BRITISH COLUMBIA

Ministry of Forests

Revenue Branch

MEMORANDUM

File: 308-07/RWPM

March 28, 2001

To: Regional Managers

From: Bill Howard
Director
Revenue Branch

Re: *Logging Residue and Waste Procedures Manual*

I hereby approve the *Logging Residue and Waste Procedures Manual*. This manual is effective on April 1, 2001, and will be available on the Internet at:

http://www.for.gov.bc.ca/revenue/manuals/rwprocedures

A complimentary hard copy will be sent to each Ministry of Forests regional and district office.

Comments or questions about the manual should be referred to John Wai, Residue Forester, Revenue Branch at 250-356-7671,

Any general public or hard copy requests for the manuals or amendments should be referred to Crown Publications, 521 Fort Street, Victoria, British Columbia, V8W 3E7, telephone 250-386-4636, facsimile 250-386-0221.

W Howard

Bill Howard
Director
Revenue Branch

Attachment

Province of British Columbia

Ministry of Forests

MANUAL REVISION TRANSMITTAL

FOR FURTHER INFORMATION OR IF YOU HAVE A CHANGE OF ADDRESS, PLEASE CONTACT:

John Wai
Residue Forester
Revenue Branch
Ministry of Forests
PO Box 9511 Stn Prov Govt
Victoria, BC
V8W 9C2
Phone: 356-7671
E-mail: John.Wai@gems6.gov.bc.ca
FAX: 387-5670

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Logging Residue and Waste Procedures Manual

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PUBLICATIONS CO-ORDINATOR

Judy Laton
Revenue Branch
Phone: 387-8356

AUTHORIZATION (Name, Title)
W. Howard
Director, Revenue Branch

Please make the following changes to your copy of the above Ministry manual. Current revisions on the attached pages are indicated by vertical lines alongside the revised text.

ACTION (Remove/Insert)	(VOL.) CHAPTER-SECTION-SUBJECT TABLE OF CONTENTS	PAGE(S)	COMMENTS
Insert	Title Page		Before the Amendments Tab
Insert	Table of Contents	i to viii	After the Table of Contents Tab
Insert	Introduction	i to vi	After the Introduction Tab
Insert	Chapter 1 - Policy and Administration	1-1 to 1-12	After the 1 Tab
Insert	Chapter 2 - Survey Planning	2-1 to 2-6	After the 2 Tab
Insert	Chapter 3 - Alternative Methods	3-1 to 3-10	After the 3 Tab
Insert	Chapter 4 - Block Planning and Plot Layout	4-1 to 4-20	After the 4 Tab
Insert	Chapter 5 - Field Procedures	5-1 to 5-68	After the 5 Tab
Insert	Chapter 6 - Check Surveys	6-1 to 6-12	After the 6 Tab
Insert	Chapter 7 - Reporting	7-1 to 7-16	After the 7 Tab
Insert	Chapter 8 - Surveyor Licenc	8-1 to 8-6	After the 8 Tab
Insert	Appendices	A-1 to A-30	After the Appendices Tab
Insert	Letter from Bill Howard, Director Transmittal Sheet		After Amendments Tab

REVENUE BRANCH

Logging Residue and Waste Procedures Manual

Effective: April 2001

BRITISH COLUMBIA

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Introduction

In British Columbia, rights to harvest Crown timber are conferred through a form of agreements specified under the *Forest Act*. The agreements may make provisions for the licensees to carry out assessments of the volumes of logging residue and waste left on the harvested areas. The residue and waste volume data compiled from the assessments are used to invoice licensees for monetary and cut control charges.

This manual outlines the administration and field measurement procedures to be used in the assessments, and is intended to serve as the foremost procedural reference for industry and government staff who conduct or check residue and waste assessments in the Province of British Columbia.

Manual Title Change

The title of this manual has been changed from the former "*Provincial Logging Residue and Waste Measurment Procedures Manual*" to *Logging Residue and Waste Procedures Manual*.

All timber harvesting tenure licence and any other documents which contain the reference that residue and waste assessments must be carried out in accordance with the *Provincial Logging Residue and Waste Measurement Procedures Manual*, dated January 1, 1994, as amended from time-to-time, now means residue and waste assessments must be carried out in accordance with the *Logging Residue and Waste Procedures Manual*, as amended from time-to-time.

To Obtain a Logging Residue and Waste Procedures Manual

The manual is available electronically on the Internet at:

http://www.for.gov.bc.ca/revenue/manuals/rwprocedures/

For those who wish to purchase a hard copy of the manual, it is available for a fee through:

Crown Publications
521 Fort Street
Victoria, BC V8W 1E7

(250) 386-4636

Manual information can be obtained from the Crown Publications, General Publications page:

http://www.crownpub.bc.ca/cat_view.cgi/CP.02.01.40.02

Comments and Suggestions

Any comments on this manual can be sent to:

Residue Policy Forester
Ministry of Forests
Revenue Branch
PO Box 9511 Stn Prov Govt
Victoria BC V8W 9C2

E-mail: John.Wai@gems6.gov.bc.ca

Manual Amendments

Future amendments to this manual can be printed from the Internet or purchased from Crown Publications.

Software Support

In support of compiling residue and waste field data, the Ministry of Forests has made available the following software programs, which together with the accompanying user guides, can be downloaded from the internet web address indicated.

To obtain a copy of the manual and the current software, please type in the appropriate site address:

1. For (full) fixed area plot surveys.

   http://www.for.gov.bc.ca/revenue/manuals/rwsystem/

Policy and Administration 1

1.1 Purpose and Rationale

1.1.1 Purpose

Residue and waste assessments provide data and information for the:

- monetary billing of avoidable waste as liquidated damages for contract non-compliance,
- determination of residue and waste volumes for Allowable Annual Cut (AAC) cut control, and
- assessment of the compliance with the licence specified timber utilization standards.

1.1.2 Rationale

Rights to harvest Crown timber are granted in a form of agreements specified in the *Forest Act*. The agreements specify the timber utilization standards required in accordance with the Timber Utilization Policy, and include:

- the felling, bucking and utilization specifications,
- the residue and waste assessment requirements, and
- the method of monetary billing of avoidable waste.

1.1.2.1 Timber Utilization Policy

Under the Timber Utilization Policy:

Waste Is the volume of timber left on the cutting authority area that should have been utilized in accordance with the timber utilization standards specified in the cutting authority. Waste volumes that are "avoidable" or "unavoidable" are subject to cut control charges.

Residue Is the volume of timber left on the cutting authority area that meets the size (or dimension) requirements but does not meet the quality (or log grade) requirements of the timber that must be utilized in accordance with the timber utilization standards specified in the cutting authority. Residue volumes that are "avoidable" or "unavoidable" are subject to cut control charges.

Residue includes:

Coast	Grade Y - chipper (except dry Grade Y from dead trees left on the harvested area).
Interior	Grade 4 - green lumber reject (except in areas where utilization is mandatory).

Under the Timber Utilization Policy (Coast), dry Grade Y logs (recorded as Grade 5) left on the harvested area are not charged for cut control purposes and are not required to be measured or recorded.

In the Interior, timber marks are classified as either endemic or catastrophic. Dead/dry sawlogs (Grade 3) from marks classified as catastrophic are charged to cut control and billed at a specified rate ($0.25/m^3) plus bonus and other levies where applicable. The total cut control volume from *all* applicable grades for a block or reporting unit is netted down by a predetermined endemic factor based on the entire cruise stand (i.e., catastrophic less endemic portion). All other dead/dry volumes (i.e., Grade 3 from endemic marks and all Grade 5) are not billed nor charged for cut control purposes.

Grade 6 logs in the Interior are logs, which are cut from trees below the minimum diameter stump height (outside bark). Left on the harvested area, these logs are not billed nor charged for cut control purposes.

Figures 1.1 and 1.2 outline the disposition of residue and waste volumes on coast and interior.

1.1.2.2 Deciduous

Where utilization of deciduous is optional in the cutting authority, wood not utilized may be considered as residue and charged for cut control purposes. Where utilization of deciduous is mandatory, wood within the utilization specification not utilized will be considered as avoidable waste subject to both monetary billing and cut control charges.

1.1.2.3 Avoidable and Unavoidable

Both Residue and Waste are classified as either avoidable or unavoidable.

- unavoidable volumes are those which cannot be removed because of physical impediments, safety considerations, environmental reasons, or other reasons beyond the control of the licensee,

- by definition, all other volumes are avoidable,

- avoidable waste volumes are billed monetarily as well as for cut control, and
- unavoidable waste and both avoidable and unavoidable residue volumes are charged for cut-control purposes only.

1.1.2.4 Waste Benchmarks

The Timber Utilization Policy has been amended to permit a level or benchmark of waste to be left on a cutblock without monetary charges.

Refer to Appendix 9 for the waste benchmarks.

If the level of waste on a cutblock is above the benchmark, the portion exceeding the benchmark will be billed monetarily.

All residue and waste volumes on the cutblocks are subject to AAC cut control charges.

1.1.2.5 Coastal Operations: Utilization as per Cutting Authority

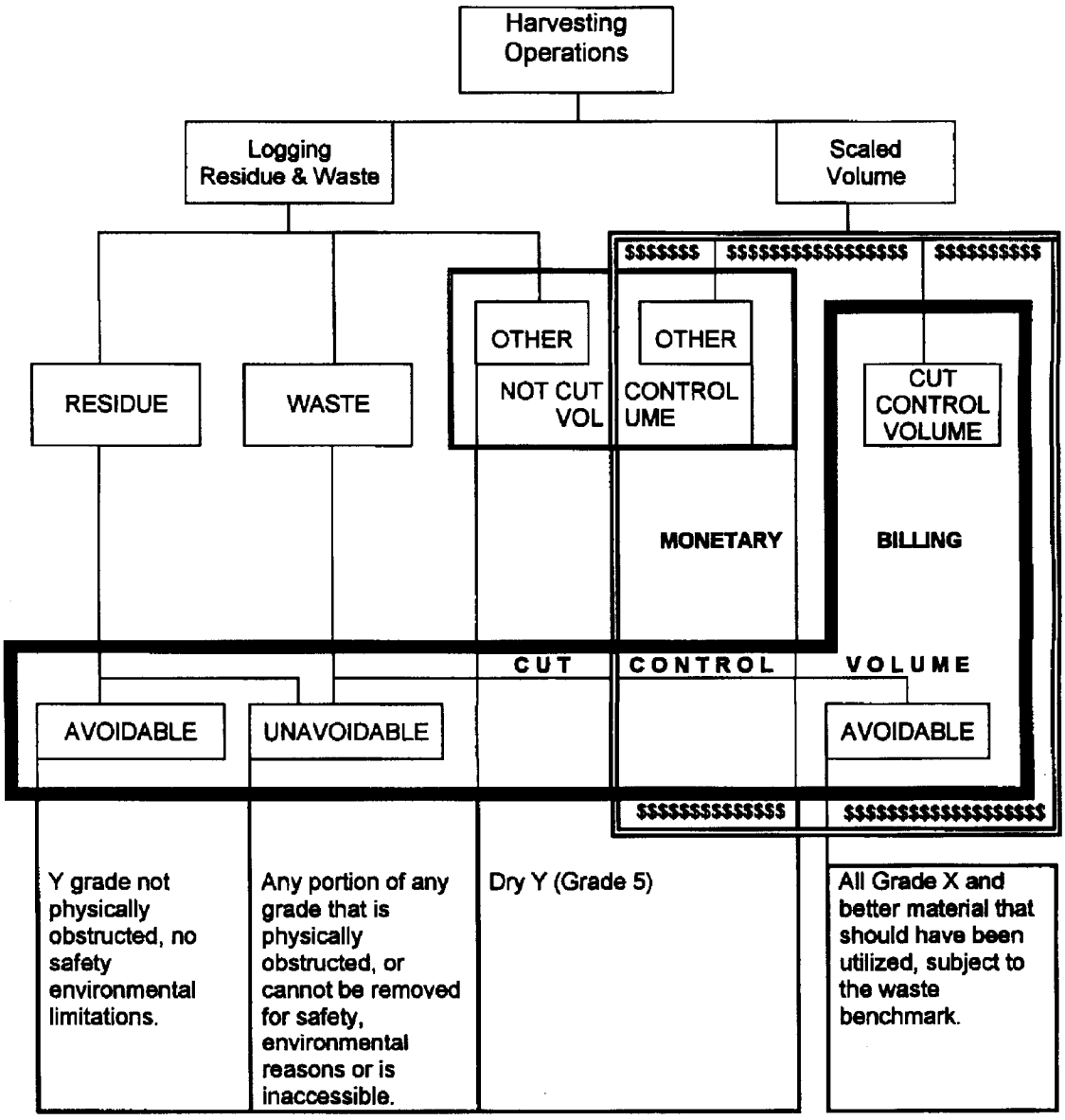

Figure 1.1 The Role of Residue and Waste Survey in Monetary Billing & Cut Control: Coast.

1.1.2.6 Interior Operations: Utilization as per Cutting Authority

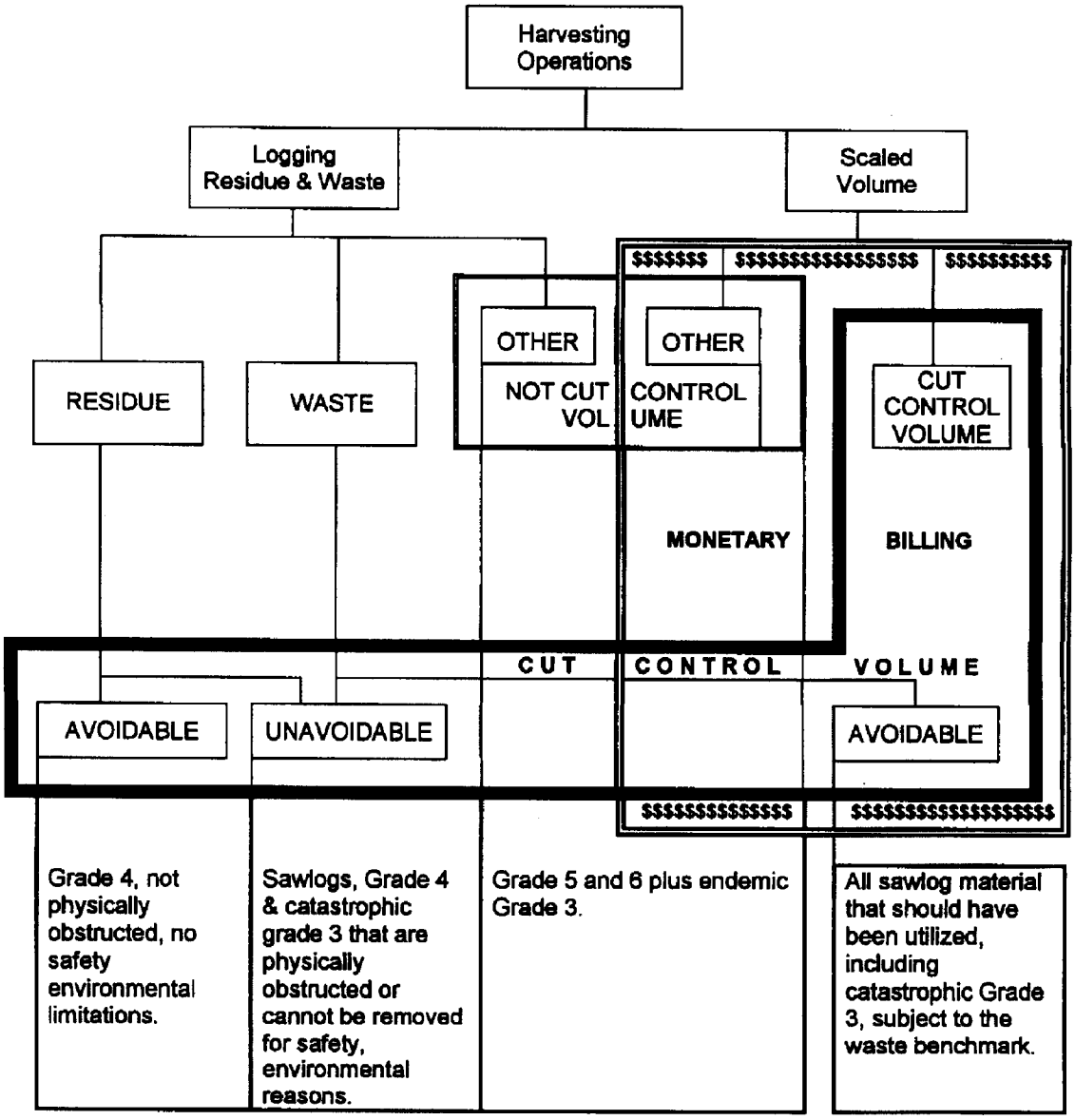

Figure 1.2 The Role of Residue and Waste Survey in Monetary Billing & Cut Control: Interior.

1.2 Authority

Residue & Waste surveys are carried out under the authority of:

1. *Forest Act.*
2. *Timber Utilization Policy.*
3. *Logging Residue and Waste Procedures Manual.*
4. Tenure Licence and Cutting Authority Document.

1.3 Background

Data for residue and waste have been collected on the coast since 1962 by the Forest Service and Industry. With the implementation of the Coast and Interior Utilization Policies in 1990, it was necessary to develop a standardized provincial measurement procedure manual for ensuring residue and waste are measured and reported in a consistent manner.

1.4 Responsibility

All major licensees must carry out residue assessments (full surveys and/or ocular estimates) for scale-based cutting authorities. The District Manager is responsible for residue assessments (full surveys and ocular estimates) on all small business timber sales, woodlot licences and TSL major with quota of up to 10 000 m^3 AAC.

The District Manager may exempt handlogging, leave strips, commercial thinnings, single tree harvesting, blowdown within selectively logged blocks and minor fringe damages, from residue assessments. Documentation of the decision to exempt should be maintained on file.

The responsibility outlines are as follows:

1.4.1 Revenue Branch

1.4.1.1 Director, Revenue Branch

The Director, Revenue Branch is responsible for:

1. Approving *Logging Residue and Waste Procedures Manual* and amendments.
2. Processing and maintaining residue and waste data.
3. Billing licensees by issuing residue and waste invoices for monetary and cut control charges.

1.4.1.2 Residue Policy Forester, Revenue Branch

The Residue Policy Forester is responsible for:

1. Developing and maintaining standards and procedures for determining and reporting residue and waste.
2. Providing training and technical support.
3. Providing policy interpretation to industry and ministry staff.
4. Maintaining software compilation programs and standards.
5. Establishing residue surveyors' licence certification examination standards.
6. Conducting technical reviews of Forest Regions and Forest Districts for policy and procedure compliance.

1.4.2 Regional Manager

The Regional Manager is responsible for:

1. Ensuring that district staff adhere to policy and procedures, and where necessary, provide training to district staff.

2. Recommending survey procedure changes where necessary, to Director, Revenue Branch.

3. Advising industry and forest distict staff on matters relating to residue and waste surveys.

4. Processing Summary of Scale (FS 72) for residue and waste monetary billing and cut control where required.

5. Conducting residue and waste surveyors licence examinations.

1.4.3 District Manager

The District Manager is responsible for:

1. Implementing and administering the policy and procedures, and recommend survey procedure changes where necessary to the Regional Manager.

2. Approving residue and waste plans.

3. Conducting residue and waste surveys or ocular estimates on licences where the Crown is responsible for surveys.

4. Conducting check surveys in accordance with manual standards.

5. Checking for completeness of licensees' submitted survey reports.

6. Processing Summary of Scale (FS 72) for residue and waste monetary billing and cut control where required.

7. Administering Residue Surveyor License suspension.

1.4.4 Licensees

Where it is specified in the licence agreement document that it is the licensee's responsibility for carrying out residue and waste assessments, the licensee is responsible for:

1. Submitting annual residue survey plans, and block survey plans for approval by the District Manager.

2. Conducting residue and waste assessments in accordance with the procedure manual.

3. Compiling residue and waste field data by using appropriate software.

4. Submitting completed survey reports in the required format to the District Manager within time frame specified in this procedure manual.

Where the above mentioned work is performed by a contractor or a sub-contractor, it is the licensee's responsibility for ensuring that the work is carried out in compliance with Ministry standards.

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Survey Planning 2

There are two main levels of residue survey planning:

- *Annual Planning* (for the entire year's residue surveys), and
- *Block Planning* (for each individual cut block survey)

2.1 Annual Residue Survey Plan

An Annual Residue Survey Plan must be developed for all blocks including road rights-of-way to be waste assessed during the year, and submitted to the District Manager for approval. It can be based on any twelve-month period.

The annual plan should include:

- a list of proposed cut blocks that will be available for waste assessments indicating their licence/CP/block numbers and the chosen reporting unit option for the cutblocks,
- the assessment methods,
- the co-efficients of variation proposed for each reporting unit subject to full surveys,
- if block exemption (Section 3.2) is to be used, the proposed parent block(s) (if known) and the related exempted blocks, and
- endemic or catastrophic block designations (interior).

> If the sampling error objective for the previous year sampling was not met, the district manager may instruct the use of a higher coefficient of variation.

The Annual Residue Survey Plan must be submitted 30 days before the expiry of the current annual plan, or as directed by the District Manager. The District Manager may approve the plan or instruct changes as appropriate.

2.2 Reporting Unit Options

There are two options for residue and waste reporting:

- the Cut Block Option, or
- the Aggregate Option

At the annual planning stage, licensees may select to have some cutblocks in the Cut Block Option and others in the Aggregate Option. These options define the residue reporting units containing harvested cutblocks available for survey in the reporting year.

2.2.1 Cut Block Option

Each cutblock is treated as a separate Reporting Unit. Each individual cutblock is sampled in accordance with the number of plots required to meet the approved sampling error objective.

The avoidable waste volume for each cutblock is billed monetarily at the twelve-month average stumpage rate for the applicable timber mark for the cutblock.

2.2.2 Aggregate Option

Cutblocks are amalgamated to form an Aggregate Reporting Unit. Aggregation of cutblocks within a forest district is permitted at the licence level (TFLs, FLs).

The entire aggregate reporting unit is sampled in accordance with the sampling intensities which meet the approved sampling error objectives.

Each cutblock within the aggregate is individually surveyed using the number of plots pro-rated by block area from the aggregate reporting unit total.

The avoidable waste volume for each cutblock within the aggregate reporting unit is billed monetarily at the twelve-month average stumpage rate for the applicable timber mark for the cutblock.

> The twelve-month average stumpage rate is dependent on the primary logging completion date for the cutblock. Because the cutblocks in the aggregate reporting unit will have different primary logging completion dates, the average stumpage rates for the cutblocks in the Aggregate will vary.

Cut blocks may be removed from an aggregate reporting unit if they qualify for Ocular Estimate or Block Exemption.

2.3 Assignment of Reporting Unit Numbers

The Forest District will issue Reporting Unit numbers when the Annual Residue Survey Plan is approved.

The number will be unique in the province for a given year and will consist of a five digit number.

The first two digits identify the forest district office responsible for the administration of the block being sampled. The first digit identifies the region and the second digit identifies the district within that region.
Region/District codes are as follows:

Forest District	No.	Forest District	No.	Forest District	No.
Vancouver		**Region - 1**			
Chilliwack	11	Squamish	13	Sunshine Coast	15
Campbell River	18	Port McNeill	19	Mid-Coast	1A
Queen Charlotte	1B			South Island	17
Prince Rupert		**Region - 2**			
Lakes	21	Morice	22	Bulkley- Cassiar	23
Kispiox	24	Kalum	25	North Coast	28
Kamloops		**Region - 3**			
Clearwater	31	Kamloops	32	Salmon Arm	33
Vernon	34	Penticton	35	Merritt	36
Lillooet	37				
Prince George		**Region - 4**			
Prince George	41	Robson Valley	43	Vanderhoof	44
Fort St. James	45	MacKenzie	46	Dawson Creek	47
Fort St. John	48	Fort Nelson	49		
Nelson		**Region - 5**			
Cranbrook	51	Kootenay Lake	57	Arrow	55
Columbia	54	Invermere	52	Boundary	56
Cariboo		**Region - 6**			
Quesnel	61	Williams Lake	62	Horsefly	63
100 Mile House	64	Chilcotin	65		

The last three digits will be designated depending on the survey responsibility as outlined in the following list:

Number	R. U. Option	Responsibility
__001 to __399 __400 to __499	Cut Block (includes ocular estimates) Aggregate	Forest Service Only
__500 to __699 __700 +	Aggregate (includes ocular estimates) Cut Block	Licensees Only

For example full surveys, the first small business timber sale in the Kootenay Lake Forest District would get Reporting Unit number 57001. The first licensee Aggregate Reporting Unit in Chilliwack would get Reporting Unit number 11500.

For ocular estimates, assign reporting unit number based on the responsibility for carrying out surveys. On those cutblocks where the Forest Service is responsible (e.g., SBFEP, woodlots, etc.) assign one reporting unit number for each cutblock under the cutblock option. On those cutblocks where the licensees are responsible, assign one reporting unit number to cover all ocular estimated cutblocks within each tenure licence under the Aggregate Option. Licensees should ensure that there are no fully surveyed cutblocks mixed in with the ocular cutblocks in a reporting unit.

Regardless of which reporting unit option is selected, residue is measured and reported in the reporting year in which it becomes available for survey.

Normally, cut blocks and partially completed cutblocks are considered available for residue survey when primary logging is completed.

The District Manager will not normally approve aggregations of cut blocks that include both mature and immature stands, or stands with a high proportion of "problem" or salvage types as this leads to unreliable and inefficient sampling (see Stratification).

2.4 Field Assessments and Reporting Time Frames

2.4.1 Cut Block Option and Ocular Estimates

Field assessments must be completed within 60 days after primary logging on the cut block has been completed and the ground being sufficiently free of snow to allow for an adequate assessment to be carried out. Assessment reports must be submitted to the District Manager within 30 days upon completion of the field assessment.

2.4.2 Aggregate Option

Field surveys must be completed within 60 days after primary logging on the cut block has been completed and the ground being sufficiently free of snow to allow for an adequate assessment to be carried out, on each cut block. Survey reports for each cut block of the aggregate reporting unit must be submitted to the District Manager, within 30 days upon completion of the field survey for the cut block.

When submitting the survey reports for the last cut block in an Aggregate Reporting Unit, a compilation disk which contains the complete reporting unit field data must be submitted concurrently.

If there is more than one timber mark, the reports must include a list of each timber mark and the corresponding hectarage in the reporting unit.

Alternative Methods 3

In addition to the normal, Full Survey procedures, there are a number of Alternative methods available, as follows:

- Reduced Sampling Intensity Surveys (RSI),
- Block Exemption (Using Parent Block Information), and
- Ocular Estimate Procedures (O/E).

These alternative methods are used under the conditions described in this chapter.

3.1 Reduced Sampling Intensity Surveys (RSI)

The Reduced Sampling Intensity (RSI) Survey will replace the Full Sampling Intensity (FSI) Survey on "low waste" blocks which meet the prescribed conditions.

3.1.1 Conditions

1. The RSI Survey will only apply to blocks that were previously planned for a FSI Survey under the Cut Block Option. The RSI Survey cannot be applied to cut blocks in the Aggregate Option.

2. The RSI Survey will only be applied to the dispersed sampling areas; the RSI will not apply to accumulations.

3. The District Manager will decide whether to accept an RSI Survey. The decision should be based on a predetermined benchmark which reflects a low level of residue and waste. This benchmark is comprised solely of avoidable waste on a volume per hectare basis. The benchmarks are established as follows:

Coast	Old Growth	25 m^3/ha
	Second Growth	10 m^3/ha
Interior	Dry Belt	5 m^3/ha
	Transition	10m^3/ha
	Wet Belt	15 m^3/ha

3.1.2 Procedures

1. When the block survey plan is submitted, the licensee may apply to the District Manager to measure the dispersed areas using an RSI Survey along with the FSI Survey plan.

2. The District Manager will evaluate the licensee application. Verification procedures will be at the discretion of the District Manager. This will be a subjective decision based on local knowledge of the district and specific knowledge regarding the block.

3. Approval will be given by the District Manager for the RSI or FSI Survey within ten working days. Written approval is required.

4. If the approval for an RSI Survey is given, the number of dispersed plots will be determined by using the appropriate tables in the "manual". The required coefficient of variation will be 100 percent. The number of dispersed plots, according to the table, will be at "one quarter" (every 4th plot) and the required plot size will be at 400 m^2 (11.28 m radius). For partial cutting cutblocks specified under Section 4.7, a smaller plot size may be used. Check with the district for plot number commencement (i.e., start at either plot #1, #2, #3 or #4).

5. The sampling error will be ignored for the RSI Survey; however, the minimum plot requirement and size must be adhered to.

6. Field measurements and recording requirements for an RSI Survey will be the same as for an FSI Survey as the information will be compiled and used for billing and cut control purposes.

7. If the results of the RSI Survey exceed the benchmark level of avoidable waste, the District Manager may require the licensee to do a FSI Survey at their own expense.

3.2 Block Exemption (Using Parent Block Information)

Block exemption procedure can be used where it is not always practical to measure the residue and waste from every block. This procedure is ideally suited to rights-of-way, salvage blocks, or small individual blocks that are "clones" of other surveyed blocks. The method of accounting for accumulations within exempted blocks is at the discretion of the District Manager.

3.2.1 Conditions

The following conditions must be met in order to exempt blocks from full survey:

1. The Blocks must be 20 ha or less in size.
2. The exempted blocks must have an acceptable parent block * from which data for waste billing and volume depletion purposes can be extrapolated.
3. The parent block must have been previously surveyed by the full survey procedures.
4. Both the Parent and the Exempted Blocks must have the same designation (i.e., both must be Endemic or Catastrophic).

* *Parent Block* - a previously surveyed block that is representative, in terms of the level of dispersed residue and waste, to the block being proposed for survey exemption.

3.2.2 Procedures

1. The proposed parent block and the exempted blocks should be identified in the Annual Survey Plan. For the licensees who chose the Aggregate Option, the proposed exempted blocks should be excluded from the plot to hectare ratio determination.
2. When a block survey plan is submitted, the licensee may apply to the District Manager to have the block exempted from survey.
3. The licensee's application should contain all relevant information on the proposed parent block as well as the block requested for exemption.
4. Field inspections should be undertaken to verify similarity of the proposed parent block to the block requested for exemption.
5. Written approval for exempting blocks will be given by the District Manager.

6. Upon receipt of the District Manager's approval, the licensee shall submit a residue and waste report for the exempted block within sixty days. This report will be based on the survey data from the approved parent block.

7. The data reported for an exempted block will be subject to auditing and used for monetary billing and cut control purposes.

8. Blocks rejected from exemption will be subject to surveys under the RSI, FSI or the Aggregate Option.

3.3 Ocular Estimate

The ocular estimate is designed to reduce surveying costs and administration time on cut blocks. Licensees will be billed for monetary and/or cut control charges as per volumes estimated.

Normally, no Logging Residue Surveyor Licence is required to conduct ocular estimates. However, if there are revenue concerns, a Regional Manager may require ocular estimate reports be accepted from licenced surveyors, in the forest region.

3.3.1 Ocular Estimate Levels

The maximum avoidable waste levels for performing ocular estimates are at the waste billing benchmark levels established in Appendix 9, for cutblocks in all forest regions excepting Vancouver Forest Region where all cutblocks are subject to 10 m^3/ha. The Regional Manager may set lower ocular levels for cutblocks within a forest region to address revenue or forest management risks.

3.3.2 Conditions

This procedure can be applied when:

1. The estimated level of avoidable waste on the cut block meets Section 3.3.1.

2. The volume of residue and waste can be reasonably estimated without a residue and waste survey, and there is minimal or no revenue risk.

If these two criteria cannot be met, a normal residue and waste survey will be required.

3.3.3 Responsibility

Similar to full surveys, major licensees are responsible for carrying out oculars on their scaled based cutting authorities. The District Manager is responsible for conducting oculars on SBFEP timber sales, woodlot licences and TSL major with quota up to 10 000 m^3 AAC.

3.3.4 Procedures

1. Licensees should review previous residue and waste assessments done on blocks with similar forest types, similar harvesting systems and conditions, and preferably logged by the same operator to determine if an ocular estimate would be appropriate, and in accordance with Section 3.3.2.

2. A final harvesting inspection should be conducted by the licensee, or its representative, preferably jointly with the Forest Service. On this inspection, enough of the cut block should be seen to get a representative picture of the timber utilization that was practiced and to decide if an ocular estimate is appropriate.

3. If an ocular is not appropriate, a full residue survey or an RSI survey is required.

4. If an ocular estimate is appropriate, the volumes of residue and waste are estimated using Form RW 01 (copy attached).

5. "Inspection plots" or transect lines should be used to support the ocular estimate. Inspection plots should be of 50 m^2 (3.99 m radius) minimum in size and selectively located in areas with representative levels of avoidable waste.

   Heavy accumulations of avoidable waste on a block may have to be excluded from the estimate and measured and returned separately.

