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Ministry of Forests
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Revenue Branch

MEMORANDUM

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March 31, 2009

BY EMAIL

To: Regional Executive Directors

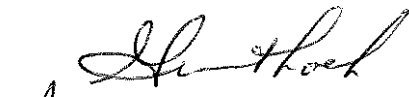
From: Murray Stech
Director
Revenue Branch

Re: Amendment No. 11 to the *Provincial Logging Residue and Waste Measurement Procedures Manual*

I hereby approve Amendment No. 11 to the *Provincial Logging Residue and Waste Measurement Procedures Manual*, and attach a copy for your use.

The purpose of this amendment is to eliminate the Annual Survey Plan requirement and to provide safe survey procedures. There are no added costs associated with the changes.

This amendment comes into force on April 1, 2009.


for Murray Stech
Director
Revenue Branch

Attachment



Ministry of
Forests and Range



MANUAL REVISION TRANSMITTAL

<p>FOR FURTHER INFORMATION OR IF YOU HAVE A CHANGE OF ADDRESS, PLEASE CONTACT:</p>
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Please make the following changes to your copy of the above Ministry manual.

ACTION (Remove/Insert)	(VOL.) CHAPTER-SECTION-SUBJECT	PAGE(S)	COMMENTS
	TABLE OF CONTENTS		
REMOVE	Table of Contents	i - vii	After Table of Contents Tab
INSERT		i - vii	
REMOVE	Chapter 2	1 - 10	After Chapter 2 Tab
INSERT		1 - 6	
REMOVE	Chapter 5	5 - 58	After Chapter 5 Tab
INSERT		5 - 60	
INSERT	Letter from Murray Stech, Director Transmittal Sheet		After Amendments Tab

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Reporting Units

2



2.1 Reporting Unit Options

There are three waste reporting options:

- the Cutblock Option,
- the Aggregate Option, and
- the Ocular Estimate Option.

Licensees may elect to have cutblocks  waste assessed using one or any combination of the three options. 

Regardless of whether the Cutblock, the Aggregate or the Ocular Estimate Option is chosen, waste assessments are conducted on a cutblock basis. Each cutblock within the cutting authority must be waste assessed when primary logging is completed for the cutblock as per requirements in Section 2.4.

For either the Cutblock or the Aggregate Option, 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.

2.1.1 Cutblock 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 in excess of the waste benchmark for each cutblock is billed monetarily using the twelve-month average stumpage rates in effect for the timber mark on the date primary logging is completed.

2.1.2 Aggregate Option

Cutblocks are amalgamated to form an Aggregate Reporting Unit. Aggregation of cutblocks within a Forest District is permitted at the licensee level. Separate aggregate reporting units are required for old growth, second growth and helicopter logging.

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 in excess of the waste benchmark for each cutblock within the aggregate reporting unit is billed monetarily using the twelve-month average stumpage rates in effect for the timber mark on the date primary logging is completed.



2.1.3 Ocular Estimate Option


Each Reporting Unit can be comprised of one cutblock or multiple cutblocks.

The ocular estimate option may be used if the waste levels are expected to be below the waste benchmarks, or if the waste benchmark is exceeded and there is minimal revenue risk, the District Manager may permit the use of oculars.

The waste volumes are estimated; there are no sampling precision requirements.

2.2 Field Assessments and Reporting Time Frames

Holders of a major licence, community forest agreement, community salvage licence, woodlot licence, road permit, and master licence to cut and timber sale licence, where so specified in that timber sale licence, are responsible for conducting waste assessments (full survey or ocular estimates) on their scale-based cutting authorities within sixty (60) days after primary logging has been completed on the cutblock or within sixty (60) days that the cutting authority expires or is otherwise terminated, whichever occurs first, or as soon thereafter that the ground is sufficiently free of snow that an assessment may be carried out on the cutblock.

The licensee must submit a waste assessment report for the cutblock  to the District Manager within thirty (30) days of the completion of the waste assessment.

2.2.1 Continuing Liability

Consistent with section 79 of the *Forest Act*, notwithstanding the time frames specified in Section 2.2 for conducting and submitting a waste assessment, and despite the expiry, surrender, suspension or cancellation of a holder's agreement, the holder is required to conduct a waste assessment, and pay the fees, costs and invoice billings owing to the government in respect of the waste assessment.

2.3 Overdue Waste Assessments and Reports

If waste assessments and reports are not completed and submitted to the District Manager as required under Section 2.2, the District Manager may carry out the assessment, and in a notice given to the licensee, may require the licensee to pay the costs incurred by the District Manager in carrying out the assessment.

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5.1.5 Grading Pieces

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

For example the minimum log length for 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*.

On the coast, due to the timber pricing changes made to Hemlock, Balsam U and X grades for all coniferous species, refer to Appendix 6 on how to grade bucking waste, stumps, logs and standing trees.

When the waste assessment of a cutblock has not been conducted within the allowable time frame, log pieces must be graded according to their conditions (i.e., grade and decay) at the time the waste survey should have been conducted.

5.1.6 Visual Estimates

If loose debris cannot be quickly moved away 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", and is only applied to the plot method.

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 waste were spread evenly through the cylinder within the plot boundaries. The measure factor is derived from $2\text{m}/5\text{m} \times 100\% = 40\%$.

