	0	0	<b>134</b>
<b>CFP</b>	0	0	14	49	57	25	12	10	2	2	0	0	<b>171</b>
<b>Total Morice TSA</b>	<b>0</b>	<b>3</b>	<b>29</b>	<b>81</b>	<b>99</b>	<b>43</b>	<b>21</b>	<b>22</b>	<b>4</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>305</b>
<b>Total All Mills</b>	<b>0</b>	<b>20</b>	<b>92</b>	<b>187</b>	<b>178</b>	<b>84</b>	<b>48</b>	<b>36</b>	<b>7</b>	<b>4</b>	<b>1</b>	<b>0</b>	<b>657</b>



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PROPORTION OF TOTAL STEMS THAT ARE LONG BUTTED

	10.1-15	15.1-20	20.1-25	25.1-30	30.1-35	35.1-40	40.1-45	45.1-50	50.1-55	55.1-60	60.1-65	65.1-70	Total
<b>L&amp;M</b>	0%	4%	17%	14%	16%	0%	0%	0%	0%	0%	0%	0%	<b>11%</b>
<b>WFM-Fraser Lake</b>	0%	0%	6%	13%	13%	6%	14%	0%	14%	0%	0%	0%	<b>10%</b>
<b>BFP</b>	0%	14%	16%	20%	14%	23%	17%	19%	7%	8%	20%	0%	<b>18%</b>
<b>Decker Lake</b>	0%	4%	10%	23%	27%	34%	23%	8%	0%	0%	0%	0%	<b>12%</b>
<b>Total Lakes TSA</b>	<b>0%</b>	<b>4%</b>	<b>12%</b>	<b>16%</b>	<b>15%</b>	<b>18%</b>	<b>17%</b>	<b>13%</b>	<b>7%</b>	<b>7%</b>	<b>13%</b>	<b>0%</b>	<b>13%</b>
<b>HFP</b>	0%	3%	8%	9%	14%	11%	6%	11%	4%	5%	0%	0%	<b>9%</b>
<b>CFP</b>	0%	0%	11%	13%	15%	18%	10%	11%	6%	17%	0%	0%	<b>13%</b>
<b>Total Morice TSA</b>	<b>0%</b>	<b>2%</b>	<b>9%</b>	<b>11%</b>	<b>15%</b>	<b>14%</b>	<b>8%</b>	<b>11%</b>	<b>5%</b>	<b>9%</b>	<b>0%</b>	<b>0%</b>	<b>11%</b>
<b>Total All Mills</b>	<b>0%</b>	<b>4%</b>	<b>11%</b>	<b>14%</b>	<b>15%</b>	<b>16%</b>	<b>11%</b>	<b>12%</b>	<b>6%</b>	<b>8%</b>	<b>4%</b>	<b>0%</b>	<b>12%</b>

(1) 5 samples were established at Decker Lake, the original plan called for 10.

(2) L&M logyard decks contained only highway loads. These loads contain logs from trees that have been bucked for length. To account for top logs the long-butted tally was reduced by a factor of 38% in two butt diameter classes, 15.1 to 20 & 20.1 to 25.

Statistical Analysis of Long Butt Samples by TSA

<u>Morice TSA all Samples</u>			<u>Lakes TSA all Samples</u>			<u>Combined Sample for Both TSAs</u>		
Mean	0.114778		Mean	0.128414		Mean	0.121141	
Standard Error	0.01151	<b>10.03%</b>	Standard Error	0.015049	<b>11.72%</b>	Standard Error	0.009296	<b>7.67%</b>
Median	0.10148		Median	0.1		Median	0.101266	
Mode	0		Mode	#N/A		Mode	0	
Standard Deviation	0.072798		Standard Deviation	0.08903		Standard Deviation	0.080509	
Sample Variance	0.0053		Sample Variance	0.007926		Sample Variance	0.006482	
Kurtosis	-1.13892		Kurtosis	1.066293		Kurtosis	0.593159	
Skewness	0.002325		Skewness	1.154034		Skewness	0.746996	
Range	0.242424		Range	0.370469		Range	0.392857	
Minimum	0		Minimum	0.022388		Minimum	0	
Maximum	0.242424		Maximum	0.392857		Maximum	0.392857	
Sum	4.591131		Sum	4.494479		Sum	9.08561	
Count	40		Count	35		Count	75	
Confidence Level(95.0%)	0.023282		Confidence Level(95.0%)	0.030583		Confidence Level(95.0%)	0.018524	