6. If the waste level appears to be higher than reported in the ocular estimate, the Forest Service may not accept the ocular estimate. A full residue and waste survey will be required by the licensee.

7. If the licensee and the Forest Service accept the estimate, the completed Form RW 01 *must be signed by both parties*.

8. The licensee will submit the completed Form RW 01 and an FS 72 to the district for processing. Please refer to the attached Flow Chart A and B for further details.

3.3.5 Monitoring

1. Senior and more experienced district staff should monitor implementation of this procedure to ensure consistency.

2. Regional Residue and Waste Coordinators should audit district's work, provide necessary training and make recommendations to the Branch on the implementation of the procedures and its effect on the residue and waste assessment program.

Residue & Waste Volumes

Forest District:_____ **Licensee:**_____

Timber Mark:_____ **RU:**_____

Licence:_____ **CP:**_____ **Block:** _____

Block Net Area:_____ **ha** **Stand (Circle):** **Endemic** **Catastrophic**

Date primary logging completed: **(YY/MM/DD)**_____

Avoidable Waste benchmark _____ **m^3/ha** **Block leading species** _____

Ocular Estimates:

	Dispersed (1)		Accumulated (2)		Blk (1) + (2)
Avoidable	**m^3/ha**	**Total * (m^3)**	**m^3/landing**	**Total ** (m^3)**	**Total (m^3)**
Sawlog waste					
Grade 3					
Grade 4					
Unavoidable					
Sawlog waste					
Grade 3					
Grade 4					

*m^3/ha x Blk net area	**m^3 x # of landings	

I hereby provide the above estimates in lieu of a residue and waste survey. I agree to the use of these figures for cut control and waste monetary billing purposes.

Additional Comments:_____

_____

_____

Signature: _____ _____

Licensee or Representative **Forest Officer**

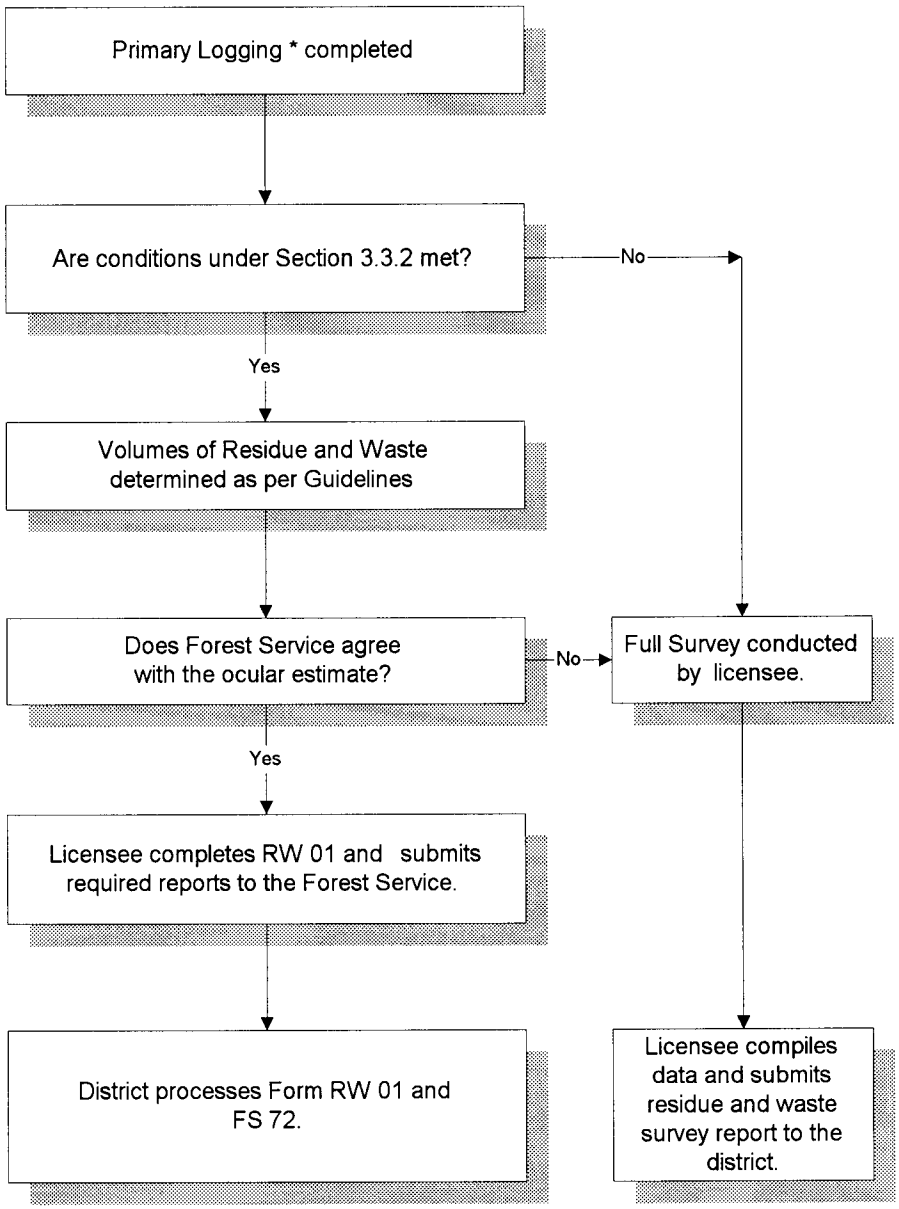
Date: _____

Form RW 01 (00.01.15)

Figure 3.1 Ocular Estimate Form.

Residue & Waste - Ocular Estimates - Flow Chart A

Majors

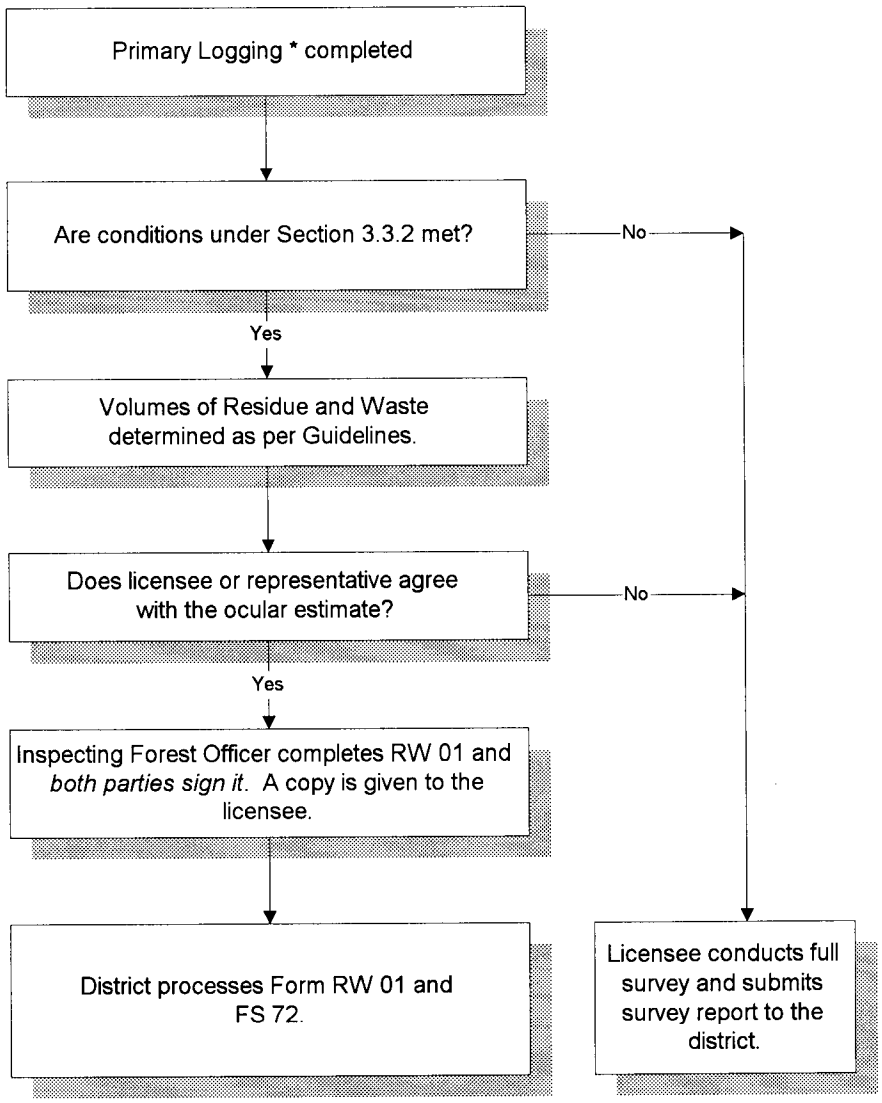


* Completion of felling and yarding of logs but excluding the loading out phase.

Figure 3.2 Ocular Estimates - Flow Chart A.

Residue & Waste - Ocular Estimates - Flow Chart B

SBFEP and Woodlots



* Completion of felling and yarding of logs but excluding the loading out phase.

Figure 3.3 Ocular Estimates - Flow Chart B.

Block Planning and Plot Layout 4

A good survey plan is essential to an efficient residue and waste survey.

4.1 The Plot Sampling Process

The planning and implementation of residue surveys involves either one cut block or an aggregation of cut blocks. For either cut-block or aggregate sampling, follow these steps:

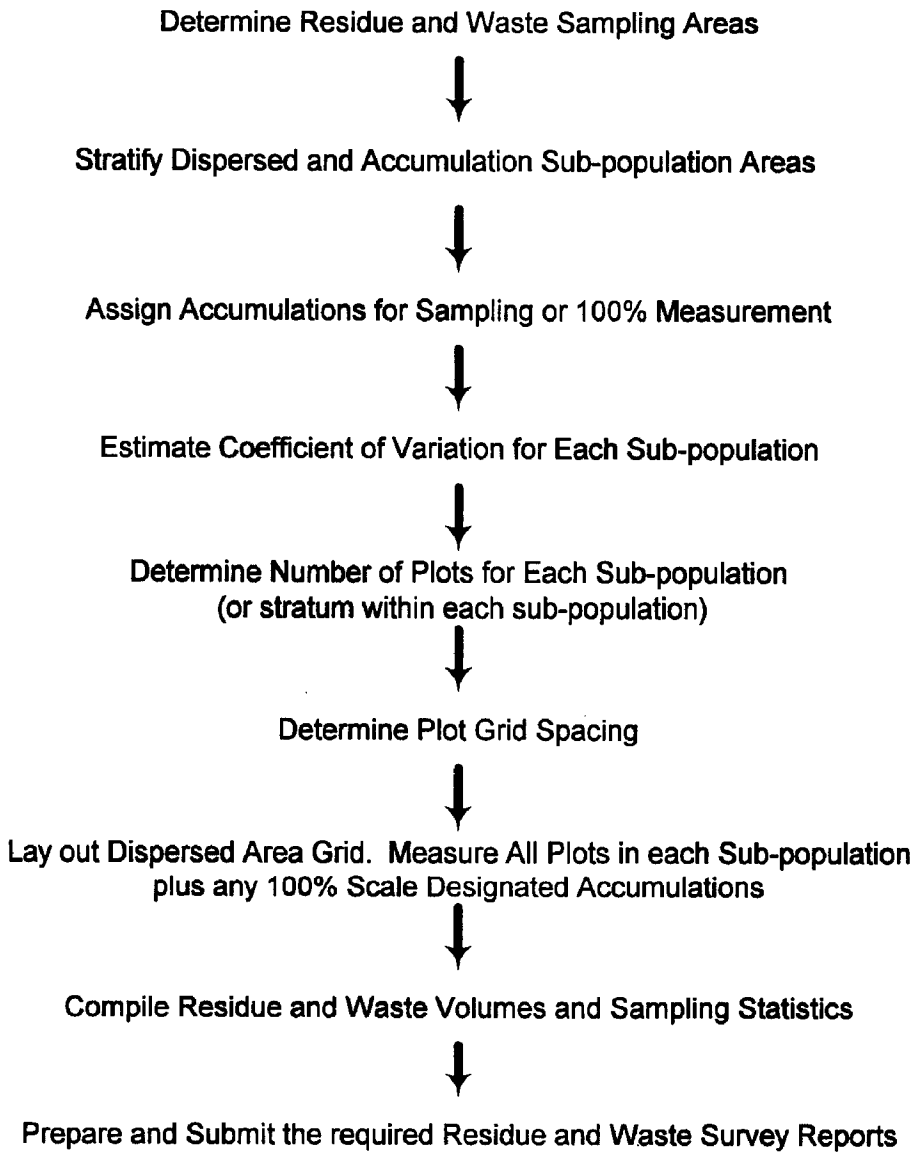


Figure 4.1 Plot Sampling Process.

4.2 Sampling Design

4.2 1 Population

The population of interest is the volume of residue and waste generated during the specified reporting year within the approved residue reporting unit. The size of the population depends on:

- the option selected for the residue reporting unit,
- the area logged in that year.

4.2.2 Sub Populations

The population of interest usually consists of three subpopulations: accumulated, dispersed and either estimated or 100 percent measured. If required, each may be subdivided into strata (e.g., tower and roadside accumulation strata).

Accumulated residue and waste occurs at landings, along roadsides and at other areas in the reporting unit where logs have been yarded or skidded to and where sample plots may be established.

Dispersed residue and waste occurs on the areas from which trees or logs have been removed and where sample plots can safely be established. Dispersed areas are sampled independently of accumulation areas. The area of the rights-of-way leading into the cutblock must be included in the net area of cutblock unless the residue and waste volume has been included in a previous residue survey or as provided under Section 4.6.2.

Estimated/100 Percent Measured residue and waste occurs where sample plots cannot be safely established, or are not appropriate. Volumes are either estimated or 100 percent piece scaled, depending on circumstances (i.e., a 100 percent measurement may be appropriate where the sub-population is small and where the hectarage is difficult to determine). Unsafe landing piles may be estimated; decked logs or felled and bucked material may be 100 percent piece scaled.

4.2.3 Stratification

Stratification can increase the precision of sub-population volume estimates, and reduce the amount of sampling required to achieve a desired level of precision.

It is therefore useful to stratify the subpopulations, where possible, by harvesting system, different logging contractor, timber type, or relative quantity of residue and waste generated.

4.2.4 Block Survey Plan

A good block survey plan is essential to an efficient residue and waste survey. The Block Survey Plan *must* be submitted to the district 30 days prior to anticipated field work (the intent is for pre-planning, communication, and to allow for all parties to be present during check surveys).

4.2.5 Mapping

A preliminary map of the proposed cut block showing at least the cut-block boundaries and road, strip and plot locations must be submitted to the District Manager with the block survey plan.

Each area of the strata must be carefully measured by mapping and planimetry. All roads, water, swamp and other non-forest areas must be delineated on the maps and the areas measured with a planimeter. Accumulations that are 100 percent measured or estimated should be clearly indicated on the maps.

The final map will be produced after the field survey is completed. All mapping must meet Ministry standards.

4.2.6 Sampling Objective

The sampling objective is to estimate the total volume of residue and waste in each sub-population to a calculated minimum level of precision, or sampling error percent (S.E. %), at the 95 percent confidence level. Generally, calculated sampling errors decrease with increased sub-population size.

The sampling error and number of plots required for each sub-population are determined from plot Tables 4-2 to 4-5 in this chapter.

4.3 Sampling Method

In both aggregate and cut-block options, the residue and waste volume in the dispersed and accumulation subpopulations is calculated based on fixed-area sample plots laid out systematically. For the estimated or 100 percent piece scale subpopulations, combined residue and waste (cut control) volumes are either estimated or 100 percent piece scaled for each specified stratum.

The fixed-area plots are established in a systematic, staggered grid pattern in dispersed types. In roadside accumulations the plot spacing depends on the average width of the accumulation. The grid spacing will also depend on the plot size and number of plots determined for the sub-population.

For accumulations, the licensees have the additional option of estimating volumes. Plots which fall on hazardous piles should be relocated; however, if unsuccessful, estimates will be allowed. Areas subject to 100 percent measurement or estimation should be typed out on the maps and be deducted from the area to be sampled.

This manual prescribes either a cut-block or aggregate option using a combination of either fixed-area plots, estimations and/or 100 percent piece scales. Any variation from this sampling method requires written approval of the Director, Revenue Branch.

The safety of the surveyor must always take precedence when estimating or measuring plots, including the wearing of proper safety equipment and footwear. Refer to Appendix 2 for detailed safety procedures.

4.3.1 Number of Plots (Sample Size)

The number of plots and maximum sampling error for each sub-population are determined from plot tables. There are two sets of tables each for the Coast and Interior (dispersed and accumulation areas). These tables embody certain underlying assumptions concerning the volume, relative proportions of residue and waste, and cruise volume, and are specific to a given plot size.

To use the plot tables, you need the sub-population area and the estimated coefficient of variation (C.V.). This C.V. is specific to the individual plot volumes in that sub-population area.

> If no coefficients of variation are available, use a "start up" C.V. estimate of 100 percent for the dispersed and accumulation subpopulations.

Subsequent estimates can be based on actual survey statistics. For the aggregate option, sampling proceeds as each cut block is logged or becomes available.

4.3.2 Procedure to Determine the Number of Plots

Determine the minimum number of plots required for each sub-population as follows:

1. Determine the sub-population area (sum of stratum areas in the dispersed *or* accumulation sub-population).

2. Estimate the sub-population coefficient of variation, or use start up values.

3. From the appropriate dispersed or accumulation plot table, read the number of plots from the body of the table.

4. Read the maximum sampling error from the right-hand column of the table.

5. The minimum number of plots per stratum is 2, based on the sub-population area.

6. For the aggregate option, the number of plots for an *individual block* will be the result of the hectare to plot ratio *for all blocks in the aggregate* divided into the area of the block and rounded to the nearest whole number, but the minimum of 2 plots per stratum still applies on *each* block.

   For example:

   If on the aggregate option you have a hectare to plot ratio of 6.2:1 and the area on one of the blocks is 41.5 ha, divide 41.5 by 6.2 to get 6.7; round up to 7 plots. If the number of plots before rounding is less than two, then at least two plots per stratum must be established on that block.

4.3.3 Grid Spacing

Follow Section 4.3.2 to determine the number of plots required.

For the Cutblock option, the number of plots required for each block is taken directly from the appropriate plot table.

For the Aggregate option, the number of plots required for each block is calculated by dividing the gross area of the block by the hectare to plot ratio for the Aggregate, rounding to the nearest whole number.

For both the Cutblock and Aggregate options, the minimum number of plots per cutblock is 2, and the grid spacing is determined for each block.

Refer to the Grid Spacing Worksheet (Table 4-1). The grid spacing is calculated from the formula of SQR (10 000 X ha/plots) where SQR means "take the square root of".

If necessary, grid spacing is reduced or increased, in 10 m increments, to fit the required number of plots within the cutblock boundaries.

4.4 Plot Layout

4.4.1 Dispersed

Plots for dispersed residue types are to be located on a systematic, staggered grid. The steps required are as follows:

1. Using the hectares and an estimate of C.V. specific to the reporting unit, look up the minimum number of plots required in either Table 4-2 (Coast) or Table 4-4 (Interior).

2. Compute the grid spacing distance (GSD) using the grid spacing work sheet (Table 4-1).

3. Locate the POC where the main road enters the cutblock, establish the baseline in the cardinal direction which most closely parallels the contours.

4. Obtain the Starting Point Interval Factor (SPIF) from the forest district staff. The SPIF multiplied by the GSD will determine the horizontal distance from the POC to the mapped location of the initial strip (IS). (SPIF will either be 1/4, 1/2, 3/4 of GSD.) The default option is 1/2 GSD.

5. Map the initial strip (IS) at the SPIF distance along and at right angles to the baseline from the POC.

6. Map all remaining strips at the full GSD along the baseline in both directions from the IS. Strips are mapped at right angles to the baseline.

7. Number the Strips:

    a. on blocks with North/South baselines number the strips sequentially from South to North, and

    b. on blocks with East/West baselines number the strips sequentially from West to East.

8. On odd numbered strips, locate the first two plots at one half the GSD along the strip in both directions from the baseline. Locate remaining plots at full GSD along the strip.

9. On even numbered strips, locate one plot at the intersection of the strip and the baseline, and all remaining plots at full GSD along the strip.

10. Number the plots. Each plot in a given block should have a unique number.

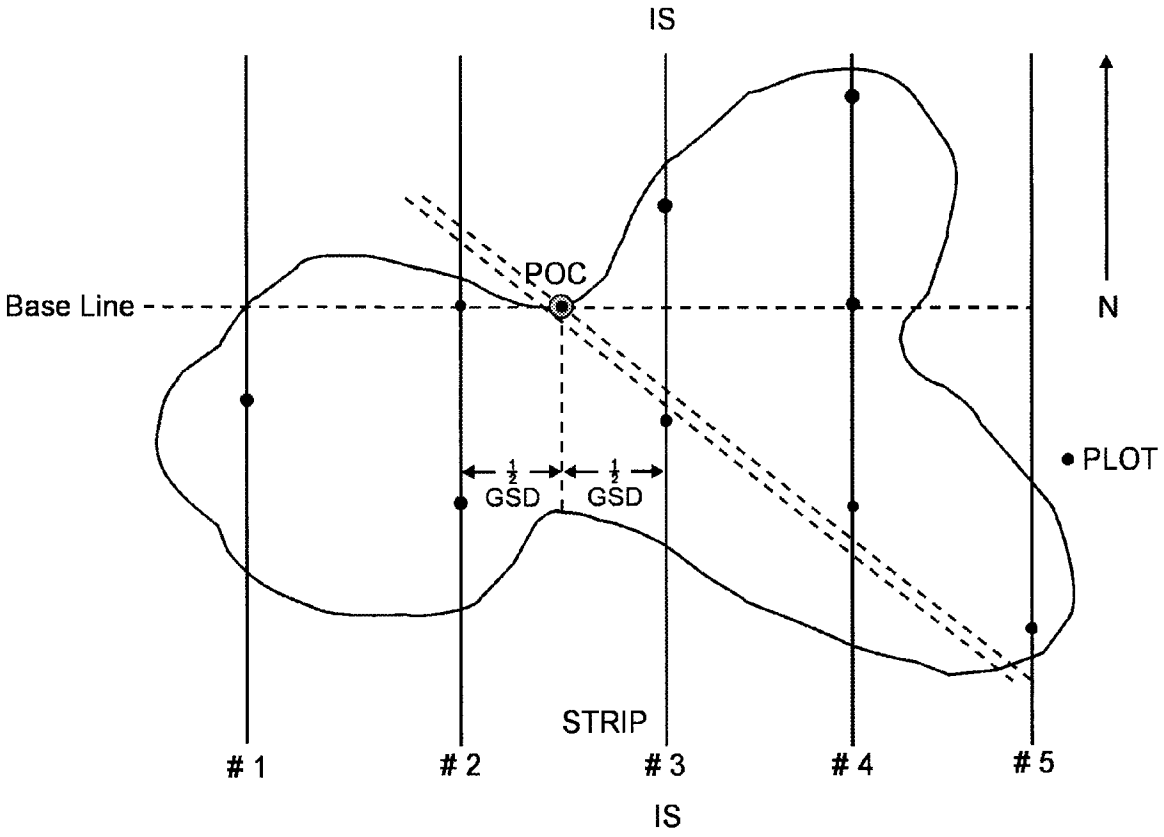


Figure 4.2 Strip and Plots Placement.

4.4.2 Roadside Accumulations

For grapple yarding roadside accumulations, the number of plots required is based on the total area of the roadside accumulations. This area is calculated by measuring the length, along the road of "one-sided" and/or for "two-sided" accumulations. The length is then multiplied by an average width for the accumulation (usually but not restricted to 10 m). The procedures are as follows:

One-sided or a mixture of one and two-sided accumulations	Two-sided Accumulations
1. Start from the POC.	1. Start from the POC.
2. Measure the length of the one-sided accumulation; and the length of the two-sided accumulations multiplied by two.	2. Measure the length of the accumulations x 2.
3. Add the one-sided and two-sided accumulations together.	3. Add the widths of the accumulations on both sides of the road together.
4. Calculate the area of the stratum as follows: Area (ha) = (length x width) / 10,000.	
5. Look up the number of plots required from Table 3 (Coast) or Table 5 (Interior).	
6. Calculate the grid spacing distance (GSD) as follows: Grid Spacing = length / number of plots required.	
Example: Total length of one-sided accumulation = 1500 m Total length of two-sided accumulation = 750 m x 2 = 1500 m 1500 m + 1500 m = 3000 m Area = 3000 m x 10 m = 3 ha = 15 plots (at 100% CV on the Coast) Grid Spacing Distance = 3000 / 15 = 200 m	Example: Total length of roadside accumulation = 3000 m x 2 = 6000 Width of roadside accumulation = 20 m (10 m on each side of the road) Area = 6000 m x 10 m = 6 ha = 16 plots (at 100% CV on the Coast) Grid Spacing Distance = 6000 / 16 = 375 m

Laying Out of the Plots

1. Start from the POC and on the right hand side of the road.

2. Using the Starting Point Interval Factor (SPIF) for the month, establish the first plot at one-quarter of the GSD, one-half of the GSD or three-quarters of the GSD along the road. If you are unable to find out the SPIF, then use the default of one-half of the GSD.

3. For one-sided or a mixture of one and two-sided accumulations, locate a full size plot on the right side of the road. For two-sided accumulations, locate a full size plot on each side of the road.

4. Break chain the end of each accumulation and resume chaining at the beginning of the next accumulation until each GSD is covered.

5. Always stay to the right hand side of the road in the direction of travel when laying out the plots. When coming to a spur, go up the spur on the right hand side. At the end of the spur, turn around and come down on the right hand side.

6. For two sided accumulations when an odd number of plots are required, establish the last plot on one side of the road. If the last digit of the cutting permit is odd, establish it on the right hand side. If the last digit of the cutting permit is even, establish it on the left hand side.

Roadside accumulations must be marked on the map so the layout can be audited. When on-site stratification is done, it must be done on a non-bias basis.

4.4.3 Spot Accumulations

Spot accumulations include highlead, spar, or tower landings, as well as skidder, helicopter landings and windrows.

Again, the number of plots is found from Table 4-3 (Coast) or 4-5 (Interior), and the minimum number of plots per stratum is two.

The method for selecting the first spot accumulation is to use the date of the month when the survey is done.

Example 1:

- 31 piles requiring 6 plots, surveyed on the 23rd of the month
  31 / 6 = 5.17 Survey every 5th pile
  Select the following piles: #23, #28, #2, #7, #12, #17

Example 2:

- 11 piles requiring 3 plots, surveyed on the 30th
  11 / 3 = 3.67 Survey every 4th pile
  30 - 11 = 19; 19 - 11 = 8
  Select the following piles: #8, #1, #5.

4.5 Stratification Procedures for Roadside Accumulations

4.5.1 Roadside Consisting of Strip Accumulations

If the roadside accumulations consist of strips, use a rectangular plot which covers the entire width of the strip or a 50 m^2 circular plot system with plot centres located alternatively at 4 m and 11 m from the roadside, for a 15 m wide strip. Strip accumulations are normally treated as one stratum but may need to be stratified according to different levels of waste or harvesting methods.

4.5.2 Spot Accumulations Resulting From Piling Roadside Slash

Treat all spot accumulations from the same harvesting method in one stratum. The space intervals between spot piles must be treated as a separate roadside stratum.

For roadside piles where plots are established on the side of the pile, the surveyor must alternate locating the plots on the front and back of the piles selected for sampling, if it is safe to work around the back of the pile. If it is not safe to work around the back of the pile, establish the plot on the side of the pile closest to the POC for odd numbered plots and farthest away from the POC for even numbered plots.

> Landing accumulations resulting from highlead, helicopter logging, etc., are always stratified separately from the roadside spot accumulations to form their own stratum.

4.5.3 Accumulations Within Dispersed Sub-population

Accumulations found within the dispersed sub-population area which had not been previously stratified will be surveyed as part of the dispersed sub-population and all pieces that fall within a dispersed plot will be measured and recorded.

4.5.4 Debuilt Road

If a road has been debuilt (logs and stumps pulled back from side-slopes and scattered over the top of the deactivated road), the debuilt road must be treated as a separate accumulation stratum and sampled accordingly. The stratum code for debuilt roads is WB0X.

Table 4-1: Grid Spacing (GS) Worksheet

LICENSEE: _____ Date: _____

Residue Reporting Unit: _____

Option for Measurement (Either Cutblock or Aggregate): _____

Estimated date of field survey: _____

Estimated completion date of Primary Logging: _____

Actual completion date of Primary Logging: _____

Tenure: _____ Division: _____

Forest District: _____ Region: _____

NOTE: Worksheet calculations will be determined upon completion of primary logging for the block. If it is certain no changes will occur in the size of the block when primary logging has been completed, then the worksheet can be submitted in advance to facilitate notice of the waste survey.

Formula for Grid Spacing = $\sqrt{10,000 * \frac{ha}{plots}}$

Column Number	(1)	(2)	(3)	(4)	(5)
CP & Block Number	Block Size (ha)	Plot Requirement from Table or Calculation	Ha/Plot Ratio Col. 1/Col. 2 equals to Col. 3 value	Total m^2 of Area in Column 3 Value of Col. 3 *10,000	Grid Spacing (m) $\sqrt{}$ value in Column 4

Table 4-2: Coast - Dispersed Area

ESTIMATED MINIMUM NUMBER OF PLOTS (n)*
TO MEET THE SAMPLING ERROR OBJECTIVE ARE SHOWN IN BODY OF TABLE
MINIMUM PLOT REQUIREMENT PER STRATUM PER SUB-POPULATION IS TWO (2)
-TABLE BASED ON TOTAL RESIDUE & WASTE IN SUB-POPULATION = 5% OF CRUISE VOLUME.**
-WASTE COMPONENT IN SUB-POPULATION = 3% OF CRUISE VOLUME IN REPORTING UNIT.

SUB - POP AREA IN HECTARES (D)	ESTIMATED COEFFICIENT OF VARIATION % (C.V.)									SAMPLING ERROR % S.E. @ .95
	50	60	70	80	90	100	110	120	130	
1	2	2	2	2	2	2	2	2	2	N/A
5	2	2	3	4	4	5	6	7	8	N/A
9	3	4	4	6	8	9	11	13	15	N/A
11	3	4	6	7	9	11	13	16	18	N/A
13	4	5	7	9	11	13	16	18	21	N/A
15	4	5	8	10	12	15	18	21	24	N/A
17	4	6	9	11	14	17	20	23	27	N/A
19	5	7	10	12	16	19	22	26	31	N/A
21	5	8	11	14	17	20	25	29	34	N/A
23	6	8	12	15	19	22	27	32	37	N/A
25	6	9	13	16	20	24	29	35	40	38.9
30	7	10	14	18	23	28	34	40	46	36.4
35	8	11	15	20	25	31	37	44	51	34.6
40	9	12	17	22	27	34	40	48	55	33.3
45	9	13	18	23	29	36	43	51	59	32.2
50	10	14	19	24	31	38	45	54	63	31.4
55	10	15	20	26	32	40	48	56	66	30.7
60	11	15	20	27	33	41	49	58	68	30.1
70	11	16	22	28	36	44	53	62	73	29.3
80	12	17	23	30	37	46	55	65	76	28.6
90	12	17	24	31	39	48	58	68	80	28.1
100	13	18	24	32	40	49	59	70	82	27.6
110	13	18	25	33	41	51	61	72	84	27.3
120	13	19	26	33	42	52	62	74	86	27
130	13	19	26	34	43	53	64	75	88	26.8
140	14	20	27	35	44	54	65	77	92	26.6
160	14	20	27	35	45	55	66	79	92	26.2
180	14	20	28	36	46	56	68	81	94	26.6
200	14	21	28	37	46	57	69	82	96	25.8
250	15	21	29	38	48	59	71	85	99	25.4
300	15	22	30	39	49	60	73	87	101	25.1
350	15	22	30	39	50	61	74	88	103	25
400	16	22	30	40	50	62	75	89	104	24.8
500	16	23	31	40	51	63	76	90	106	24.6
800	16	23	32	41	52	63	78	93	109	24.4
1000	16	23	32	42	52	65	79	94	110	24.3
1500	16	24	32	42	53	65	80	95	110	24.1
2000	17	24	32	42	54	66	80	95	112	24.1
3000	17	24	33	43	54	66	80	96	112	24
4000	17	24	33	43	54	67	81	96	113	24
5000	17	24	33	43	54	67	81	96	113	24
7000	17	24	33	43	54	67	81	96	113	23.9
10000	17	24	33	43	54	67	81	97	113	23.9

* Based on 400 square metre plot size. For a different plot size calculate a new coefficient of variation from the following formula and then determine the probable minimum number of plots needed to achieve the sampling error @ .95 using the new C.V.