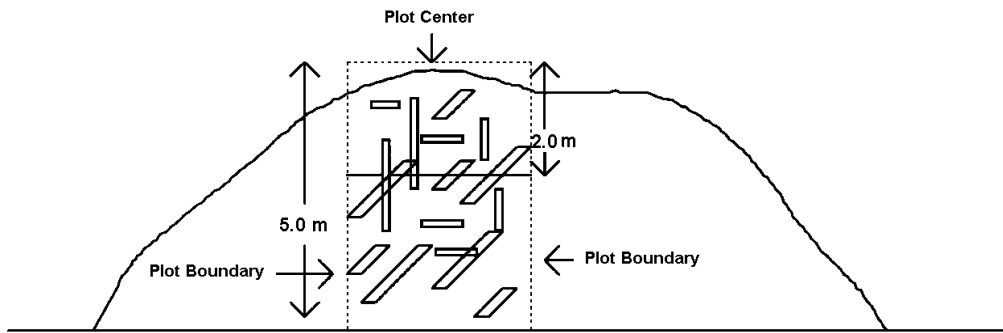


Figure 5.1 Measure Factor.

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, surveyor calculates the volume deduction for rot but records the deduction equivalent in rads and/or metres, along with the most appropriate "decay type".

5.1.9 Waste Survey Safety Procedures

In accordance with Section 3.12(1) of the Occupational Health and Safety Regulation - "A person **must not** carry out or cause to be carried out any work process or operate or cause to be operated any tool, appliance or equipment if that person has reasonable cause to believe that to do so would create an undue hazard to the health and safety of any person."

The objective of this section is to provide an alternative method of determining waste volumes where a portion or the entire plot or block cannot be measured safely.

1. Where a piece or portion of a plot or an entire plot cannot be measured safely, attempt to complete the piece or plot through estimation from a nearby location.
2. Where the plot cannot be measured or estimated safely, move the plot to a safe location as specified in Section 5.2.3 up to a maximum of 48 meters. If there is no safe location within 48m, drop the plot.
3. When a plot must be dropped for safety, use replacement data of an existing plot from the same cut block or license that has similar waste levels, species and grade profile, age and method of harvesting. The surveyor may have to use a measure factor to adjust the volume to make it representative of the actual waste levels.

If replacement data from another plot is used, ensure the volume is the same or less of the dropped plot. If the volume is less, then apply the measure factor to increase the waste volume to the appropriate level. The waste system cannot reduce a plot volume; therefore, assigning a measure factor greater than 100% will not work.

4. Where more than half of the plots cannot be established safely, the waste volumes on the cutblock can be determined using the Block Exemption or Ocular Estimate method.

5.2 Plot Establishment

All P.O.Cs and tie points should be marked with aluminium 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 aluminium 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:

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

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

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

$$1.2441 \times 11.28\text{m} = 14.03 \text{ m Slope distance}$$

Table 5-1 following contains the corrected slope distance for a 11.28 m plot radius (400 m² plot).

Table 5-1: Slope Distances for 11.28 m Plot 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% - 13.04 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).

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

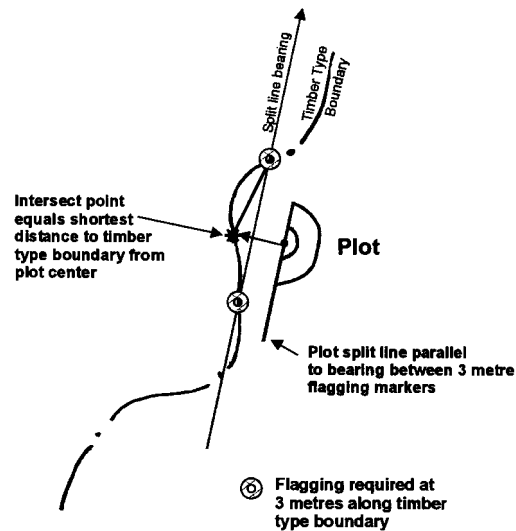


Figure 5.2 Border Plot.

If a 400 m² 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 fieldwork.

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 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 m² (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 m² (3.99 m in radius) or rectangular (i.e., 5 m x 10 m). The formula for calculating the horizontal plot radius is: $\text{SQR}(\text{plot size in m}^2 / \text{PI})$, 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	<p>200 m² rectangular (i.e., 10 m x 20 m where 10 m is the average width of the roadside accumulation).</p> <p>100 m² rectangular.</p> <p>50 m² rectangular (for strips 10 m wide or less).</p> <p>50 m² circular (for a 15 m wide strip, locate plot centres alternatively at 4 m and 11 m from the roadside).</p>

For fixed width roadside stratus that are over 15 m wide, rectangular plots must be used and the minimum acceptable size is 50 m². 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 m² rectangular plots covering the entire width of the stratum are acceptable.

For varying width stratus, 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 m² unless the maximum width of the stratum is 10 m or less and then 50 m² 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 timber merchantability specification diameter for at least 3 m of length.

Logs are measured in accordance with the *Scaling Manual* and *Scaling Regulation*, 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 contractual diameter, and then a length deduction (from the 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 waste survey, the term "logs" encompasses all down logs, slabs, that are a minimum of 3 m in length with a top diameter of 10 cm or 15 cm. Record as "L" under "Kind of Material" on the plot survey card (FS 161).

5.3.2 Trees

Trees left standing after timber harvesting that are not reserved for silviculture, biodiversity or a forest management reason are measured in a waste assessment and classified as avoidable or unavoidable waste.

Appropriate documents such as tenure licence documents, timber appraisal applications and maps need to be referenced to determine the conifer and/or deciduous leave trees identified by species to be retained as reserved timber for the cutblock being waste assessed. These specifications apply to trees outside of the mapped wildlife tree patches.

5.3.2.1 Clearcut

Individual standing tree volumes that are measured must be kept separate from the plot waste volumes. Standing tree dimensions are recorded using FS 161, Waste Survey Plot Tally. Trees that were left scattered sparingly throughout the cutblock are measured individually and each tree is numbered and marked with paint. Record the timber merchantability specification top diameter in rads as the top diameter. The length is determined using a tape/chain and a clinometer or an electronic measuring device such as a laser instrument. The waste surveyor visually estimates the location of the top diameter and then measures the length from this point down to the timber merchantability stump height (must make a 3 m log that meets the timber merchantability specifications). If the top is broken, the waste surveyor visually estimates the diameter at the break, and measures the length from the break mid-point to the stump height. The butt diameter is obtained by measuring the tree diameter at the timber merchantability specification stump height, accounting for flare.

