TIMBER PRICING BRANCH

Provincial Logging Residue and Waste Measurement Procedures Manual – Interior Version

Effective: April 1, 2019

Includes Amendments	Effective Date
Amendment No. 1	July 22, 2019
Amendment No. 2	September 1, 2020
Amendment No. 3	April 1, 2021
Amendment No. 4	June 17, 2021
Amendment No. 5	November 15, 2021
Amendment No. 6	April 1, 2022
Amendment No. 7	November 21, 2022
Amendment No. 8	May 15, 2023
Amendment No. 9	September 1, 2023

BRITISH COLUMBIA

Amendment No. 9 – Provincial Logging Residue and Waste Procedures Manual – Interior Version Highlights

Section, Table or Appendix Number	Description
4.3	Reporting requirements have been revised. The Timber Pricing Branch area calculation spreadsheet must be included in a submission.
4.3.2	Eligibility criteria for using district averages instead of a field survey have been revised. Forest Investment Program tenures may use district averages instead of a field survey.

Table of Contents

Appendices

List of Figures

List of Tables

1. Administration

1.1 Introduction

In British Columbia, the right to harvest Crown timber is conferred through the form of agreements under the Forest Act. The Forest Act and subsequent agreements require licensees to carry out waste and residue assessments.

Waste assessments are carried out to quantify the volumes of waste and residue remaining on harvested areas following the completion of harvesting operations. Waste assessments obtain an unbiased estimate of the volume and quality of timber on a cutblock whether standing or felled, that meets or exceeds the timber merchantability specifications which was not removed from the cutting authority area and was not reserved from cutting. The 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 reference for industry and government staff who conduct or check waste assessments in British Columbia.

The Waste Assessment Policy can be found online at:
https://www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/timber-pricing/forest-residue-waste

1.2 Authority and Obligations

1.2.1 Authority

The right to harvest Crown timber is granted in the form of agreements under the *Forest Act.*

Waste assessments are carried out under the authority of:

1. The *Forest Act* section 103.1 and other related sections,
2. Agreements and cutting authority documents, and
3. The *Provincial Logging Residue and Waste Measurement Procedures Manual*.

The licensee has the discretion of whether or not to harvest the timber from the agreement area subject to the forest management standards required.

Under the *Forest Act* and the agreements, the licensee must pay a waste assessment for timber not harvested.

1.2.2 Continuing Liability

In accordance with section 79 of the *Forest Act***,** and notwithstanding the timeframes specified in section 4.2 for conducting and submitting a waste assessment, and despite the expiry, surrender, suspension or cancellation of a holder's agreement, the holder of an agreement 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.

1.3 Applicability

The manual is applicable to waste assessments located in the North Area, South Area, and Manning Park.

1.3.1 Application Dates

This manual applies to timber sales advertised, or cutting authorities issued on or after the dates specified in the most recent amendment of the *Provincial Logging Residue and Waste Measurement Procedures Manual.*

1.3.2 Scale Based Cutting Authorities

Where the amount of stumpage payable on the timber harvested from a cutting authority is calculated using the information reported in a scale of the timber, the holder of the agreement must conduct a waste assessment on that cutting authority.

1.3.3 Cruise Based Cutting Authorities

On a cruise based cutting authority, where the amount of stumpage payable is calculated using information reported in a cruise of the timber, the entirety of merchantable volume is billed as harvest volume. Therefore, the holder of the agreement is not required to conduct a waste assessment on that cutting authority.

On an area based cutting authority where the amount of stumpage payable is calculated using the Reserve Stumpage Rate ($/hectare) listed in Table 6-8 of the Interior Appraisal Manual, the entirety of merchantable volume is billed as harvest volume. As such, that cutting authority is treated as a cruise based cutting authority and a waste assessment is not required.

1.3.4 Forestry Licence to Cut Issued Under *Licence to Cut Regulation Section 1 - Protecting Communities from Wildfire*

This section applies to Forestry Licences to Cut that are issued with a contract to intensively manage forest fuels for the purpose of protecting communities from wildfire. Waste in the dispersed subpopulation is minimized as part of the fuel management prescription.

This section applies to a Forestry Licence to Cut that meets all of the following conditions:

1) The Forestry Licence to Cut is issued under Licence to Cut Regulation Section 1 - Protecting Communities from Wildfire.
2) The cost of performing contract obligations is expected to be greater than the value of the forest products that are authorized for harvest. A documented process is used to ensure that economic harvest opportunities are identified and in those scenarios this section does not apply.
3) The Forestry Licence to Cut is issued as part of a contract under a government of BC program to protect communities from wildfire.

The contract is supervised by a qualified receiver (QR) who is a Government of BC employee.
4) The amount of timber to be retained is described in the contract.

Where the conditions in this section are met, the waste assessment is determined using one of the methods below:

1) A waste survey is performed, such that:
   a) The dispersed subpopulation is sampled using sampling methods described in the contract,
   b) The accumulation subpopulation is sampled using single waste assessment area sampling methods described in other sections of this manual, or
2) District averages may be used for the entire waste assessment area if eligible under Section 4.3.2.

Cut pieces that may be required to meet coarse woody debris requirements are counted as avoidable waste and are included in the waste benchmarks.

Standing trees are not tallied as waste within these treatment areas. Previously existing windfall trees that are specified in the contract to be treated (branches removed) and left on the harvest site are not tallied as waste.

The District Manager may require the contract holder to conduct a full waste survey under other sections of this manual if contract requirements are not met.

1.4 Responsibility

The responsibilities are as follows:

1.4.1 Timber Pricing Branch

1.4.1.1 Director, Timber Pricing Branch

The Director, Timber Pricing Branch is responsible for:

1. Approving *Provincial Logging Residue and Waste Measurement Procedures Manual* and amendments.
2. Processing and maintaining waste data.
3. Billing licensees by issuing waste invoices.

1.4.1.2 Residue and Log Salvage Policy Forester, Timber Pricing Branch

The Residue and Log Salvage Policy Forester is responsible for:

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

1.4.2 Area Director of Pricing and Tenures

The Area Director of Pricing and Tenures 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 the Director, Timber Pricing Branch.
3. Advising industry and forest district staff on matters relating to waste assessments.
4. Processing waste reports and FS 702 for waste monetary billing and cut control where required.