New C.V. = $\sqrt{[(C^2) * \sqrt{(Y/X)}]}$

Where: C = C.V. using old plot size (%)

Y = old plot size (m^2)

X = new plot size (m^2)

** Cruise volume in reporting unit = cruise volume per hectare * population area.

Table 4-3: Coast - Accumulation Area

ESTIMATED MINIMUM NUMBER OF PLOTS (n)*
TO MEET THE SAMPLING ERROR OBJECTIVE ARE SHOWN IN BODY OF TABLE
MINIMUM PLOT REQUIREMENT PER STRATUM PER SUB-POPULATION IS TWO (2)
-TABLE BASED ON TOTAL RESIDUE & WASTE IN SUB-POPULATION = 9% OF CRUISE VOLUME.**
-WASTE COMPONENT IN SUB-POPULATION = 5% OF CRUISE VOLUME IN REPORTING UNIT.

SUB - POP AREA IN HECTARES (A)	ESTIMATED COEFFICIENT OF VARIATION % (C.V.)									SAMPLING ERROR % S.E. @ .95
	50	60	70	80	90	100	110	120	130	
0.25	2	2	2	2	2	2	2	2	3	N/A
0.50	2	2	2	2	2	3	3	4	5	N/A
0.75	2	2	2	3	4	4	5	6	7	N/A
1	2	2	3	4	5	6	7	8	9	N/A
1.5	2	3	4	5	7	8	9	11	13	N/A
2	3	4	6	7	9	11	13	15	17	N/A
2.5	4	5	7	9	11	13	16	19	22	N/A
3	4	6	8	10	13	15	19	22	26	55.3
3.5	4	6	8	10	13	15	19	22	26	55.3
4	4	6	8	10	13	16	19	22	26	55.3
4.5	4	6	8	10	13	16	19	22	26	55.3
5	4	6	8	10	13	16	19	22	26	55.3
5.5	4	6	8	10	13	16	19	22	26	55.3
6	4	6	8	10	13	16	19	22	26	55.3
6.5	4	6	8	10	13	16	19	22	26	55.3
7	4	6	8	10	13	16	19	22	26	55.3
7.5	4	6	8	10	13	16	19	22	26	55.3
8	4	6	8	10	13	16	19	23	26	55.3
9	4	6	8	10	13	16	19	23	26	55.3
10	4	6	8	10	13	16	19	23	26	55.3
11	4	6	8	10	13	16	19	23	26	55.3
12	4	6	8	10	13	16	19	23	27	55.3
13	4	6	8	10	13	16	19	23	27	55.3
14	4	6	8	10	13	16	19	23	27	55.3
15	4	6	8	10	13	16	19	23	27	55.3
16	4	6	8	10	13	16	19	23	27	55.3
17	4	6	8	10	13	16	19	23	27	55.3
18	4	6	8	10	13	16	19	23	27	55.3
19	4	6	8	10	13	16	19	23	27	55.3
20	4	6	8	10	13	16	19	23	27	55.3
22	4	6	8	10	13	16	19	23	27	55.3
24	4	6	8	10	13	16	19	23	27	55.3
26	4	6	8	10	13	16	19	23	27	55.3
28	4	6	8	10	13	16	19	23	27	55.3
30	4	6	8	10	13	16	19	23	27	55.3
32	4	6	8	10	13	16	19	23	27	55.3
34	4	6	8	10	13	16	19	23	27	55.3
36	4	6	8	10	13	16	19	23	27	55.3
38	4	6	8	10	13	16	19	23	27	55.3
40	4	6	8	10	13	16	19	23	27	55.3

* Based on 50 square metre plot size. For a different plot size calculate a new coefficient of variation from the following formula and then determine the probable minimum number of plots needed to achieve the sampling error @ .95 using the new C.V.

New C.V.= $\sqrt{[(C^2) * \sqrt{(Y/X)}]}$
Where: C = C.V. using old plot size (%)
Y = old plot size (m^2)
X = new plot size (m^2)

** Cruise volume in reporting unit = cruise volume per hectare * population area.

Table 4-4: Interior - Dispersed Area

ESTIMATED MINIMUM NUMBER OF PLOTS (n)*
TO MEET THE SAMPLING ERROR OBJECTIVE ARE SHOWN IN BODY OF TABLE
MINIMUM PLOT REQUIREMENT PER STRATUM PER SUB-POPULATION IS TWO (2)
-TABLE BASED ON TOTAL RESIDUE & WASTE IN SUB-POPULATION = 2% OF CRUISE VOLUME.**
-WASTE COMPONENT IN SUB-POPULATION = 1% OF CRUISE VOLUME IN REPORTING UNIT.

SUB-POP. AREA IN HECTARES (D)	ESTIMATED COEFFICIENT OF VARIATION % (C.V.)									SAMPLING ERROR % S.E. @ .95
	50	60	70	80	90	100	110	120	130	
1	2	2	2	2	2	2	2	2	2	N/A
5	2	2	3	3	4	5	6	7	8	N/A
9	3	3	5	6	7	9	10	12	14	N/A
11	3	4	5	7	9	11	13	15	17	N/A
13	3	5	6	8	10	12	15	17	20	N/A
15	4	6	7	9	12	14	17	20	23	N/A
17	4	6	8	11	13	16	19	23	26	N/A
19	5	7	9	12	15	18	22	25	29	N/A
21	5	8	10	13	16	20	24	28	32	N/A
23	6	8	11	14	18	22	26	31	36	N/A
25	6	9	12	15	19	24	28	33	39	40
30	7	10	14	18	22	27	32	38	44	37.4
35	8	11	15	19	24	29	35	42	49	35.5
40	8	12	16	21	26	32	38	45	53	34.1
45	9	13	17	22	28	34	41	48	56	33.1
50	9	13	18	23	29	36	43	51	60	32.2
55	10	14	19	24	31	38	45	54	62	31.5
60	10	14	19	25	32	39	47	56	65	30.9
70	11	15	21	27	34	42	50	59	69	30
80	11	16	22	28	36	44	53	62	73	29.3
90	12	17	23	29	37	45	55	65	76	28.8
100	12	17	23	30	38	47	57	67	78	28.3
110	12	18	24	31	39	48	58	69	80	28
120	13	18	24	32	40	49	59	70	82	27.8
130	13	18	25	32	41	50	61	72	84	27.4
140	13	19	25	33	42	51	62	73	85	27.2
160	13	19	26	34	43	52	63	75	88	26.9
180	14	19	26	34	44	54	65	77	90	26.6
200	14	20	27	35	44	55	66	78	91	26.4
250	14	20	28	36	46	56	68	81	94	26
300	14	21	28	37	47	58	69	82	97	25.8
350	15	21	29	37	47	58	71	83	98	25.6
400	15	21	29	38	48	59	71	85	99	25.4
500	15	22	30	39	49	60	73	86	101	25.2
800	16	22	30	39	50	62	74	89	104	25
1000	16	23	31	40	50	62	75	89	105	24.9
1500	16	23	31	40	51	63	76	90	106	24.7
2000	16	23	31	41	51	63	76	91	107	24.7
3000	16	23	31	41	52	64	77	92	107	24.6
4000	16	23	31	41	52	64	77	92	108	24.6
5000	16	23	31	41	52	64	77	92	108	24.5
7000	16	23	31	41	52	64	77	92	108	24.5
10000	16	23	31	41	52	64	77	92	108	24.5

* Based on 400 square metre plot size. For a different plot size calculate a new coefficient of variation from the following formula and then determine the probable minimum number of plots needed to achieve the sampling error @ .95 using the new C.V.

New C.V.= $\sqrt{[(C^2) * \sqrt{(Y/X)}]}$
Where: C = C.V. using old plot size (%)
Y = old plot size (m^2)
X = new plot size (m^2)

** Cruise volume in reporting unit = cruise volume per hectare * population area.

Table 4-5: Interior - Accumulation Area

ESTIMATED MINIMUM NUMBER OF PLOTS (n)*
TO MEET THE SAMPLING ERROR OBJECTIVE ARE SHOWN IN BODY OF TABLE
MINIMUM PLOT REQUIREMENT PER STRATUM PER SUB-POPULATION IS TWO (2)
-TABLE BASED ON TOTAL RESIDUE & WASTE IN SUB-POPULATION = 15% OF CRUISE VOLUME.**
-WASTE COMPONENT IN SUB-POPULATION = 9% OF CRUISE VOLUME IN REPORTING UNIT.

SUB-POP. AREA IN HECTARES (A)	ESTIMATED COEFFICIENT OF VARIATION % (C.V.)									SAMPLING ERROR % S.E. @ .95
	50	60	70	80	90	100	110	120	130	
0.25	2	2	2	2	2	2	2	2	3	N/A
0.50	2	2	2	2	3	3	4	4	5	N/A
0.75	2	2	3	3	4	5	6	7	8	N/A
1	2	3	3	4	5	6	7	9	10	N/A
1.5	3	4	5	6	7	9	11	13	15	N/A
2	4	5	6	8	10	12	14	17	20	N/A
2.5	4	6	8	10	12	15	18	21	24	N/A
3	5	7	9	12	14	18	21	25	29	52
3.5	5	7	9	12	15	18	21	25	29	52
4	5	7	9	12	15	18	21	25	29	52
4.5	5	7	9	12	15	18	21	25	29	52
5	5	7	9	12	15	18	22	25	29	52
5.5	5	7	9	12	15	18	22	25	29	52
6	5	7	9	12	15	18	22	25	30	52
6.5	5	7	9	12	15	18	22	25	30	52
7	5	7	9	12	15	18	22	25	30	52
7.5	5	7	9	12	15	18	22	25	30	52
8	5	7	9	12	15	18	22	25	30	52
9	5	7	9	12	15	18	22	25	30	52
10	5	7	9	12	15	18	22	25	30	52
11	5	7	9	12	15	18	22	26	30	52
12	5	7	9	12	15	18	22	26	30	52
13	5	7	9	12	15	18	22	26	30	52
14	5	7	9	12	15	18	22	26	30	52
15	5	7	9	12	15	18	22	26	30	52
16	5	7	9	12	15	18	22	26	30	52
17	5	7	9	12	15	18	22	26	30	52
18	5	7	9	12	15	18	22	26	30	52
19	5	7	9	12	15	18	22	26	30	52
20	5	7	9	12	15	18	22	26	30	52
22	5	7	9	12	15	18	22	26	30	52
24	5	7	9	12	15	18	22	26	30	52
26	5	7	9	12	15	18	22	26	30	52
28	5	7	9	12	15	18	22	26	30	52
30	5	7	9	12	15	18	22	26	30	52
32	5	7	9	12	15	18	22	26	30	52
34	5	7	9	12	15	18	22	26	30	52
36	5	7	9	12	15	18	22	26	30	52
38	5	7	9	12	15	18	22	26	30	52
40	5	7	9	12	15	18	22	26	30	52

* Based on 50 square metre plot size. For a different plot size calculate a new coefficient of variation from the following formula and then determine the probable minimum number of plots needed to achieve the sampling error @ .95 using the new C.V.

New C.V.= $\sqrt{[(C^2) * \sqrt{(Y/X)}]}$
Where: C = C.V. using old plot size (%)
Y = old plot size (m^2)
X = new plot size (m^2)

** Cruise volume in reporting unit = cruise volume per hectare (V) * population area (H).

4.6 Surveying Road Rights-of-Way

4.6.1 Reporting

Unless otherwise previously approved by the District Manager to have residue and waste reported under a Road Permit, the normal procedure is to have the rights-of-way included in the reporting of the nearest logging completed cutblock.

4.6.2 Procedures

The road right-of-way is the access road leading into the cutblock from the closest previously logged cutblock or the preceding road junction with the main road. There are two surveying options:

1. No plot sampling is required. The area of the road right-of-way area (from edge of the travelled surface to edge of the timber) is included with the dispersed sub-population area of the cutblock.

2. Sample with plots (usually 50 m^2) in a separate roadside stratum. The stratum code to be used is OT0X.

The procedure for locating the plots is to start from the POC for the cutblock (where the road enters the cutblock) and put in rectangular plots covering the width of the area between the edge of the road and the edge of the timber using the right hand rule.

4.7 Surveying Partial Cutting (Variable Retention) Cutblocks

Partial cutting (variable retention) cut blocks contain leave trees in groups (over 0.25 ha in size is termed group retention) and/or as dispersed individual trees or small groups of a few trees (dispersed retention).

It is important that a proper map of the cut block which shows leave areas and corridors be obtained and used as the Block Survey Plan.

For full surveys, proper stratification of the cut block is required. Leave areas and corridors should be stratified out. Any stratum that have trees removed must be sampled.

New stratum codes for variable retention cut blocks have been created, and they are "G" for group retention, and "D" for dispersed retention. The use of smaller than 400 m^2 plot size is permitted for these strata. If a smaller plot size is used, the CV must be recalculated and adjusted using the formula indicated in the bottom of the plot tables.

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Field Procedures 5

This manual chapter assumes the residue surveyor is knowledgeable in the principles of sampling and surveying and is familiar with log scaling and grading procedures.

All of the procedures in this chapter will be administered using the following three guiding philosophies:

1. Common sense must always prevail in situations where instructions do not apply to specific circumstances.

2. Decisions based on opinion, where no clear decision can be made based on fact, will be accepted based on the old adage "the benefit of the doubt goes to the operator".

3. An atmosphere of co-operation will be fostered and maintained for the conduct and the administration of this residue surveying system.

5.1 General Requirements

5.1.1. Material to be Measured

Only billing and cut-control accountable volumes within the plot boundaries must be measured and recorded according to the *Utilization Standards* specified in the cutting authority document.

For pieces that lie across the plot boundary, record the in-plot portion only but classify (kind, waste class, grade) based on the entire piece as if it were completely within the plot.

Dimensions for all Grade 3 endemic, Grade 5 (Dry Y) and Grade 6 pieces are not required to be estimated or recorded unless the cutting authority document supersedes the Minimum Utilization Standards and states that they must be utilized.

All species and all grades which are specified in the cutting authority document as mandatory utilization, must be measured, recorded and billed.

The licensee may collect additional company information, provided this does not confuse interpretation of the basic residue and waste survey data.

5.1.1.1 Road Deactivation Material

If arrangements have been made by the licensee with the Forest District for the removal of the road deactivated material; such material will be scaled at a scale site and billed, they will not be part of the residue survey.

If no arrangement has been made, all road deactivated material left on a cutblock at the time of the survey must be scaled and billed.

5.1.2 Recording Standards

To measure residue and waste material, follow the rules in the Ministry of Forests *Scaling Manual* except where otherwise described in this manual. For example the minimum log length when measuring residue and waste is 3 m unless superseded by the cutting authority.

Record the (inside bark) gross dimensions of each piece including rot or other defects. In addition, the residue surveyor calculates the volume deductions for any defects and records the deduction equivalent under "Deduction for Rot/Holes" in rads and/or metres, along with the most appropriate "decay type."

When netting-down the dimensions of a log because of defect, the gross length will be used to determine if the piece meets the 3 m minimum log length. Therefore, the net length of a log used for volume calculations can be less than 3 m.

Record gross length measurements to the nearest one-tenth (0.1) of a metre and gross diameter measurements in radius class units (rads, 1 rad = 2 cm). Record deductions in length to the nearest one-tenth (0.1) of a metre and deductions in radius to the nearest rad.

Top measurements on logs which have very little taper must be made carefully, due to the length of merchantable wood involved between radius classes. For oversized tops, the measurement is to be made at the last occurrence (i.e., uppermost on the tree) of the applicable cutting document specification. When using a scale stick, for a 10 cm top, it will be the mid-point of the 5 radius class. For a 15 cm top, it will be the line separating the 7 and the 8 radius class. All measurements are inside bark.

The measurement of the portion of borderline pieces outside the plot may be recorded but are not mandatory. The minimum requirement will be the measurements of the portions of the pieces within the plot, together with a code (when needed) that will override computer checks on minimum log length.

> Detailed measurement protocol and standards are included later in this chapter.

5.1.3 Waste Class

Residue and waste classification must not be biased for any reason such as accommodating inadequate planning and supervision, poor harvesting methods, inadequate/careless logging practices or a licensee's own manufacturing or market specifications (which may differ from those specified in the cutting authority).

All residue and waste must be classified as either avoidable or unavoidable.

> Unavoidable volumes are those which cannot be removed because of physical impediments, safety considerations, environmental constraints, or for other reasons beyond the control of the licensee.

By definition, all other volumes are *avoidable*.

5.1.3.1 Some Unavoidable Examples

1. Due to physical impediments:
   - logs wedged between boulders, or
   - a log stranded on a ledge.
2. Due to environmental constraints:
   - a log if removed will cause excessive site disturbance or soil degradation, or
   - approved high stumps due to snowpack (Section 5.2.3.4).
3. Due to safety:
   - the portion of a high stump (with a rock against it) between the maximum allowable stump height and the height where the stump could have been safely cut (Figure 5.4),
   - logs with shards of imbedded rock from blasting (Section 5.3.8),
   - log pieces that were cut to create escape paths for the fallers (Secion 5.3.4.1),
   - bucking waste with severe deformities as outlined in Figure 5.7, or
   - logs that are unsafe to remove due to site specific circumstances beyond the control of the licensee.

5.1.4 Piece Numbers

Residue and waste pieces are usually recorded with one set of measurements.

However, where high stumps or forks are found, the piece may have both avoidable and unavoidable segments.

In these situations, the segments are recorded separately, *each with it's own piece number*. Record MP on the comment column of FS 161 to indicate multiple pieces. Mark all pieces measured in the plot clearly with the piece number, using tree marking paint.

5.1.5 Grading Pieces

Material must be graded according to the rules in the *Scaling Manual* except where the residue and waste rules are different and then the residue and waste rules are used.

For example the minimum log length for residue and waste is 3 m instead of the 2.5 m in the *Scaling Manual.*

For more information on the grading rules see the *Scaling Manual* and the Scaling Manual Interior Log Grade Summary that is located in Section 5.9.

5.1.6 Visual Estimates

If loose debris cannot be quickly moved away (i.e., 15 seconds) to facilitate measurements in dispersed plots, or if logs and/or branches in landings prevent measuring one of the ends or the length of a log, visually estimate the missing dimension. In order to correctly establish the grade, at least one end must be visible or the piece should not be recorded.

5.1.7 Measure Factor

In deep accumulations, it may not be possible to measure or visually estimate each piece. In these cases, first measure and/or visually estimate the material that is accessible.

Then, project the plot boundaries down to the ground and visually estimate what portion of the volumes within the plot boundaries were measured. Record this portion on the plot tally card under "measure %."

This percent is known as the "Measure Factor."

Measure as many pieces as possible, even when some dimensions of an individual piece must be estimated.

In the example below: If you were able to measure down approximately 2 m, you would record a measure factor of 40 percent providing that the volumes of residue and waste were spread evenly through the pile. If they weren't you would adjust the measure factor accordingly.

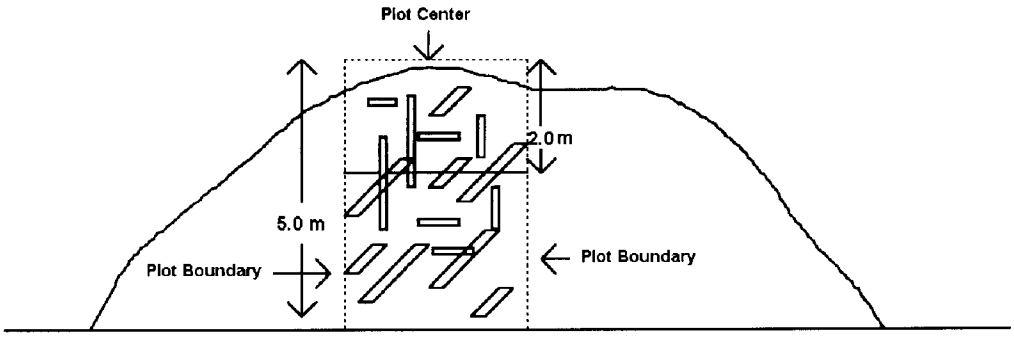


Figure 5.1 Measure Factor.

5.1.8 Deductions for Rot

For material containing rot, measure and record the gross dimensions of the piece (actual size) including rot. In addition, the residue surveyor calculates the volume deduction for rot but records the deduction equivalent in rads and/or metres, along with the most appropriate "decay type".

5.2 Plot Establishment

All P.O.C's and tie points should be marked with aluminum tags and either flagging ribbon or high-visibility paint and be easily observed from access roads.

Plot centres are to be marked with a sturdy stake driven well into the ground and made clearly visible with paint or surveyors flagging ribbon and identified with waterproof felt pen or aluminum tags.

Plot boundaries are to be clearly marked on all borderline pieces with paint.

Plot boundaries are to be measured from the point where the plot stake enters the ground.

Recorded pieces are to be clearly numbered with tree marking paint.

The formula for calculating the horizontal radius of a circular plot is:

$$\sqrt{[\text{plot size in } m^2 / \pi]}$$

Any odd shaped accumulations may be sampled with a long rectangular plot or strip so long as the plot size is consistent within the stratum.

All distances (between plots etc. and plot radii) are to be corrected for slope and must be measured to the standards listed in Chapter 6. The formula used to correct for slope is:

$$\text{COS [Tan}^{-1} \text{ (slope \%/100)]}$$

The inverse of this number is multiplied by the plot radius to obtain the corrected slope distance.

e.g. slope of 74% and plot radius of 11.28m

$\text{COS [Tan}^{-1} \text{ (74/100)]} = 0.8038$ $\qquad 0.8038^{-1} = 1.2441$

1.2441 x 11.28m = 14.03 m Slope distance

Table 5-1 following contains the corrected slope distance for a 11.28 m plot radius (400 m^2 plot).

Table 5-1: Slope Distances for 11.28 m Plot Radius Radius

5% - 11.29 m	39% - 12.11 m	73% - 13.97 m
6% - 11.30 m	40% - 12.15 m	74% - 14.03 m
7% - 11.31 m	41% - 12.19 m	75% - 14.10 m
8% - 11.32 m	42% - 12.23 m	76% - 14.17 m
9% - 11.33 m	43% - 12.28 m	77% - 14.24 m
10% - 11.34 m	44% - 12.32 m	78% - 14.31 m
11% - 11.35 m	45% - 12.37 m	79% - 14.38 m
12% - 11.36 m	46% - 12.42 m	80% - 14.45 m
13% - 11.38 m	47% - 12.46 m	81% - 14.52 m
14% - 11.39 m	48% - 12.51 m	82% - 14.59 m
15% - 11.41 m	49% - 12.56 m	83% - 14.66 m
16% - 11.42 m	50% - 12.61 m	84% - 14.73 m
17% - 11.44 m	51% - 12.66 m	85% - 14.80 m
18% - 11.46 m	52% - 12.71 m	86% - 14.88 m
19% - 11.48 m	53% - 12.77 m	87% - 14.95 m
20% - 11.50 m	54% - 12.82 m	88% - 15.03 m
21% - 11.53 m	55% - 12.87 m	89% - 15.10 m
22% - 11.55 m	56% - 12.93 m	90% - 15.18 m
23% - 11.58 m	57% - 12.98 m	91% - 15.25 m
24% - 11.60 m	58% - 13.10 m	92% - 15.33 m
25% - 11.63 m	59% - 13.10 m	93% - 15.40 m
26% - 11.66 m	60% - 13.16 m	94% - 15.49 m
27% - 11.68 m	61% - 13.21 m	95% - 15.56 m
28% - 11.71 m	62% - 13.27 m	96% - 15.64 m
29% - 11.75 m	63% - 13.33 m	97% - 15.71 m
30% - 11.78 m	64% - 13.39 m	98% - 15.79 m
31% - 11.81 m	65% - 13.45 m	99% - 15.87 m
32% - 11.84 m	66% - 13.52 m	100% - 15.95 m
33% - 11.88 m	67% - 13.58 m	110% - 16.77 m
34% - 11.91 m	68% - 13.64 m	120% - 17.62 m
35% - 11.95 m	69% - 13.71 m	130% - 18.50 m
36% - 11.99 m	70% - 13.77 m	140% - 19.40 m
37% - 12.03 m	71% - 13.83 m	150% - 20.34 m
38% - 12.07 m	72% - 13.90 m	

5.2.1 Locating Landing Plots

Landing plots are located on a line starting from the geographic centre of the landing. Mark the centre of the landing (with orange ribbon or paint) so that the check surveyor will be able to find your P.O.C.

The first line is always run north from your P.O.C.

A plot is located at mid distance between the points where the line enters and exits the accumulation. This distance must be at least twice the plot radius because the plot must fall completely within the accumulation.

If a circular plot cannot be established on the North bearing, try East, then South, then West. If a circular plot cannot be established on these bearings try N45E, S45E, S45W and N45W consecutively. If a circular plot still cannot be established try N22.5E, N67.5E, S67.5E, S22.5E, S22.5W, S67.5W, N67.5W and N22.5W consecutively around the compass.

If a circular plot still cannot be established using the smallest plot size available ($50m^2$ - 3.99 m radius) then a rectangular plot can be established or 100 percent of the pile measured.

In blocks where there is only one landing or one landing that is safe to work on the minimum of two plots must still be established so a landing may have to have more than one plot established on it. In this case distribute the plots as evenly as possible over the accumulation(s).

> This procedure is auditable so the plot must be established at the first successful attempt using the sequence of steps listed above.

5.2.2 Locating Dispersed Plots

Dispersed plots are to be located on a systematic staggered grid as per the Block Survey Plan drawn up for the block. See Plot Layout-Dispersed in Section 4.4.1.

5.2.3 Moving Dispersed Plots

5.2.3.1 Using Border Plots

If the dispersed plot centre falls within the stratum to be sampled but a 400 m^2 circular plot cannot be established because part of the plot falls outside the stratum, establish a 400 m^2 half circular plot (15.96 m radius).

To establish a plot proceed the shortest possible distance to the edge of the stratum, measure 3 m in each direction along the edge of the stratum and take a compass bearing between the two points. This compass bearing will be used, from plot centre, to determine the split line (boundary) of the half-circle plot.

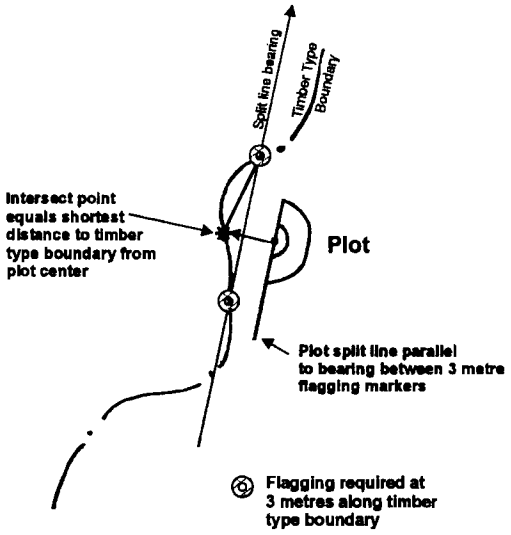


Figure 5.2 Border Plot.

If a 400 m^2 half-circle plot (15.96 m radius) cannot be established without sampling outside of the stratum, move the plot as per Section 5.2.3.2.

5.2.3.2 Using Compass

Dispersed plots that fall outside the type stratum they were intended to sample are to be moved in a consistent and therefore auditable manner. The procedures for moving plots are as follows:

1. Move the plot North one plot radius (12 m) to establish either a full circle plot or a half circle (border) plot. If this fails, try East with the same distance and procedure, then South, then West.

2. If the above fails, repeat the same procedure but increase the distance by 12 m increments. A plot must be established at the first possible location.

Never move a plot that falls completely within the stratum it was intended to sample.

A stratum can be defined in advance of the field work.

For example, roadside accumulations are often defined as 10 m wide and along both sides of the roads throughout the entire block.

If a large volume of residue has slid down a steep slope from a roadside accumulation and a dispersed plot lands on the pile, that is where it must stay so long as the outside edge of the dispersed plot does not fall within the predetermined width of the roadside accumulation. Again, unless that pile were previously delineated and removed from the dispersed area, it is part of the dispersed sub-population.

Gravel pits and large swamps should be typed out and plots which fall on these locations must be moved to a spot within a type stratum.

Therefore, typing is *very* important to obtain reliable estimates.

5.2.4 Plot Sizes

Plots in dispersed slash must be circular and may not be smaller than 400 m^2 (11.28 m in radius) unless the block is a Variable Retention (partial logging) cutblock under Section 4.7. Plots in accumulations may be rectangular or circular and may be as small as 50 m^2 (3.99 m in radius) or rectangular (i.e., 5 m x 10 m). The formula for calculating the horizontal plot radius is: SQR (plot size in m^2 / PI), where SQR means "the square root of", and PI means 3.1415927.

Different plot sizes may be used for different stratum but once a plot size has been chosen it cannot be changed (i.e., all plots within a stratum must be the same size). Recommended plot sizes and shapes are as follows:

Open slash	400 m^2 round (radius = 11.28 m)
Felled and bucked	400 m^2 round (radius = 11.28 m) or 100 percent scale if area is small
Accumulations	50 m^2 round (radius = 3.99 m) or rectangular (i.e., 5 m x 10 m)
Roadside accumulations	200 m^2 rectangular (i.e., 10 m x 20 m where 10 m is the average width of the roadside accumulation). 100 m^2 rectangular. 50 m^2 rectangular (for strips 10 m wide or less). 50 m^2 circular (for a 15 m wide strip, locate plot centres alternatively at 4 m and 11 m from the roadside).

For fixed width roadside stratums that are over 15 m wide, rectangular plots must be used and the minimum acceptable size is 50 m^2. Each plot must cover half the width of the stratum by the distance required to make the plot size. The plots will be staggered with the odd number plots covering the outside half of the stratum and the even number of plots covering the inside half (i.e., for a 20 m wide stratum each plot would be 10 m wide by 5 m long). Alternatively, 100 m^2 rectangular plots covering the entire width of the stratum are acceptable.

For varying width stratums, map the width of the stratum every 25 m along the road. Rectangular plots (which cover the entire width of the stratum where the plot is located) must be used. The minimum acceptable plot size is 100 m^2 unless the maximum width of the stratum is 10 m or less and then 50 m^2 plots are acceptable (i.e., for a 18 m wide stratum use an 18 m by 5.56 m plot).

5.3 Kind of Material

5.3.1 Logs

A log is defined as any near-round piece with more than half of its *original circumference* remaining and with an average diameter equal to or larger than the minimum utilization diameter for at least 3 m of length.

Logs are measured in accordance with the *Scaling Manual* and *Scaling Regulations*, with some exceptions, as specified in this manual.

Measure the diameter to the nearest radius class unit on the scale stick (1 rad = 2 cm) and measure the length to the nearest 0.1 m (i.e., nearest decimetre).

"Log length" is the length that a scaler records to accurately determine the gross volume of the piece; i.e., without making any deductions for rot.

A broken top piece is measured from the top utilization diameter, and then a length deduction (from the utilization diameter to the XY line) is applied to account for the missing wood, as illustrated in Section 5.5.1.1 (Figure 5.10).

In a residue survey, the term "logs" encompasses all logs, slabs, trees and snags (whether standing or down) that are a minimum of 3 m in length unless superseded by the cutting authority to a top diameter of 10 cm or 15 cm. Record as "L" under "Kind of Material" on the plot survey card (FS 161).

For standing timber, the residue surveyor visually estimates the location of the minimum top radius and then measures the length from this point down to the contractual stump height with a clinometer. If the top is broken at a point where the radius (inside bark) is larger than the minimum radius, the residue surveyor visually estimates the radius at the break, and measures the length from the break midpoint down to the contractual stump height.

5.3.2 Slabs

A slab is defined as any non-round piece with less than half of its original circumference remaining, a minimum thickness of 10 cm and an average diameter equal to or larger than the minimum utilization diameter. The *only* exception is mature Red Cedar (on the coast only) which must have a minimum thickness of 15 cm to be graded X or better. That portion of a mature red cedar slab between 15 cm thickness and 10 cm thickness is Y grade. Only the portion of a slab less than 10 cm thick is Z grade.

Slabs are measured, graded and recorded as a "Log" (L) if they have a minimum thickness of at least 10 cm for at least 3 m in length or as "Bucking Waste" (W) if they are bucked at the butt end or both ends and have a minimum thickness of a least 10 cm for less than 3 m but at least a tenth (0.1) of a metre.

Chapter 5 of the *Scaling Manual* should be referred to for measurement procedures for slab ends in various shapes (i.e., semi-circle, quadrant, sector, segment, etc). Alternatively, the following method is continuously accepted for computing slab diameters, for residue and waste purposes.