On the FS 161, under Kind, record T for standing trees or D for downed trees, classify the trees as avoidable or unavoidable. Enter the dimensions for length, top and butt diameters, end codes, and assign a log grade.

One possible method for determining the volume of standing trees is to record the species and diameter of each tree and use the Extended Type Stand and Stock Table from the timber cruise compilation.

For trees that were left in a large patch where individual tree measurement is impractical, the waste surveyor will perform a closed traverse measuring the precise area represented by the tree patch. The cruise net volume per hectare (for that timber type(s)) will be used to determine the volume of timber in the tree patch that was not harvested. A patch is defined to be a grouping of trees occupying an area of more than one hectare. For a patch that is less than one hectare, a surveyor may apply the cruise net average or opt for individual tree measurement.

For scattered standing trees, the standing tree areas must be properly stratified. Plots will be allowed but the block must be surveyed using the Cutblock option.

Except for individual standing or downed trees where each tree is individually graded, the grade allocations for large tree patches left in clearcuts, are based on the historic billing grade profile of the timber mark for the cutting authority. Only in the absence of the

billing history records or if an RPF or RFT considers the historical records are unrepresentative of the grade profile on site, grades may be derived by an RPF or RFT based on examinations of the actual grade compositions of the stand left on site.

5.3.2.2 Partial Cut

Surveyors should reference appropriate documents that provide the volume percent reduction by either one or more of species, timber type, risk group/tree class or treatment unit for each individual cutblock within the cutting permit or agreement.

Timber volume that is left in excess of the leave volume will be billed as waste subject to the application of the waste benchmarks.

There are at least two methods - recruise, fixed area waste plots, for determining the unharvested standing tree volume in a partial cut. Choose a method that is appropriate for the cutblock.

For a recruise, a licensee must strive to put in a sufficient number of cruise plots that will either meet or exceed the sampling error achieved in the original cruise.

If waste plots are used, the plot size should be 400 m². A licensee must strive to put in a sufficient number of waste plots that will meet or exceed the sampling error objective approved for the reporting unit. The minimum sampling intensity required is at least two plots per stratum or if the cutblock is not stratified, two plots per cutblock.

Once the unharvested standing tree volume has been derived, the timber scale grades will be assigned using the historic billing grade profile of the timber mark for the cutting authority. Only in the absence of the billing history records or if an RPF or RFT considers the records are unrepresentative, grades may be derived by an RPF or RFT on the basis of actual grade compositions of the stand left on site.

The survey results for cutblocks that have been harvested using partial cut systems must be sponsored by an RPF or RFT. This is to confirm that the partial cut timber harvesting requirements that were previously stated in Schedule B, or the Percent Reduction Report in the Appraisal Cruise Compilation Submission have been met and there are no waste billing concerns on the remaining standing tree volumes. If a field or office review by ministry staff identifies an apparent discrepancy with the species or volume harvested, the licensee or the TSM may be directed by the District Manager to recruise or resurvey the residual standing trees.

5.3.2.3 Unharvested Cutblocks

The District Manager may bill an unharvested cutblock in an expired, surrendered or cancelled cutting permit or authority. The billings will be made on the basis of the net cruise volume attributed to the unharvested cutblock.

Once the net cruise volume is determined, the grade allocations will be based on the historic billing grade profile of the timber mark for the cutting authority. Only in the

absence of the billing history records or if an RPF or RFT considers the records are unrepresentative, grades may be derived by an RPF or RFT based on examinations of the actual grade compositions of the stand left on site.

5.3.3 Slabs

A slab is defined as any non-round piece with less than half ($1/2$) of its original circumference remaining, a minimum thickness of 10 cm and an average diameter equal to or larger than the timber merchantability specification diameter. The *only* exception is mature red cedar (on the Coast only) which must have a minimum thickness of 15 cm to be measured or recorded.

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 at 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 waste purposes.

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

1. Measure and average 3 thickness.

$$\text{i.e., } 11 + 9 + 13 = 33/3 = 11 \text{ rads}$$

2. Measure 1 width between 5 rad edges.

$$\text{i.e., Width} = 31 \text{ rads}$$

3. Average the thickness and the width.

$$\text{i.e., } 11 + 31 = 42/2 = 21 \text{ rads}^*$$

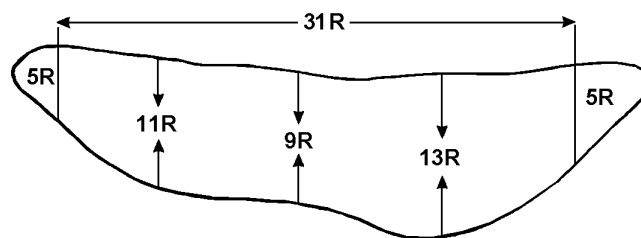


Figure 5.3 Measuring Slabs.

5.3.4 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 stump height of 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 stump height of 0.3 m 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 stump height 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, dead stumps will only be measured and recorded where the timber stand is designated to be catastrophic.

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.

5.3.4.1 Measuring and Recording Stumps

Careful measurement of stumps is critical because they contain high 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 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.

5.3.4.2 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 the timber merchantability 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 TMS 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 reasons or to hold back logs.

- A. Timber Merchantability Specifications (TMS) Stump Height.
- B. Allowed Stump Height.
- C. Total Stump Height.