5. Providing Waste System guidance and training to district staff and industry users.

1.4.3 District Manager

The District Manager is responsible for:

1. Conducting check surveys in accordance with manual standards.
2. Implementing and administering the policy and procedures and recommending survey procedure changes where necessary to the Regional Manager.
3. Approving waste assessments and issuing reporting unit numbers in the Waste System.
4. Checking for completeness of licensees submitted reports.
5. Processing waste reports and FS 702 for waste monetary billing and cut control where required.

1.4.4 Timber Sales Manager

Unless otherwise specified in the agreement, the Timber Sales Manager is responsible for:

1. Ensuring BCTS Licensees submit waste assessments in accordance with licence agreements, Waste Policy and the *Provincial Logging Waste Measurement Procedures Manual.*
2. Where a BCTS Licensee does not submit a waste assessment as required under section 1.4.4(1) the Timber Sales Manager may carry out the assessment, and in a notice given to the holder, may require the holder to pay the costs incurred by the Timber Sales Manager in carrying out the assessment.

1.4.5 Licensees

Agreement holders are responsible for conducting waste assessments on their scale based cutting authorities in accordance with the *Forest Act*.

The licensees are responsible for:

1. Submitting waste assessment plans.
2. Conducting waste assessments in accordance with this manual.
3. Submitting waste data into the online Waste System.

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

1.4.5.1 Complete and Accurate Information

In accordance with section 105.1 (3) of the Forest Act, the licensee must ensure that any information that is submitted to the government for the purposes of a waste assessment or check survey is complete and accurate at the time the information is submitted.

1.5 Waste Assessor Qualifications

The minimum requirements for completion and submission of waste surveys are as follows.

1.5.1 Waste Sample Planning

Preparation of sample plans including development of sample populations, sampling designs and waste assessment area survey plans must be completed or endorsed by a Registered Forest Professional (RPF or RFT).

1.5.2 Field Survey

Field survey work, including the establishment of survey plot samples, estimation of plot volumes, measurement of plot pieces, collection of waste data, and upload of waste data into the Harvest Residue Compiler software must be completed by a person that is competent in field measurements, plot survey techniques, cruising and/or scaling.

1.5.3 Survey Compilation and Reporting

Compilation and reporting of waste assessment information must be completed or endorsed by a Registered Forest Professional (RPF or RFT).

1.6 Data Collection and Compilation Programs

To support the collection and compilation of waste data, the Ministry of Forests, Lands, Natural Resource Operations and Rural Development maintains three software programs: the Waste System, the Harvest Residue Compiler (HRC), and EForwasteBC.

1.6.1 The Waste System

The Waste System is used to submit waste information, generate reports and upload data into the Harvest Billing System for billing.

1. Access is provided through the Waste System application located on the Timber Pricing Branch website.
2. The system can be accessed at: https://apps.nrs.gov.bc.ca/ext/waste-for/
3. Users may follow the procedures in the *Waste System User Procedures Manual* at: http://www.for.gov.bc.ca/hva/rh/rwtraining/

1.6.2 The Harvest Residue Compiler

The Harvest Residue Compiler (HRC) is used by waste planners to create waste sampling plans, collect and compile waste assessment area and population information and export data to the Waste System.

1. HRC is available at: https://apps.nrs.gov.bc.ca/pub/hrc/
2. Users may follow the procedures in the *Harvest Residue Compiler User Guide* on the Timber Pricing Branch website.

1.6.3 EForwasteBC

EForwasteBC (EFW) is an iPad-based software application used by waste surveyors to collect waste assessment area survey information.

1. EForwasteBC is available from the Apple App store.
2. A user manual is available on the Timber Pricing Branch website.
3. The most recent available version of EForWasteBC must be used to collect survey information.
4. The following data changes are restricted:
    a. Plot data changes must be rare and justifiable. A rationale with signature must be

provided for specific changes, where supported by the EForWasteBC version in use. To ensure accurate information is submitted, as required by the Act, internal company audits must be done before survey data is submitted to government.

b. A plot can be created, and data can be entered only in the field at the established plot location.

c. Plots can only be deleted where they were entered in error (e.g., a typo).

d. Plot prediction volumes cannot be changed after the original estimate is entered.

e. Measure factors can only be changed where they were entered in error.

f. Other plot data can only be changed where they were entered in error.

g. An EForWasteBC file for a survey file must not be deleted. A survey can only be submitted using data that was collected in the field at the appropriate plot locations. (Data cannot be re-typed by hand after the original data was collected. Merged files are acceptable where multiple surveyors worked on the same population). Where more than one surveyor worked on a population, the original EFW files must be provided upon request.

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2. Waste Relief

2.1 Applications

A licensee may apply, in writing, for waste relief with respect to the timber left on a cutting authority provided the government has not issued a waste assessment (invoice) for the timber to the licensee.

2.1.1 Initiating an Application for Waste Relief

An application for waste relief must include:

1. a written statement from the licensee that:
    a. identifies the applicable Part of the Waste Relief Policy under which the application is made; and
    b. explains the basis on which the licensee considers that the circumstances relating to the cutting authority meet the criteria of that Part;
2. any evidence upon which the licensee relies; and
3. data on the timber volumes and grades in relation to which the licensee is seeking the relief (the "**supporting data**")

(collectively, the "**application**").

The supporting data under paragraph 3 must:

a. provide an accurate estimate of the timber volume remaining on each cutblock in the cutting authority. The estimate of remaining timber volume may be determined by methods that include, but are not necessarily limited to, one or more of the following:
    i. a full waste survey conducted in accordance with this manual;
    ii. a timber cruise with a map showing the locations of the timber included in the application.
b. be submitted into the Waste System with a notation or comment in the Waste System identifying that the information pertains to an application for waste relief.

The licensee must submit the written statement and evidence to the Area Director of Pricing and Tenures and the supporting data into the Waste System.

2.1.2 Processing of Application

Following receipt of an application that complies with the requirements of section 2.1.1, the Area Director of Pricing and Tenures will direct the preparation of a draft information package that includes:

1. the licensee's application;
2. relevant additional information on the cutting authority;
3. an estimated waste monetary assessment based on the timber grade profile (for each cutblock in the application as applicable) and the applicable waste rates;

4. if the application is made under Part 2 of the Waste Relief Policy, an assessment of the opportunity for resale of the timber included in the application, including the current market value; and
5. a draft Briefing Note to the ADM providing analysis of whether the application meets the criteria of the Waste Relief Policy and should be approved.