DETERMINATION OF A METHOD TO REALIZE THE INCREMENTAL VOLUME GAIN FROM HARVESTING WITH LOW STUMPS IN THE MORICE  
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## **Appendix III**

# **Morice Forest District, Multi-year Aggregate Method of Residue & Waste Assessment**



DETERMINATION OF A METHOD TO REALIZE THE INCREMENTAL VOLUME GAIN FROM HARVESTING WITH LOW STUMPS IN THE MORICE  
AND LAKES TIMBER SUPPLY AREAS

**Morice Forest District**

**Multi-Year Aggregate Method - Overview**

Forest Licence holders are required to ensure post-harvest timber residue and waste volumes are measured, and report the results of these surveys to the MOF in the prescribed format. All field surveys are then subject to a 10% plot check by MOF staff, as well as further document checks. The MOF uses the survey results to initiate a billing for timber waste volumes, and to ensure residue and waste is also recorded against the licensee's Annual Allowable Cut (AAC). The multi-year aggregate is an additional method to stratify and compile residue and waste information, which saves time and costs for both the MOF and major tenure licensees. This method looks beyond a one year 'aggregate' as quantified in the Provincial Residue and Waste Manual, by combining the current year block data with that of previous years. In essence, an unending survey year is created, which uses a finite data set at the time of compilation. Every time data is added and/or dropped off, the whole data set is recompiled to come up with a new weighted volume multiplier for billing purposes. This allows surveys for a given year to be conducted on a reduced block, minimum plot basis, while still retaining statistical integrity. The ultimate benefit is a net reduction in the number of survey plots that require measurement, and a subsequent reduction in checks to be conducted by the MOF. With the method indicated below, an estimated 75% time and cost saving is realized by both MOF and industry over the current aggregate and full cutblock survey options described in the manual.

**The specific methodology is described below:**

**SPECIFIC METHOD:**

1. Licensees may stratify their operations to best capture variations in logging method, timber type, logging season, or other factors.  
Examples: Stratification of summer vs. winter logged areas,  
Stratification of geographic areas having different timber types.

This initial stratification ensures that an accurate cross-section of blocks can be chosen for survey and compilation representing the variations to be found as a result of forest type, logging method, time of year (snow depth), etc.

2. A full stratified list of all cutting permit's and blocks requiring survey and billing is completed and submitted to the MOF by the licensee.



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3. 25% of all blocks by stratum are chosen for survey by the MOF from the list provided by the licensee. These are chosen randomly so as not to introduce bias.
4. The remaining 75% of blocks logged in the stratification period are exempted from survey.
5. 3 and 4 above form the basis of the Annual Residue & Waste Survey Plan, along with the sum of the area surveyed previously to a total of 3 (or more) years' worth of data.
6. The plot sample plan is designed for the chosen 25% of blocks as follows:

“For the Multi-Year Aggregate option, the number of plots for an **individual block** will be the result of the hectare to plot ratio for all sample blocks in the current year plus the hectares of sample blocks in the previous two or more years of the aggregate divided into the area of the block and rounded to the nearest whole number. In the event that the formula shows less than two plots, the minimum of 2 plots per stratum will apply on **each** block surveyed“
7. In order to reap the maximum benefit or cost saving, the survey planner should achieve an aggregate size of approx. 2000 hectares or greater using a coefficient of variation (CV) of 100%, or the local CV if known. The aim is to achieve the minimum plot requirement of 2 per stratum per block as determined from the tables found at the end of the *Provincial Logging Residue & Waste Procedures Manual* section 4. Depending on the size of the Licence's annual cut in hectares, it may be necessary to combine a longer time period than 3 years, or a slightly larger sample size than 25% to achieve this goal.
8. Data disks for previous 2.5-3 years of residue & waste surveys are retrieved by the licensee. The current plot data is entered into the residue and waste program, and combined with historical plot data as indicated in point # 6 above. Alternately, as is the case with Canfor Houston, the licensee may write their own compilation program subject to MOF review and approval to complement the MOF residue and waste compiler program.
9. A complete recompilation is made combining new and old data to arrive at a new **weighted volume** (m<sup>3</sup> per hectare) to be used as a multiplier for both accumulated and dispersed areas on current year blocks, and cleared road right-of-ways. The previous year's data may be dropped off when adding current data, so long as the data set remains large enough to achieve the preferred minimum sample size and statistical integrity.
10. By combining the old and new data, statistical sampling objectives are met by combining a large and small data set, respectively. In effect all the data is treated as if it were created in one survey year. The 'aggregate' method described in the provincial residue and waste manual requires that the statistical integrity be met over one year by combining many blocks from the current year.
11. The new **weighted volume** is then used to determine both the billing and cut control volumes for both the 25% of blocks surveyed and the 75% of blocks exempted from survey. This represents all the blocks approved within the Annual Residue and Waste Survey Plan for the current year.