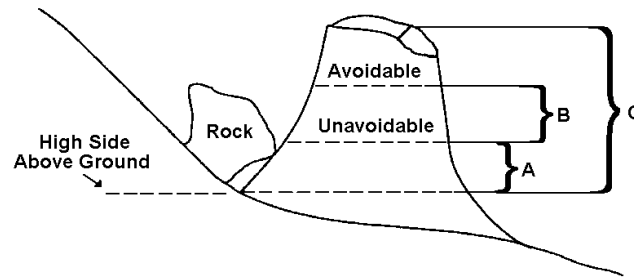


Figure 5.4 Avoidable and Unavoidable Waste (High Side).

5.3.4.2.1 Definitions:

- A. *Timber merchantability specifications (TMS) stump height* of 30 cm is measured from the ground on the *high side*. This part is not recorded. If the stump is higher, length measurements start from the 30 cm mark.
- B. *Allowed stump height* is 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.

5.3.4.3 Recording Stumps in Segments

If there are both avoidable and unavoidable components of waste, the stump is recorded as two pieces each with its 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 TMS stump height in the length field, and the top radius of this lower segment in the top field. Classify this piece as unavoidable (U).

5.3.4.4 High Stumps - Snowpack

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 the TMS 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 TMS 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 TMS 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.

5.3.4.5 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 waste 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.

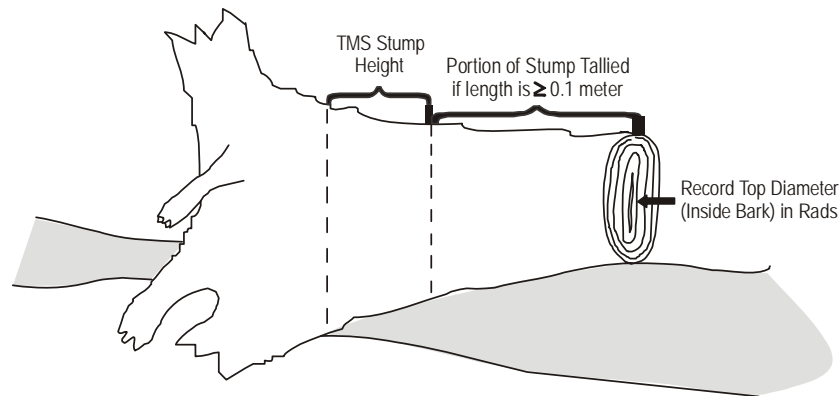


Figure 5.5 Windfall Stump.

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 TMS stump 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.

5.3.4.6 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 entire stump.

5.3.5 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 TMS 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 knots.

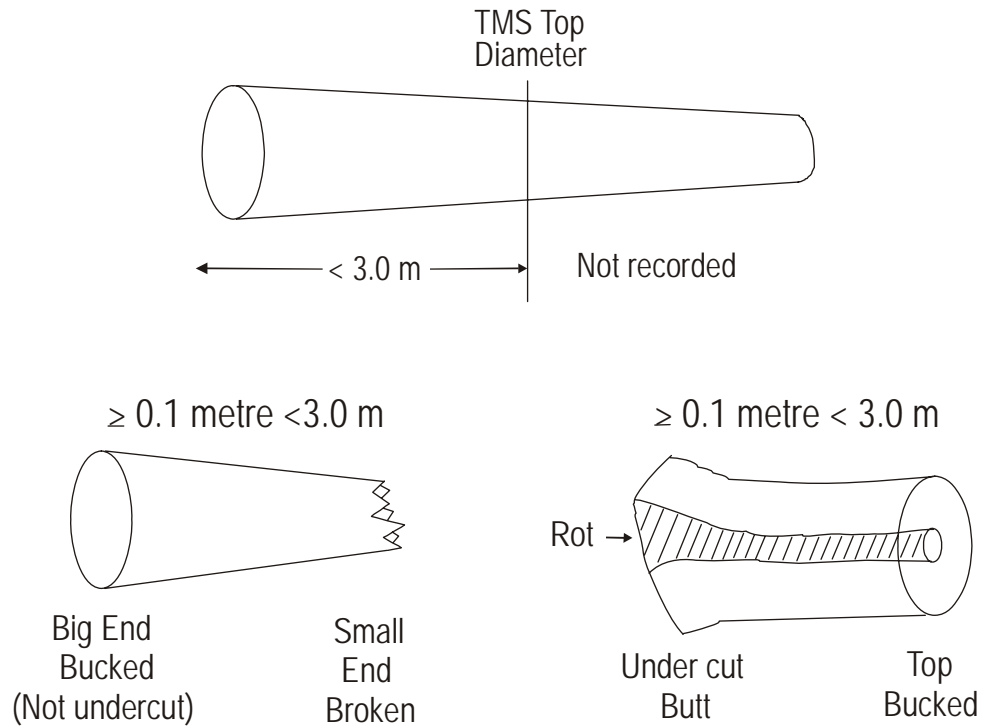


Figure 5.6 Examples of Bucking Waste.

5.3.5.1 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 deformities 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.