The Area Director of Pricing and Tenures will forward the draft information package in electronic form to the Director, Timber Pricing Branch, Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

The Director, Timber Pricing Branch will review, update, and submit the information package to the ADM for a preliminary assessment.

If the ADM's preliminary assessment following review of the information package is that the application:

1. should not be approved:
    a. the ADM will disclose to the licensee the evidence and rationale supporting the preliminary assessment and offer the licensee the opportunity to respond within a defined period;
    b. any response from the licensee must be submitted to the ADM and is appended into the information package;
    c. if the ADM determines that further clarification is needed, the ADM will offer the licensee the opportunity to provide such clarification within a defined period, and any response from the licensee must likewise be submitted to the ADM and appended into the information package;
    d. once the ADM is satisfied that no further clarification is required regarding the licensee's response the information package is deemed to be final; and
    e. the final waste relief determination is made under section 2.1.3.
2. should be approved:
    a. the information package is deemed to be final, and the final waste relief determination is made under section 2.1.3.

2.1.3 Final Waste Relief Determination

Following review of the final information package, the ADM will approve or reject the application and notify the licensee, with a copy to the District Manager, the Timber Sales Manager in the case of BCTS agreements, and the Area Director of Pricing and Tenures.

If the application is rejected, the waste survey will be processed, and an invoice will be issued for the timber included in the application.

If the application is approved, the waste survey submission status in the Waste System will be updated so that billing will not occur for the timber included in the application.

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3. Timber Merchantability Specifications and Waste Monetary Billing

3.1 Timber Merchantability Specifications

Timber merchantability specifications are based on the determination of maturity in a timber cruise of the cutblock and are further refined by species.

Table 3-1 Interior Timber Merchantability Specifications

Description		**All Stands**
Stumps **Measured on the side of the stump adjacent to the highest ground.		
•	No higher than	30 cm
Diameter (outside bark) at stump height		
•	Lodgepole pine: all timber that meets or exceeds	7.5 rads (15 cm)
•	All other species: all timber that meets or exceeds	10 rads (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	5 rads (10 cm)
•	For all cedar older than 141 years	7.5 rads (15 cm)
Minimum length		
•	Log	3 m
•	Bucking waste	0.1 m

3.2 Waste Monetary Billing

Waste volumes are measured and billed monetarily in accordance with the following table.

Table 3-2 The Disposition of Residue and Waste Volumes in Monetary Billing

Table Effective April 1, 2019 (Valid for All Species)							
Waste Type	**Grade**	**Avoidable**			**Unavoidable**		
		Measure / Record	**Rate**	**AAC**	**Measure / Record**	**Rate**	**AAC**
Sawlog	1 and 2	Yes	Full $[1]	Yes	Yes	$0.00	Yes
Lumber Reject (Green or Dead and Dry)	4	Yes	$0.25	Yes	Yes	$0.00	Yes
Undersize	6	Do not tally unless mandatory utilization[2]	$0.25[3]	No	Do not tally unless mandatory utilization[2]	$0.00	No
Firmwood Reject	Z	Do not tally	$0.00	No	Do not tally	$0.00	No

1: Full Waste Rate ($/m^3) from section 3.2.2
2: Do not tally unless required to be measured by the cutting authority document.
3: Except where the upset stumpage rate is determined under section 6.2.1(1)(a) and (b) and 5.1.1(4) of the Interior Appraisal Manual.

3.2.1 Waste Amount Payable

For merchantable Crown timber that is not cut and removed, the amount payable is calculated by multiplying the volumes of avoidable waste reported in a waste assessment by the applicable waste rate.

Unavoidable waste volumes will not result in amounts payable but will be included in the harvested volume for cut control purposes when applicable in accordance with the *Forest Act*.

3.2.2 Waste Rate

The application of a waste rate is dependent on whether there has been timber harvesting on a cutting authority. A waste rate is determined for each waste assessment area in the cutting authority when timber has been harvested.

The waste rate applies to dispersed waste, accumulations, and standing timber within the waste assessment area and will be determined as outlined in this section.

The applicable rates charged will include any bonus bids and levies as applicable.

1. Avoidable coniferous species graded:
    a. Grade 1 and 2 are billed using the weighted average sawlog stumpage rate for the 12 month period multiplied by the waste monetary reduction factor (WMRF), and
    b. Grade 4 is billed using the rates established in the *Interior Appraisal Manual*.
2. Avoidable deciduous species graded:
    a. Sawlog is billed using either:
        i. The appraised rate, or, if there is no appraised rate,
        ii. The fixed rate for the species as specified in the *Interior Appraisal Manual*, and
    b. Other than sawlog is billed using the fixed rate in the *Interior Appraisal Manual*.

3.2.2.1 Waste Assessment Areas with Harvesting

For waste assessment areas with harvesting, the waste rate for coniferous sawlogs is calculated using the weighted average stumpage rate invoiced for the sawlogs (grade code 1 and 2) using the following formula:

$$\mathbf{WR = TS / TV}$$

Where:

1. **WR** = The waste rate for the cutting authority.
2. **TS*** = Total billed sawlog stumpage (sum of Upset Stumpage*, and Bonus Bid) for timber harvested under the applicable timber mark for the twelve-month period ending one month after the month the waste assessment area was PLC.
3. **TV*** = Total billed volume (accumulated volume in cubic metres that derived the total billed stumpage for the sawlogs) for the twelve-month period ending one month after the month the waste assessment area was PLC.

a. ***TV** includes silviculture and development levies.

Remaining areas of standing timber within a waste assessment area that are left unharvested at the expiry, surrender, termination, or cancellation of the cutting authority are waste billed using the PLC date for the cutblock.

3.2.2.2 Cutblocks with No Harvesting but Harvesting has Occurred on the Cutting Authority

If there has been no harvesting on the cutblock but there has been harvesting for the cutting authority, then the conifer stumpage rate for the cutblock is derived using the average of the cutting authority's four quarterly timber appraisal stumpage rate (plus any bonus and levies where applicable) in effect during the twelve-months preceding the date of cutting authority's expiry, surrender, termination, or cancellation.

The formula to be used is:

WR = ACASR

Where:

1. **WR** = The waste rate for the cutblock
2. **ACASR** = Average Cutting Authority Stumpage Rate over the four quarters preceding the expiry, surrender, termination, or cancellation date.