Using Figure 5.3, slab diameters are computed using the following steps:

1. Measure and average 3 thickness.

   i.e., 11 + 9 + 13 = 33/3 = 11 rads

2. Measure 1 width between 5 rad edges.

   i.e., Width = 31 rads

3. Average the thickness and the width.

   i.e., 11 + 31 = 42/2 = 21 rads*

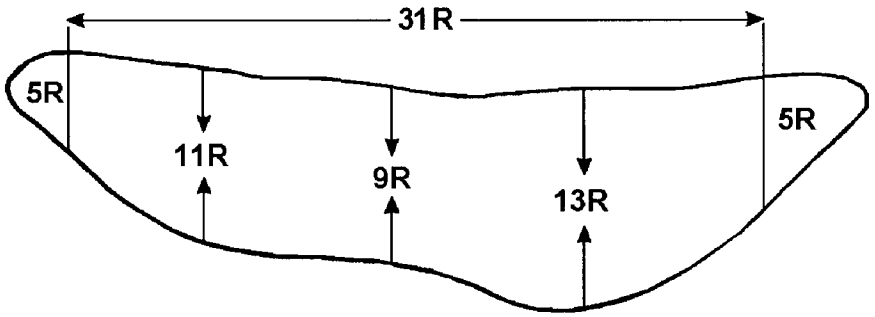


Figure 5.3 Measuring Slabs.

5.3.3 Stumps

A stump is defined as any piece with more than half (1/2) of its original circumference remaining, less than 3.3 m in length and still attached to the roots. The length is to be measured from the high side of the stump. A stump that is at least 3 m in length after the maximum allowable stump height (usually 30 cm) has been deducted is classified as a log because of its length.

Stump heights are always measured from the high side.

Stump height *is not* measured from the top of any root flare or any obstacles such as accumulated bark, moss, or other loose duff and vegetation that could be kicked away easily by the faller. No consideration should be given to brush and undergrowth that the faller should cut away before falling.

Measure from where the ground meets the base of the stem to the top of the felling cut (as shown in Figure 5.4) to the nearest tenth (0.1) of a metre. The volume of the undercut is included in the measured stump volume. Deduct the contractual stump height (usually 0.3 m) and record the result under length on the FS 161.

If the total stump height is less than or equal to the contractual stump height (usually 0.3 m as measured from the high side), then the stump *does not have to be recorded.*

For raised stumps where the tree has grown out of a rotten log, the contractual stump height (usually 0.3 m) should be measured from the point of germination, or the high side, whichever is higher.

Stumps will not normally be graded and will default to sawlog grade. However, if the log from the stump is present the stump should be graded the same as the log.

If the stump has less than 50 percent firmwood volume, the stump is not recorded.

In the interior, residue and waste in dead stumps will only be measured and recorded where the utilization is mandatory (e.g., Catastrophic grade 3).

On the Coast, dead stumps will not be measured nor recorded except Cedar, Cypress and White Pine. Use the following guidelines to differentiate between dead/live stumps:

Dead	considerable crumbling sap rot and/or loose or missing bark.
Live	little or no crumbling sap rot and bark not loose.

Sometimes stumps can be broken up in logging. Any stump fragments are ignored. Conversely, any stumps with missing fragments are measured as if the fragment was still in place.

5.3.3.1 Measuring and Recording Stumps

Careful measurement of stumps is critical because they contain much volume per unit of length.

Measure the top diameter (inside bark) of the stump (unless the total height of the stump exceeds 1.3 m) and record it in the "top" column.

For a stump whose total height (which includes the contractual stump height) exceeds 1.3 m, record the diameter (inside bark) at 1.3 m above the ground on the high side of the stump. The taper of the stump should be finished at approximately that point and recording the top diameter above 1.3 m would end up under estimating the volume of the stump.

Stump diameter is always measured inside bark, and recorded to the nearest rad.

No entry is required in either the top or butt end code fields on the FS 161.

5.3.3.2 Waste in Stumps

Unless there are physical obstructions or safety precautions because of decayed wood, waste in stumps is classified as avoidable waste.

Unavoidable waste occurs where excessive snow depth or an obstruction prevents cutting the tree to contractual specifications. Where there are physical obstructions or excessive snow depth, the lowest height that the tree could have been cut must be established.

Frequently, trees and snags with butt rot are felled above the contractual stump height for safety reasons. Under these circumstances, a stump may have both avoidable and unavoidable components. This situation is illustrated below in Figure 5.4.

The District Manager may approve a higher allowed stump height on all or a portion of the cutblock for safety or holding back logs.

A. Contractual Stump Height.

B. Allowed Stump Height.

C. Total Stump Height.

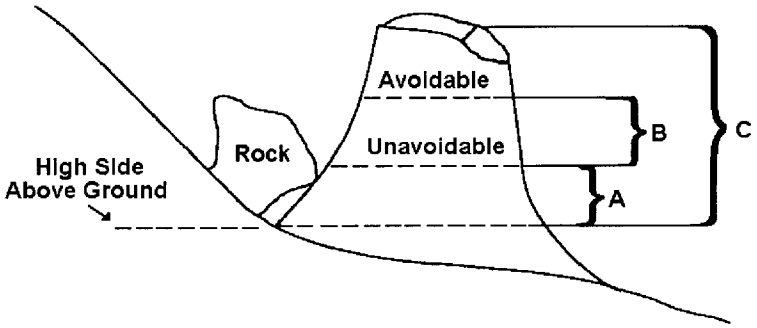


Figure 5.4 Avoidable and Unavoidable Waste (High Side).

Definitions:

A. *Contractual stump height* is the maximum allowable stump height, indicated in the contract, as measured from the ground on the *high side*. This part is not recorded. If the stump is higher, length measurements start from the contractual stump height.

B. *Allowed stump height* is the highest of the distance from the ground on the *high side* to the top of the contractual stump height, or the height specified in the District Manager's letter for heavy snow packs, or the minimum distance from the ground on the *high side* of a stump up to a point above a physical obstruction which allows for safe falling. B minus A = unavoidable piece.

C. *Total stump height* is the distance from the ground on the *high side* to the top of the felling cut. C minus B = avoidable piece.

5.3.3.3 Recording Stumps in Segments

If there are both avoidable and unavoidable components of waste, the stump is recorded as two pieces each with it's own piece number and record appropriate comment code such as MP on FS 161 to indicate multiple pieces.

Record the top portion as avoidable piece. Enter the difference between the total stump height and the allowed stump height in the length field, and the top radius in the top field. Classify this piece as avoidable (A).

Record the lower portion as unavoidable piece. Enter the difference between the allowed stump height and the contractual stump height in the length field, and the top radius of this lower segment in the top field. Classify this piece as unavoidable (U).

5.3.3.4 High Stumps - Snowpack

In the Interior, winter logging can result in unavoidable waste occurring in high stumps due to snowpack, especially alongside winter skid trails.

Where winter logging is approved and contractual stump heights cannot be achieved by operators because of snow conditions, the waste portion is considered avoidable unless a written exemption is issued by the District Manager.

This exemption will specify a new maximum stump height to reflect acceptable winter stump heights.

The portion of the stump between the contractual stump height and the allowed stump height specified in the exemption letter is considered unavoidable.

The portion of the stump above the allowed stump height specified in the exemption letter is considered avoidable.

In all cases, trees must be cut as close to the contractual stump height as possible.

Survey crews must confirm if an exemption letter has been issued prior to the survey.

In addition, the decision to classify stumps as unavoidable because of snow should not be automatic. Prudent operators with a mix of operating areas are expected to avoid high snow areas through sound planning.

5.3.3.5 Blowdown Stumps

It is very difficult to determine whether a stump on a blowdown area is avoidable or unavoidable after the logging has been completed since there could have been a dangerous obstruction that has since been removed.

> Safety is the primary consideration for the person cutting the log off a tree that has been blown over. Therefore, if there is any question as to whether the stump should be called avoidable then the residue surveyor should give the licensee the benefit of the doubt and call it unavoidable.

Unavoidable waste in blowdown stumps also occurs in the form of long butts. Where this occurs, as illustrated below in Figure 5.5, the long butt is treated as a stump with the length being measured from the side 30 cm adjacent to high ground.

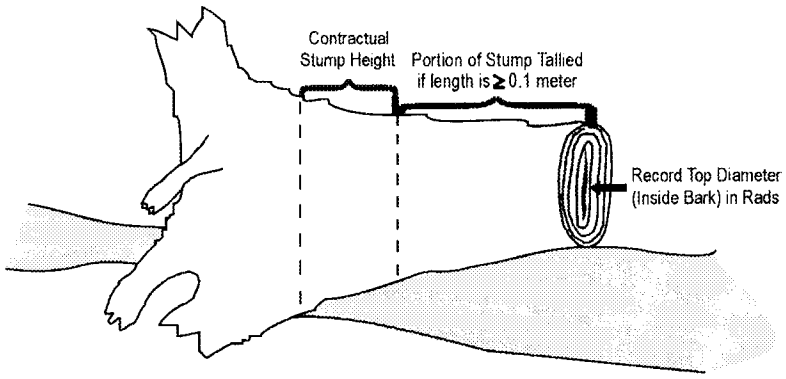


Figure 5.5 Windfall Stump.

In some blowdown situations, there may be wind sheared trees resulting in high stumps that could not yield a minimum-length clean log. These stumps are classified as unavoidable, provided that the Forest Service has been advised immediately after the field work for the affected block has been completed. Occasionally, there may be valid safety reasons for leaving a wind sheared high stump that could have yielded a minimum-length log, but normally such high stumps are classified as avoidable.

Unavoidable stumps can also occur when windfalls obstruct the trunks of standing trees preventing lower cuts.

Where feasible, especially where there are many blowdown trees, fallers should consider making their first cut just over one log length from the root wad. The resulting log with the root attached may then be yarded or skidded into the landings and the roots safely cut off.

Blowdown stumps which stand back up when the logs are bucked off should be classified as unavoidable because they were probably cut high for safety reasons.

If bucking could safely produce a minimum length log from such stumps, the volume above the contractual stump height or other specified height should be recorded as avoidable waste.

Guy line stumps can be accepted as unavoidable if there is no unnecessary waste of wood. Any portion that is excessive waste must be classified as avoidable. Blowdown stumps on a landing should be classified as unavoidable.

5.3.3.6 Borderline Stumps

For borderline stumps, measure the horizontal distance from the plot centre to the geometric centre of the stump at a point 30 cm above the high side. If this point is located inside the plot, the entire stump is recorded. If it is not, the entire stump is not recorded.

For knocked-over and uprooted stumps, measure the horizontal distance from the plot centre to a point 30 cm above the high side or the point of germination (POG), whichever is higher. If this point is located inside the plot, measure the portion inside the plot.

5.3.4 Bucking Waste

Bucking waste is defined as any piece less than 3 m in length (originating from a log at least 3 m in length) that has been cut at the large end or at both ends. It has been cut too short to be of any use through improper or careless bucking practices.

A piece cut at the small end (top) and broken at the large end (butt) is considered unavoidable breakage (not recorded) in the dispersed sub-population but is measured and recorded as bucking waste in accumulation sub-populations. However, if the logging system was inappropriate or there was excessive breakage in the dispersed sub-population then all pieces cut at the small end (top) and broken at the large end (butt) should be recorded as avoidable breakage.

Some examples of bucking waste are when tops are bucked off at a diameter larger than the minimum utilization diameter, when the 0.1 m trim allowance has been exceeded (big end cut and small end broken) and when decay has been bucked off a log and the remaining piece is more than 50 percent sound. Trim ends less than 50 percent sound which are less than the dimensions of a slab need not be measured. Trim ends which are heavily fractured are not to be measured.

Bucking Waste is recorded as "W" under "Kind of Material" on the FS 161 (Plot Survey Card). Bucking waste is normally graded sawlog and can only be downgraded for excessive twists and oversize knotts.

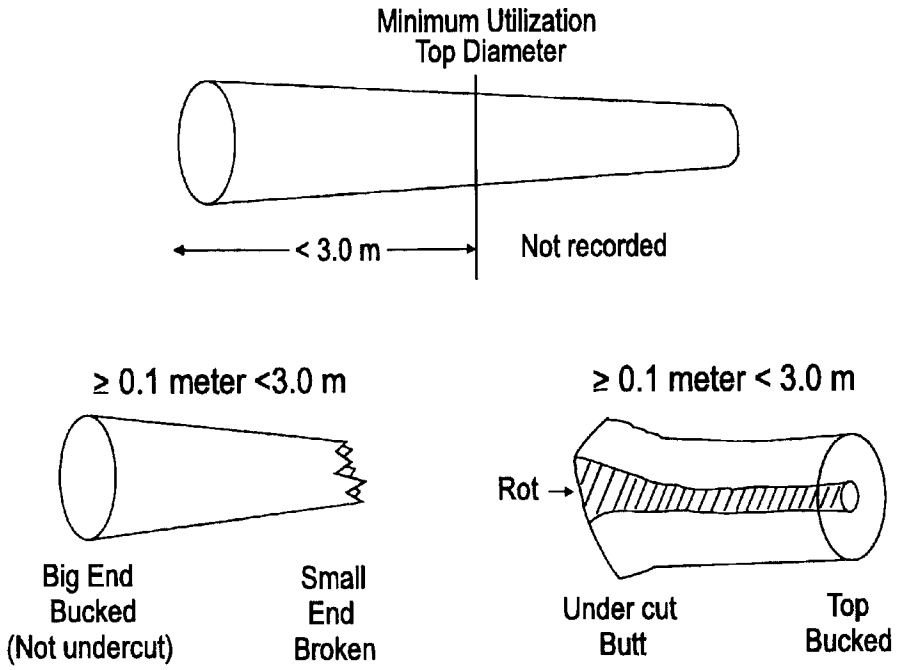


Figure 5.6 Examples of Bucking Waste.

5.3.4.1 Avoidable/Unavoidable

Bucking waste is considered avoidable unless there is clear evidence that pieces were cut out for safety reasons in falling (escape path) and bucking (oblique cuts), in which case they may be classified as unavoidable.

Pieces with severe physical deformaties such as forks, crooks, pistol butt or extreme sweep, and gall or goitres may be pencil bucked to separate avoidable and unavoidable portions as shown in the examples of pieces under 3 m below.

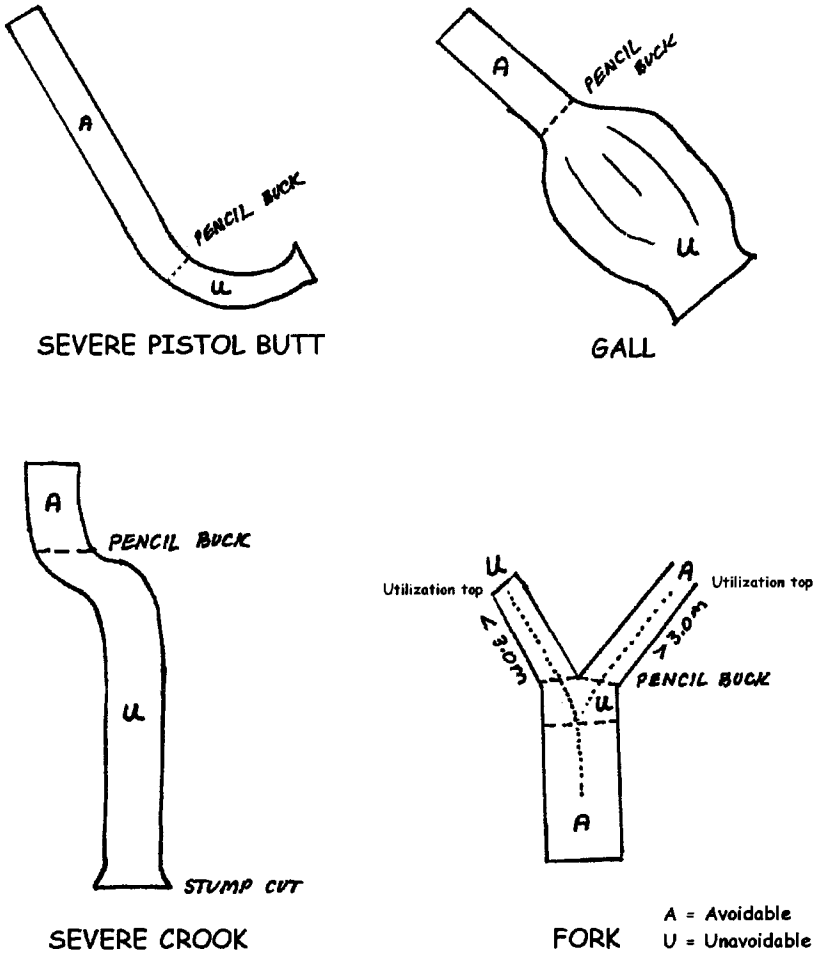


Figure 5.7 Avoidable/unavoidable Bucking Waste.

5.3.5 Breakage

Breakage is defined as any piece, meeting the minimum diameter of the cutting authority, which is shorter than 3 m in length and broken at the large end or broken at both ends.

If it resulted from "normal" falling or yarding, it is unavoidable and *not tallied.*

If it is excessive (or careless) it is considered avoidable and *is tallied* as such. In this case, it will be included in the cut-control volume.

This definition is not consistent with the inventory definition of breakage nor is it intended to be.

Undercut butts less than 3 m in length with a broken top are classified as breakage and should not be tallied.

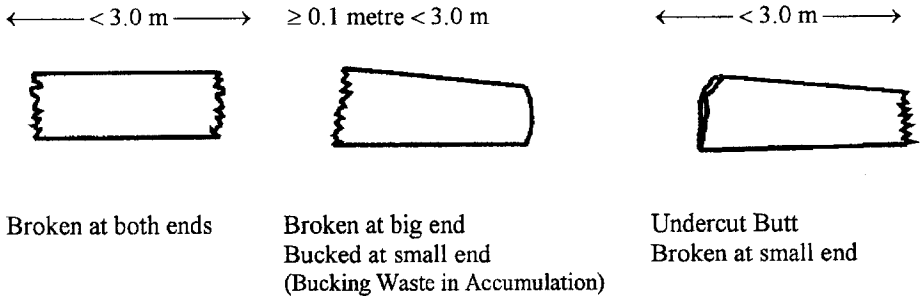


Figure 5.8 Examples of Breakage.

5.3.5.1 Recording Breakage

Normal breakage is not usually recorded.

If a licensee wishes to measure breakage for its own purposes, it should all be tallied as *unavoidable* breakage which is not included in the cut-control volumes.

However, where breakage is considered excessive because of an inadequate harvesting method or was intentionally caused by the logging crew, it should all be recorded as *avoidable* residue or waste. These volumes will be included in the cut-control volume.

In addition, breakage must be measured and charged to cut control where the inventory for the TSA or TFL has not been netted down for breakage. Breakage is recorded as "B" under "Kind of Material" on the FS 161 (Plot Survey Card).

A log lying in a dispersed area that is heavily fractured and common sense indicates that it would likely break into chunks below the minimum utilization standard in handling between "stump to dump", should be classified as breakage and not recorded.

5.3.6 Forks

A fork is defined to be a division of a log into two or more stems. Forks which measure greater than 3 m are measured as logs. If the diameters of forks are greater than or equal to the minimum diameter of the cutting authority specifications, the portion(s) of the tree, above the fork or crook must meet the criteria for minimum log length to be considered avoidable residue or waste.

If the portion(s) of the tree, above the fork or crook, doesn't meet the minimum log length criteria (3 m), it is considered unavoidable residue and must be recorded for cut control purposes.

In Figure 5.9, segment A, if visually extended to the minimum top diameter (5R), would meet the minimum log length (3 m); therefore, is classified as avoidable waste.

However, segment B, if visually extended to the minimum top diameter (5R), would not meet the minimum log length (3 m) and therefore is classified as unavoidable waste.

Segment C is recorded as unavoidable waste for safety reasons because lumber cannot be cut from it. The maximum length of segment C is 0.3 m unless the butt end of segment D shows two separate piths and then segments C and D are recorded as one unavoidable segment.

Segment D (with one pith showing) is recorded as avoidable waste.

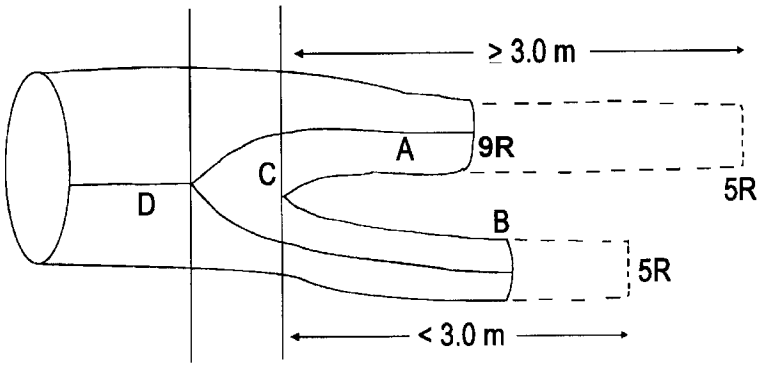


Figure 5.9 Forked Log.

Segments A, B, C and D are recorded as separate pieces on the FS 161, each with it's own piece number. Use FK as comment code to indicate the pieces belong to a fork.

5.3.7 Long Butts

For long butts under 3 m in length, pieces that are less than 50 percent sound are not required to be recorded; pieces that are more than 50 percent sound, the entire piece (net volume) is classified and graded as avoidable sawlog waste. In the interior, if the long butt originated from a dead tree, it may be classified as avoidable grade 3 waste.

If there is clear evidence that bucking was done to raise the grade of the parent log from lumber reject to sawlog, then the long butt may be graded lumber reject. Log butts may be downgraded for forks, crooks, excessive twist, or oversized knots.

For long butts over 3 m in length, the piece is measured and graded as a log.

5.3.8 Coarse Woody Debris

Refer to Appendix A10.2 for Definition and Composition.

5.3.9 Special Cases

Residue surveyors often encounter pieces, usually less than the minimum log length, that are hard to classify as waste or breakage, or as avoidable or unavoidable. A few of these circumstances are listed here:

- embedded rock, usually resulting from blasting. If the pieces are trimmed within 20 cm of the rock, such pieces may be classified as unavoidable. If the pieces have been trimmed longer, the segment beyond the rock should be classified as avoidable, without making any trim allowance,

- chunks on the tail-spar or skidding trails used to support the road beds, that resulted in the breakage of pieces greater than the minimum log length. Such pieces are classified as avoidable, and may be graded according to the characteristics of the whole piece,

- windfalls will be tallied in the usual manner for in-plot portions. The exceptions are windfalls that are blown down after harvesting with their roots sitting outside the block. These pieces will not be tallied,

- helicopter bucking waste. Incorrect estimation of log weights may result in having to buck the logs shorter after attempting to lift them. Such waste is always regarded as avoidable,

- chunks in the landing, bucked at both ends and used to support a steel tower. Classify as avoidable waste and grade as per the parent log,
- avoidable breakage is recorded,
- unavoidable breakage is *not* recorded, or
- unavoidable bucking waste is recorded.

5.4 Summary of Material Disposition

In reporting the results of residue and waste surveys, the disposition of the material is determined by the "Kind of Material", "Waste Class" (A or U), and Grade. Refer to the back of the FS 444 (Block Summary Card) for a full description of the codes to be used on the tally cards. See Figure 5.13.

The material disposition is summarized in Table 5-2.

Table 5-2: The Disposition of Residue/Waste Volumes

In Monetary Billing and Cut - Control (See Figures 1.1 and 1.2)
Table Values Effective January 1, 2001 Valid for all Species Product Combinations

LOG TYPE	GRADES		ALL STANDS							
			AVOIDABLE (from field data)				UNAVOIDABLE (from field data)			
			Class	Measure	Cut	Rate	Class	Measure	Cut	Rate
	Coast	Interior	W/R/X	YES/NO	CUT/N	S/$.25/..	W/R/X	YES/NO	CUT/N	S/$.25/..
Saw Log	X or better	____	W	YES	CUT	S*	W	YES	CUT	NB
Dead Dry Saw Log		3 Endemic	X	NO	N	NB	X	NO	N	NB
		3 Catastrophic	W	YES	CUT	$.25	R	YES	CUT	NB
Lumber Reject	Y	4 Optional	R	YES	CUT	NB	R	YES	CUT	NB
		4 Mandatory	W	YES	CUT	$.25	W	YES	CUT	NB
Dead	5		X	NO	N	NB	X	NO	N	NB
Dry Lumber Reject		5 Endemic & Catastrophic	X	NO	N	NB	X	NO	N	NB
Undersize		6 Optional	X	NO	N	NB	X	NO	N	NB
		6 Mandatory	W	YES	N	$.25	X	NO	N	NB
Firmwood Reject	Z	Z	X	NO	N	NB	X	NO	N	NB

Class: Waste, Residue, X other
Measure/Record: YES or NO
Cut: CUT CONTROL accountable, Not cut control accountable.
Rate: S = Average 12-month stumpage rate, $.25 = fixed base rate. NB = No Billing
All rates charged will include any bonus bids and levies where applicable.
* For small scattered volumes, the Regional Manager may set a different rate.
Effective January 1, 1999, see Appendix 9 for waste billing benchmarks.

All deciduous volumes will be measured where utilization is mandatory. The avoidable component will be billed at a specified fixed rate (plus any bonus bids and levies) and the volume will be applied to cut control. Where utilization is optional, these volumes may be considered as residue and charged to cut control.

If endemic Grade 3 is of mandatory utilization, it is treated the same as Grade 3 Catastrophic and must be measured and recorded.

5.5 Measurement Protocol and Standards

5.5.1 Lengths

Lengths will be recorded to the nearest tenth (0.1) of a metre:

- for exact 0.05 m lengths round to the lower tenth (0.1) of a metre.

Example:

- A log 4.25 m in length - record as 4.2 m
- A log 4.26 m in length - record as 4.3 m

The determination of KIND (logs, bucking waste, breakage) is made on the basis of gross length.

5.5.1.1 Broken Tops

The length measurement procedures for broken tops are (refer to Figure 5.10):

Step 1 Locate the top utilization diameter (must have minimum slab thickness of 5R) measured from the small end.

Step 2 Measure gross length which commences from the top utilization diameter.

Step 3 Locate the X Y line upon which the volume above the top utilization diameter to the X Y line (Section B) equals to the void of the missing wood (Section A).

Step 4 Record a length deduction which is measured from the top utilization diamenter to the X Y line.

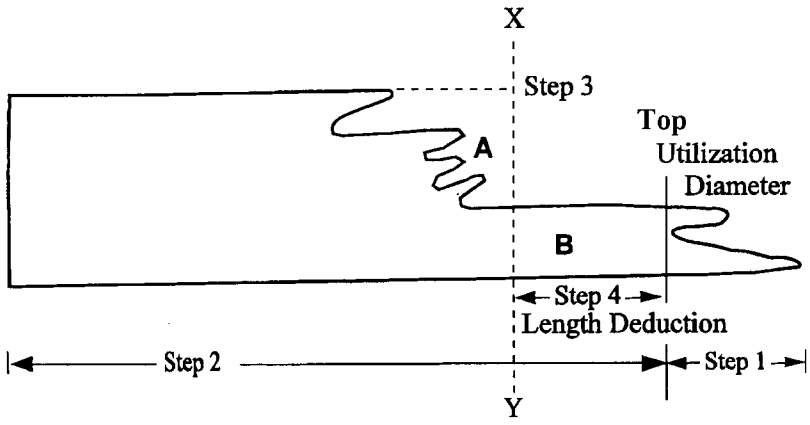


Figure 5.10 Measuring Broken Tops.

Logs broken at both ends are tallied only if they meet or exceed 3 m, midpoint to midpoint. Logs of less than 3 m are breakage and not tallied.

Example:

- A log 2.99 m in length - is breakage - do not tally
- A log 3 m in length - is a log - tally as 3 m
- A log 3.06 m in length - tally as 3.1 m

5.5.1.2 Shattered Ends

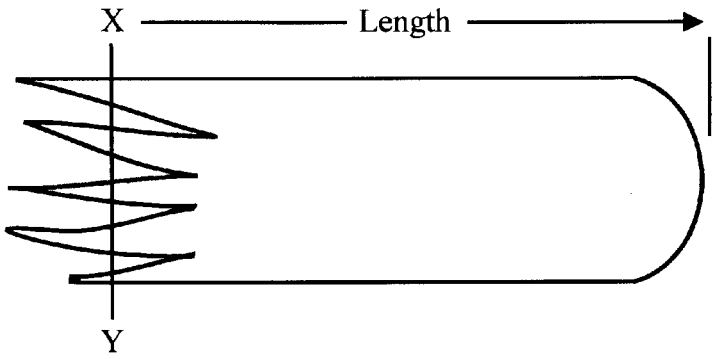


Figure 5.11 Measuring Shattered Ends.

Length is measured to the XY line where the protrusions are folded in to compensate the missing wood in the voids.

5.5.1.3 Stump Heights

Minimum stump height must be 36 cm above high side to be tallied: rounding to nearest 10th of a metre gives 0.4, less 0.3 m stump allowance, nets 0.1 m to be tallied.

Examples of Stump Heights:

- Stump height 0.35 m - do not tally
- Stump height 0.36 m - tally and record as 0.1 m
- Stump height 0.36 m - tally and record as 0.1 m
- Stump height 0.45 m - tally and record as 0.1 m
- Stump height 0.46 m - tally and record as 0.2 m

5.5.2 Diameters

Diameters will be recorded to the nearest radius class unit (rad), inside bark.

If the end is out of round, the average of measurements taken across two or more representative diameters shall be recorded as the end measurement.

All half measurements shall be taken to the nearest even number. Thus 24.5 will be recorded as 24 while 25.5 will be recorded as 26.

Minimum utilization standards reflect log diameters in centimetres, which must be converted to radius class units for field measurement.

Example:

15 cm =	7.5 rads - represented on the scale stick by the black line between 7 and 8 rads.
10 cm =	5 rads - represented on the scale stick by the red line in the middle of the 5 rad class.

5.5.2.1 Stump Diameters

In the Interior, a minimum diameter at stump height (outside bark) is specified in the contract document and this dsh is measured at a point 0.3 m above the high side of the stump. The minimum dsh must be obtained without rounding up or the stump is grade 6 and doesn't have to be tallied.

All tallied stumps have their top diameters measured and recorded inside bark so it is possible to have a stump diameter which is less than the minimum dsh in the cutting authority document.

Stumps whose total height, which includes the contractual stump height (usually 30 cm), is less than 1.3 m have their top diameters measured on the top of the stump. Stumps whose total height exceeds 1.3 m have their top diameter measured at 1.3 m above the ground on the high side.

On the Coast, where no minimum dsh is specified, a stump will only be considered if a log equal to or exceeding the minimum utilization standards was deemed to have been cut from it.

Where no minimum dsh is specified, the minimum dbh above high-side in the cruise will apply as the minimum dsh (inside bark). That is, 12.0 cm dbh (outside bark, immature on the Coast) will be a 6.0 rad dsh; a 17.5 cm dbh (mature on the Coast) will be rounded up to 9.0 rads dsh.

5.5.3 Bucking Waste

Cut at both ends - tally to the nearest tenth (0.1) of a metre regardless of length.

Cut at large end - tally as waste if length meets or exceeds a tenth (0.1) of a metre.

Example:

- 0.09 m in length - do not tally,
- 0.10 m in length - tally as a tenth (0.1) of a metre.

5.5.4 Deductions

Deductions for defect should be calculated in the field using the British Columbia metric scale stick.

The compilation program will subtract numbers (if any) in the deduction columns for length, top and/or butt from gross length, top and/or butt dimensions respectively. The resulting dimensions will then be used to calculate volume.

The numbers that are tallied in the deduction columns are not actual dimensions but length or radius deductions i.e. a log with gross dimensions of 4.2 m and 18 rad top / 20 rad butt with 0.6 m, 2 rad top and 5 rad butt deductions would be calculated as a 3.6 m, 16 rad top / 15 rad butt log.

5.6 Data Status and Recording Format

As an aid to the residue surveyor, throughout this guide the items (or fields) of information or data to be recorded on the two field cards have been grouped into 5 status categories and coded as follows:

R	Indicates fields of critical data that REQUIRED for the compilation program and therefore must always be correct and complete. (Field must never be left blank).
~S~	Indicates fields of data that are required only occasionally (i.e., when the item being identified is SUPPLEMENTAL or quantified is actually present, decay for example). (Field may be left blank when no data is required.)
U	Indicates data that is USEFUL for the residue surveyor to make correct field decisions. This data should be recorded in the office before proceeding to the field to establish plots (field may be left blank).
O	Indicates OPTIONAL data that need not be recorded. If it is decided not to record this data, it must be left blank consistently within a cut block.

Abbreviations used to identify the correct recording format for each character within a field are as follows:

n	-	Numeric characters only.
a	-	Alpha characters only.
An	-	Any combination of alpha and/or numeric characters.
Rj	-	Right justified.
Lj	-	Left justified.
Nba	-	No blank characters allowed in the whole field.
Bp	-	Blanks are permitted within the field.
n.n	-	Left number quantifies total numeric characters in the field, right number quantifies the number of numeric characters to the right of an unseen decimal.

The timber mark, license number, cutting permit number and block number must be identical on all plots in a block when you are entering them in the compilation program or you will get an error message.

5.7 Completing the FS 444 (Block Summary Card)

One FS 444 must be completed for each block sampled regardless of which sampling option has been chosen and the number of plots to be established in it.