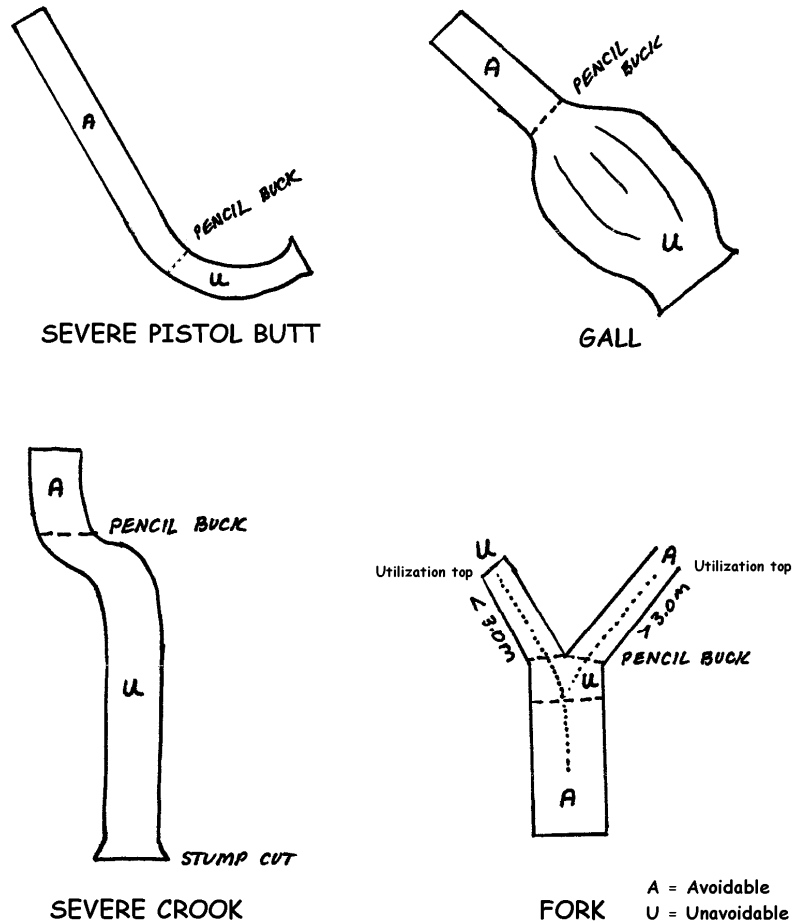


Figure 5.7 Avoidable/unavoidable Bucking Waste.

5.3.6 Breakage

Breakage is defined as any piece, meeting the minimum diameter of the TMS, 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.

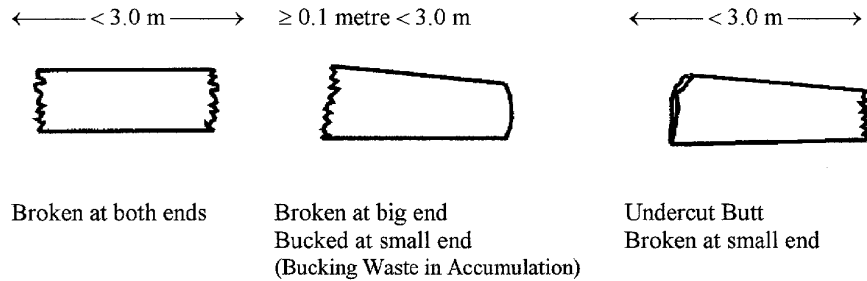


Figure 5.8 Examples of Breakage.

5.3.6.1 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* 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 TMS specifications in handling between "stump to dump", should be classified as breakage and not recorded.

5.3.7 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 timber merchantability specifications, the portion(s) of the tree, above the fork or crook must meet the criteria for minimum log length to be considered avoidable 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 waste 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.

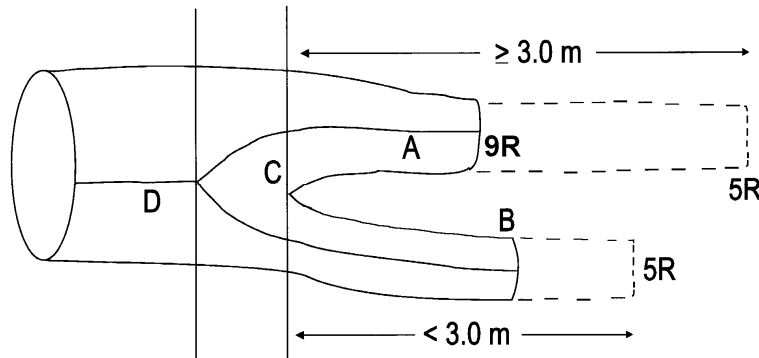


Figure 5.9 Forked Log.

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

5.3.8 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.

5.3.9 Coarse Woody Debris

Log pieces that may be required to meet coarse woody debris requirements are included in the waste benchmarks. No special provisions are made for coarse woody debris in waste assessments.

5.3.10 Special Cases

Waste 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 roadbeds, 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 Field Standards

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

5.4.1 Maps

The block survey map should be at a scale of 1:5000 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.

5.4.2 Field Equipment and Supplies

The waste 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,
- toposil 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.

5.4.3 Traverse Notes

When a field assessment 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.

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 TMS top diameter (must have minimum slab thickness of 5R) measured from the small end. |
| Step 2 | Measure gross length which commences from the top diameter. |
| Step 3 | Locate the X Y line upon which the volume above the top 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 diameter to the X Y line. |

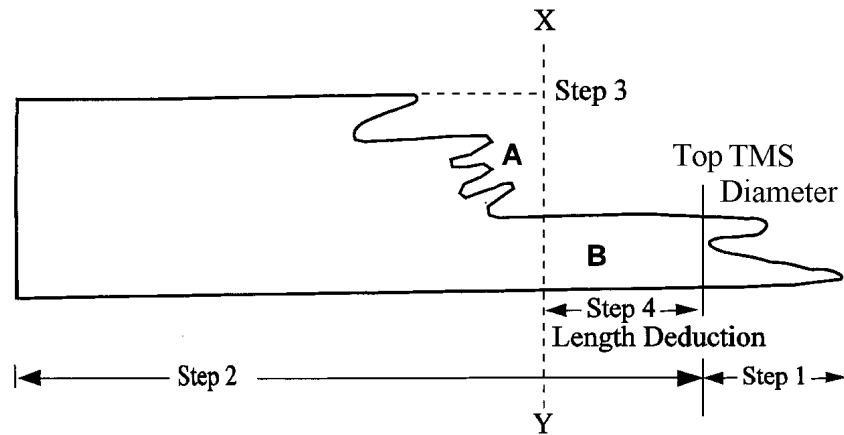


Figure 5.10 Measuring Broken Tops.