Example 1

If Cutting Authority A (CP A) became effective on September 5, 2017, and expires on September 4, 2018, then the ACASR is the simple average of the four quarterly stumpage rates for CP A from October 1, 2017, January 1, 2018, April 1, 2018 to July 1, 2018.

Example 2

If Cutting Authority B (CP B) became effective on April 20, 2016, and is surrendered on September 5, 2016, then the ACASR is the simple average of the April 20, 2016 and July 1, 2016 stumpage rates for CP B.

3.2.2.3 Cutblocks with No Harvesting and No Harvesting has Occurred on the Cutting Authority

If there has been no harvesting on the cutblock and there has been no harvesting on the cutting authority, then waste billings do not apply to cutblocks upon expiry, surrender, termination or cancellation of the cutting authority.

3.3 Waste Benchmarks

3.3.1 Benchmark Levels

The following waste benchmarks will be used for monetary billing of avoidable conifer sawlog grade waste volumes and are applied on an individual waste assessment area basis until further notice.

Table 3-3 Interior Benchmark Levels

	Dry Belt	**Transition**	**Wet Belt**
Benchmark Level	4 m^3/ha	10 m^3/ha	20 m^3/ha

Where a cutblock or a partial cutblock contains one or more biogeoclimatic zones, the benchmark applying to the waste assessment area will be determined by the zone covering the largest proportion of the cutblock area.

The waste benchmarks by biogeoclimatic zone are available on the Timber Pricing Branch website.

3.3.2 Benchmark Eligibility

The benchmarks are administered on an individual waste assessment area basis. Therefore, each waste assessment area must be individually assessed to determine whether the avoidable waste within the waste assessment area is above or below the benchmark.

Waste benchmarks do not apply to unharvested cutblocks.

Merchantable volume that may be required to meet coarse woody debris requirements must be tallied as waste and will be included in the waste benchmarks. No special provisions are made for coarse woody debris in waste assessments.

3.3.3 Benchmark Calculations and Billings

The waste benchmark volume for a waste assessment area is derived by multiplying the benchmark level value with the total of the dispersed, accumulation, and standing trees subpopulation area reported in a waste assessment.

Avoidable waste volumes in conifer sawlog grades 1 and 2 from the dispersed, accumulated and the standing tree subpopulations of the waste assessment area will be applied to the benchmarks.

Where the avoidable waste volumes in conifer sawlog grades are below the established benchmark for the waste assessment area, no monetary billing of avoidable waste in conifer sawlog grades will be made.

Where the avoidable waste volumes in conifer sawlog grades are above the established benchmark for the waste assessment area, monetary billings will be made on the conifer sawlog grade volumes exceeding the benchmark. Avoidable waste volumes in grade 4 will not be applied to the benchmark but will be billed monetarily in all cases.

3.3.4 WMRF and Billing

A waste monetary reduction factor (WMRF) is calculated for billing purposes. The WMRF is applied to the waste rate as determined in section 3.2.2 to calculate the conifer grade 1 and 2 waste amount payable.

The WMRF is calculated to 4 decimal points and the minimum is 0.0000.

The formula for calculating the WMRF is:

$$\frac{\mathbf{AV - BM}}{\mathbf{AV}} = \mathbf{WMRF}$$

Where:

1. **AV*=** Avoidable Sawlog Waste Volume (m^3/ha)
    a. ***AV** is the avoidable coniferous sawlog (grade 1 and 2) waste volumes.
2. **BM =** Benchmark Value (m^3/ha)
3. **WMRF =** Waste Monetary Reduction Factor

See Appendix 2 for an example.

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4. Reporting Structure, Timeframes, and Requirements

4.1 Reporting Structure

Waste assessments are reported in the Waste System using a reporting unit that is unique to a Forest District and the client number associated with a licence (or licences).

In the Waste System, reporting units are created for the following reporting options:

1. Cutblock option – used to report a single waste assessment area as a sampling population.
2. Aggregate option – used to report multiple waste assessment areas as a combined sampling population.

4.1.1 Single Waste Assessment Area Population Reporting Units

Where the holder of an agreement uses the single waste assessment area option, each waste assessment area may be submitted:

1. In separate reporting units, or
2. In one reporting unit. Under this option, a new reporting unit must be created every calendar year.

4.1.2 Aggregate Population Reporting Units

Where the holder of an agreement uses the aggregate population option, waste assessment areas form an aggregate reporting unit. Individual reporting units must be created for each sample plan.

4.2 Timeframes

The completion and submission of waste surveys are linked to the PLC date and the seasonal ability to complete field measurements. Waste surveys cannot be completed when snow is present in sufficient quantities to prevent the accurate measurement and grading of waste pieces.

4.2.1 Submission Timelines

Each waste assessment area has a unique due date for final submission to the Waste System, based on its PLC date. When building a survey population, care must be taken to ensure that none of the waste assessment areas within an aggregate population will be submitted late. Survey plans, interim submissions and final submissions to the Waste System must be submitted within the timelines in Table 4-1, below.

Table 4-1 Submission Due Dates

Extensions will not be granted on these submission due dates.

Population Format	Submit Sample Plan to District Manager?	Initial Sample Plan Due Date	Waste Assessment Area Survey Map Due Date	Interim Submission Due Date	Compilation and Submission into the Waste System Due Date
Single Waste Assessment Area	No	N/A	A minimum of 1 day before the survey	30 days after survey date.	12 months after PLC.
Aggregate Population	Yes	A minimum of 7 days before starting the field survey.	A minimum of 1 day before the survey.	30 days after survey date.	12 months after PLC.
Simplified Waste Survey				n/a	12 months after the earliest PLC in the population.
Surveys using District Averages				n/a	12 months after PLC.

Field surveys must be coordinated to allow sufficient snow-free time for an interim submission and field audit as may be required by ministry staff, prior to the following activities:

1. The commencement of any silvicultural site treatments.
2. The reduction of the fuel hazard as required by the Wildfire Regulation section 12.1, or as required by the WUI practice requirement.

The activities above may commence 30 snow-free days after the interim submission where:

1. Ministry staff have not indicated that a field audit is planned for the cutblock.

The activities above may commence earlier than 30 snow-free days where:

1. Ministry staff have indicated that a field audit has met the standards in this manual and no further audit is planned.
2. Ministry staff have received and reviewed an interim or final submission and indicated that the cutblock will not be field audited.
3. The randomized block selection identified that the cutblock is a non-sample block in an aggregate population.
4. The endorsed HRC sampling plan identifies the cutblock as not requiring any plots.