5.7.1 Header

F.D. - FOREST DISTRICT *R* (2n-nba)	Identifies the Ministry of Forest's District Office responsible for the administration of the block being sampled. The first digit identifies the Region and the second digit identifies the District within that Region.

Forest District	No.	Forest District	No.	Forest District	No.
Vancouver		**Region - 1**			
Chilliwack	11	Squamish	13	Sunshine Coast	15
Campbell River	18	Port McNeill	19	Mid-Coast	1A
Queen Charlotte	1B			South Island	17
Prince Rupert		**Region - 2**			
Lakes	21	Morice	22	Bulkley - Cassiar	23
Kispiox	24	Kalum	25	North Coast	28
Kamloops		**Region - 3**			
Clearwater	31	Kamloops	32	Salmon Arm	33
Vernon	34	Penticton	35	Merritt	36
Lillooet	37				
Prince George		**Region - 4**			
Prince George	41	Robson Valley	43	Vanderhoof	44
Fort St. James	45	MacKenzie	46	Dawson Creek	47
Fort St. John	48	Fort Nelson	49		
Nelson		**Region - 5**			
Cranbrook	51	Kootenay Lake	57	Arrow	55
Columbia	54	Invermere	52	Boundary	56
Cariboo		**Region - 6**			
Quesnel	61	Williams Lake	62	Horsefly	63
100 Mile House	64	Chilcotin	65		

*REP. YR. - REPORTING YEAR *R** (2n-nba)	Identifies the last two digits of the year in which the sampling for the block was completed.
*REPORTING UNIT *R** (5n-rj)	Identifies the area for which the weighted sampling error objectives must be met. If the block sampling option is being used, each block is a Reporting Unit (RU) and will be given a unique RU number. If an aggregate sampling option is being used, each aggregate (group of blocks) is an RU and will be given a unique RU number. RU numbers will be issued by the Ministry of Forests district office upon approval of the Annual Residue Survey Plan (see Section 2.3).
*YEARS LOGGED *R** (2 of 2n-nba)	Identifies the last two digits of the year primary logging started on the cut block and the last two digits of the year primary logging was completed. If the logging was done in one year, use the same two digits in both fields. District Managers will require blocks that are to be harvested over more than 2 seasons be split for administrative reasons because the weighted average stumpage rate applicable to the avoidable waste volume will be based on the preceding 12 months only. Therefore, portions of blocks logged in one year must be surveyed no later than the following year.
*TIMBER MARK *R** (6an-lj)	Identifies the timber mark used for the block. If more than one timber mark was used for the block then a separate FS 444 must be completely filled out for each mark, specifying all the information for that area (net area, stratums, stratum areas and plot sizes, utilization standards etc.). A separate FS 72 will be printed for each block/mark combination. For wavy lines, record ":", for bars, record "-", for crescents records "'" and for old "X" timber sales, record "<". Some examples are as follows:

	TFL 22, CP 7	22/7	FL A01369, CP 9	F76009
	TL within TFL	HZ0021	TSL A48416 -	48416

<table>
<tr><td>LICENCE *R*
(6an-lj)</td><td colspan="4">Identifies the licence number of the block being sampled. Some examples are as follows:</td></tr>
<tr><td></td><td>TFL 1</td><td>TFL001</td><td>FL A17645 -</td><td>A17645</td></tr>
<tr><td></td><td>LOT 217</td><td>LOT 217</td><td>Wood Lot 443</td><td>W0443</td></tr>
<tr><td>CP - CUTTING PERMIT *R*
(4an-rj)</td><td colspan="4">Identifies the cutting permit number under which harvesting of the block was authorized. The cutting permit document contains the utilization standards for that cutting permit.</td></tr>
<tr><td>BLOCK - CUT BLOCK *R*
(4an-rj)</td><td colspan="4">Identifies the actual cut block or opening being sampled. The cut block numbers recorded on the FS 444 should correspond to the cut block numbers listed in the annual plan.</td></tr>
<tr><td>PLC DATE *R*
(3 of 2n-rj)</td><td colspan="4">Identifies the last two digits of the year, the month and the day on which primary logging was completed for the cutblock.</td></tr>
<tr><td>SURVEY DATE *R*
(3 of 2n-rj)</td><td colspan="4">Identifies the last two digits of the year, the month and the day in which the last plot was established in the block.</td></tr>
<tr><td>NET AREA *R*
(4.2n rj)</td><td colspan="4">Quantifies, in hectares, the total area of all stratum areas available for sampling and/or estimating.

This area includes any accumulation areas not within a cut-block such as in helicopter logging or when logs are skidded off a cut-block to a nearby central landing area. Landings will include only the area of the actual residue and waste piles.</td></tr>
</table>

*ROADS NP.NF*R** (4.2n-rj)	Quantifies, in hectares, the total area of road surface, non-productive and non-forest land. Road surface can be calculated by measuring the total length from the map (so long as it is sufficiently accurate) and multiplying by an average width for the road (usually 8.0 m). Do not include the ditch in the road surface area calculation as it is part of the population being sampled. Do not include skid roads, cat roads, or back spar trails etc. as they are part of the dispersed type stratum. NP and NF areas to be included are only those that have been typed out on the operational cruise used for the stumpage appraisal.
Waste Benchmark "R" (4n-rj)	Quantifies, in cubic metres, per hectare of avoidable waste threshold. Refer to Appendix 9.
*CRUISE VOLUME per ha *R** (4n-rj)	Quantifies, in cubic metres per hectare, the average cruise volume for the block. Data available from cruise summaries. Estimate if data is unavailable.
*REAS. - REASON FOR SURVEY *R** (1a)	Identifies the purpose of the sampling. This allows the FS 444's and the FS 161's to be used for more than one type of residue and waste measurements on the same block without the data becoming mixed up in the computer files. See the back of the FS 444 for codes.
*SNOW Y/N *R** (1a)	Identifies the presence of snow at the time of logging. See the back of the FS 444 for codes.
*SNOW MAX STUMP HT.M *R**	Quantifies, in metres, a maximum stump height which is different than the utilization policy (0.3 m). This occurs almost exclusively in the interior when, under certain circumstances, logging can only proceed during the winter. In any case, approval to leave stumps over 0.3 m due to snow (and therefore classify them unavoidable on FS 161) must be in writing from the MOF District Manager.

5.7.2 Area Statement

*TYPE STRATUM *R** (aana-nba)	Type stratum is a term that describes any and all subdivisions of a sub-population within a block made for sampling purposes.

This is a very critical item because it ties the plots, the plot sizes and the hectares together. Errors made when recording this type will cause totally incorrect results. Each type stratum line on the area statement must have one and only one area recorded on it. (i.e., use a new line for each type stratum).

The FIRST character, (alpha) starting from the left, identifies the residue type. Each residue type is also a stratum and must have a minimum of 2 plots.

The recognized residue types and their codes are as follows:

Residue Types		Code
1.	Dispersed Types	
	Open Slash/Clearcut	S
	Felled and bucked	F
	Group Retention	G
	Dispersed Retention	D
2.	Accumulated Types	
	Landings	L
	Roadside	R
	Windrow, Debuilt road	W
	Cold decked	D
	Spot accumulation	P
	Off-site landing (i.e. not in the block)	O

The "O" for off-site landings is required to identify those landings where the area of the landing is needed to calculate volume and this area *should* be included in the block net area.

The SECOND character (alpha) identifies the method used to harvest the residue type being sampled. This is a descriptive label only and will not cause a separate stratum to be created. Harvesting method codes are shown as follows:

Harvesting Method	Code
Spar (high lead)	S
Grapple yarder	G
Tractor (cat)	T
Horse	P
Rubber-tired skidder	R
Hand logging	M
Hoe chucking	B
Helicopter	H
Wyssen	W
Other	O
Any combination	C

Open slash that has been logged using more than one harvesting method can be given the code for the predominant method or the code for a combination of methods.

The THIRD character (alphanumeric) identifies the *plot size* used. Only one plot size may be used within one type stratum. The number codes to use are:

0 - 50 m^2	5 - 500 m^2	E - percent estimate
1 -100 m^2	6 - 600 m^2	E - volume estimate
2- 200 m^2	7 - your choice	S - 100% piece scale
3 - 300 m^2	8 - your choice	
4 - 400 m^2	9 - your choice	

The FOURTH character (alphanumeric) identifies any *substratification* of residue types into waste levels.

When significantly different levels of waste occur within a residue type and they can be easily identified and mapped, the residue surveyor may substratify them into waste levels.

The codes: "L", "M" and "H" for "light, medium and heavy" respectively or one to nine (1 to 9) may be used.

If no substratification is done, or for 100 percent piece scales, record "X".

> Stratification, if done carefully, can reduce the coefficient of variation and therefore also reduce the sampling error.

Stratification of accumulation residue types, when significantly different waste levels exist, can help accomplish this in either sampling option.

Stratification of dispersed residue types could also be beneficial in the cut block sampling option. It will, however, be of limited use in the aggregate sampling option due to the generally small number of plots involved.

Each stratum created in either the accumulation or dispersed sub-population requires a minimum of two plots.

> If sampling error is reduced with good stratification in the field, it is possible to reduce the number of plots required for the next sampling year.

Caution must be used, however, because poor stratification will cause the sampling error to increase and therefore unnecessary extra field work will result.

> Any stratification of residue types must be supported with field notes and a map.

An accurate area calculation is required for each stratum and all of the plots attributed to a stratum must fall within its boundaries (i.e., stratification cannot be done on a plot by plot basis).

*DISPERSED AREA *R** (4.1 n-rj)	Each line on the area statement quantifies, in hectares, the area of a dispersed residue type or waste level.
*ACCUMULATIONS - 100% *R** (5.2n-rj)	Each line on the area statement quantifies, in hectares, the area of a residue type or waste level that has been 100% scaled or estimated (i.e., not sampled with plots). Normally only single and/or very small landings, cold decks, small concentrated spot accumulations, unsafe piles or small patches of felled and bucked timber would be measured in this manner. If this measurement option is chosen for a stratum or substratum, all of the volume in the stratum or substratum must be either 100 percent scaled or estimated. "S" Not Used - Leave Blank. This is the column between "100 percent" and "Fixed".
*FIXED *R** (5.2n-rj)	Each line on the area statement quantifies, in hectares, the area of any accumulated residue types or waste levels (i.e. type stratum) that have been sampled with plots of a fixed radius (a 400 m^2 plot = 11.28 m radius). 3P Not used - leave blank.

The areas recorded on the area statement will be subject to audit by MOF staff.

*PLOT SZ m^2 - PLOT SIZE *R** (3n-rj)	Each line quantifies, in square metres, the plot size used for the various type stratum. The normal plot size for dispersed residue types is 400 m^2 (circular with radius of 11.28 m). Smaller plot sizes are allowed for partial cutting. Accumulated residue types can be sampled with a 50 m2 plot (circular with radius of 3.99 m), or rectangular or square plots of 100, 200, or 400 m^2. The plot radius formula is $\sqrt{(plot\,size(m^2)/\pi)}$.

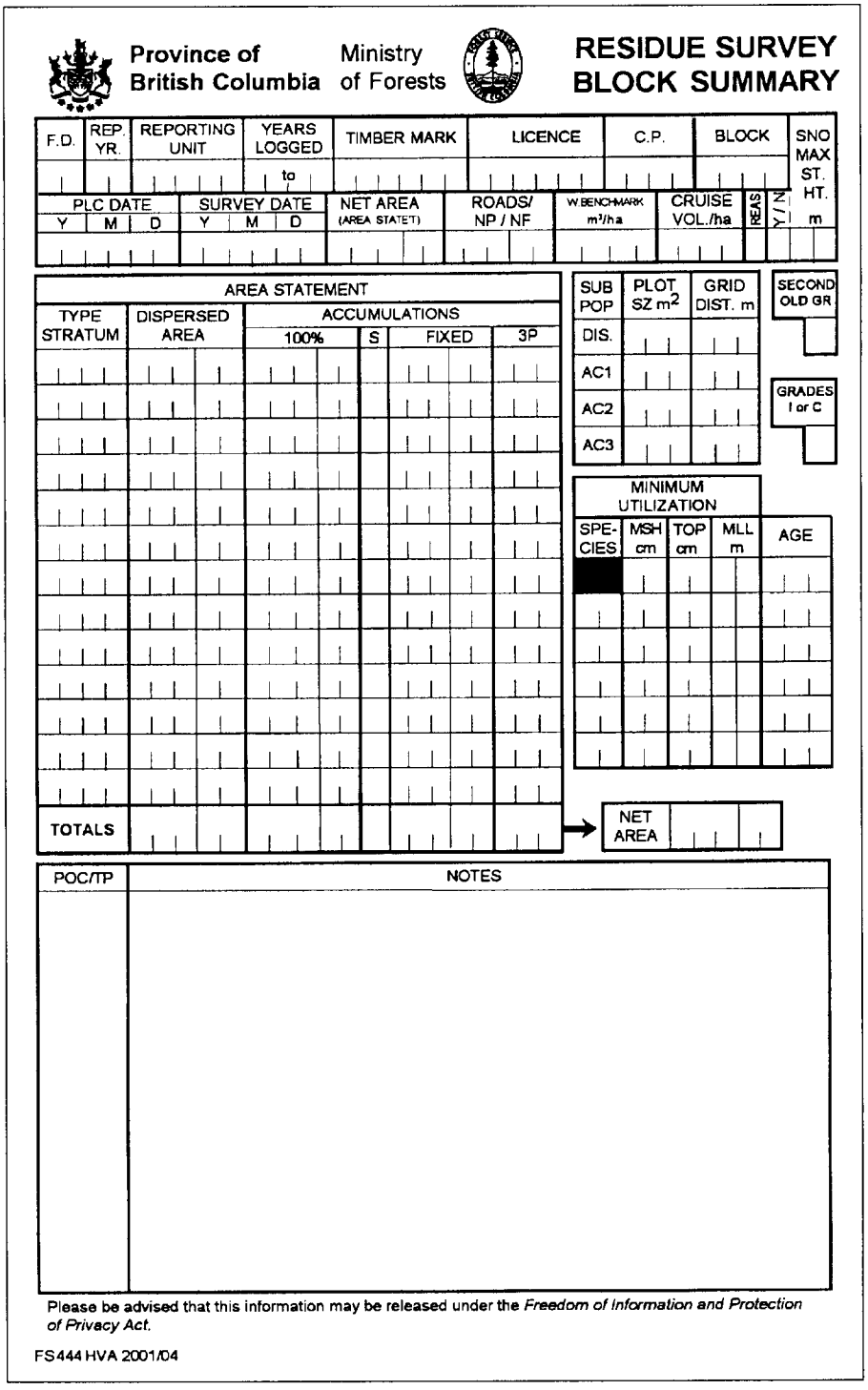
All plots within a type stratum must be the same size.

*GRID DIST.m - GRID DISTANCE *R** (3n-rj)	Quantifies, in metres, the horizontal distance between plots on a strip and between strips on a baseline for dispersed residue types. It can also be used to quantify the horizontal distance between plots along the roadside accumulations.
*SECOND OLD GR - SECOND or OLD GROWTH *U** (1a)	Identifies the predominant age class of the timber that was in the cut block. Codes are "O" for old growth (121 years and older) and "S" for second growth (under 121 years).
*GRADES *U** (1a)	Identifies whether Coast or Interior grades are applicable for the block. I = Interior and C = Coast.

5.7.3 Minimum Utilization

These specifications are all on the cutting authority document.

*SPECIES *R** (2a-bp)	Identifies any species that have abnormal utilization standards. Where the species is blanked out on the first line, the blank refers to all species). Only the first line is used on the Coast because they do not have any abnormal utilization standards.
*MSH cm - MAXIMUM STUMP HEIGHT *R** (2n-rj)	Quantifies, in centimetres, the maximum stump height allowed by the cutting authority contract. The residue surveyor needs this information to assign the correct waste class to stumps. On the coast it is always 30 cm.
*TOP cm *R** (2n-rj)	Quantifies, in centimetres, the minimum top diameter, inside bark, that must be recovered or billed under the cutting authority contract. On the coast it is always 15 cm for old growth timber and 10 cm for second growth. In the Interior, for red cedar 140 years or older, the top diameter is 15 cm; for younger red cedar and all other coniferous species it is 10 cm.
*MLL m - MINIMUM LOG LENGTH *R** (2.1n-rj)	Quantifies, in metres, the minimum log length that must be recovered or billed under the cutting authority contract. Currently it is 3 m for both the Coast and the Interior.
*AGE *R** (3n-rj)	Identifies the age of any species where abnormalities occur in the minimum utilization standards. Applies to the Interior only, leave blank on the Coast.



Province of British Columbia Ministry of Forests

RESIDUE SURVEY BLOCK SUMMARY

F.D.	REP. YR.	REPORTING UNIT	YEARS LOGGED	TIMBER MARK	LICENCE	C.P.	BLOCK	SNO MAX ST. HT.
			to					

PLC DATE Y M D	SURVEY DATE Y M D	NET AREA (AREA STATET)	ROADS/ NP / NF	W.BENCHMARK m^3/ha	CRUISE VOL./ha	REAS	Y / N	m

AREA STATEMENT

TYPE STRATUM	DISPERSED AREA	ACCUMULATIONS 100%	S	FIXED	3P
TOTALS					

SUB POP	PLOT SZ m^2	GRID DIST. m
DIS.		
AC1		
AC2		
AC3		

SECOND OLD GR

GRADES I or C

MINIMUM UTILIZATION

SPE-CIES	MSH cm	TOP cm	MLL m	AGE

NET AREA

POC/TP	NOTES

Please be advised that this information may be released under the *Freedom of Information and Protection of Privacy Act.*

FS444 HVA 2001/04

Figure 5.12 Front of FS 444 (Block Summary Card).

COMMENTS

PREPARED BY	SIGNATURE

Coding for Block/Plot Headers

REASON FOR SURVEY:	B - billing, C - check, S - special purpose
SNO:	Y/N - Snow Pack: Y - yes (when logged), N - none Max. Stump Height: m (DM prior approval letter)
SECOND/OLD GROWTH:	S - second, O - old
GRADES:	I - Interior, C - Coast
PLOT TYPE:	A - accumulation D - dispersed
PLOT SHAPE:	C - circular, S - square, R - rectangular; 3 - 3P, X - 100% scale
MEASURED %:	blank - dispersed plots; for accumulations, 05-95 (5% to 95%), 00 - 100%

Coding for Plot Tallies

SEGMENTS:	use different piece numbers
SPECIES:	use the scaling codes: Fl, CE, HE, BA, SP, CY, LO, WH, WB, YE, LA, AL, AS, Bl, CO, MA, OT
KIND OF MATERIAL:	L - log, slab, sliver, chunk, S - stump, D - down tree/snag, U - undersize, T - tree/snag, B - breakage (< min. log length), W - bucking and trimming waste, X - special product (shake bl.)
CLASS:	A - avoidable, U - unavoidable
END CODE:	B - broken, C - cut (bucked), N - natural (min. cutting specs.- pencil bucked), U - felling undercut (butt)
DECAY TYPE:	blank - none, H - heart rot (through), T - top rot, B - butt rot, R - ring rot, C - conk rot, P - pocket rot, S - sap rot
GRADE	Coast - U, X, Y, 5 (dry Y); Interior - blank (sawlog), 3, 4, 5, 6
BORDERLINE CODE:	blank - completely inside plot, B - borderline piece, X - length exceeds plot width

CODED COMMENTS:

BK - bunch knots and burls	LB - long butt
BR - buried	MP - multiple pieces
CA - candelabra	SA - sapling
CL - culvert log	SB - shake block
CR - severe crook or pistol grip	SL - slab
DP - "dead potential" (inv. classif.)	US - unsafe
DU - "dead useless" (inv. classif.)	WD - woody debris
FK - fork	WF - windfall
FL - fluted butt	WS - windshear

Figure 5.13 Back of FS 444 (Block Summary Card).

5.8 Completion of the FS 161 (Plot Tally Card)

5.8.1 Header

At least one FS 161 must be completed for each plot established.

If a plot has no pieces, record "*Nil Plot*" across the card.

If more than one page is required, record the page number on all pages.

Fill out the header line on all individual plot cards so that if the cards become separated they can be identified and reunited.

*LICENCE *R** (6an-lj)	See "LICENCE" on FS 444. Must be identical to the licence number recorded on the FS 444.
*C.P. - CUTTING PERMIT *R** (3an-rj)	See "CUTTING PERMIT" on the FS 444. Must be identical to the cutting permit recorded on the FS 444.
*BLOCK - CUT BLOCK *R** (4an-rj)	See "BLOCK" on the FS 444. Must be identical to the block number recorded on the FS 444.
*DATE *R** (3 of 2n-rj)	Identifies the year (last two digits), month and day when the plot was established.
*CERT - CERTIFICATE NUMBER *R** (4an-rj)	Identifies the certificate number of the residue surveyor responsible for the establishment of the plot.
*RET # - RETURN NUMBER *R** (3n-rj)	Identifies the return number of the residue surveyor responsible for the establishment of the plot. Return numbers will increment by one for each new block sampled in a given year. If two residue surveyors are establishing plots in the same block they should each use their own return number.

It is the responsibility of each certified residue surveyor to keep track of his/her own return number. These numbers automatically revert to "001" on January 1st of each year.

*B.LINE - BASELINE *R** (1a)	Identifies the baseline the plot is tied to. Use codes "A" "B" "C" etc.
*STRIP *R** (2n-rj)	Identifies the strip number that plots are located on.
*PLOT NO. *R** (2nrj)	Identifies the plot number. The strip/plot number combination must be unique within a type stratum.
*TY. - PLOT TYPE *R** (1a)	Use this field to identify the subpopulation type for the plot as recorded on the FS 444. Use codes, "D" for dispersed, "A" for accumulation, "E" for estimate or "M" for 100 percent scale.

Dispersed Samples (Sub-population "D")

Sample plots sizes can be 400, and measure factors can be used. Occasionally, an estimate may be chosen in the dispersed area and if so, use sub-population "V" under.

> You cannot use a measure factor in an estimated stratum.

Accumulation Samples (Sub-population "A")

Sample plot sizes must be $\geq$ 50 m^2 and measure factors can be used. If an entire accumulation pile is sampled and is $\geq$ 50 m^2 in size, call each pile a separate stratum and specify the plot size as the size of the pile (e.g., 78 m^2).

If the area of the pile (stratum size) is $\leq$ 50 m^2, call the plot size 50 m^2 and divide the stratum size by 50. Enter this number, expressed as a percent, in the measure factor field (e.g., 36 m^2 stratum size / 50 m2 = .72 or 72 percent).

If the plot already has a measure factor, e.g. 60 percent, multiply the 0.72 x measure factor expressed as a decimal to get a corrected measure factor (e.g., .72 * .60 = .432 expressed as a percent is 43.2 percent). Enter the percent to the nearest whole number (e.g., 43 in the measure factor field).

Estimates or 100 percent piece scales can also be put in. Use sub-population "P" for estimates or "M" for 100 percent piece scales. You cannot use a measure factor for either of these sub-populations.

Estimates (Sub-population "V" or "P")

Volumes for some accumulations or dispersed areas cannot be reasonably determined or measured safely by establishing plots.

When this is the case determine the area of the stratum or pile. Then make an estimate of the volume of billable and cut control accountable material in one of *two* ways.

1. Percent Estimate

   Estimate the total billable and cut-control accountable volume in the stratum or pile and then break this volume out in percent for each species, kind of material, waste class and grade combination.

   This estimate must be entered into the EST. VOL field in the R & W program. If this field is left blank, the program will only accept volume estimates as noted in 2. Volume Estimate. Please note estimated volume in the blank space under PLOT NO. on the FS 161.

   For example, an estimate of 20 m^3 in a pile:

SP	Kind	Waste Class	Grade	Percent of Est. Volume
LO	L	A	-	25%
LO	L	A	3	15%
SP	L	A	-	20%
SP	L	A	3	25%
SP	W	A	4	15%

Enter "P" for accumulation estimates and "V" for dispersed estimates under TY (PLOT TYPE) on the FS 161.

> The estimated volume in the blank space under "*Plot No.*" and the percentages (right justified) in the *Deduction Length* field of the FS 161.

2. Volume Estimate

Estimate the total billable and cut-control accountable volume in the stratum or pile by estimating a specific volume for each species, kind of material, waste class and grade combination.

SP	Kind	Waste Class	Grade	Volume (m)
LO	L	A	-	5.0
LO	L	A	3	3.0
SP	L	A	-	4.0
SP	L	A	3	5.0
SP	W	A	4	3.0

Enter "P" for accumulation estimates and "V" for dispersed estimates under TY (PLOT TYPE) on the FS 161.

Note each volume in the PIECE VOLUME field. Ignore the implied decimal place and record to 1 decimal place right justified, (i.e., 0025 for 2.5 m^3).

A measure factor cannot be applied to an estimated stratum.

100 % Measure (Sub-population "M")

Sometimes 100 percent of the pieces in an accumulation, a small dispersed area, a log deck or an area of felled and bucked can be measured (scaled).

Measure each piece (full length down to minimum top diameter) and record on the FS 161.

A measure factor cannot be applied in a 100 percent measure stratum.

The sub-population type is "M" and the third character in the type stratum is "S".

PLOT SH – PLOT SHAPE **R** (1a-bp)	Identifies the plot shape. Use codes "C" = Circular, "R" = Rectangular, "S" = Square. Must be blank for estimated plots and 100 percent measure plots.
MEAS.% - MEASURE % **R** (2n-rj)	Quantifies the percentage of the volume, within the plot boundaries that has been measured and recorded. A reasonable effort must be made to measure as much as possible even if one end of the piece cannot be seen and must be estimated. See the codes on the back of the FS 444. Do not leave blank for dispersed residue types. Use code 00 for 100 percent.
*TYPE STRATUM *R** (aana-nba)	See "TYPE STRATUM" on the FS 444. Must be identical to the type stratum code (listed on the FS 444) for the type stratum in which the plot falls.

5.8.2 Piece Descriptions

*PIECE NO. *R** (3n-rj)	Identifies the piece. Increment by one for each new piece. For pieces that are segmented for classification purposes (i.e., a stump with one avoidable segment and one unavoidable segment), use a different piece number for each segment and record MP on the comment column to indicate multiple pieces.	
*BOR.LINE – BORDERLINE *S** (1a)	Identifies pieces that lay across the plot boundary. Also identifies pieces having a length that exceeds the diameter of the plot because the plot is on a steep slope or because the piece is standing on end (tree or piece standing in a pile).	
	Blank	= Piece completely inside plot.
	B	= Borderline piece (measure inside portion only).

	X	= Pieces that exceed the plot diameter.		
*SPECIES *R** (2a-bp)	Identifies the species of the piece. Acceptable codes are as follows:			
	DOUGLAS FIR	- FI	WHITEBARK PINE	- WB
	RED CEDAR	- CE	CYPRESS	- CY
	WHITE PINE	- WH	BIRCH	- BI
	YELLOW PINE	- YE	LARCH	- LA
	ASPEN	- AS	BALSAM	- BA
	COTTONWOOD	- CO	SPRUCE	- SP
	LODGEPOLE PINE	- LO	ALDER	- AL
	HEMLOCK	- HE	MAPLE	- MA
*KIND *R** (1a)	Identifies the nature or shape of the piece. See the back of the FS 444 for the codes.			

Logs (L)

Includes all logs and slabs which are at least 3 m in length. Trees and snags, whether standing or down, should be recorded as logs.

Stumps (S)

Includes all stumps greater than 0.3 m and less than 3.3 m in total height measured from the high side to the top of the felling cut.

Only record that portion of each stump that is above the contractual stump height (0.3 m) measured from the ground on the high side of the stump.

Stumps over 3.3 m in length should be measured from the contractual stump height (0.3 m) and classified as logs.

Dead stumps normally are not required to be tallied. The exception is catastrophic grade 3 stumps or depending on the mandatory utilization.

Bucking Waste (W)

Includes all portions of logs and slabs and less than 3 m in length and cut on at least one end in accumulations and cut at the larger or both ends in dispersed residue types.

Special Products (X)

Includes already manufactured products less than 3 m in length such as shake bolts or fence posts that have been left on the block.

Breakage (B)

Includes all pieces shorter than 3 m and broken at both ends. "Normal" breakage is not tallied.

If a licensee wishes to measure breakage for its own purposes, it should be tallied as *unavoidable* and will not be included in the cut-control volume.

However, where breakage is considered excessive because of an inadequate harvesting method or was intentionally caused by the logging crew it should be tallied as *avoidable* breakage and billed monetarily and against the licensees cut-control according to it's grade.

Do not scale or record breakage unless specifically requested to do so or it is excessive & avoidable.

WASTE - WASTE CLASS **R** (1a)	Identifies the waste class (avoidable/unavoidable) of the piece. This is based solely on the physical accessibility and/or safety concerns for recovery of each piece. Waste class has nothing to do with quality. See "Waste Class" in Section 5.1.3 for a detailed description of how to identify the waste class of a piece.

5.8.3 Gross 'In Plot' Dimensions for Pieces

The piece dimensions recorded for residue surveying are inclusive of decay (i.e., they are not reduced to account for the volume of decay).

They include only the portion of the piece within the plot boundaries.

Length is measured to the plot boundary and the diameter of that end is taken there.

*LENGTH *R** (3.1 n-rj)	Quantifies, in metres, the "in plot" length of the piece.
*TOP *R** (3n-rj)	Quantifies, in rads, the gross diameter, inside bark, of the top end.
*E - END DESCRIPTION *R** (1a)	Describes whether the top end is natural (N), cut (C), Broken (B) or buried (X).
*BUTT *R** (3n-rj)	Quantifies, in rads, the gross diameter, inside bark, of the large end.
*E - END DESCRIPTION *R** (1a)	Describes whether the butt end is undercut (U), cut (C), natural (N), Broken (B) or buried (X).
*GRADE *R** (1a)	Identifies the grade of the piece regardless of the kind of wood or waste class. For a complete description of the log grades, Coast or Interior, refer to the *Scaling Manual.* For residue surveyors on the *Coast*, it is not essential to know all of the log grades for each species but you must be able to correctly identify "U", "X", "Y" and "Z" grades. Any pieces left ungraded will default to "U" grade. Use the alpha codes in the scaling manual to identify coast log grades except "Y" grade material originating from dead/dry snags, (code with a "5") which doesn't have to be recorded. Residue surveyors in the *Interior* must be able to correctly identify all interior grades (sawlog, 3, 4, 5, 6 and Z).

5.8.4 Deduction for Rot or Holes

It is a standard scaling convention in British Columbia to account for the volume of decay by reducing the gross dimensions of a piece by a *length and/or diameter (rad) deduction* (computed using the volume data on the scale stick). This gives net dimensions that will produce a volume equal to the net volume of the piece. This process is well documented in the scaling manual.

For residue surveys the *length and/or diameter (rad) deductions* must be recorded along with the gross dimensions of the piece and the compilation program calculates the net volume of the piece.

> This is different from Scaling where they only record the net dimensions of each piece.

Residue surveyors must be able to calculate these deductions accurately and then record them on the FS 161.

*LENG. - LENGTH *S** (2.1n-rj)	Quantifies the length deduction in tenths of metres.
*TOP *S** (2n-rj)	Quantifies, in rads, the diameter deduction for the top end.
*BUTT *S** (2n - rj)	Quantifies, in rads, the diameter deduction for the butt end.
*D - DEFECT TYPE *S** (la)	Identifies the type of decay in the piece. Must be recorded whenever a deduction has been recorded. See the back of the FS 444 (Figure 5.13) for codes.

5.8.5 Outside Plot Measurements

Everything to the right of decay type on the Residue Survey Plot Tally Card is optional and does not be have to be completed.

The comment codes are very useful for explaining the waste classification or grade assigned to the piece. This information is not subject to audit.

The "outside measurements" are essential if any studies of average piece size are contemplated (e.g., the outside butt diameter will help to substantiate the grade of the piece).

*FAR END *O** (2n-rj)	Quantifies the diameter, in rads, of the actual end of the piece when it is outside the plot boundary. This diameter can be estimated.
*ADD LENGTH - ADDITIONAL LENGTH *O** (3.1 n-rj)	Quantifies, in metres, the additional length of the piece that is outside the plot boundary. This length can be estimated.
*COMMENT CODE *O** (2a)	Additional descriptive information that may be useful. See the back of the FS 444 for codes that the computer compilation program will accept.
BLANK COLUMN (unlabelled)	For your own use.
PIECE VOLUME	This column allows for recording piece and plot volumes.