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

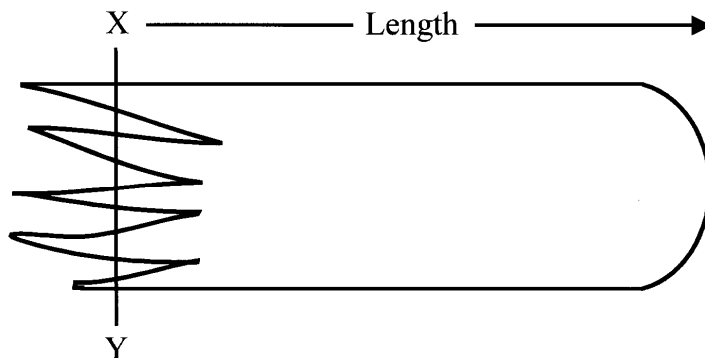


Figure 5.11 Measuring Shattered Ends.

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.

Top log diameter 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 timber merchantability specification 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.

If the stump total height, which includes the TMS of 30 cm, is less than 1.3 m, measure the top diameter on the top of the stump. If the stump total height exceeds 1.3 m, measure the top diameter 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 timber merchantability specifications 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 waste 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 waste 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.

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.

This section may be further revised when the new Waste System is in full implementation.

5.7.1 Header

<i>F.D. - FOREST DISTRICT</i> <i>*R* (2n-nba)</i>	Identifies the Ministry of 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.
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The use of forest district numbers is not required in the Waste System.

Coast Forest Region

District Name	District Number
Chilliwack	11
Squamish	13
Queen Charlottes	1B
Campbell River	18
Sunshine Coast	15
South Island	17
North Island Central Coast (Port McNeill)	19
North Coast	1C

Northern Interior Region

District Name	District Number
Kalum	25
Skeena Stikine (Kispiox)	24
Skeena Stikine (Smithers)	29
Nadina (Houston)	22
Nadina (Burns Lake)	21
Fort St. James	45

District Name	District Number
Vanderhoof	44
Prince George	41
Mackenzie	46
Peace (Dawson Creek)	47
Peace (Fort St. John)	48
Fort Nelson	49

Southern Interior Region

District Name	District Number
Kamloops	32
Headwaters (McBride)	43
Headwaters (Clearwater)	31
Cascades (Lillooet)	37
Cascades (Merritt)	36
Okanagan Shuswap (Vernon)	34
Okanagan Shuswap (Penticton)	35
Okanagan Shuswap (Salmon Arm)	33
Columbia (Revelstoke & Golden)	54

District Name	District Number
Arrow Boundary (Castlegar)	55
Arrow Boundary (Grand Forks)	56
Rocky Mountain (Cranbrook)	51
Rocky Mountain (Invermere)	52
Kootenay Lake	57
Central Cariboo (Williams Lake)	62
Central Cariboo (Horsefly)	63
Quesnel	61
Chilcotin	65
100 Mile House	64

<i>REP. YR. - REPORTING YEAR *R* (2n-nba)</i>	Identifies the last two digits of the year in which the sampling for the block was completed.			
<i>REPORTING UNIT *R* (5n-rj)</i>	<p>Identifies the area for which the weighted sampling error objectives must be met.</p> <p>If the block sampling option is being used, each block is a Reporting Unit (RU) and will be given a unique RU number.</p> <p>If an aggregate sampling option is being used, each aggregate (group of blocks) is an RU and will be given a unique RU number.</p> <p>RU numbers will be issued by the Ministry of Forests district office upon approval of the Annual Waste Assessments Plan (see Section 2.3).</p>			
<i>YEARS LOGGED *R* (2 of 2n-nba)</i>	<p>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 may require blocks that are to be harvested over more than 2 seasons be split for administrative reasons. Therefore, portions of blocks logged in one year must be surveyed no later than the following year.</p>			
<i>TIMBER MARK *R* (6an-lj)</i>	<p>Identifies the timber mark used for the block.</p> <p>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, stratum, stratum areas and plot sizes, utilization standards etc.). A separate FS 72 will be printed for each block/mark combination.</p> <p>For wavy lines, record ":", for bars, record "-", for crescents records "" and for old "X" timber sales, record "<". Some examples are as follows:</p>			
	TFL 22, CP 7	22/7	FL A01369, CP 9	F76009
	TL within TFL	HZ0021	TSL A48416 -	48416

<i>LICENCE *R*</i> (6an-lj)	Identifies the licence number of the block being sampled. Some examples are as follows:			
	TFL 1	TFL001	FL A17645 -	A17645
	LOT 217	LOT 217	Wood Lot 443	W0443
<i>CP - CUTTING PERMIT *R*</i> (4an-rj)	Identifies the cutting permit number under which harvesting of the block was authorized.			
<i>BLOCK - CUT BLOCK *R*</i> (4an-rj)	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.			
<i>PLC DATE *R*</i> (3 of 2n-rj)	Identifies the last two digits of the year, the month and the day on which primary logging was completed for the cutblock.			
<i>SURVEY DATE *R*</i> (3 of 2n-rj)	Identifies the last two digits of the year, the month and the day in which the last plot was established in the block.			
<i>NET AREA *R*</i> (4.2n rj)	<p>Quantifies, in hectares, the total area of all stratum areas available for sampling and/or estimating.</p> <p>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 waste piles.</p>			