Submissions must be complete and accurate to be considered submitted. Hazard abatement or site prep must not be conducted on a cutblock with a waste survey in rejected status, or where ministry staff have indicated that the cutblock will be field audited, or where ministry staff have indicated that the cutblock does not meet standards in this manual.

Where interim submissions are submitted later than September 15, the licensee accepts that hazard abatement or site prep will be delayed until a snow free period of at least 30 days for ministry checking has been provided. Ministry staff will coordinate with licensees if more time is required to conduct field audits on specific cutblocks.

Under the above timelines, seasonal snow will not restrict completion timelines, and extensions to the above due dates will not be granted. Extensions for a final aggregate submission to the waste system will not be granted.

In accordance with Table 4-1, survey plot data for individual waste assessment areas must be submitted to the Natural Resource District within 30 days after the survey date. The interim submission must include:

1. Survey data (.efw file),
2. Marked up original survey plan map with all information that is required on the final map. It may have hand-written notes or iPad notations.

3. Stratum areas, and any supporting information that will affect compiled volumes (billable and cut control) and grades.

Woodlot licences and Community Forest Agreements must define the PLC date and submit waste surveys at least once for each year and each cutblock in which harvesting occurred.

4.2.2 Overdue Waste Assessments and Reports

The Waste Assessment Regulation is in effect. The Minister or their delegate may issue penalties for late waste assessments:

Waste Assessment Regulation (gov.bc.ca)

Late submission of a waste survey may also result in billing delays.

For the purposes of the Waste Assessment Regulation, interim submissions and submissions to the Waste System are both considered to be proposed waste assessments. As such, late waste penalties may be applied if timelines for either of these are not met.

Where the holder of an agreement, other than an agreement entered into with the timber sales manager, does not complete the waste assessment and submit it to the District Manager as required under section 4.2, the District Manager may, in a notice given to the licensees, take actions to complete and submit a waste assessment for a block or blocks. The District Manager may complete a survey or hire a contractor and require the holder to pay the costs incurred in carrying out the assessment.

Where the holder of an agreement entered into with the Timber Sales Manager that is required by that agreement to conduct a waste assessment, fails to conduct that waste assessment, the Timber Sales Manager may carry out the assessment, and in a notice given to the holder, may require the holder to pay the costs incurred by the Timber Sales Manager in carrying out the assessment.

4.2.3 Waste Survey Extensions in 2022

Timelines for compilation and submission into the Waste System have been extended in 2022. Surveys that were required by this manual to be submitted in June 30, 2022 or September 15, 2022 are now due on December 31, 2022.

4.3 Reporting Requirements

Waste assessments must be surveyed and submitted to the Waste System and include the items outlined below:

1. Licensees must enter and submit the data into the Waste System for a waste assessment area as required in section 4.2.
2. A final survey map for each waste assessment area as required in Table 6-1.
3. The Timber Pricing Branch Area Calculator must be included in the submission <deleted text>.
4. A post-harvest certification that reconciles remaining trees, standing waste, and reserved timber in the final appraisal or reappraisal. See section 9.5.2 and Appendix 12 for details. describing the post harvest condition of the waste assessment area.
    a. This form is not required for cutblocks within cutting authorities that are billed using tabular rates, since standing waste does not apply.
    b. This form is not required for cutblocks within BCTS tenures, since post-harvest reappraisal does not apply and all uncut trees that remain within the cutting authority area are tallied as standing waste.
    c. This form is required for non-sample cutblocks within an aggregate population.
5. The following files must be uploaded into the Waste System using zip files:
    a. The final version of the sample plan report from HRC,
    b. The Original Aggregate Sample Plan,
    c. The EFW file, and
    d. The HRC file used for compilation.
    e. Original survey map.
    f. Plot prediction report from EForWasteBC.
6. If the person submitting the survey information into the Waste System is not a Registered Forest Professional, an endorsed cover letter from a Registered Forest Professional accepting responsibility for the submission information must be submitted. This letter must include the Registered Forest Professional's designation and registration number.
7. The agreement between parties when a population contains waste assessment areas from different client codes.

HRC, EFW files, GPS shapefiles, PRP tables, traverse notes, and plot cards will be stored by the Licensee and made available to the Ministry upon request.

4.3.1 Material Disposed of Prior to Waste Assessments

The procedures in this section do not supersede the requirement to complete a survey to the applicable standards described this manual. It is a contravention of the Act to burn or dispose of timber before requirements or approvals in this manual are achieved.

If waste materials within any strata of a waste assessment area are burnt or disposed of prior to the completion and submission of a waste assessment as specified in section 4.2, the licensee must notify the District Manager. Where a fire or other event has destroyed timber that is required to be included in a waste assessment, the District Manager may require district averages that are published on the Timber Pricing Branch website to be used in the waste assessment. The District Manager may determine higher waste volumes using other information if district averages do not provide a reasonable assessment.

4.3.2 Waste Assessment Areas Using District Averages

The following waste assessment areas may not require field sampling:

1. Forestry Licence to Cut with a volume limit of 2,000 m^3 or less, written in the licence agreement.
2. Occupant Licence to Cut with a volume limit of 2,000 m^3 or less, written in the licence agreement.
3. Forestry Licence to Cut issued under 47.6 (3) of the Act in conjunction with an activity funded out of the BCTS account.
4. Forestry Licence to Cut issued under Section 47.6 (2)(d) of the Act and Section 4 of the LTC Regulation, and utilizes Section 6.2.1 (1)(d) of the Interior Appraisal Manual (with set sawlog stumpage rate of $\$1.20/m^3$) in conjunction with an activity funded by the Forest Investment Program (i.e. Forests for Tomorrow).
5. A scale based right of way accessing a cruise based cutblock.
6. A cutblock within a blanket salvage cutting authority (under the Interior Appraisal Manual section 6.4.2).
7. A cutblock smaller than 2.0 ha. This paragraph does not apply to partial cutblocks or patch cut cutblocks.

Where this method is used, a letter must be attached to the waste system submission that describes which criterion applies.

The waste volume for the waste assessment areas described in this section will normally be billed using district average waste volumes and grades published on the Timber Pricing Branch website. Species percentage is determined using Mark Monthly Billing History Selection Report in HBS.