A simple formula for computing volume with a pocket calculator is:

$$VOLUME = [(t * t) + (b * b)] * L * K$$

Where	V	=	volume in cubic metres
	t	=	top diameter in rads
	b	=	butt diameter in rads
	L	=	Length in metres
	K	=	0.000157

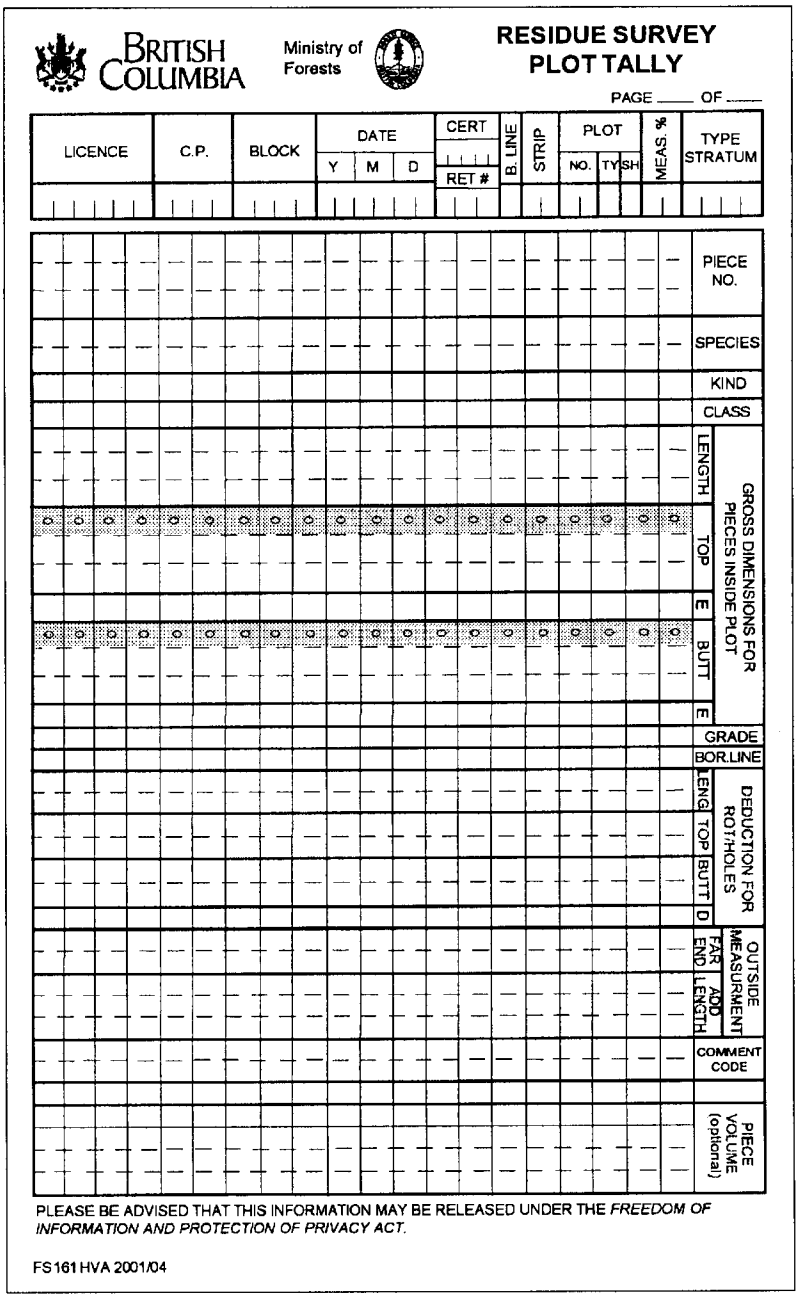


Figure 5.14 Front of the FS 161 (Plot Tally Card).

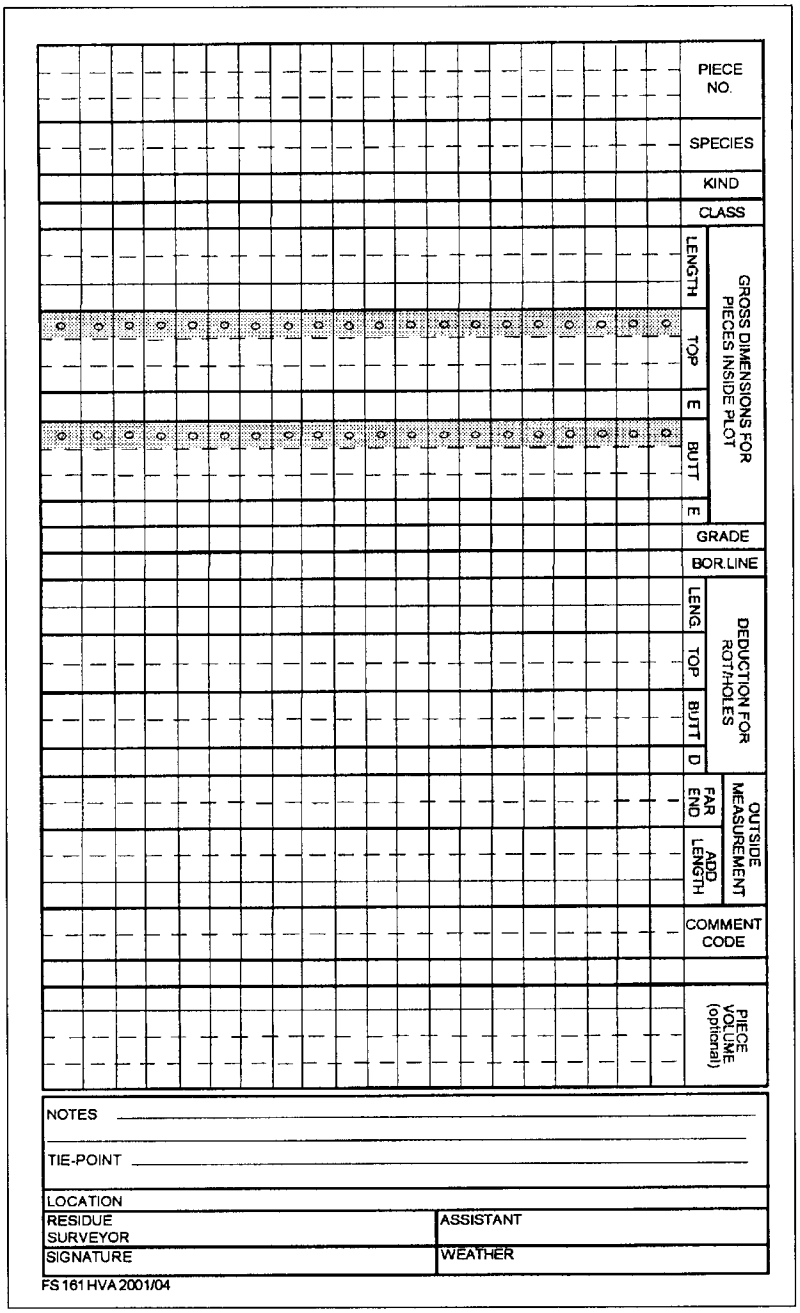


Figure 5.15 Back of the FS 161 (Plot Tally Card).

5.9 Scaling Manual – Interior Log Grade Summary

5.9.1 Summary of the Interior Log Grades

Code	Grade
(Blank)	Sawlog
3	Dead/Dry Sawlogs
4	Lumber Reject
5	Dead/Dry Lumber Reject
6	Undersized Log Grade
Z	Firmwood Reject

5.9.2 Lumber Quantity and Quality Criteria

Species	Lumber Quantity	Lumber Quality
	% of log that must be suitable to manufacture lumber	% of lumber manufactured that must be merchantable or better
HE	75%	50%
CE: Mid Point Diameter:		
25R and less	75%	50%
greater than 25R	50%	50%
BA	67%	50%
Other Species	50%	50%

5.9.3 Minimum Gross Dimensions of Logs for Manufacture

Minimum Gross Dimensions required for logs and log segments to be suitable to manufacture lumber:

			Length	Diameter
1.	Logs and Log Segments		2.5 m Interior (2.6 m Coast)	5 R
2.	Slabs and Slab Segments		2.5 m Interior (2.6 m Coast)	7.5 R
3.	Collars of Firmwood Around			
	a.	Holes & Rot if defect 20 percent of end diameter	2.5 m	7.5 R
	b.	Ring Shake Ring Rot & Pocket Rot	2.5 m	5 R
4.	Sound Hearts (includes charred wood & sap rot)		2.5 m	5 R

5.9.4 Minimum Log Quality Requirements

Knot Criteria

Top Diameter	Maximum Knot Diameter
5 - 7 R	2 R
8 - 13 R	3 R
14 - 18 R	4 R
19 - 24 R	5 R
25 - 37 R	6 R
38 + R	7 R

Knot Assessment for Long Logs

For logs longer than 8 m in length, the log is measured at the midpoint and:

1. Knots on the top log segment are assessed using the top diameter.
2. Knots on the bottom log segment are assessed using the midpoint diameter.

Twist

1. Measure over 30 cm (15R) of 1 representative log section.
2. Maximum Allowable = 15 percent of top diameter if twist is greater than 2 R up to a maximum allowable of 4.5 R.
3. If log length is more than 8 m assess twist on basis of the midpoint diameter.

5.9.5 Grading Rules/Requirements

Sawlog Grade = Grade Code Blank (-)

Summary of the Grade Rule:

Logs and log segments 2.5 m or more in length and 5 R or more in diameter where the lumber quantity and quality criteria on the preceding pages are met or exceeded:

For residue surveys the minimum log length is 3 m.

Dead/Dry Sawlog = Grade Code 3

Summary of the Grade Rule:

1. Logs and slabs graded as sawlog cut from trees which were dead and dry when harvested.

Requirements for the grade (i.e., to be considered dead/dry):

See log requirements for the grade under Grade Code 5.

Dead/Dry grades apply only to logs from trees which were dead and dry when harvested. They do not apply to timber which was green when harvested but dries prior to scaling (e.g., where timber is decked prior to transport and scaling).

Lumber Reject Grade = Grade Code 4

Summary of the Grade Rule:

Logs and slabs that are lower in grade than sawlog but better than firmwood reject.

Dead/Dry Y (Coast) or Dead/Dry Lumber Reject (Interior) = Grade Code 5

Summary of the Grade Rule (for all species)

Logs and slabs graded as lumber reject and cut from trees which were *dead and dry when harvested.*

Log requirements for the grade: (Apply to Grade Code 3 and 5)

To be classified as dead/dry the log *must* have one or more of the following characteristics (INDICATORS):

- deteriorated cambium,
- loose or shedding bark,
- sap rot (encircling log end),
- wood borers,
- blue stain (encircling log end), or
- deep checks (not weather checks).

Logs *cannot* be classified as dead/dry if they display any of the following characteristics (Contraindicators):

- curling bark,
- green needles,
- fresh cambium (sticky),

- mildew or mould on wood surface (except on windthrow),
- charred wood (recent fire kill),
- dark weathered ends (indicative of decked timber), or
- pitching log ends.

Logs which display both *Indicators* and one or more *Contraindicators* are deemed to have come from a live, green tree.

Where the logs being scaled have been subjected to prolonged decking prior to scaling, they do not qualify for consideration in the dead/dry grades.

Additionally, if there is any doubt whether or not the tree was dead/dry when harvested, the log must *not* be classified as Grade 3 or Grade 5.

Undersized Log Grade = Grade Code 6

1. Summary of the Grade Rule:
   - Logs of a grade better than firmwood reject and cut from a tree which was below the minimum diameter at stump height (outside bark) that was specified in the interior utilization standards.
2. Log requirements for the grade:
   - Log must show sufficient evidence such as an undercut or butt flare to indicate it comprises a small tree or a butt log from a small tree.
   - The unrounded outside bark measurement at a point 15 cm from the butt face must be less than the minimum diameter stump height specified in the interior utilization standards (15 cm for lodgepole pine and 20 cm for other coniferous species).

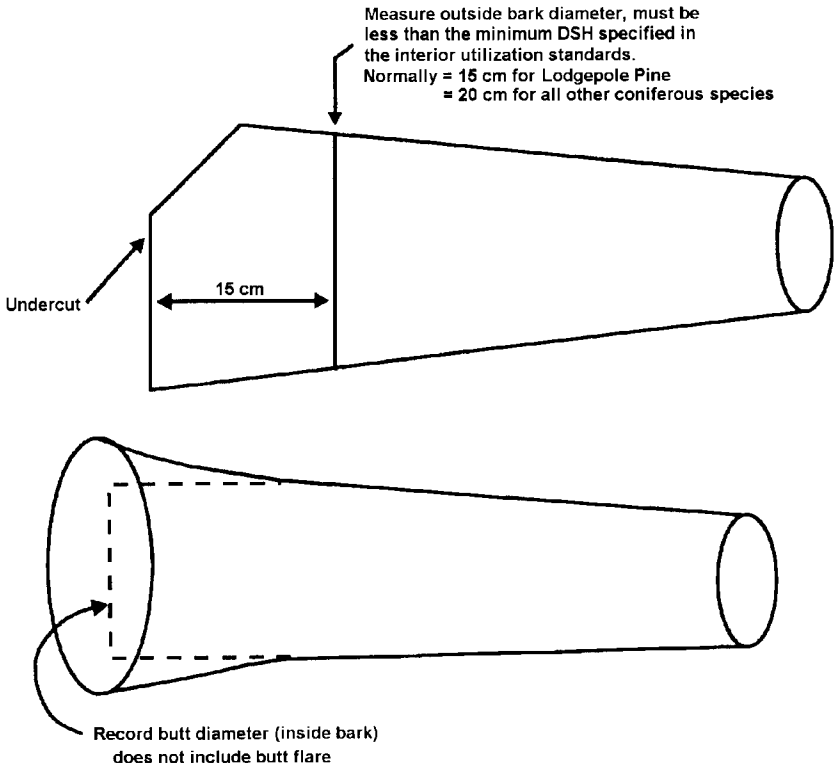


Figure 5.16 Determining and Recording Grade 6 Butt Diameters.

Firmwood Reject (Grade Code Z, Species Code R)

Summary of the Grade Rule:

Firmwood reject means a log where:

1. Heart rot or hole runs the whole length of the log being scaled and the residual collar of the firmwood constitutes less than 50 percent of the gross scaled volume of the log.

2. There is sap rot, charred wood, or catface and the residual firmwood is less than 10 cm (5 R) in diameter at the butt end.

3. Slabs or parts of slabs less than 10 cm (5 R) in thickness.

4. There is rot and the net length estimated by the scaler is less than 1.2 m.

5. Includes the part of the log that is under 10 cm (5 R) in diameter.

5.9.6 Deductions to Establish Log Grade

Lumber Quantity Deductions

Logs, log segments, slabs or slab segments not meeting minimum gross dimensions are not considered suitable to cut lumber and are 100 percent grade deduction.

Grade deduction for logs with rots, holes, bark seams or fractures is calculated after adding an 1 rad trim allowance on all sides of the defect.

Grade deduction for sap rot, surface checks, charred wood, or clusters of defect is calculated after enclosing the defect(s) in circles or rectangles which are representative of the volume lost for cutting lumber.

Dead and dry logs cut from trees which were dead and dry when harvested and are 7.5 R or less at the midpoint are 100 percent grade deduction if they have two or more checks at least 2 R in depth.

Lumber Quality Considerations

Logs, log segments, slabs or slab segments exceeding maximum twist or knot criteria are not considered suitable for cutting merchantable or better quality lumber.

5.9.7 Grading Notes

Deductions

- Grade and quality deductions are used only for the assessment of log grade and are not recorded on the tally sheet.

Blank Entries

- All logs other than sawlogs must be coded on the tally sheet. Blank grade entries automatically default to sawlog.

Dead/Dry Grades

- These grades apply only where logs are cut from trees that were dead and dry when harvested. They do not apply where timber is harvested green and dries prior to scale, and

- Logs classified as dead/dry must show mandatory characteristics. Scale grades make no reference to the endemic or catastrophic classification.

Grade 6 (Undersized)

- Grade 6 logs must show sufficient evidence the log is from an undersized tree and not a top,
- the unrounded outside bark diameter measure is for grading purposes only,
- the tally sheet entry for the butt diameter follows usual scaling convention (i.e., inside bark allowing for normal taper),
- if eligible logs fit another grade, Grade 6 takes precedence (i.e., small sawlog is graded as 6 if it meets criteria),
- in all cases parts of logs less than 5 R in diameter are recorded as firmwood rejects,
- tops found in the dispersed area can be graded as grade 6 if the top is lying adjacent to a parent log which clearly meets the grade 6 scaling specifications including butt flare or undercut, and
- Grade 6 logs below the interior utilization standards (15 cm for lodgepole pine and 20 cm for other coniferous species) specified to be mandatory utilization in the cutting authority, need to be measured and recorded as waste. When the FS 72 is processed, the Grade 6 volumes will be charged a stumpage rate of $0.25 plus any bonus and/or levies.

Check Surveys 6

6.1 Field Standards

Those responsible for residue surveys must ensure that proper field procedures are followed, including the use of industry standard equipment, materials and conventions. Surveys which are not carried out properly will be rejected by the District Manager.

6.1.1 Maps

The block survey plan and final survey report must include an accurate 1:5000 large-scale map, showing the cut-block boundaries, roads, landings, strata and other features required to correctly determine the area logged. If acceptable to the District Manager, another large scale may be used. In addition, the plot locations, base lines and points of commencement must be marked.

The style and map notation must be consistent with good forestry practice. Map symbols should be explained if they are not obvious. The cartographic standards used by the Ministry of Forests are mandatory.

6.1.2 Field Equipment and Supplies

The residue survey crew should use equipment that can perform the work within the allowable error limits. The minimum recommended equipment is:

- hand compass, with declination adjustment,
- clinometer with percent scale,
- topofil strings, 50 m metal or braided nylon chain, graduated in metres,
- logger's tape,
- BC metric scale stick,
- axe; tree marking paint, and
- tally book with waterproof tally cards, flagging ribbons, aluminum tags and felt markers.

The tie-points, plot centres, plot boundaries, and measured pieces must be clearly marked in the field. Tie points and plot centres must be marked with a solid stake well-driven into the ground, taped or painted, and numbered on aluminum tags, or with permanent felt marker. Orange paint is recommended for stakes. Plot boundaries and pieces must be clearly marked. The accuracy of boundary marking is only critical when measured pieces cross the boundary. Blue paint is recommended for boundaries and pieces. Paint must be log or tree-marking grade.

6.1.3 Traverse Notes

When a field survey involves traversing areas, proper notes must be kept to support the area compilations. These notes will show:

- the forward sighting of the bearings,
- the slope in degrees or percent,
- slope distances in metres,
- horizontal distances in metres, and
- retain traverse notes with all other working papers for inspection by Forest Service check-survey or audit staff.

Any typing within subpopulations must be supported by field notes and may not be done on a plot-by-plot basis.

Plot Tallies

Plot tally cards must contain at least the information prescribed in this manual, and be in the prescribed format. They must be printed on moisture-resistant and durable field material.

6.2 Audit Procedures

6.2.1 General Requirements

Harvesting practices are audited to assure the public that licensees are meeting the minimum utilization standards specified under their harvesting licence agreements. Ministry of Forests check surveys are a major audit activity.

Check surveys determine whether:

- surveys are properly planned,
- residue measurements and classifications are carried out according to the *Logging Residue and Waste Procedures Manual*, and
- residue survey reporting is correct and completed on schedule.

These audits may be carried out by independent parties, and the audit reports will be made available to the licensees upon request. If the audits determine that problems exist, the District Manager may take corrective action. Licensees should advise the District Manager if scheduled field work dates change to ensure their on-site presence during check surveys. Where possible, check surveys will not delay site preparation or other site treatment activities.

6.2.2 Check Surveys

Ministry of Forests staff may check more than the minimum requirement if it is necessary to ensure compliance with the manual standards. (i.e., previous check(s) showed borderline acceptable work).

To enable the district to conduct check surveys while the survey crew is on site, Block Survey Plans should be submitted to the District Manager at least 30 days prior to expected field work. Any changes to scheduled field work should be communicated to the district as soon as possible to facilitate rescheduling of check surveys. If a 30-day notice was given by the licensee or their consultant prior to the commencement of field work, then the Ministry of Forests staff should conduct a check survey concurrent with field work or within 30 days after survey completion date. If no check or alternate arrangement was made, the survey results will not be normally contested (except fraud). If no 30-day notice was provided, it is the Ministry of Forests prerogative to conduct a check survey at any time. If the survey crews will not be on site during the check survey, then the plot cards must be submitted to the district office no later than 1 week after the completion of the survey on that block.

Check surveys verify that the field measurements are taken and recorded correctly. The check survey will re-measure all the pieces that should have been measured in the original plot. The survey or parts of a survey of a cutblock or a reporting unit can be accepted or rejected based on the results of the check survey.

In addition to meeting the requirements in Section 6.3 (Maximum Allowable Errors), residue surveys should meet minimum sampling intensities requirements.

The Ministry of Forests objectives for check surveys are:

Number of Blocks

1. Cut Block Option.

   To check at least 25 percent of the measured cut blocks to a minimum of at least one cut block. This applies to both Licensees and Small Business cut blocks.

   - To check all plot cards, reports, and data entry.

2. Aggregate Option.

   To check 10 percent of the measured cut blocks in each reporting unit to a minimum of at least one block.

   - To check 10 percent of the plot cards for every block against the plot listing report for data entry errors or incorrect methods of recording plot information.

Number of Plots Per Block

In check surveys the following number of plots are re measured:

1. Cut Block Option.

   Dispersed Area:

   - at least 10 percent of the plots in each block that was selected to be checked, or
   - a minimum of three plots or at least 1 plot per stratum, whichever is greater.

   Accumulations:

   - at least 10 percent of the plots in each block that was selected to be checked,
   - a minimum of 2 plots, or
   - at least 1 plot per stratum, whichever is greater

2. Aggregate Option.

   - at least 10 percent of the plots in the selected blocks must be checked, or
   - at least 2 plots per stratum, whichever is greater in each selected block.

   If more than one survey crew conduct surveys within the reporting unit, each crew should be checked on a weighted basis. For Small Business blocks, if each unit has been surveyed by a different surveyor, then each reporting unit must be checked.

6.3 Maximum Allowable Errors

Measurement of a random selection of sample plots within a cut block are used to assess the acceptability of the survey results. The items to be checked and their acceptable limits of errors are specified below.

Net Volume	The net volume difference is the main determining factor for accepting or rejecting a survey. The net volume of all checked plots must not vary by the specified percentage for each sub-population: Dispersed - 10 percent for Coast, 5 percent for Interior. Accumulation - 10 percent for Coast, 5 percent for Interior (after measure percent is applied). The net volume parameters apply separately to both the billable volume (avoidable waste) and the cut control volume (avoidable and unavoidable waste and residue). Exceeding the net volume parameter for either the billable volume or the cut control volume is grounds for rejection of the survey.
Grades	Plus or minus 3 grade errors per block (grading errors must affect the monetary or cut control values).
Waste Class (avoidable/unavoidable)	Three (3) waste class errors per block (errors must affect the monetary or cut control values).
Species	One (1) species code error per plot (the error must affect the monetary or cut control values).
Lengths	A minimum of 90 percent of gross individual length measurements must be within plus or minus 0.1 m. The error must affect the monetary or cut control volumes.
Radii	A minimum of 90 percent of gross end measurements must be within plus or minus 1 rad. The error must affect the monetary or cut control volumes.

Missed Pieces	Three (3) per block. Do not include in length or radii calculations.
Sample Error	S.E.% must fall within the indicated S.E. percent for the dispersed and accumulation areas on Tables 5-4 and 5-5 (Interior) or Tables 5-2 or 5-3 (Coast).
Horizontal Distance	Strip to strip and plot to plot must be plus or minus 3 percent.
Area (stratum)	Plus or minus 2 percent.
Bearing	Plus or minus 2 degrees (strip to strip or plot to plot).
Measure Percent	Plus or minus 10 percent.
Estimated Plots	Plus or minus 20 percent.

Failure to follow the procedures specified throughout the *Logging Residue and Waste Procedures Manual* may result in rejection of the survey. Some examples are:

- incorrect location of plots (not using the correct POC and Grid Spacing Distance),
- locating plots in the wrong stratum,
- establishing more plots or less plots than required,
- establishing a plot which samples outside the stratum it is located in,
- check surveyor is unable to audit the layout of the plots,
- check surveyor is unable to audit the plots and pieces due to poor marking, and
- using an incorrect method of selecting the piles to be sampled.

6.4 Acceptability of Block Results

If the net volume of the checked plots falls within the specified variance, then the survey is deemed to be acceptable unless there are serious deviations in parameters which affect monetary or cut control values. Any obvious bias in grades and/or waste class which affect monetary billing will result in rejection of survey.

If the net volume parameter is not met then the check survey will pinpoint the areas of weakness and allow that portion or entire survey to be redone.

If more than 30 percent of the checked cutblocks within a reporting unit are rejected, the district manager may order that all the cutblocks within that reporting unit be re-surveyed if the same surveyor(s) worked on all blocks.

Rejection of a survey will count against the residue surveyor for the purposes of suspension or cancellation of their certification. If more than 1 residue surveyor worked on a cutblock, the rejection will count against the residue surveyor whose fieldwork caused the rejection.

6.5 Non-Compliance With Survey Standards

If the licensee's or contractor's survey work is rejected after a check survey, the District Manager may order:

- a second survey to replace the original residue survey, or
- the licensee or contractor to re-survey those portions of the original survey that were rejected.

The licensee or contractor will be responsible for any costs they incur in re-surveying those portions of the survey that were rejected.

6.6 Second Surveys (Surveys under Forest Service Responsibility)

This section does not apply to Major Licensees.

When the district manager is in receipt of the survey results, the licensee should be notified, using the form letter in Section 7.6.2.1, and be provided with 14 days to review the survey results. If the licensee has any concerns, they should first discuss the results of the survey with the district staff. If the licensee disputes the results of the survey, the following procedures apply:

- Block has not been check surveyed.

  District staff shall perform a check survey. If the maximum allowable errors* are exceeded, a second survey will be performed by the Ministry at no cost to the licensee. The original billing will be cancelled and replaced by the results from the second survey.

- Block has been check surveyed.

  The licensee has the option to hire a contractor, at the licensee's own cost, to carry out a second survey which must be completed within 60 days of notification made by the licensee that the licensee is going to carry out a second survey. If the report from the second survey has not been received within the 60 days, the original survey will be used for billing purposes. The second survey will be audited by the district staff, and if approved, waste billings will be made on the basis of the second survey.

No dispute can be made where the residue and waste pieces in the block have been removed or destroyed, or silvicultural treatment(s) have taken place.

Refer to Section 7.6.2 for notification and Section 7.7 for relogging options.

* Maximum allowable errors as specified under Section 6.3.

6.7 Material Disposed of Prior to Residue Surveys

If residue and waste materials on a cutblock, landings, and roadside or spot accumulations are disposed of prior to the completion of residue surveys, the District Manager may bill the licensee monetarily and for cut control by using the higher of the district or the licensee residue and waste volume average experienced for the stratum type in the past year or the best information.

Additionally, the District Manager may bill the licensee for the administration and field costs incurred in preparing the estimates.

Reporting 7

7.1 Reporting Requirements

For both the Cut Block and Aggregate Options, submit the field cards and a final block survey plan map along with two sets of the survey reports or one complete set of the survey reports and one PC compilation disk. Ensure the Waste Billing Benchmark Worksheet is completed and attached to each FS 72 report.

> These must be submitted to the District Manager within 30 days from the completion of the field survey as specified under Section 2.4.

If delays in the loading-out phase postpone the survey and report, the delay time and reason should be submitted to the District Manager along with the Block Survey Plan. Submit this plan 30 days before the anticipated field survey work.

The District Manager *may* extend these deadlines.

> For major licensees, survey reports submitted to the District Manager after November 15th may result in having invoices issued in the year following.

7.2 Compilation

All residue survey plots must be compiled using the Ministry of Forests compilation program.

Examples of the compilation reports are included in Appendix 3.

A copy of the current Residue and Waste compilation program and the corresponding manual are available electronically from the Revenue Branch Internet site.

The web site address is:

http://www.for.gov.bc.ca/revenue/manuals/rwsystem/

7.3 Review of Reports

The district office of the Ministry of Forests will review and approve in writing *all* reporting unit reports. Results for each reporting unit will be entered on the district work chart.

7.3.1 Report Checklist

When in receipt of the reports, the district may check the following:

1. Area Summary Report and Block Listing Report:

    a. Check that the entered information matches the information on the FS 444 (Block Summary Card).

2. Plot Piece Listing Report:

    On several randomly selected plots:

    a. Check that the entered piece information matches the piece information on the corresponding FS 161 (Plot Tally Card).

    b. Check that the sub-population and plot size are correct and match the stratum information in the Block Listing Report.

    c. Check for volumes that seem to be excessively high and look for data entry errors on those pieces.

    d. Check that there are at least two plots in every stratum. If only one plot has been entered in a stratum other than the estimated stratum then the volumes will show up in the plot piece listing report and plot species summary report but will not be included in the volumes on the Summary of Scale (FS 72).

3. Block Type Summary Report:

    Check that there are volumes in all of the stratums.

    a. If a stratum has no volume showing in it a mistake has likely been made somewhere in the above mentioned reports. Unless you have a stratum with absolutely no recorded pieces, of any grade, there must be volume showing in the stratum.

4. Sampling Statistics and Sampling Summary Report:

   a. Cut Block Option only.

      i. For blocks over 25 ha check that the sampling error requirement for the dispersed area has been met.

      The sampling error requirement for blocks under 25 ha has been waived.

      ii. For blocks that have at least 3 ha of accumulation piles check that the accumulation sampling error requirement has been met.

      The sampling error requirement for blocks with less than 3 ha of accumulations has been waived.

   b. Aggregate Option only

      i. The sampling statistics and sampling summary reports don't need to be checked until the entire aggregate has been completed.

      ii. If the aggregate has been completed check that the sampling error requirements have been met.

      If the sampling error requirements have not been met check whether the licensee used a reasonable C.V. to determine the number of plots required and whether they established the required number of plots.

      If the answer is yes then the aggregate is acceptable.

      If the answer is no, a higher C.V. may be required from the licensee before approving the licensee's Annual Residue Survey Plan for the following year.

5. Summary of Scale (FS 72)

   Check the following:

   a. The residue surveyor's number and return number (if there is more than one cut block, ensure that return number is incremented by one for each additional cut block, as per page 5 – 40 of the manual) have been filled out and that the residue surveyor has a residue license which is not under suspension.

   b. The reporting unit number is correct

   c. The region number (column 12 to the left of the log count) is filled out. Vancouver – 1, Prince Rupert – 2, Kamloops – 3, Prince George – 4, Nelson – 5, Cariboo – 6.

d. The licence number, cutting permit number and block number are written on the comment lines at the bottom of the page so that they will show up on the S+R invoice.

e. On the four comment lines at the bottom of the page note if there is anything unusual about the block such as grade 4 being mandatory utilization and thus subject to monetary billing.

6. Summary of Scale Addendum (Page 2 of FS 72)

Check the following:

a. The primary logging date has been filled out and is accurate.

b. The timber mark is filled out correctly.

c. The endemic/catastrophic designation is correct.

d. The number of plots shown on the addendum matches the number of plots on the Area Summary Report.

e. The residue surveyor has signed the addendum and indicated whether it has been surveyed as part of an aggregate or under the cut block option.

7. Worksheets for Waste Billing Against Benchmarks.

Check the licensee has completed a worksheet for each cut block and is attached to the FS 72.

Check the worksheet calculations:

a. For full surveys, the avoidable dispersed and accumulated waste volume per hectare in row A matches with the figure in Sampling Statistics under Total Average m^3/ha.

b. The benchmark volume per hectare in row B is allowed for the site/stand type or location.

c. The monetary billing rate reduction factor in row D, C/A is derived correctly to four decimals.

7.4 Processing Summary of Scale (FS 72) for Billing and Cut Control Purposes

Once checking is completed as per Section 7.3.1, the ministry will obtain and code the average stumpage rate on the FS 72.

7.4.1 Average Stumpage Rate

The average stumpage rate for each cutting authority is derived from the weighted average stumpage rate charged for the sawlogs (graded sawlogs on the Coast, grade code blank sawlogs in the Interior) in invoices issued during the 12-month period ending one month after the month in which primary logging on the area was completed or upon the expiry of the cutting authority as the case may be, in respect of timber harvested under the applicable timber mark.

This average stumpage rate will include the bonus bid and levy where applicable. Please refer to Appendix 7 for a detailed description of the calculation of the average stumpage rate.

7.4.1.1 Obtaining Average Stumpage Rate

To obtain the average stumpage rate for a cutting authority, refer to the *Harvest Billing Reporting (HBR) Manual* and use the following procedure:

On status bar, click start, select Forests Mainframe. When FS mainframe screen appears, type FS username, enter password.

Type "g hbr" while in PROFS (OFFICEVISION electronic mail).

Select Option 5 - "Volume, Value, Average Rate for Waste Report" by typing "5" and click enter.

Enter the end date(s) which is the primary logging date plus one month and then enter all the timber marks for that date.

If the end date was May 25,1999 you would enter 199905.