DETERMINATION OF A METHOD TO REALIZE THE INCREMENTAL VOLUME GAIN FROM HARVESTING WITH LOW STUMPS IN THE MORICE AND LAKES TIMBER SUPPLY AREAS

12. The new weighted volume is multiplied by the net area (dispersed and accumulated, respectively) for each block and the results recorded by the licensee on an FS 72 billing form by hand for each block based. Alternately, the licensee may design a computer spreadsheet for this function. Currently, version 2.67 of the residue and waste computer program is not designed to produce an FS 72 based on the multi-year aggregate.
13. **Separate recom compilations must be made for:**
  - a) fall/winter blocks surveyed in spring;
  - b) summer blocks surveyed prior to snow fall.

This will accommodate timely billing of residue and waste volumes by ensuring that the correct volume multiplier is available in both spring and fall.
14. Later recom compilations should automatically incorporate any earlier survey data (i.e. the fall recom compilation will be a combination of fall, previous spring and previous year's data).
15. **Blocks identified through inspection prior to survey as having poor utilization may be assigned a separate reporting unit number and could be required to have a full cut block survey.** This separate survey would not form part of the historical data set so as not to skew the annual data set away from the 'normal average waste'. This will also prevent licensee concern about negatively affecting the larger data set with abnormally high waste findings on specific blocks.
16. By surveying 25% of blocks each year, changes in environmental conditions, harvesting methods, stand types etc. can be captured. In this way, the new weighted volume figure is always being refreshed. Data older than approx. 3 years may be dropped, so that only the last 3 or so years are recom compiled each time, keeping in mind the aim of minimum sample size (plots per block). Retaining the data beyond 3 years will ensure more accurate long term averages.
17. **The major differences between the “Multi-YR Aggregate method and the Provincial Residue and Waste ‘Aggregate Survey’ methodology are as follows:**
  - a) 25% of blocks are surveyed annually at a minimum number of plots, rather than 100% of blocks.
    - i) In the ‘**Multi-year Aggregate**’, billings and cut control are based on a recom compilation combining 25% of the current year plus previous year's information providing a new **weighted volume** multiplier. Statistics are met through increasing the sample size by adding previous year's information. **In essence, all data is treated as if it occurred in the same survey year.**

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- ii) In the present 'Aggregate' method, statistics are met in a single survey year, through the annual plan. All billing and cut control volume is based on the single sample year.

18. **The Licencee must meet the following critical dates:**

- Submit Plans – by April 17 & September 22 annually,
- Submit field work – continuous as completed up to July 17 and October 23 annually. (The fall plan and work dates are designed to ensure fieldwork is completed and checked prior to snowfall. The plan can be amended by mutual agreement to include blocks logged around or after Sept 22 annually as long as fieldwork for both the Licencee and the MOF can be accommodated.)
- Submit Final reports and FS 72 billing forms – by August 15 and November 30

19. **The following survey direction will apply for small and large block units:**

**i. For multi-phase blocks:**

- The individual cut units will be outlined and numbered as separate survey units for dispersed and accumulation plots. The licensee must attach a map to the current survey plan depicting this detail.
- Plot frequency for unit size between 4-60 ha will be 2 accumulated/2 dispersed plots.
- If the unit size is over 60 ha, the number of plots will be doubled to a minimum of 4 per stratum for both the accumulated and dispersed areas.
- If the unit size within the multi-phase block is less than 4 ha's, it will be aggregated with another unit so that the combined area exceeds 4 has. Plot frequency will then depend on whether the combined area is under or over 60 has.
- If a unit under 4 has is the only harvesting that occurs within the multi-phase block in a survey period, it will form part of the 75% unsurveyed ground, unless harvest inspections have identified utilization problems during the harvesting phase. A full survey may then be required.