This section does not apply to tenures in which an excessive volume of timber has been left on site or where all timber has been cut and left on the cutting authority area. (E.g. glading or "felled and bucked" timber.) The District Manager may determine higher waste volumes using other information if district averages do not provide a reasonable assessment. The District Manager or Regional Manager may direct the licensee to complete a full waste survey involving field sampling according to other sections of this manual.

5. Sample Populations and Sampling Designs

5.1 Overview

The sampling designs provide the basis for obtaining the waste and residue volume estimate for the sample population.

The main steps in selecting a sample design and creating a sample plan are:

1. Defining the population of interest.
2. Selecting a sampling design.
    a. Some of the sampling options are designed to increase the efficiency of sampling (i.e. lower costs) and improve the precision of the estimates.
    b. The sampling design chosen will determine how waste assessment areas are selected for sampling, how data is collected within the waste assessment areas, and how the results from the sample are applied to the population.
3. Developing the sample plan for the population.
    a. The sample plan describes the details of how the sample will be completed, including what waste assessment area(s) are included in the sample, and where the plots are located.

Once these steps are completed, the plan can be implemented. This involves collecting field data from the sample plots, compiling the data, reviewing the results, and submitting the information into the Waste System.

5.2 Sample Populations

The sample population is the total net area of all waste assessment areas where estimates of waste and residue volumes are required.

The population is determined by the number of waste assessment areas in the population.

The sample populations are:

1. Single Waste Assessment Area
    a. The sample population is one waste assessment area.
    b. In this population, a single waste assessment area is sampled to obtain the waste and residue estimate.
2. Aggregate Population:
    a. The sample population contains 2 or more waste assessment areas with a total net area of less than 3,000 ha.
    b. Waste assessment areas in an aggregate population are aggregated into one population for sampling and reporting.
    c. In an aggregate, the results for the population are applied to each waste assessment area within the population, with each stratum receiving the same estimate of volume per hectare by species and grade.
    d. Waste assessment areas within the aggregate that are not selected for sampling do not require stratification. These waste assessment areas are assigned stratum areas proportional to the total stratum areas of the sampled waste assessment areas.

5.3 Sampling Designs

The sampling principles used to collect and compile waste information are simple random sampling (SRS) and ratio adjustment (Ratio) sampling. The sampling design names specify which principle is used.

5.3.1 Single Waste Assessment Area or Aggregate Population Sampling Designs

The following designs are used on single waste assessment areas or aggregate populations and employ a single sampling principle to develop the result:

- SRS, or
- Ratio.

5.4 Sampling Designs Within Single Waste Assessment Area and Aggregate Populations

5.4.1 Simple Random Sampling

Simple random sampling uses only measure plots. Within the waste assessment area, a predetermined number of sample plots are established, measured, and averaged to determine an estimate of volume for the population.

5.4.2 Ratio Adjustment Sampling

In ratio adjustment sampling, a predetermined number of prediction plots are established, and a random selection of these plots are measured. After a prediction is entered into EForWasteBC, the software randomly determines whether the plot will require measurements. This system can increase sampling efficiency, while maintaining a low sampling error.

In a prediction plot, the surveyor must predict (estimate) the total volume (m^3) of merchantable timber (total of Grade 1, 2, and 4 only) within all dispersed or accumulation strata plots in the field at each plot location.

In this method:

1. Ratio adjustment sampling is implemented at the plot level,
2. A ratio between the measured plot volumes and predicted plot volumes is calculated. This ratio adjustment is applied to the average volume per hectare from all prediction plots in the stratum, and
3. The ratio-adjusted volumes per hectare are used to determine an estimated volume for the population, and
4. Volumes for each stratum are added to determine the total waste assessment area volume.

6. Sample Plans

6.1 Waste Sample Plan Development and Implementation

A waste sample plan involves the creation of a population using one of the sample designs described in Chapter 5 and calculation of the required number of plots for each waste assessment area in the plan.

The waste sample plan is the key document that provides the information needed by the waste surveyor to complete a waste survey and provides assurances to the Ministry that the waste assessment data was collected in an unbiased manner.

Waste sample plans are professional documents and must be:

1. Prepared by a qualified registered member (RPF, RFT) of the Association of BC Forest Professionals, or
2. Supervised and endorsed by a registered member (RPF, RFT) of the Association of BC Forest Professionals.

A licensee must submit initial and completed waste sample plans, and a waste assessment area survey map in accordance with section 4.2. A completed waste sample plan is prepared after all field surveying is complete and is submitted with the sample population.

The waste sample plan must be compliant with procedures within this manual; however it is not required to be approved by the District Manager.

A review of the sample plan may be completed at the time of initial submission or at the time of the final waste submission at the discretion of the District Manager. The initial plan will be compared to the final submission to ensure compliance with this manual.

6.2 Sample Plan Composition

6.2.1 Waste Assessment Area

A waste sample plan is composed of waste assessment areas. The estimated net waste areas and stratum areas used in the sample plan must be determined with care and due diligence. There can only be justifiable differences between the estimated and the final submission areas.

A waste assessment area can be a complete cutblock or the harvested portion of a cutblock.

Harvested portions of cutblocks may be submitted and sampled as separate waste assessment areas for each year of harvest when the harvest of a cutblock has occurred over multiple years.

Cutblocks containing both helicopter and conventional harvest methods must be separated into two waste assessment areas and sampled separately.

6.3 Population Structure

6.3.1 Aggregate Populations

An aggregate sample plan and population must meet the following requirements:

1) It is comprised of at least two waste assessment areas.
2) It has a net population size of less than 3,000 ha.
3) It is fully contained within:
   i) a single Natural Resource Region for Woodlots and Community Forest Agreements with a sharing agreement.
   ii) a single Natural Resource District for all other tenures.
4) Primary logging must be complete for all waste assessment areas in the population at the time of initial sample plan submission.
5) Helicopter-harvested areas cannot be combined with areas harvested by other methods.
6) BCTS waste assessment areas may be combined only with other waste assessment areas within the same Timber Sale Licence. BCTS waste assessment areas cannot be combined with non-BCTS waste assessment areas.
7) A population may be comprised of two or more licensees (client codes) if a written sharing agreement has been made between the licensees. The sharing agreement must bind each licensee to accept the aggregate survey results. Each licensee will need a separate RU for reporting purposes in the Waste System. The sharing agreement must be submitted in the Waste System in each reporting unit.
8) Woodlot Licences and Community Forest Agreements may establish sharing agreements between each other as described in (7) above. However, Woodlot Licences and Community Forest Agreements cannot be combined in an aggregate with any other tenures.
9) Cutblocks requiring utilization of Grade 6 cannot be combined with cutblocks where Grade 6 utilization is not required.