<p><i>ROADS NP.NF*R*</i> (4.2n-rj)</p>	<p>Quantifies, in hectares, the total area of road surface, non-productive and non-forest land.</p> <p>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).</p> <p>Do not include the ditch in the road surface area calculation as it is part of the population being sampled.</p> <p>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.</p>
<p><i>Waste Benchmark "R"</i> (4n-rj)</p>	<p>Quantifies, in cubic metres per hectare of avoidable waste threshold. Refer to Appendix 5.</p>
<p><i>CRUISE VOLUME per ha *R*</i> (4n-rj)</p>	<p>Quantifies, in cubic metres per hectare, the average cruise volume for the block. Data available from cruise summaries. Estimate if data is unavailable.</p>
<p><i>REAS. - REASON FOR SURVEY *R*</i> (1a) (RWS 2.70 only)</p>	<p>Identifies the purpose of the sampling.</p> <p>This allows the FS 444's and the FS 161's to be used for more than one type of waste measurements on the same block without the data becoming mixed up in the computer files.</p> <p>See the back of the FS 444 for codes.</p>
<p><i>SNOW Y/N *R*</i> (1a) (RWS 2 - 70 only)</p>	<p>Identifies the presence of snow at the time of logging. See the back of the FS 444 for codes.</p>
<p><i>SNOW MAX STUMP HT.M *R*</i> (RWS 2 - 70 only)</p>	<p>Quantifies, in metres, a maximum stump height which is different than the TMS (0.3 m).</p> <p>This occurs almost exclusively in the interior when, under certain circumstances, logging can only proceed during the winter.</p> <p>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.</p>

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.
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Each type stratum is comprised of a four-character code.

5.7.2.1 Dispersed and Accumulated Types

The FIRST character, (alpha) starting from the left, identifies the waste type.

The recognized waste types and their codes are as follows:

Waste Types		Code
1.	Dispersed Types	
	Open Slash/Clearcut	S
	Felled and bucked	F
	Group Retention	G
	Dispersed Retention	D
	Standing Stem	T
2.	Accumulated Types	
	Landings	L
	Roadside	R
	Windrow, Debuilt road	W
	Cold decked	C
	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 waste 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 identifies the assessment method used.

There are four assessment methods, and their codes are:

•Ocular Estimate	O
•Estimate Percent	E
•100% Measure	S
•Plot	P

When a method other than plot is used, use the "alpha" method code.

When the plot method is used, select the "Numeric" code that corresponds with the plot size in the table below. There must be at least two plots in each stratum.

0 - 50 m ²	5 - 500 m ²
1 - 100 m ²	6 - 600 m ²
2 - 200 m ²	7 - 1 000 m ²
3 - 300 m ²	8 - 5 000 m ²
4 - 400 m ²	9 - 10 000 m ²

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

When significantly different levels of waste occur within a waste type and they can be easily identified and mapped, the waste surveyor must 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 waste types, when significantly different waste levels exist, can help accomplish this in either sampling option.

Stratification of dispersed waste 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.

Where the plot method is used, 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 waste 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).

5.7.2.2 Standing Trees

Depending on the assessment method used, the stratum codes are:

<i>STRS</i>	Where trees are measured individually using the one hundred percent measure method.
<i>STRE</i>	Where tree volumes in a patch is estimated using the estimate percent method.

<i>DISPERSED AREA *R*</i> (4.1 n-rj)	Each line on the area statement quantifies, in hectares, the area of a dispersed waste type or waste level.
<i>ACCUMULATIONS - 100% *R*</i> (5.2n-rj)	<p>Each line on the area statement quantifies, in hectares, the area that has been 100% measured or estimated (i.e., not sampled with plots).</p> <p>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.</p> <p>If this measurement option is chosen for a stratum or substratum, all of the area in the stratum or substratum must be either 100 percent measured or estimated.</p> <p>"S" Not Used - Leave Blank. This is the column between "100 percent" and "Fixed".</p>

<i>FIXED *R*</i> (5.2n-rj)	<p>Each line on the area statement quantifies, in hectares, the area of any accumulated types or waste levels (i.e. type stratum) that have been sampled with plots of a fixed radius (a 400 m² plot = 11.28 m radius).</p> <p>3P Not used - leave blank.</p>
<i>PLOT SZ m² - PLOT SIZE *R*</i> (3n-rj)	<p>Each line quantifies, in square metres, the plot size used for the various type stratum.</p> <p>The normal plot size for dispersed types is 400 m² (circular with radius of 11.28 m). Smaller plot sizes are allowed for partial cutting.</p> <p>Accumulated 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 m².</p> <p>The plot radius formula is $\sqrt{(plot\ size(m^2) / \pi)}$.</p>

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

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

5.7.3 Timber Merchantability Specifications

These specifications are described in this manual.

<i>SPECIES *R*</i> (2a-bp)	Identifies the species. Where the species is blanked out on the first line, the blank refers to all species).
<i>MSH cm - MAXIMUM STUMP HEIGHT *R*</i> (2n-rj)	Quantifies, in centimetres, the TMS stump height allowed of 30 cm.
<i>TOP cm *R*</i> (2n-rj)	Quantifies, in centimetres, the minimum top diameter, inside bark. 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.
<i>MLL m - MINIMUM LOG LENGTH *R*</i> (2.1n-rj)	Quantifies, in metres, the minimum log length that must be recovered. Currently it is 3 m for both the Coast and the Interior.
<i>AGE *R*</i> (3n-rj)	Identifies the age of any species. Applies to the Interior only, leave blank on the Coast.