**ii. For regular cut blocks:**

- Where the block size is between 1-60 has, plot frequency will be determined by the formula described in paragraph number 6 above.
- Where the block exceeds 60 has, the number of plots will be doubled to a minimum of 4 per stratum for both the accumulated. and dispersed areas.



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Gerry Vanderkwaak  
Field Operations Supervisor  
Compliance & Enforcement  
Morice Forest District



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## **Appendix IV**

# **Comparison of procedures to achieve the volume gain attendant to harvesting with low stumps**



**DETERMINATION OF A METHOD TO REALIZE THE INCREMENTAL VOLUME GAIN FROM HARVESTING WITH LOW STUMPS IN THE MORICE AND LAKES TIMBER SUPPLY AREAS**

Morice & Lakes IFPA Stump Height Project

Review of Procedures to Achieve Volume Gain Attendant to Achieved Stump Height of Under 30 Centimeters

The project is composed of three activities, each has its own specific objective. These objectives are listed below.

1. Determination of an effective process to quantify achieved stump height.
2. Determination of volume gain attendant to an achieved stump height of less than 30 cm.
3. Determination of an effective method whereby licensees can realize the volume gain.

The following tables identify the various procedures by which each of the three objectives may be achieved, and provides brief descriptions of the pros and cons of each procedure together with recommendations for implementation.

1. Procedures to quantify achieved stump height.

Procedures	Pros	Cons	Recommendations
<p><b>R&amp;W Surveys:</b></p> <p>Incorporate measure of sufficient stump samples with Residue &amp; Waste (R&amp;W) surveys to derive statistically valid achieved stump height.</p>	<ul style="list-style-type: none"> <li>• Provides new data over time, annually, or whenever R&amp;W surveys are required.</li> <li>• Cost of stump height data collection is reduced if included in required survey.</li> </ul>	<ul style="list-style-type: none"> <li>• R&amp;W surveys are not required as of 2002 for beetle salvage harvest in Lakes TSA.</li> <li>• Cost is borne by the licensee.</li> </ul>	<ul style="list-style-type: none"> <li>• Where R&amp;W surveys are required, then incorporate stump height measurements.</li> </ul>
<p><b>Special Sampling:</b></p> <p>Undertake special sampling program to determine statistically valid achieved stump height by TSA. Implement over three years to reduce cost and sample a variety of winter conditions, (as per the Morice Multi-year R&amp;W process).</p>	<ul style="list-style-type: none"> <li>• Captures winter variation over three seasons, this will reduce the annual variability of height.</li> <li>• Independent of R&amp;W surveys.</li> <li>• Potential to combine with other post harvest surveys.</li> </ul>	<ul style="list-style-type: none"> <li>• More expensive than combined R&amp;W and stump height data collection.</li> <li>• Cost is borne by the licensee.</li> </ul>	<ul style="list-style-type: none"> <li>• Recommended if R&amp;W surveys are not required, which is the current situation in the Lakes TSA.</li> </ul>



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Procedures	Pros	Cons	Recommendations
<p><b>Variation of Morice District Multi-Year R&amp;W Aggregate Method:</b></p> <p>R&amp;W surveys derive results from aggregation of data obtained from three successive years of surveys. Each year's surveys collect about 1/3 of the data of normal R&amp;W process. Effective means for collection of stump height data, and potential for other post harvest data such as CWD, site degradation.</p>	<ul style="list-style-type: none"> <li>Least cost.</li> <li>Aggregation of successive annual data sets ensures winter variability of stump height is accounted for.</li> <li>Monitoring for certification may require post harvest surveys, even if R&amp;W surveys are not undertaken.</li> </ul>	<ul style="list-style-type: none"> <li>Cost is borne by the licensee.</li> </ul>	<ul style="list-style-type: none"> <li>Best method to determine achieved stump height.</li> <li>Recommended for stump data collection in the Morice TSA.</li> <li>Not available in the Lakes TSA as the requirement for post harvest R&amp;W surveys has been dropped.</li> <li>This sample design method is recommended for the Lakes TSA.</li> </ul>