6.4 Stratification

Stratification can increase the precision of population volume estimates and reduce the amount of sampling required to achieve a desired level of precision. Therefore, it is useful to stratify subpopulations where possible and practical.

In waste assessments, stratification should be limited to significant differences in the relative quantity of waste. Unique strata must be easily and consistently identifiable and must be estimated in the same manner throughout the population. All stratification decisions must occur prior to field sampling and be identified on the waste assessment area survey map.

All strata within a waste assessment area must be correctly reported in the survey submission.

Each stratum must be assigned one of the three subpopulation types listed below and requires the minimum number of samples required for that stratum type. Each subpopulation must be sampled independently of other subpopulation areas.

Any stratification of waste types must be supported with field notes and a map, and must be consistently applied within each waste assessment area of the population.

Stratification of non-sampled waste assessment areas in aggregate populations is not required. HRC applies the stratum distribution present in the sampled waste assessment areas to the non-sampled waste assessment areas.

6.4.1 Subpopulations

Three subpopulations exist: accumulated, dispersed, and standing waste (trees). Each subpopulation may be subdivided into one or more strata.

Each subpopulation is a unique area, which cannot overlap another subpopulation. Likewise, one stratum cannot overlap another stratum. Accordingly, subpopulations and strata are always sampled independently of each other.

As described in 6.4.1.3.2, single or scattered trees may be included as part of the dispersed subpopulation.

6.4.1.1 Dispersed

Dispersed waste occurs on the areas from which trees have been cut and forwarded away from the stump. The majority of area in a waste survey will be in this stratum.

6.4.1.2 Accumulations

Accumulated waste occurs at receiving areas, such as landings or roadsides where trees have been forwarded and manufactured into logs. Accumulated strata can include spot accumulations,

roadside accumulations, windrows, and cold decks. Spot accumulations can also occur in the dispersed area where waste and debris has been gathered into piles.

Accumulated strata are differentiated from dispersed strata by different waste levels resulting from the deposition and processing of forwarded trees at a concentrated area.

Accumulation strata must not be confused with areas of high waste volume in the dispersed stratum.

There are various acceptable methods for stratification and sampling accumulations, which are described in section 8.5. Depending on the method used, these piles may be included as part of the dispersed subpopulation or the accumulation subpopulation.

6.4.1.3 Standing Waste

Standing waste consists of either patches, single, or scattered trees that are appraised for harvest, but are not cut. The surveyor must ensure that a standing waste stratum, where it consitutes its own subpopulation, is assigned the correct area in hectares, which is separate from the area in hectares of the dispersed subpopulation.

6.4.1.3.1 Standing Waste in Patches

Standing tree patches are areas of unharvested timber occupying an area of equal to or greater than 0.05 hectare. These patches must be stratified separately from the dispersed and accumulation strata and the volumes are determined with methods described in section 9.5.2. Only one standing waste stratum code for standing waste in patches may be used in a population.

6.4.1.3.2 Standing Waste Occurring as Individual Standing Trees

The method used to stratify individual standing tree waste must be consistent throughout a population. These trees may be stratified using one of two methods.

1) 100% scale or percent estimate.

2) Measurement within the dispersed plots.

Only one standing waste stratum code for individual standing trees may be used in a population.

6.5 Sample Size and Number of Plots

The selection of non-sampled waste assessment areas (for aggregates) and the required number of plots is based on the population or size.

To determine the number of plots within a sample plan:

1. For single waste assessment area populations, use Appendix 4
2. For aggregate populations, HRC auto-populates the number of plots in the sample plan using Appendix 4.

Non-sampled waste assessment areas are not used to determine the required number of plots.

6.5.1 Non-Sampled Waste Assessment Areas in an Aggregate

An aggregate population with a net size greater than 200 ha may not require all waste assessment areas to be sampled. A random process is used to select non-sampled waste assessment areas using the following formula:

The approximate area to be surveyed is:

$$200 + ((H - 200) * 0.33)$$

Where H is the total population size in hectares.

Non-sampled waste assessment areas will have waste assessments calculated as an average of the compiled waste volumes from all sampled waste assessment areas within the population.

6.6 Amendments

The integrity of a sample design depends on the identification of a population prior to sampling, and an unbiased plan that remains unchanged. Changes to a plan can significantly impact the sample size and the number of plots required. Since all waste assessment areas must be "primary logging complete" when the sample design is created, any amendments to a sample plan are expected to be very rare. Population and stratum areas affect the number of required plots and plot spacing; therefore, the sampling plan must be correct and durable. A waste survey may be rejected if there are unsubstantiated changes between the plan and the final submission.

Changes to a sampling plan should only be related to issues that affect good forest management or other operational issues (i.e. wildfire or landslide occurred after the sampling plan was submitted).

The submitting forest professional recognizes that changes to a plan, such as the addition or removal of a waste assessment area or a significant change in area will significantly alter the sample plan requirements. The forest professional will assess the impact of the changes against the principles of sampling identified in these standards.

The submitting forest professional will submit a rationale for any changes to a sample plan. This model is consistent with the direction of professional reliance.

For guidance on how to prepare a professional rationale, please refer to the document *Guidance for Professional Quality Rationales and Commitments* published by and available on the Association of BC Forest Professionals website.

The District Manager, applying the principles identified in this manual, will make a determination on each change on a case by case basis and decide if the amended plan is acceptable.

6.7 Implementation

6.7.1 Single Waste Assessment Area Sample Plans

1. Identify the sample population,
2. Select a sampling design,
3. Determine the sample size, including:
    a. The number of plots in dispersed strata
    b. The number of accumulation samples,
4. Prepare the waste assessment area survey map,
5. The waste assessment area survey map is signed by a Forest Professional, and
6. Submit the waste assessment area survey map.