It is necessary to add one month to the primary logging completion date to allow for the scale returns for that last month of logging to be processed.

When you have finished entering all the marks with corresponding end dates hit enter to submit the report. Enter Y to confirm report request.

The report will be routed to your printer.

If the average stumpage rate cannot be obtained, use the average of the appraisal stumpage rates in effect for the twelve-month period preceding the end date.

7.4.1.2 Coding Rates

Due to the implementation of the waste billing benchmarks, the rates obtained from HBR need to be adjusted in order that only the volumes in excess of the benchmarks are billed monetarily.

For full surveys compiled using the latest ministry software, the FS 72 addendum includes an automated calculation of the Waste Monetary Reduction Factor (WMRF), based on the input values for the cutblocks. For ocular surveys, and for instances where mandatory utilization log grade(s) is other than sawlog, use the worksheet indicated under Figure A9.1.

The rate to be coded on FS 72 for avoidable sawlogs is derived by multiplying the WMRF with the average rate obtained from the HBR.

Using this procedure, only the volume in excess of the waste benchmark is billed montearily and yet the entire residue and waste volume is charged to the licensee's.

7.4.2 Residue and Waste Tallies

Refer to Figure A3.7 to A3.9 for samples of the FS 72.

The following sections of the FS 72 need to be completed by licensee. They will be checked by the Billing Clerk for completeness and accuracy

- Residue Surveyor Number,
- Return # (3 numbers - zero fill from left if necessary),
- Copy to code (if desired),
- Column 12 - Forest Region scaled in (1 to 6),
- Licence, Cutting Permit & Block number are written on a Notation Line *,
- Primary logging date is written on a Notation Line,
- Endemic or Catastrophic designation is written on a Notation Line, and
- If FS 72 is manually produced ensure A or U is filled in for column 21.

*This will ensure that this information is printed at the bottom of each invoice so the licensee can identify the correct block.

Please make sure that Survey Expenses - column 53-61 has not been filled in.

The following information must be entered on the FS 72 by the Billing Clerk before the tally is sent to Victoria for processing:

- coded rates using procedures under Section 7.4.1.2 (ensure "end date" used when calculating twelve-month average rate),
- correct "payable by" code, and
- correct "Copy to code" (if requested).

A printout of the twelve-month average rate and the Waste Billing Benchmark Workshhet should be kept on file for audit purposes.

All Waste Tallies mailed to Victoria will be clearly flagged "Waste" whether by themselves or accompanying other tallies.

All processed documents should be ledgered and filed in the normal manner.

In Summary:

- Predominant mark is coded "Waste",
- Only one mark coded per tally,
- Residue Surveyor Number or dummy scaler number issue for each region,
- Rates are manually coded by Ministry staff,
- NMV must be either unavoidable (U) or avoidable (A),
- Tallies may be hand-coded or computer-generated,
- Dummy scale station number is "ZZZ" - Generated by the software on the computerized tally,
- Scaler's log count is the total *line* count of species entered,
- NSF (position 13) will be forced to "N" - no scaling fees charged - not to be manually coded,

- Position 53-61 - Survey Expenses - not used at this time,
- On the record type 1 - the number of pieces for each species will always be coded as one (1),
- The mark must be entered for each species listed, and
- Residue volumes such as grade 4 or grade Y are coded $0.00 rate.

7.5 Field Descriptions - Summary of Scale Return (FS 72)

Residue and Waste Surveys

Region:		Code provided by R&W System: Region number, space.
District:		Code provided by R&W System.
Page_of_:		Provided by R&W System.
Date yy/mm/dd		Provided by R&W System; date of data entry.
Surveyed by:		Manually entered by person submitting report (name of surveyor).
Cols		
1-4	Sequence #:	Hardcoded as 0000 by R&W System.
5-8	Residue Surveyor #:	The residue surveyor's number must be entered here.
9-11	Return #:	Return # must be entered by hand.Each R&W Surveyors numerical list of blocks surveyed to date in current year; commencing with001 in January of each year and going up inincrements of one for each new *block* surveyed. Not related to the Reporting Unit #.
12-18	Predominant Mark:	Hardcoded as WASTE by R&W System.
19-32	# of Chains:	Not required.
33-42	Reporting Unit & Year:	Contains Reporting Unit Number and year. (10 characters, numeric); provided by R&W.
System		
51-53	Section:	Not required.
54-59	Survey Date:	Contains the date of the last plot surveyed (yymmdd). Provided by R&W System.

60-64	Pay by:	Five numeric name and address code,manually entered by regional Billing Clerk
65-69	Copy to:	Manually entered by regional Billing Clerk, if needed.
70-74	Expenses:	Not required.
Cols		
1-4	Sequence #:	Hardcoded as 0011 by R&W System.
12-14	FNF:	Region number located in column 12.
15-18	Log Count:	Detail line count, supplied by R&W System.
19-21	Station #:	Default number (ZZZ) supplied by R&W System. If FS 72 is manually coded, please code "ZZZ".
22-52	Place of survey: Optional.	Manually entered by person submitting report.
53-61	Survey Expenses:	Not in use.
1-4	Sequence #:	Four spaces, incremented in tens from 14 by row, e.g., 0014, 0024, 0034, provided by R&W System.
12-18	Mark:	Provided by R&W System.
19-20	Paint:	Leave Blank.
21	Unav/AV:	Provided by R&W Systems.
22-26	# of Pieces:	Hardcoded as "1" on each line. Provided by R&W Systems.
27-29	Species/Grade:	Provided by R&W Systems.
30-32	Other Desc.:	Leave Blank.
33-39	Quantity:	Provided by R&W Systems.
40-44	Rate:	Manually entered by Billing Clerk from Harvest Billing Reports (OFFICEVISION).

Comment Lines:	Any other special notes or information can also be manually entered on these lines as needed. Please note that any information on these lines *will* show on the Scale and Royalty Invoice (FS 37).
	All FS 72's *must* have: Licence, Cutting Permit & Block number noted, primary logging date noted (if not on addendum), endemic or catastrophic designation noted.
	Other information: date of approval and initials of person approving FS 72 noted below comment lines so it doesn't show on the Stumpage Invoice and Scale Summary.

7.6 Notification of Results

7.6.1 Major Licensees

If no notification is sent by the District Manager within 60 days (excluding period of snow) from the date of receipt of the residue survey reports, the survey results will be deemed to be acceptable.

This only applies to reports that the district received within 30 days from completion of field survey.

7.6.2 Forest Service Responsible To Survey

When the District Manager has received the results of the residue survey and before the reports are sent to the regional office, the district should immediately notify the licensee using the form letter in Section 7.6.2.1, and provide a 14 day period to review the survey results. If the licensee chooses to dispute the results of the survey, procedures under Section 6.6 should be followed.

7.6.2.1 Example of Notification Letter (FS responsible to survey)

Columbia Forest District
Box 9158, RPO #3
Revelstoke, British Columbia
V0E 3K0
(604) 837-7611

File: 21160-45/
RU54002-93

March 9, 2001

ABCDE Logging Ltd.
Box 99999
Revelstoke BC.
V0E 2S0

Dear Licensee:

Re: Residue and Waste Survey on Timber Sale A12345

A residue and waste survey has been conducted on Timber Sale A12345 in accordance with Section 5 (waste and damage assessments) of the timber sale licence document.

The results of this assessment are shown on the attached table(s).

Avoidable waste includes all species/grades that must be utilized according to the timber sale licence document. Subject to the waste bench mark, the waste volume above the benchmark is billed at the 12-month average stumpage rate.

A monetary billing for **37.1** cubic meters of avoidable waste will be initiated on (*add 14 days plus reasonable mailing time to the current date*) unless you have contacted the undersigned to make arrangements to utilize the avoidable waste that was left on TS A12345 or to dispute the results of the residue survey.

Please contact the undersigned if you have any questions regarding this billing.

Yours truly,

Small Business Forester

Figure 7.1 Example of Notification Letter.

7.7 Relogging

If the licensee intends to utilize any residue and waste from the cutblock after the residue survey, an application in writing must be received by the District Manager within 14 days of receipt of the notification, or as specified in the notification made under Section 7.6.2.1.

If the District Manager approves the relogging, the relogged volumes will be scaled and billed at the stumpage rates in effect for the Cutting Authority.

If the relogging occurs after the residue survey, but before the issuance of the invoice, the District Manager may adjust the original waste survey volume, using the scaled volumes, or allow a second survey (commencing from a new Point of Commencement (POC), at the licensee's own costs, to replace the original survey.

If the relogging occurs after the residue survey, and after the issuance of the invoice for the cutblock, the relogged volumes will be scaled and billed. There shall be no cancellation and replacement of the original waste invoice issued for the cutblock.

In the Vancouver Forest Region, refer to Circular Letter VCR-99:002 for guidelines on relogging.

Surveyor Licence 8

8.1 Residue Surveyor Licence

Every residue surveyor must hold a valid residue surveyor's licence. No scaling licence is required to perform residue surveys or check surveys for both Coast and Interior.

Each candidate seeking a licence must take the required examinations.

8.1.1 Examination Qualifications

Before allowed to take the examinations, the applicant must have:

- a demonstrated competency in residue survey, cruising and/or scaling with at least two years practical experience in one or combined fields; or,
- a forestry-related technical school diploma, or
- completed a residue surveyor course (course instructors must hold a valid Logging Residue Surveyor Licence).

8.1.2 Licence Examinations

Licence examinations consist of a three hour (closed book) written examination and a three hour Practical (field) examination.

For the written examination, each applicant will be tested on the knowledge of measurement and planning procedures, survey design, plot establishment, and scaling. For the field examination, each applicant will be tested on his or her competency in scaling, grading, classifying and recording of pieces. An examination fee of $50.00 (G.S.T. included) is payable to the Ministry of Forests examiner on the date of the exam.

A minimum pass mark of seventy-five percent (75%) in each of written and the field examinations is required for licensing.

8.1.3 Licence Register

Upon having successfully completed the examination requirements, each candidate will be issued a Logging Residue Surveyor Licence with a term of five years. The licence number on the certificate will be used to identify the individual's work.

A register is established and maintained of all Logging Residue Surveyors. The register contains data on the names, addresses, licence numbers, and dates of licensing.

8.1.4 Licence Renewal

Upon expiry of the licence, a residue surveyor who has stayed active (e.g., by attending residue seminars, workshops, or has performed work in residue surveys, ocular estimates, or check surveys) can submit a request to the Ministry of Forests for renewing the licence for another five year term. Inactive surveyors may be required to successfully complete the examination requirements before they will be issued a new Logging Residue Surveyor Licence.

8.1.5 Coast/Interior Endorsement

An individual applicant who has passed the coastal exam is only licensed to work on the Coast. Similarly; an individual who has passed the interior exam is licensed to work only in the Interior.

A surveyor licensed for either coast or interior need only pass the practical exam in the other (coast/interior) to obtain ministry endorsement. A surveyor who possesses a valid scaling licence with grading endorsement for the other (coast/interior) area is exempted from this practical exam requirement. In order to have the Logging Residue Surveyor Licence endorsed for both coast and interior, the person must notify the ministry of his or her scaling grade endorsement.

8.2 Suspension or Cancellation of Licence

All residue survey measurements must be conducted to Ministry of Forests standards. Errors in work should be brought to the original surveyor's attention immediately, preferably including an on-site discussion so that borderline differences can be discussed and incorrect procedures remedied. Wherever corrective action is required, the advisory must be specific.

An individual who is unable to achieve standards may have his or her licence suspended. In severe instances where flagrant contravention of the residue and waste procedures has occurred, the licence may be cancelled.

In all cases, the Ministry of Forests must ensure that individuals not meeting standards are advised of their shortcoming and given the opportunity to improve their skills.

8.2.1 Administrative Guidelines

When administering licence suspensions and cancellations, use the following guidelines:

- If a survey is rejected, issue a warning letter.
- If a second survey is rejected within six months of a previous warning letter, issue a second warning letter.
- If a third survey is rejected over any twelve-month period, the surveyor's licence may be suspended.
- Fraud will result in suspension and/or cancellation of the licence.

8.2.2 Suspension Procedures

The District Manager is responsible for administering and issuing Residue Surveyor Licence suspension, using procedures as follows:

- Notice of non-compliance

  A letter by registered mail is sent to the surveyor citing the incidence(s) of non-compliance. Concurrently, a hearing is scheduled for the surveyor to present any evidence before the District Manager makes a determination regarding the alleged non-compliance.

- Case file

  A case file is prepared by the ministry staff and distributed to each attendee of the hearing. This case file normally contains:

  - detailed descriptions of non-compliance incidences (who, where and when);
  - previous related correspondences;
  - pertinent legislation, policy, procedures, tenure licence and contract provisions affecting the case;
  - considerations for the decision maker;
  - options for the determinations.

- Hearing

  The hearing is attended by the pertinent ministry staff, the surveyor and if the surveyor is contracted to or subcontracted to a licensee, the licensee's representative.

  The case file is reviewed by all hearing attendees. The surveyor may make presentations or respond to the alleged non-compliance.

- Determination

  After the hearing, the District Manager may make a determination of whether to suspend the surveyor's licence for a period of time.

  The District Manager may also attach conditions for restating the licence.

8.2.3 Cancellation Procedures

The Chief Forester or designate is responsible for administering and issuing Residue Surveyor Licence cancellation, whether or not the licence is under suspension.

Grounds for licence cancellation are repeated licence suspensions and intentional falsification of plots or piece measurements.

The cancellation procedures are the same as in Section 8.2.2.

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Appendices

Appendix 1 Glossary

Accumulations	Areas where residue and waste are concentrated (e.g., at landings and along roadsides).	
Accuracy	The nearness of a measurement to the actual value of the variable being measured.	
Aggregate Option	Sampling and measurement of a residue and waste reporting unit comprised of an approved aggregation of cut blocks and/or cutting authorities. It cannot cross a District or T.S.A. boundary.	
Allowed Stump Height	The higher of:	
	1.	contractual stump height,
	2.	height specified in District Manager letter for heavy snow packs,
	3.	the minimum distance from the ground on the high side of a stump up to a point above a physical obstruction which allows for safe falling. Allowed stump height minus contractual stump height = unavoidable piece.
Allowable Annual Cut (AAC)	The rate of harvest determined by the Chief Forester for Timber Supply Areas (TSAs) andTree Farm Licenses (TFLs), and by the District Manager for Woodlot Licences (WLs),and the rate of harvest specified in a licence or in a management and working plan.	
Average Stumpage Rate	The average stumpage rate for each cutting authority is derived from the weighted average stumpage rate charged for the sawlogs (graded sawlogs on the Coast, grade code blank sawlogs in the Interior) in invoices issued during the 12-month period ending one month after the month in which primary logging on the area was completed or upon the expiry of the cutting authority as the case may be, in respect of timber harvested under the applicable timber mark.	

Availability of Cut Blocks	Cut blocks and partially completed cut blocks are available for residue surveys upon completion of primarily logging and the ground is sufficiently free of snow to allow for an adequate assessment to be carried out. Field surveys must be completed within 60 days after primary logging and the survey reports must be submitted to the District Manager within 30 days of completion of the field survey.	
Avoidable Residue or Waste	Residue or waste wood volumes left on the ground that could have been removed safely, were not physically obstructed and were not inaccessible.	
Bias		Measurement bias occurs when the mean of the measured values differs from the mean of the actual values.
		Sampling bias occurs when certain sampling units are more likely to be included than others (lack of randomness).
		Statistical bias occurs when the expected value of the statistic differs from the population parameter.
Breakage	Breakage is defined as any piece, meeting the minimum diameter of the cutting authority, which is shorter than 3 m in length and broken at the large end or at both ends. Normal breakage is not usually recorded.	
Bucking Waste	Bucking waste is defined as any pieces less than 3 m in length that has been cut at the large end, or at both ends. It has been cut through improper or careless bucking practices.	
Catastrophic Losses	Damage to timber from fire, windfall, insects or disease that inflicts losses well above the norm reflected in the forest inventory for the locality or region.	
Chunk	A short piece of residue or waste that has resulted from end trimming logs, or from breaking logs during extraction operations.	
Closure Error	The square root of the sum of the squared sum of latitudes plus the squared sum of departures, which may also be expressed as a ratio to or percent of the perimeter length. A closure error of 1 percent will result in an area error of approximately 2 percent.	

Coast	This refers to the Vancouver Forest Region and the North Coast Forest District of the Prince Rupert Region.
Coefficient of Variation	A relative measure of variation, equal to the sample standard deviation expressed as a percentage of the sample mean.
Confidence	An expression of accuracy of sample estimates, usually assessed by confidence intervals, a specified proportion of which, such as 95 percent confidence intervals, contain the true population parameters.
Contractual Stump Height	The allowed stump height, specified in the minimum utilization standards of the cutting authority, as measured from the ground on the high side.
Cut Block	A discrete area logged according to the harvesting plan approved for the cutting authority issued under the license.
Cut Block Option	Each cutting block will be sampled as a separate population, and reported as a separate residue and waste reporting unit.
Cut Control	The Ministry of Forests procedure for accounting the volumes of timber harvested under a licence as specified under Part 4 of the *Forest Act*.
Cutting Authority	Cutting Authority means a Timber Sale Licence, a Licence to Cut, a Road Permit, or a cutting permit issued under a Tree Farm Licence, Forest Licence, Timber Licence or a Woodlot Licence.
Cutting Specifications	The timber cutting specifications contained in the Minimum Utilization Standards of the cutting authority.
Endemic Losses	Damage to timber from normal populations of insects or disease that inflicts average losses over the long term for the locality or region, as reflected in the forest inventory.
Fixed-area Plot Sampling	A sampling method where each plot within a stratum is exactly the same size and shape.
Full Sampling Intensity (FSI)	A full sampling intensity survey on which a sampling error or hectare to plot ratio must be met as specified in Tables 4-2, 4-3, 4-4 and 4-5.

High Side (stumps)	The position where the ground meets the stump on the uphill side, ignoring any root flare, obstacles, vegetation, and loose matter that has accumulated at the base of the tree. Length measurements usually start from 30 cm above this point.
Interior	This refers to the Nelson, Kamloops, Cariboo, Prince George and Prince Rupert (except North Coast Forest District) Forest Regions.
Licensee	The holder of the cutting authority.
Log Grade	Those log grades that are defined in the Scaling Regulation.
Measure Factor	A visual estimate of the percentage of an accumulation that was physically measured and/or estimated. Recorded as the "measure percent."
Minimum Utilization Standards	The standards of timber cutting and log utilization specified in the cutting authority.
Parent Block	A previously surveyed block that is representative, in terms of the level of dispersed residue and waste, to the block being proposed for survey exemption.
Plot Sampling	The estimation of residue and waste within a cut block or reporting unit from sample plot measurements, and the determination of the sampling error associated with the plot estimates.
Population	The residue and waste component within the residue and waste reporting unit that is to be estimated by sample plot measurements.
Precision	The closeness, to each other, of repeated measures of the same quantity, expressed as Sampling Error or Standard Error of the sample estimate.
Primary Logging Completion Date	The date on which the tree falling, yarding or forwarding of logs to central landings or roadside of a logging operation on a cut block is completed. The load-out phase is specifically excluded from this definition. Relogging of a cut block will not affect the original primary logging completion date.

Reduced Sampling Intensity (RSI)	A reduced sampling intensity which may be applied to cut-blocks that qualify (i.e., clean logging or low billing volumes). The plot requirement is one quarter of the minimum full sampling intensity using a C.V. of 100 percent. It applies only on dispersed subpopulation areas.
Reporting Unit	The area for which the waste is measured and reported. It may be either a cut block, several cut blocks, a licence, or part of a licence.
Reporting Unit Number	The unique number assigned by the Forest Service to any one license within a residue and waste reporting unit for a given year.
Reporting Year	The 12-month period in which the cut blocks in the residue and waste reporting unit are first available for measurement. The District Manager will approve the 12-month period.
Residue	The volume of timber left on the harvested area which meets or exceeds the size requirements but is below the log grade requirements of the minimum utilization standards specified in the cutting authority. Residue volumes that are "avoidable" or "unavoidable" are subject to cut control charges.
Radius Class Unit (rad)	The measurement of log or stump diameters to the nearest 2 cm of diameter (1 cm of radius), and as specified in the *Scaling Manual.*
Sampling Error (S.E.)	A measure of the variation among sample means is the standard error of the mean. It can be thought of as a standard deviation among sample means; it is a measure of the variation among sample means, just as the standard deviation is a measure of the variation among individuals. When we increase our confidence level above one standard deviation, i.e. two standard deviations for residue and waste, we refer to the statistic as the sampling error. The residue and waste calculations for sampling error include a finite population correction factor, which implies random sampling without replacement.

Standard Deviation (S.D.)	The Standard Deviation is the square root of variance. It characterizes dispersion of individuals about the mean and gives some idea whether most of the individuals in a population are close to the mean or spread out. On the average, about two-thirds of the unit values of a normal population will be within one standard deviation of the mean. About 95 percent will be within two standard deviations and about 99 percent within 2.6 standard deviations.
Stratum	A non-overlapping sub-unit of a subpopulation for which separate sampling statistics are calculated.
Stratification	The process of delineating strata boundaries within a subpopulation, where each stratum has unique characteristics (timber type, logging contractor, season or year logged).
Stumpage	Stumpage is the price that is paid to the provincial government for timber harvested from Crown land. Very simply, each log removed from the forest will have a value that varies according to its species, size, quality and geographical location. The stumpage value is derived in accordance with the applicable Coast or Interior Appraisal Manuals.
Subpopulations	Subdivisions of the reporting unit or cut block (population). For example, the dispersed and accumulation volumes are each typically treated as subpopulations.
Survey Crew	The residue surveyor who is authorized to conduct the residue and waste survey together with field assistants.
Timber	Trees, whether standing, fallen, living, dead, limbed, bucked or peeled.
Timber Supply Area	Large contiguous areas of Crown land on which an annual allowable cut is calculated.
Total Stump Height	The distance from the ground on the high side to the top of the felling cut. Total stump height minus allowed stump height = avoidable piece.
Total Residue and Waste	The sum of avoidable and unavoidable residue and waste.

Trimming "Waste"	Avoidable waste or residue that results from topping, slashing, bucking and end-trimming in a manner that does not maximize utilization under the cutting specifications.
Unavoidable Residue or Waste	That component of the residue or waste that is physically obstructed or cannot be removed for safety or environmental constraints, or for other reasons, beyond the control of.the licensee.
Utilization	The removal of timber from a cut block in accordance with the utilization standards specified in the cutting authority.
Variance	The mean of squared deviations of observations about a sample mean (these deviations or differences from the mean are called residuals).
Waste	The volume of timber left on the cutting authority area that should have been utilized in accordance with the timber utilization standards specified in the cutting authority. Waste volumes are subject to cut control charges.

Appendix 2 Safe Work Procedures

A2.1 Safety Rules

The following safety rules are applicable when conducting residue and waste measurements and/or check surveys.

DO

1. Wear personal protective equipment (PPE):
   - approved hi-vis safety headgear; *
   - safety footwear; ** and
   - hi-visibility apparel. ***
2. check that all logs/branches used for support or balancing to aid in safe movement on accumulations are secure and will provide the expected support or help:
   - have a #2 first aid kit in each vehicle.

DO NOT

1. Attempt to measure if there is active work taking place on or adjacent to the piles or other plots you want to measure.
2. Work on piles if jumping is necessary.
3. Walk on unstable material or among root wads.
4. Walk on unstable piles.
5. Crawl or work on or under overhanging material.
6. Crawl into a pile.
7. Work on slopes below loose or unstable material.
8. Work below another employer where material may be dislodged.

* W.C.B.'s I.H. & S. Reg. 14.12 (1 to 4).

** Caulked boots or caulked leather sandals (Dayton), *shall* be worn by workers whenever they are required to walk on logs, decked logs, cull piles, poles or other round timbers. See W.C.B.'s I.H. & S Reg. 14.10.

** Workers regularly exposed to the hazard of moving vehicles *shall* wear
* distinguishing hi-vis apparel. The minimum requirement will be hi-vis hardhats and hi-vis vests. At least one hi-vis sign must be prominently displayed at the place where measurements are taking place. See W.C.B's I.H. & S. Reg. 14.06.

A2.2 Safe Work Procedures for Assessment of Waste Piles

1. Determine whether or not the volume, size and grade of the material warrants measuring as per *Logging Residue and Waste Procedures Manual*.

2. Where *measuring* is necessary, determine if working on or around the piles and/or other conditions would be safe. See Section A2.3 for procedure.

3. If any condition is considered unsafe, select another pile and/or modify the plot shape, move plot centre or wait for conditions to improve (winds to subside, snow/ice to melt).

4. If unable to establish any plots in the accumulation piles due to safety concerns, do an ocular estimate. A good look at the edge compilation of the piles should be taken to help you come up with a better estimate of residue and waste in the pile.

A2.3 Determining Safety Conditions

A pre-measurement walk completely around the pile must be made. Do not walk directly under or down hill of piles where there is potential for injury from logs or other debris which may become dislodged. Assess conditions and determine:

1. The stability of the pile:

   - consider slope,
   - size of material,
   - arrangement of the material,
   - holes or overhangs in the pile, or

- material mixed with snow/mud.

> if unsafe, do not measure,
> UNLESS
> portions of the pile are considered safe, (i.e. the landing side of pile that is on a slope, in this case a rectangular plot may be used to avoid the unstable material at the edge of the pile).

- if safe, carry out routine measurement procedures.

2. Whether or not snow or ice coverage presents a hazard.

> if unsafe, do not measure,
> UNLESS
> it can be done later when the surface ice or snow conditions have improved after a thaw; or the survey can be done after snow and mud in the piles have thawed, dried and the pile has settled.

- if safe, carry out routine measuring procedures.

3. Whether or not the size, distribution and compaction of the material would allow for safe access and measuring:

- if there are many small stems or chunks and blocks, rotten logs, root wads lying on their side, pieces with saw cuts, logs lying parallel to "fall-lines" on steep areas, especially "buck-skins", etc. that make walking risky or create a rolling or sliding risk, *do not measure*, select another pile;

- if distribution and size would require jumping from one piece to another, *do not measure*, select another pile;

- if size and arrangement would require crawling and constitute an undesirable amount of jill-pokes, *do not measure*, select another pile;

- if the above conditions are within acceptable limits and you feel that the measurement of the pile could be done safely, *measure the pile*.

4. Whether or not wind speed conditions are creating a hazard:

   - if adjacent standing trees, danger trees, snags, or selective cutting leave-trees could become overhead hazards due to blown down, top and/or branch breakage, *do not measure*, select another pile in an area protected from the wind; OR return to the pile after the winds have subsided;

   - if the wind speed can cause you to loose your balance while standing in waste material, *do not measure*, select another pile in an area protected from the wind; OR return to the pile after the winds have subsided;

   - if wind speed is not a factor or is not likely to create wind breakage, *measure the pile*.

Appendix 3 Examples of the Standard Reports

AREA SUMMARY REPORT — Page 1
Residue and Waste System - Rel 2.70e — 2001.03.19
COAST — Ministry of Forests — 11501 2001

* All areas in hectares

License	Cutting Permit	Cut Block	Timber Mark	Roads NP/NF	Type Strm	ACCUMULATIONS -- Sampled -- Area	ACCUMULATIONS -- Sampled -- Plots	ACCUMULATIONS -- Est/100% - Area	ACCUMULATIONS -- Est/100% - Plots	DISPERSED -- Sampled -- Area	DISPERSED -- Sampled -- Plots	DISPERSED -- Est -- Area	DISPERSED -- Est -- Plots	Type Strm Net Area	Total Block Area
TFL999	9999	9999	999999	0.99	DC2X	0.00	0	0.00	0	10.00	2	0.00	0	10.00	
					DH1X	0.00	0	0.00	0	9.99	2	0.00	0	9.99	
					FS2X	0.00	0	0.00	0	20.00	2	0.00	0	20.00	
					GG0X	0.00	0	0.00	0	10.00	2	0.00	0	10.00	
					GT4X	0.00	0	0.00	0	10.00	2	0.00	0	10.00	
					LS0X	5.00	2	0.00	0	0.00	0	0.00	0	5.00	
					RG2X	5.00	2	0.00	0	0.00	0	0.00	0	5.00	
					SG0X	0.00	0	0.00	0	10.00	2	0.00	0	10.00	
					SG4X	0.00	0	0.00	0	20.00	2	0.00	0	20.00	
				Block Total		10.00	4	0.00	0	89.99	14	0.00	0	99.99	100.98
Reporting Unit Total				0.99		10.00	4	0.00	0	89.99	14	0.00	0	99.99	100.98

Figure A3.1 Area Summary Report.

```
                                BLOCK LISTING                                  Page   1
                        Residue and Waste System - Rel 2.70e                  2001.03.19
COAST                           Ministry of Forests                           11501 2001

       Cut  Cut  Timber  Yrs Primry Survey    Net Roads B.Mark  Cruise R E S Max
Licens Perm Blck Mark   Logd Loggng Date     Area NP/NF  m3/ha   m3/ha E C P S.H
TFL999 9999 9999 999999 9901 990930 010101  99.99  0.99   35.0  666.00 B E N 0.3

             TYPE STRATIFICATION

             Type                          Plot
             Strm  Subpopulation    Area  Size
             DC2X  DISP-Fixed      10.00   200
             DH1X  DISP-Fixed       9.99   100
             FS2X  DISP-Fixed      20.00   200
             GG0X  DISP-Fixed      10.00    50
             GT4X  DISP-Fixed      10.00   400
             LS0X  ACCU-Fixed       5.00    50
             RG2X  ACCU-Fixed       5.00   200
             SG0X  DISP-Fixed      10.00    50
             SG4X  DISP-Fixed      20.00   400

             MINIMUM UTILIZATION STANDARDS

                      Max  Min
             Species  S.H  Top  MLL  Age
             @@        30   10  3.0  250
             AL        20    5  2.5  100
             AS        25    8  3.0  130
```

Figure A3.2 Block Listing.