2. Procedures to determine volume gain attendant to an achieved stump height of less than 30 centimeters.

Procedure	Pros	Cons	Recommendations
<p><b>Surrogate-Operational Cruise:</b></p> <p>Utilize the achieved stump height in representative operational cruises to determine the incremental gain in volume. The volume gain will be reduced by 11% or 13% to account for long butted trees.</p>	<ul style="list-style-type: none"> <li>Effective in the absence of ability to revise inventory file for achieved stump height.</li> <li>Effective for determination of volume gain on a CP basis.</li> </ul>	<ul style="list-style-type: none"> <li>Not as accurate as determination of proportional gain using the TSA inventory files and VDYP.</li> </ul>	<ul style="list-style-type: none"> <li>Use until the MoF have completed VDYP version 7.</li> </ul>
<p><b>VDYP Volume - TSA Inventory File:</b> Derive volumes using VDYP version 7, incorporating the achieved stump height as utilization level. The volume gain will be reduced by 11% or 13% to account for long butted trees.</p>	<ul style="list-style-type: none"> <li>This is the proper way to determine the proportional increase in volume attributable to low stumps.</li> </ul>	<ul style="list-style-type: none"> <li>Will be possible when version 7 of VDYP has been completed. Work is underway on the new version presently.</li> </ul>	<ul style="list-style-type: none"> <li>Use when VDYP version 7 is available.</li> </ul>



**DETERMINATION OF A METHOD TO REALIZE THE INCREMENTAL VOLUME GAIN FROM HARVESTING WITH LOW STUMPS IN THE MORICE AND LAKES TIMBER SUPPLY AREAS**

3. Procedures to determine an effective method whereby licensees can realize the volume gains attendant to achieved stump height of less than 30 centimeters.

Procedure	Pros	Cons	Recommendations
<p><b>Revise License Specs:</b></p> <p>The RM may revise the utilization specifications for the licenses (FL) in the TSA, &amp; the DM can revise specs for TSL's. The achieved stump height could be used as the utilization spec in place of 30 cm.</p>	<ul style="list-style-type: none"> <li>▪ The attendant volume gain would be realized through TSR.</li> </ul>	<ul style="list-style-type: none"> <li>• The R&amp;W procedure would potentially negate much of the gain, as stumps taller than the achieved stump height would be classed as avoidable waste.</li> </ul>	<ul style="list-style-type: none"> <li>• Not recommended</li> </ul>
<p><b>Credit to AAC:</b></p> <p>The volume gain attributable to stumps less than 30 cm would be applied as a credit in the R&amp;W process. This could potentially mean R&amp;W surveys may recommend increase to the cut control.</p>	<ul style="list-style-type: none"> <li>▪ Would be a simple addition to the R&amp;W process.</li> </ul>	<ul style="list-style-type: none"> <li>• Will require revision to the R&amp;W procedures,</li> <li>• time consuming to collect data &amp; process.</li> <li>• If there are no R&amp;W surveys undertaken, then opportunity for credit is not available.</li> </ul>	<ul style="list-style-type: none"> <li>• Not recommended, currently the requirement for post harvest R&amp;W surveys has been dropped in the Lakes and may be dropped in the Morice TSA.</li> </ul>
<p><b>Addition to the CP Document:</b></p> <p>Treat the portion of the tree that is below 30 cm as optional utilization. Gain in volume due to achieved stump height of less than 30 cm does not contribute to cut control.</p>	<ul style="list-style-type: none"> <li>▪ Simple in concept.</li> <li>▪ No further work required apart from determination of achieved height and volume gain calculation.</li> <li>▪ Would be implemented by the District Manager, as an addendum to the CP document.</li> <li>▪ Implementation may result in small reduction in stumpage.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitoring stump height and determination of attendant volume gain would be an obligation of the licensees.</li> </ul>	<ul style="list-style-type: none"> <li>• Recommended process for immediate implementation.</li> <li>• Implement now and review results at the time of the next TSR. The Chief Forester may consider the gain attendant to low stumps in the determination of the TSA harvest level.</li> </ul>