[illegible][illegible]

POC/TP	NOTES

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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: FI, CE, HE, BA, SP, CY, LO, WH, WB,
 YE, LA, AL, AS, BI, 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 BR - buried CA - candelabra CL - culvert log CR - severe crook or pistol grip DP - "dead potential" (inv. classif.) DU - "dead useless" (inv. classif.) FK - fork FL - fluted butt	LB - long butt MP - multiple pieces SA - sapling SB - shake block SL - slab US - unsafe WD - woody debris WF - windfall WS - windshear
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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.

<i>LICENCE *R*</i> (6an-lj)	See "LICENCE" on FS 444. Must be identical to the licence number recorded on the FS 444.
<i>C.P. - CUTTING PERMIT *R*</i> (3an-rj)	See "CUTTING PERMIT" on the FS 444. Must be identical to the cutting permit recorded on the FS 444.
<i>BLOCK - CUT BLOCK *R*</i> (4an-rj)	See "BLOCK" on the FS 444. Must be identical to the block number recorded on the FS 444.
<i>DATE *R*</i> (3 of 2n-rj)	Identifies the year (last two digits), month and day when the plot was established.
<i>CERT - CERTIFICATE NUMBER *R*</i> (4an-rj)	Identifies the certificate number of the waste surveyor responsible for the establishment of the plot. Those without a waste licence number may use the following: Coast Forest Region = WACO Southern Forest Region = WASI Northern Forest Region = WANI Individuals conducting plot surveys who are not licenced waste surveyors must include the name and registration number of the sponsoring forestry professional in the comment field of the system/report.

<i>RET # - RETURN NUMBER *R*</i> (3n-rj)	<p>Identifies the return number of the waste surveyor responsible for the establishment of the plot.</p> <p>Return numbers will increment by one for each new block sampled in a given year.</p>
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It is the responsibility of each certified waste surveyor to keep track of his/her own return number. These numbers automatically revert to "001" on January 1st of each year.

<i>B.LINE - BASELINE *R*</i> (1a)	<p>Identifies the baseline the plot is tied to.</p> <p>Use codes "A" "B" "C" etc.</p>
<i>STRIP *R*</i> (2n-rj)	Identifies the strip number that plots are located on.
<i>PLOT NO. *R*</i> (2nrj)	Identifies the plot number. The strip/plot number combination must be unique within a type stratum.
<i>TY. - PLOT TYPE *R*</i> (1a) (used only in RWS 2.70 program only)	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.
<i>PLOT SH – PLOT SHAPE *R*</i> (1a-bp) (RWS 2.70 only)	Identifies the plot shape. Use codes "C" = Circular, "R" = Rectangular, "S" = Square. Must be blank for estimated plots and 100 percent measure plots.
<i>MEAS.% - MEASURE % *R*</i> (2n-rj)	<p>Quantifies the percentage of the volume, within the plot boundaries that has been measured and recorded.</p> <p>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.</p> <p>See the codes on the back of the FS 444.</p> <p>For RWS 2.70, use code 00 for 100 percent. For the new waste system, measure percent is always defaulted to 100.</p>

<i>TYPE STRATUM *R*</i> (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.
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5.8.2 Piece Descriptions

<i>PIECE NO. *R*</i> (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.			
<i>BOR.LINE – BORDERLINE *S*</i> (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).			
	I	= Piece completely inside plot.		
	B	= Borderline piece (measure inside portion only).		
	X	= Pieces that exceed the plot diameter.		
<i>SPECIES *R*</i> (2a-bp)	Identifies the species of the piece. Acceptable codes are as follows:			
	DOUGLAS FIR	- FI	WHITEBAR K 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

	LOGGEPOLE PINE	- LO	ALDER	- AL
	HEMLOCK	- HE	MAPLE	- MA
<i>KIND *R*</i> (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.

Down Trees (D)

Includes all down trees exceeding the timber merchantability specification.

Standing Trees (T)

Includes all standing trees exceeding the timber merchantability specifications.

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 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.

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 waste 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 licensee's cut-control according to its 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.
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5.8.3 Gross 'In Plot' Dimensions for Pieces

The piece dimensions 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)	<p>Identifies the grade of the piece regardless of the kind of wood or waste class.</p> <p>For a complete description of the log grades, Coast or Interior, refer to the <i>Scaling Manual</i>.</p> <p>Waste surveyors on the <i>Coast</i>, must correctly identify "J", "U", "X", "Y", "dry Y" and "Z" grades.</p>  <p>Waste surveyors in the <i>Interior</i> must be able to correctly identify all interior grades (1, 2, 4, dry 4, 6 and Z).</p>
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Dry Y (Coast) or Dry 4 (Interior), (former grade 5, not measured in waste, and is defined as follows)

Summary of the Grade Rule (for all species)

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

Log requirements for the grade:

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

- deteriorated cambium,
- loose or shedding bark,
- sap rot,
- wood borers,
- deep checks (not weather checks).

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

- curling bark (green bark that is curling or cupping due to the drying process),
- 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 at least one *Indicator* plus one or more *Contraindicators* are deemed to have come from a live, green tree.

Where the logs display characteristics (e.g., sun checks) which were caused by delays between timber felling and survey, they do not qualify as dry 4 or Y.

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 waste assessments 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.

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

<i>LENG. - LENGTH *S*</i> (2.1n-rj)	Quantifies the length deduction in tenths of metres.
<i>TOP *S*</i> (2n-rj)	Quantifies, in rads, the diameter deduction for the top end.
<i>BUTT *S*</i> (2n - rj)	Quantifies, in rads, the diameter deduction for the butt end.
<i>D - DEFECT TYPE *S*</i> (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

Outside plot measurements are not required in the new Waste System.

Everything to the right of decay type on the Waste Survey Plot Tally Card is optional and does not 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).

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

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

$$\text{VOLUME} = [(t * t) + (b * b)] * L * K$$

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).

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

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