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                                PLOT PIECE LISTING                                  Page   1
                        Residue and Waste System - Rel 2.70e                      2001.03.19
COAST                            Ministry of Forests                               11501 2001

       Cut  Cut  Timber  Survey    Res.  Ret  B    ---- Plot --- Mes   Est  Type
Licens Perm Blck Mark    Date      Surv  No.  L St No SP Sh Size Per   Vol  Strm
TFL999 9999 9999 999999  01.01.02  006  001   A 01 01 D  C   400 100   0.0  SG4X

                R         E     E   B DEDUCTIONS Far Add Cm -- Net Volume m3 ---
       Pc# Sp K C Len Top C But C G L Ln Tp Bt D End Len Cd   Bill    Cut  Other
         1 FI L A  34  12 C  20 C A N  0  0  0 N   0   0 NO  0.291  0.291  0.000 A
         2 HE L A  43  20 C  24 C B N  0  0  0 N   0   0 NO  0.659  0.659  0.000 A
         3 CE L A  45  20 B  30 C C N  0  0  0 N   0   0 NO  0.919  0.919  0.000 A
         4 FI L A  31  11 C  23 C D N  0  0  0 N   0   0 NO  0.317  0.317  0.000 A
         5 FI L A  32  34 C  35 C E N  0  0  0 N   0   0 NO  1.197  1.197  0.000 A
         6 FI L U  43  12 C  32 C U N  0  0  0 N   0   0 NO  0.000  0.789  0.000 A
         7 FI L U  43  21 C  23 C X N  0  0  0 N   0   0 NO  0.000  0.655  0.000 B
         8 FI L U  43  23 C  25 C Y N  0  0  0 N   0   0 NO  0.000  0.779  0.000 L
         9 FI L U  45  34 C  36 C Z N  0  0  0 N   0   0 NO  0.000  0.000  1.733 P
       MEASURED TOTALS                                          3.383  5.606  1.733
       PLOT TOTALS                                              3.383  5.606  1.733

       Cut  Cut  Timber  Survey    Res.  Ret  B    ---- Plot --- Mes   Est  Type
Licens Perm Blck Mark    Date      Surv  No.  L St No SP Sh Size Per   Vol  Strm
TFL999 9999 9999 999999  01.01.02  006  001   A 01 02 D  C   400 100   0.0  SG4X

                R         E     E   B DEDUCTIONS Far Add Cm -- Net Volume m3 ---
       Pc# Sp K C Len Top C But C G L Ln Tp Bt D End Len Cd   Bill    Cut  Other
         1 FI L A  34  23 C  33 C X N  0  0  0 N   0   0 NO  0.864  0.864  0.000 B
         2 FI L A  45  34 C  35 C Y N  0  0  0 N   0   0 NO  0.000  1.683  0.000 L
         3 CE L A  45  23 B  33 C Y N 11  0  0 B   0   0 NO  0.000  0.864  0.000 L
         4 FI L A  34  11 C  23 C Z N  0  0  0 N   0   0 NO  0.000  0.000  0.347 P
         5 HE L A  34  21 C  33 B U N  0  0  0 N   0   0 NO  0.817  0.817  0.000 A
       MEASURED TOTALS                                          1.681  4.228  0.347
       PLOT TOTALS                                              1.681  4.228  0.347

       Cut  Cut  Timber  Survey    Res.  Ret  B    ---- Plot --- Mes   Est  Type
Licens Perm Blck Mark    Date      Surv  No.  L St No SP Sh Size Per   Vol  Strm
TFL999 9999 9999 999999  01.01.02  006  001   A 02 01 D  C   200 100   0.0  FS2X

                R         E     E   B DEDUCTIONS Far Add Cm -- Net Volume m3 ---
       Pc# Sp K C Len Top C But C G L Ln Tp Bt D End Len Cd   Bill    Cut  Other
         1 FI W A  23   5 C  10 C U N  0  0  0 N   0   0 NO  0.045  0.045  0.000 E
         2 CE W A  25  23 C  33 B X N  0  0  0 N   0   0 NO  0.635  0.635  0.000 E
         3 FI W A  22  21 B  25 C Y N  0  0  0 N   0   0 NO  0.000  0.368  0.000 L
         4 CE W A  26  21 C  30 C Z N  0  0  0 N   0   0 NO  0.000  0.000  0.548 P
         5 FI W A  12  31 C  33 C A N  0  0  0 N   0   0 NO  0.386  0.386  0.000 E
         6 FI W A  21  44 C  45 C M N  0  0  0 N   0   0 NO  1.307  1.307  0.000 E
       MEASURED TOTALS                                          2.373  2.741  0.548
       PLOT TOTALS                                              2.373  2.741  0.548

       Cut  Cut  Timber  Survey    Res.  Ret  B    ---- Plot --- Mes   Est  Type
Licens Perm Blck Mark    Date      Surv  No.  L St No SP Sh Size Per   Vol  Strm
TFL999 9999 9999 999999  01.01.02  006  001   A 02 02 D  C   200 100   0.0  FS2X

                R         E     E   B DEDUCTIONS Far Add Cm -- Net Volume m3 ---
       Pc# Sp K C Len Top C But C G L Ln Tp Bt D End Len Cd   Bill    Cut  Other
         1 HE W U  21  12 C  22 C B N  0  0  0 N   0   0 NO  0.000  0.207  0.000 E
         2 HE W U  24  33 C  35 B E N  0  0  0 N   0   0 NO  0.000  0.872  0.000 E
         3 HE W U  11  45 C  46 C U N  0  0  0 N   0   0 NO  0.000  0.716  0.000 E
```

Figure A3.3 Plot Piece Listing.

PLOT SPECIES LISTING — Page 1
Residue and Waste System - Rel 2.70e — 2001.03.19
COAST — Ministry of Forests — 11501 2001

License	Cutting Permit	Cut Block	Timber Mark	End Cat
TFL999	9999	9999	999999	E

Type Strm	B L	St	Plot No	SP	Sh	Size	Mes Per	Sp	RW Class	Material Class	Num Seg	Volume (m3)
LS0X			01	A	C	50	80	LO	AVOID	Sawlog-U&Btr	1	1.274
										Sawlog-X	1	2.927
										BckWst+SpProd	2	1.181
										GrdY+Inter4	1	1.140
										Off/<MUS/Int6	2	0.140
									RW CLASS TOTAL.....		7	6.662
								SPECIES TOTAL.....			7	6.662
							MEASURED TOTAL.....				7	6.662
							PLOT TOTAL.....					8.327
LS0X			02	A	C	50	80	SP	UNAVD	Sawlog-U&Btr	1	0.616
										Sawlog-X	1	1.191
										BckWst+SpProd	2	1.150
										GrdY+Inter4	1	0.516
										Off/<MUS/Int6	2	2.184
									RW CLASS TOTAL.....		7	5.657
								SPECIES TOTAL.....			7	5.657
							MEASURED TOTAL.....				7	5.657
							PLOT TOTAL.....					7.071
RG2X			01	A	R	200	90	AL	AVOID	Sawlog-X	1	0.053
										FirmwoodRejec	1	0.926
									RW CLASS TOTAL.....		2	0.980
								SPECIES TOTAL.....			2	0.980
								AS	AVOID	Sawlog-U&Btr	1	0.085
										GrdY+Inter4	1	0.876
									RW CLASS TOTAL.....		2	0.961
								SPECIES TOTAL.....			2	0.961
								LO	AVOID	Sawlog-U&Btr	1	0.926
										Sawlog-X	1	0.569
										Stumps	2	0.239
										BckWst+SpProd	2	1.021
										Avd Brk S/L	2	1.177
									RW CLASS TOTAL.....		8	3.933
								SPECIES TOTAL.....			8	3.933
							MEASURED TOTAL.....				12	5.873
							PLOT TOTAL.....					6.526
RG2X			02	A	R	200	90	AL	UNAVD	Sawlog-X	1	0.328
										FirmwoodRejec	1	2.798
									RW CLASS TOTAL.....		2	3.126
								SPECIES TOTAL.....			2	3.126
								AS	UNAVD	Sawlog-U&Btr	1	0.200
										GrdY+Inter4	1	0.816
									RW CLASS TOTAL.....		2	1.016
								SPECIES TOTAL.....			2	1.016
								SP	UNAVD	Sawlog-U&Btr	1	0.373
										Sawlog-X	1	0.227
										Stumps	2	0.971
										BckWst+SpProd	2	0.619
										Unavd Breakag	2	1.502

Figure A3.4 Plot Species Listing.

BLOCK TYPE SUMMARY — Page 1
Residue and Waste System - Rel 2.70e — 2001.03.19
COAST — Ministry of Forests — 11501 2001

License	Cutting Permit	Cut Block	Timber Mark	End Cat
TFL999	9999	9999	999999	E

Type Strm: DC2X — Area (Ha): 10.00

Sp	RW Class	Material Class	Volume (m3) Billng	Volume (m3) CutCtl	Volume (m3) Other	m3/Ha Billng	m3/Ha CutCtl	m3/Ha Other
CE	AVOID	Sawlog-U&Btr	435.8	435.8	0.0	43.6	43.6	0.0
		Sawlog-X	87.2	87.2	0.0	8.7	8.7	0.0
		GrdY+Inter4	0.0	155.9	0.0	0.0	15.6	0.0
		FirmwoodRejec	0.0	0.0	696.3	0.0	0.0	69.6
		RW CLASS TOTAL	523.0	679.0	696.3	52.3	67.9	69.6
	SPECIES TOTAL.....		523.0	679.0	696.3	52.3	67.9	69.6
HE	UNAVD	Sawlog-U&Btr	0.0	408.4	0.0	0.0	40.8	0.0
		Sawlog-X	0.0	231.6	0.0	0.0	23.2	0.0
		GrdY+Inter4	0.0	117.9	0.0	0.0	11.8	0.0
		FirmwoodRejec	0.0	0.0	93.2	0.0	0.0	9.3
		RW CLASS TOTAL	0.0	757.8	93.2	0.0	75.8	9.3
	SPECIES TOTAL.....		0.0	757.8	93.2	0.0	75.8	9.3
ALL SPECIES		Sawlog-U&Btr	435.8	844.2	0.0	43.6	84.4	0.0
		Sawlog-X	87.2	318.8	0.0	8.7	31.9	0.0
TYPE STRATUM TOTAL.....			523.0	1436.8	789.5	52.3	143.7	78.9

Type Strm: DH1X — Area (Ha): 9.99

Sp	RW Class	Material Class	Volume (m3) Billng	Volume (m3) CutCtl	Volume (m3) Other	m3/Ha Billng	m3/Ha CutCtl	m3/Ha Other
FI	UNAVD	Unavd Breakag	0.0	0.0	1691.1	0.0	0.0	169.3
		RW CLASS TOTAL	0.0	0.0	1691.1	0.0	0.0	169.3
	SPECIES TOTAL.....		0.0	0.0	1691.1	0.0	0.0	169.3
HE	AVOID	Avd Brk S/L	511.2	511.2	0.0	51.2	51.2	0.0
		Avd Brk Y&4	0.0	152.3	0.0	0.0	15.2	0.0
		Avd Brk 6,Z,3	0.0	0.0	682.6	0.0	0.0	68.3
		RW CLASS TOTAL	511.2	663.6	682.6	51.2	66.4	68.3
	SPECIES TOTAL.....		511.2	663.6	682.6	51.2	66.4	68.3
TYPE STRATUM TOTAL.....			511.2	663.6	2373.7	51.2	66.4	237.6

Type Strm: FS2X — Area (Ha): 20.00

Sp	RW Class	Material Class	Volume (m3) Billng	Volume (m3) CutCtl	Volume (m3) Other	m3/Ha Billng	m3/Ha CutCtl	m3/Ha Other
CE	AVOID	BckWst+SpProd	317.7	317.7	0.0	15.9	15.9	0.0
		FirmwoodRejec	0.0	0.0	273.8	0.0	0.0	13.7
		RW CLASS TOTAL	317.7	317.7	273.8	15.9	15.9	13.7
	SPECIES TOTAL.....		317.7	317.7	273.8	15.9	15.9	13.7
FI	AVOID	BckWst+SpProd	869.1	869.1	0.0	43.5	43.5	0.0
		GrdY+Inter4	0.0	184.2	0.0	0.0	9.2	0.0
		RW CLASS TOTAL	869.1	1053.3	0.0	43.5	52.7	0.0
	SPECIES TOTAL.....		869.1	1053.3	0.0	43.5	52.7	0.0
HE	AVOID	BckWst+SpProd	362.1	362.1	0.0	18.1	18.1	0.0

Figure A3.5 Block Type Summary.

SAMPLING STATISTICS — Page 1
Residue and Waste System - Rel 2.70e — 2001.03.19
COAST — Ministry of Forests — 11501 2001

FIGURES REPRESENT ONLY CUT CONTROL VOLUMES

Licens	Cut Perm	Cut Blck	Timber Mark	Sub Population	Type Strm	Area (Ha)	Total Plots	m3 per Hectare Billing	m3 per Hectare Cut Ctrl	Std Dev	C.V.%	S.E.% (@.95)	Volume m3 Billing	Volume m3 Cut Ctrl
TFL999	9999	9999	999999	DISP-Fixed	DC2X	10.00	2	52.30	143.68	1653.94	1151.11	10321.47	523.0	1436.8
TFL999	9999	9999	999999	DISP-Fixed	DH1X	9.99	2	51.17	66.42	245.58	369.73	3318.48	511.2	663.6
TFL999	9999	9999	999999	DISP-Fixed	FS2X	20.00	2	77.44	165.81	33.22	20.04	179.83	1548.9	3316.2
TFL999	9999	9999	999999	DISP-Fixed	GG0X	10.00	2	26.22	96.72	103.25	106.75	958.61	262.2	967.2
TFL999	9999	9999	999999	DISP-Fixed	GT4X	10.00	2	85.39	122.95	72.95	59.33	530.92	853.9	1229.5
TFL999	9999	9999	999999	ACCU-Fixed	LS0X	5.00	2	672.69	1249.34	1630.34	130.50	1171.27	3363.5	6246.7
TFL999	9999	9999	999999	ACCU-Fixed	RG2X	5.00	2	113.09	235.58	164.23	69.71	623.82	565.4	1177.9
TFL999	9999	9999	999999	DISP-Fixed	SG0X	10.00	2	38.38	202.24	43.45	21.49	192.95	383.8	2022.4
TFL999	9999	9999	999999	DISP-Fixed	SG4X	20.00	2	63.29	122.93	24.34	19.81	177.58	1265.8	2458.5
		BLOCK TOTALS		ACCU-Fixed		10.00	4	392.89	742.46	819.30	110.35	335.41	3928.9	7424.6
				SUBTOTAL		10.00	4						3928.9	7424.6
				AVG m3/Ha									392.9	742.5
				DISP-Fixed		89.99	14	59.44	134.40	186.62	138.86	231.76	5348.8	12094.2
				SUBTOTAL		89.99	14						5348.8	12094.2
				AVG m3/Ha									59.4	134.4
				SAMPLED		99.99	18					192.09	9277.7	19518.8
				AVG m3/Ha									92.8	195.2
				EST+100%		0.00	0						0.0	0.0
				AVG m3/Ha									0.0	0.0
				TOTAL		99.99	18						9277.7	19518.8
				AVG m3/Ha									92.8	195.2
		REPORTING UNIT TOTALS		ACCU-Fixed		10.00	4	392.89	742.46	819.30	110.35	175.28	3928.9	7424.6
				SUBTOTAL		10.00	4						3928.9	7424.6
				AVG m3/Ha									392.9	742.5
				DISP-Fixed		89.99	14	59.44	134.40	186.62	138.86	80.08	5348.8	12094.2
				SUBTOTAL		89.99	14						5348.8	12094.2
				AVG m3/Ha									59.4	134.4

Figure A3.6 Sampling Statistics.

SUMMARY OF SCALE (FS 72)
Residue and Waste System - Rel 2.70e
Ministry of Forests

Region: 1
District: 11
Surveyed by:

S+R No.:
Page 1 of 2
Date 2001.03.19
COAST

Sequence Number	Residue Surveyor Number	Return Number	Predominant Mark	Number of Chains	Reporting Unit	Reporting Year	Section
Cols 1-4	5-8	9-11	12-18	19-32	33-37	39-42	51-53
0000	006	___	WASTE	_____	11501	2001	___

Survey date YYMMDD	Pay by	Copy to	Expenses
Cols 54-59	60-64	65-69	70-74
010102	_____	_____	__.__

Sequence Number	FNF	Log Count	Station Number	Place of Survey
Cols 1-4	12-14	15-18	19-21	22-52
0011	1	38	ZZZ	_____

Survey Expenses
Cols 53-61
_____.__

Sequence Number	Mark	Paint	Unav /Av	Number of Pieces	Species Grade	Other Desc.	Quantity m3	Rate $.c/m3
Cols 1-4	12-18	19-20	21	22-26	27-29	30-32	33-39	40-44
0024	999999		A	1	ALX		7.4	__.__
0034	999999		A	1	ALZ		128.7	__.__
0044	999999		A	1	ASU		11.8	__.__
0054	999999		A	1	ASY		121.6	__.__
0064	999999		A	1	CEU		1732.4	__.__
0074	999999		A	1	CEX		87.2	__.__
0084	999999		A	1	CEY		1266.2	__.__
0094	999999		A	1	CEZ		1530.5	__.__
0104	999999		A	1	FIU		1417.7	__.__
0114	999999		A	1	FIX		216.0	__.__
0124	999999		A	1	FIY		604.9	__.__
0134	999999		A	1	FIZ		86.8	__.__
0144	999999		A	1	HEU		1895.5	__.__
0154	999999		A	1	HEY		397.1	__.__
0164	999999		A	1	HEZ		758.0	__.__
0174	999999		A	1	LOU		2001.1	__.__
0184	999999		A	1	LOX		1908.5	__.__
0194	999999		A	1	LOY		712.7	__.__
0204	999999		A	1	LOZ		87.5	__.__
0214	999999		U	1	ALX		45.5	__.__
0224	999999		U	1	ALZ		388.6	__.__
0234	999999		U	1	ASU		27.8	__.__
0244	999999		U	1	ASY		113.3	__.__
0254	999999		U	1	CEU		458.9	__.__
0264	999999		U	1	CEY		133.0	__.__
0274	999999		U	1	CEZ		254.2	__.__
0284	999999		U	1	FIU		572.9	__.__
0294	999999		U	1	FIX		163.8	__.__
0304	999999		U	1	FIY		194.9	__.__
0314	999999		U	1	FIZ		2124.4	__.__

Figure A3.7 Summary of Scale Page 1 (FS72).

SUMMARY OF SCALE (FS 72)
Residue and Waste System - Rel 2.70e
Ministry of Forests

Region: 1
District: 11
Surveyed by:

S+R No.:
Page 2 of 2
Date 2001.03.19
COAST

Sequence Number	Residue Surveyor Number	Return Number	Predominant Mark	Number of Chains	Reporting Unit	Reporting Year	Section
Cols 1-4	5-8	9-11	12-18	19-32	33-37	39-42	51-53
0000	006	___	WASTE	_____	11501	2001	___

Survey date YYMMDD	Pay by	Copy to	Expenses
Cols 54-59	60-64	65-69	70-74
010102	_____	_____	__.__

Sequence Number	FNF	Log Count	Station Number	Place of Survey
Cols 1-4	12-14	15-18	19-21	22-52
0011	1	38	ZZZ	_____

Survey Expenses
Cols 53-61
_____.__

Sequence Number	Mark	Paint	Unav /Av	Number of Pieces	Species Grade	Other Desc.	Quantity m3	Rate $.c/m3
Cols 1-4	12-18	19-20	21	22-26	27-29	30-32	33-39	40-44
0324	999999		U	1	HEU		1984.4	__.__
0334	999999		U	1	HEX		231.6	__.__
0344	999999		U	1	HEY		737.8	__.__
0354	999999		U	1	HEZ		4080.7	__.__
0364	999999		U	1	SPU		1376.5	__.__
0374	999999		U	1	SPX		775.9	__.__
0384	999999		U	1	SPY		322.3	__.__
0394	999999		U	1	SPZ		1573.7	__.__
Totals				38			30531.9	

NOTES TO APPEAR AT THE FOOT OF THE INVOICE

Sequence Number	Notation text
Cols 1-4	Col 12-67
0405	Primary Logging Date 1999.09.30_____
0415	L TFL999 CP 9999 CB 9999 TM 999999_____
0425	ENDEMIC _____
0435	_____

Figure A3.8 Summary of Scale Page 2 (FS72).

```
                          SUMMARY OF SCALE ADDENDUM                    Page   1
                     Residue and Waste System - Rel 2.70e             2001.03.19
COAST                        Ministry of Forests                      11501 2001


Region                  Cutting   Cut     Timber   Endemic          Net      Primary
District   License      Permit    Block   Mark     Catastrophic     Area     Logging
11         TFL999       9999      9999    999999   ENDEMIC          99.99    1999.09.30


                      ACCUMULATION PLOTS      DISPERSED PLOTS
                      Sampled   Est/100%      Sampled     Est
                           4          0           14       0


Surveyed by:_________________        Aggregate/Cut Block:_________________


                  ____________________________________
                 |                                    |
                 |   WASTE BENCHMARK CALCULATION      |
                 |____________________________________|

          Average Block Billing Volume =     92.8 m3/ha

                      Block Benchmark =     35.0 m3/ha

Waste Monetary Reduction Factor (WMRF) =   0.6228


. . . . . .
                       FOREST SERVICE USE ONLY
. . . . . .

If WMRF is < or = 0.0000, code $0.00 rate on FS 72 for all species avoidable
sawlogs.

If WMRF is > 0.0000, request average rate from HBR.

                 Average Rate from HBR = $_______.___ /m3 .....  (A)

Rate to be coded for all coniferous avoidable sawlogs = WMRF x (A)

                                       = $_______.___ /m3

If deciduous species is mandatory, obtain rate from CP document

                                       = $_______.___ /m3 .....  (B)

Rate to be coded for deciduous avoidable sawlogs = WMRF x (B)

                                       = $_______.___ /m3

If grades other than sawlogs are mandatory, use worksheet calculations in manual.
```

Figure A3.9 Summary of Scale Addendum.

Appendix 4 Annual Residue Survey Plan Approval

File: 21160-20
(RU #)

(Date)

(Comany Name/Address)

Attention: Licensee

Dear:

Re: Annual Residue Survey Plan

Your 20__ Annual Residue Survey Plan dated _____ for C.P. _____located near _____ in the _____ T.S.A. has been approved and the following list of Reporting Unit numbers assigned:

RU # - Licence, CP #
RU # - Licence, CP #
RU # - Licence, CP #

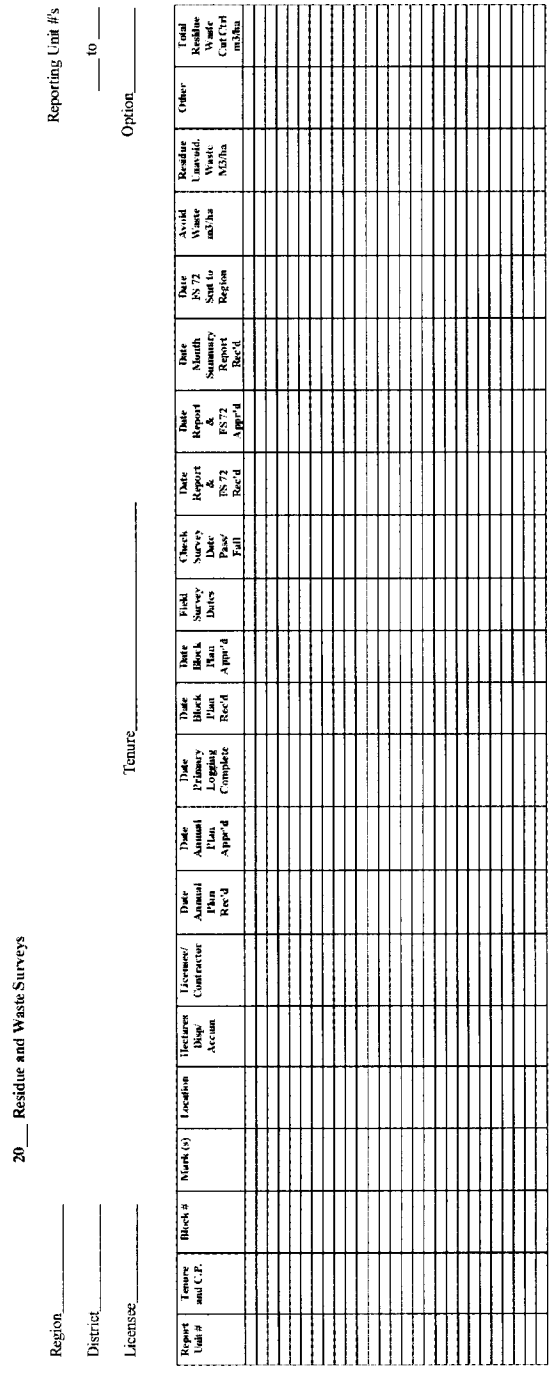
Please submit a Block Survey Plan for each of these blocks to our office 30 days prior to field work. In addition, please note that survey reports & FS 72's must be submitted in accordance with the manual requirements.

Sincerely,

District Manager

Figure A4.1 Sample of Annual Residue Survey Plan Approval.

Appendix 5 Sample Ledger



20__ Residue and Waste Surveys

Reporting Unit #'s

Region_____ ____to____

District_____ Option_____

Licensee_____ Tenure_____

Report Unit #	Tenure and C.P.	Block #	Mark (s)	Location	Hectares Disp. Accum	Licensee/ Contractor	Date Annual Plan Rec'd	Date Annual Plan Appr'd	Date Primary Logging Complete	Date Block Plan Rec'd	Date Block Plan Appr'd	Field Survey Dates	Check Survey Date Pass/ Fail	Date Report & FS 72 Rec'd	Date Report & FS72 Appr'd	Date Month Summary Report Rec'd	Date FS 72 Sent to Region	Avoid Waste m3/ha	Residue Unavoid. Waste M3/ha	Other	Total Residue Waste Cut Ctrl m3/ha

Appendix 6 Timber Utilization Standards

The following standard timber utilization requirements normally apply to all timber harvesting except for salvage cutting, experimental and research sales, partial cutting, environmental and silviculture requirements, and deciduous species:

COAST

Description		Mature*	Immature*
Stumps**			
•	no higher than	30 cm	30 cm
Top diameter (inside bark)			
•	all timber that meets or exceeds	15 cm	10 cm
Slab thickness (cedar only)			
•	all slabs that meet or exceed	15 cm	10 cm
Minimum length			
•	log or slab	3 m	3 m
*	For these purposes, "mature" means timber which has an average age of 121 years or older and "immature" means timber which has an average age of less than 121 years.		

INTERIOR

Description		Mature*	
Stumps**			
•	no higher than	30 cm	
Diameter (outside bark) at stump height			
•	Lodgepole pine: all timber that meets of exceeds	15 cm	
•	All other species: all timber that meets or exceeds	20 cm	
Top diameter (inside bark or slab thickness)			
•	For all species and ages, except Cedar older than 141 years, all timber that meets or exceeds	10 cm	
•	For Cedar older than 141 years	15 cm	
Minimum length			
•	log or slab	3 m	
**	Measured on the side of the stump adjacent to the highest ground.		

Appendix 7 Waste Average Stumpage Rate Determination

The average stumpage rate for each cutting authority is derived from the weighted average stumpage rate charged for the sawlogs (graded sawlogs on the Coast, grade code blank sawlogs in the Interior) in invoices issued during the 12 - month period ending one month after the month in which primary logging on the area was completed or upon the expiry of the cutting authority, as the case may be, in respect of timber harvested under the applicable timber mark. The formula to be used is:

$$AR = TS/TV$$

Where:

AR	=	Average Stumpage Rate for the cutting authority.	
TS	=	Total billed sawlog stumpage which is the sum of:	
			Upset Stumpage *, AND Bonus Bid
		*	Include silviculture and development levies.
TV	=	Total billed volume which is the accumulated volume in cubic metres (m^3) that derived the total billed stumpage for the sawlogs.	

Where utilization of deciduous is mandatory, the average stumpage rate charged for the deciduous species is either the appraised stand as a whole reserve rate or the specified fixed rate for the species, plus any bonus bid and levies where applicable.

In the Interior, where utilization of grade 3, 4, 5 or 6 is mandatory, the average stumpage rate charged for these grades is $0.25 per m^3, plus any bonus and levies where applicable.

Appendix 8 Riparian Management Zone (RMZ)

A8.1 Survey Method

For residue and waste surveys to be conducted within the riparian management zone, the survey method should commensurate with the silvicultural system used, as follows:

•	single tree selection	-	100 percent piece scale, or 50 m^2
•	group selection	-	100 percent piece scale or (circular or rectangular) plot of 50 to 400 m^2 that best fits the group selection harvested area.

Refer to Section 4.7 for surveying partial cutting (variable retention) cutblocks, and Section 5.7.2 for stratum codes.

A8.2 Stream Clean-out

For stream clean-out conducted in accordance with the Riparian Management Area Guidebook, the waste classification procedures are as follows:

1. Where the PHSP requires falling and yarding away from streams and a log is left across a creek, classify the log as unavoidable for environmental reasons.

2. If a creek was machine cleaned and it was reasonable to recover the log pieces, classify the pieces as avoidable.

3. If a creek was hand cleaned and the log was bucked into small segments and thrown out of the creek channel, classify the pieces as unavoidable.

Appendix 9 Waste Billing Benchmarks

1. Benchmarks

   On an individual cut block basis, the following benchmarks will be used for monetary billing of avoidable waste:

	Second Growth	Old Growth	
Coast	10 m^3/ha	35 m^3/ha	
	Dry Belt	**Transition Zone**	**Wet Belt**
Interior	4 m^3/ha	10 m^3/ha	20 m^3/ha

   The benchmarks consist of only avoidable waste (excluding residue and unavoidable waste volumes), and cover both the dispersed and accumulated subpopulations. The benchmarks apply to all species and grades specified to be mandatory utilization in the cutting authorities.

2. Billings

   Where the avoidable waste volume is below the established benchmark for the cut block, no monetary billing of avoidable waste will be made.

   Where the avoidable waste volume is above the established benchmark for the cut block, the licensee will be billed monetarily for the avoidable waste volume exceeding the benchmark.

   There is no change to cut control. All avoidable and unavoidable residue and waste volumes of the cut blocks will be continually charged to the licensees AAC cut control.

3. Cut Block Eligibility

   All cut blocks where primary logging had been completed after January 1, 1999 will qualify for the benchmark billings.

   The benchmarks are administered on an individual cut block basis, regardless of whether the cutblock is in the Cut Block or the Aggregate Reporting Unit. Therefore, each cut block within the Cut Block and the Aggregate Report Unit Options must be individually assessed to determine whether the avoidable waste within the cut block is above or below the benchmark.

Upon completion of survey or ocular estimate of each cut block, in addition to the reports normally required to be submitted by the forest districts, all licensees must complete and submit for each cut block the worksheet entitled Worksheet for Waste Billing Against Benchmarks and the required documents to the Forest Service.

BRITISH COLUMBIA

Ministry of Forests

Worksheet for Waste Billing Against Benchmarks

To be Completed by by Licensees

Licence No.		CP No.		Cut Block	
Timber Mark			Reporting Unit No.		
Primary Logging Completion Date					
Location			Stand/Site Type		

Calculations

Actual field surveyed avoidable waste (dispersed and accummulated) = _____ M^3/ha..... (A)

Established benchmark = _____ M^3/ha..... (B)

(A) - (B) = _____ M^3/ha..... (C)

If (C) < or = 0, stop

If (C) > 0, proceed as follows:

Monetary Billing Rate Reduction Factor = (C) / (A) = #DIV/0! (to four decimals) ..... (D)

(Attach sampling statistics report)

To be Completed by Forest Service

Processing

If (C) is < or = 0.0000, code $0.00 rate on FS 72 for avoidable sawlogs for all species.

If (C) is > 0.0000, request average rate report from HBR. If deciduous is mandatory get rate from CP Document.

Average Coniferous Rate from HBR = $ _____ /m^3..... (E)

Other mandatory utilization species and grade = $ _____ /m^3..... (F)
(e.g., Deciduous, grade 4)

Rate to be coded for all Avoidable Coniferous sawlogs (D x E) = $ #DIV/0! /m^3..... (G)

Rate to be coded for other(s) = $ #DIV/0! /m^3..... (H)

Approved by Forest Officer (signature)	Date

Figure A9.1 Sample of Worksheet for Waste Billing Against Benchmarks.

Appendix 10 Coarse Woody Debris

A10.1 Management Strategy

Forest Practices Branch is responsible for managing CWD (Coarse Woody Debris) and has released a short term strategy (available at http://www.for.gov.bc.ca/research/deadwood/Dtgui.htm). This strategy identifies various measures which promote the recruitment of CWD. It is intended, during the next three years, pilot projects will be undertaken for refining the guidance on CWD management.

The current stategy is to maximize the ecological value of CWD chosen to be left on site considering timber utilization standards specified in the cutting authorities, waste billing benchmarks as per Appendix 9, managing CWD without increasing logging costs, and whenever possible using wood below utilization standards and/or wood with no economic value as CWD.

The strategy allows for either CWD qualitative or quantitative objectives to be stated in forest development plans and silviculture prescriptions. Qualitative objectives focus on appropriate distribution of debris throughout the cutblock. Quantitative objectives define the volume and/or number of pieces of appropriate size that should be left on a cutblock.

A10.2 CWD Composition and Definition

CWD is composed of the following material classes found in the dispersed subpopulation of the cutblock only.

- Residue (avoidable and unavoidable) is timber belonging to log grades for which utilization is optional under the cutting authority, as measured and reported in a residue survey.
- Waste (avoidable and unavoidable) is timber belonging to log grades for which utilization is mandatory under the cutting authority, as measured and reported in a residue survey.
- Debris is timber or material other than avoidable and unavoidable residue and waste and is not measured nor reported in a residue survey. This includes firmwood rejects, breakage, and may include log grades and species not required to be utilized in the cutting authority.

A10.3 Debris Definition and Examples

Debris is one component of CWD.

Debris is timber or material other than the species and log grades specified to be mandatory or optional utilization in the cutting authority.

Unless specified in the SP or in the licence contract, debris is defaulted to a piece at least 2.5 m in length and at least 10 cm diameter at the small end.

Some examples of debris are (except where mandatory utilization):

- dead useless logs,
- grade 3 (endemic), dead sawlog,
- grade 5, dead lumber reject,
- grade Z, firmwood reject,
- breakage, branches, > 2.5 m < 3 m, 10 cm diameter at small end, or
- species generally not required to be utilized such as cottonwood, yew, etc.

A10.4 Debris Volumes and Charges

Debris volumes are not required to be measured nor reported in residue surveys.

No monetary or AAC cut control charges are applicable for debris.

A10.5 Waste Assessments Considering CWD Objectives

During the three-year pilot study period, CWD (which is a silviculture objective) will be accommodated within the waste benchmarks established respectively for the different site types for coast and interior. Quantitative CWD objectives are not expected to be commonly written into silviculture prescriptions at the present time. Residue and waste surveys will be conducted and compiled as normal. Avoidable waste volumes in excess of the waste benchmark of the cut block will be billed monetarily as per current policy.

In areas where there is little residue, waste and debris left after logging, logs greater than 3 m in length may be marked to leave and reserved for CWD purposes if required in an approved Silviculture Prescription. These logs must be painted with a letter "D" prior to a residue survey (won't be yarded to landings or roadside, and to differentiate these wood from avoidable residue and waste). When found inside a residue survey plot, these pieces are classified as unavoidable residue or waste, and record WD as comment code for woody debris.

No other action is required from residue surveyors relating to CWD. Copies of the residue and waste reports may be made available if requested, to the forest district staff responsible for CWD objectives.