6.7.2 Aggregate Sample Plans

1. Identify the sample population,
2. For populations larger than 200 ha, submit the list of waste assessment areas and required details to Timber Pricing Branch using the required template. This step is optional. If a randomizer request is not submitted, all waste assessment areas in the population must be included in the sampling plan.
3. Timber Pricing Branch will select the non-sampled waste assessment areas using a randomizer application. The selection list will be sent back to the submitter with a copy to the District and Area.
4. Select a sampling design (SRS or ratio),
5. Using the Aggregate Sample Plan in HRC, enter all waste assessment areas in the population and identify which are selected by Timber Pricing Branch for sampling:
    a. Number of plots in dispersed strata,
    b. Number of plots in other strata as required,
    c. The plots are distributed with a consistent plot intensity within the population and are allocated using a random starting point,
    d. The exact plot numbers assigned in the Aggregate Sample Plan Report in each waste assessment area and stratum combination must be used to label the plots on the survey map and to record the plots in EForwasteBC,
    e. Some small waste assessment areas selected for sampling may not be assigned any plots in the Aggregate Sample Plan. These will be treated as non-sampled waste assessment areas and do not require stratification or fieldwork.
6. The sample plan is endorsed by a Forest Professional,

7. Prepare waste assessment area survey maps,
8. Submit the sample plan report and waste assessment area survey maps.

6.8 Waste Assessment Area Survey Map

Once an initial sample plan is complete, a waste assessment area survey map must be created.

The initial waste assessment area survey map must meet requirements of this manual but is not required to be approved by the District Manager.

6.8.1 Waste Assessment Area Survey Map Requirements

The maps used in a waste survey must accurately reflect the post-harvest condition of a cutblock including the location and shape of areas of unharvested standing timber, and reserved timber, whether grouped or dispersed.

A waste assessment area survey plan map must show the cutblock boundaries, roads, the point of commencement, point of intersection, strip and plot locations, stratum types and locations, and any other areas that are excluded from waste estimations.

The waste assessment area survey plan map is required as part of a complete waste submission. The cartographic standards used by the Ministry of Forests, Lands and Natural Resource Operations are mandatory. Maps drawn digitally must be produced using geographic information system (GIS) software (i.e. ArcGIS).

The waste assessment area survey plan map must:

1. Be legible and of good quality 1:5,000 scale,
    a. Note: a 1:10:000 scale map may be accepted at the discretion of the District; however, it will be rejected if the required items cannot be mapped legibly due to the scale,
2. Provide neat and clean lines, lettering and numbers,
3. Reflect the post-harvest conditions of the cutblock, and
4. Include the items indicated in Table 6-.

Only one waste assessment area survey map may be submitted for each waste assessment area and it must align with the submitted sample plan.

After the field survey is completed, the final waste assessment area survey plan map must be submitted with the waste submission.

Accumulations, standing trees not harvested, and areas subject to 100% measurement or estimation must be clearly indicated on the final waste assessment area maps. In situations where there are a significant number of piles and they cannot be mapped neatly, individual pile locations do not need to be shown; however, the pile plot locations must be identified on the final map.

Table 6-1 Waste Assessment Area Survey Plan Map and Final Waste Submission Map Requirements

Requirements	Waste Assessment Area Survey Plan Map	Final Waste Submission
Tenure, CP, timber mark areas	Yes	Yes
Forest Region and District	Yes	Yes
Cutblock identifier	Yes	Yes
Map scale	Yes	Yes
Harvest boundary (with verifiable reference points such as falling corners)	Yes	Yes
Non-harvest areas (non-productive etc.)	Yes	Yes
Biogeoclimatic zone(s) (Interior)	Yes	Yes
North arrow, declination, map base	Yes	Yes
Cutblock maturity (where applicable)	Yes	Yes
Roads and other NP areas	Yes	Yes
Areas of reserved timber and zones of partial cutting (when identified in a cutting authority and appraisal)	Yes	Yes
Areas of high stump exemptions	Yes	Yes
Strata type lines and identifier	If known	Yes
Waste assessment area and strata net areas	If known	Yes
POC, point of intersection, local grid, baseline, Starting Point Interval Factor (SPIF), and plot	Yes	Yes
Strip line direction of travel	No	Yes
Contour lines - clearly legible	Yes	Yes
Physiographic features	Only if they affect sampling	Only if they affect sampling
Reporting unit number	If known	Yes
Surveyor name(s)	If known	Yes
Sampling design	Yes	Yes

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7. Waste Area Determination

7.1 Principles

The determination of the area to be surveyed is an important component in obtaining the correct waste volume per hectare, the waste assessment area volume, and waste billing.

The waste survey planner must develop waste assessment area survey maps and conduct area calculations to determine accurate areas for waste reporting.

A cutblock can contain areas of reserved timber, non-productive areas (roads), merchantable timber areas (standing timber), and areas outside of the appraised cutblock boundaries (i.e. external landings) that contain waste from the waste assessment area to be sampled.

The area used to calculate waste volumes is the sum of the cutting authority area and associated areas that could reasonably be expected to contain waste material from the waste assessment area (i.e. stumps, logs, bucking waste, cold decks or standing timber).

When any changes to harvest or reserve areas have occurred:

1. The correct areas must be used in the sample plan. These areas must align with the areas stated in the post harvest certification document <text deleted>,
2. Prior to completing any field work, updated maps (with maps and tables attached for standing timber as described in the Waste and Residue Post Harvest Certification) must be given to the waste surveyor, and
3. The correct areas must be entered in EForWasteBC, compiled in HRC, and uploaded into the Waste System by a forest professional.

7.2 Net Waste Area Calculation

1. The net waste area of a waste assessment area is calculated as follows:
    a. Find the gross harvest area
        i. In the Electronic Commerce Appraisal System (ECAS) for fully appraised cutting authorities, or
        ii. In cutting authority documents or GPS'd or traversed areas for non-appraised cutting authorities).
    b. Subtract the area of any reserves or retention from the waste assessment area. See Section 9.5.2 for treatment of reserved timber and standing waste.
    c. Add the area of associated road permits.
    d. Add any areas associated with the cutblock where forwarding, decking, processing, or cutting of merchantable timber have occurred (i.e. pre-existing right of way, off site landings, etc.)

2. Subtract the area of non-productive areas (i.e. bare road running surface). Road surface areas that contain waste (i.e. piles or windrows) must be included. NP areas that do not contain any waste material are removed from the waste assessment area and are not sampled.

    To calculate the NP area of roads for waste area calculations, the road surface area is the same as the road running surface area (as shown in Figure 1 below); it does not include ditches and fill slopes.

    To determine the road NP area:

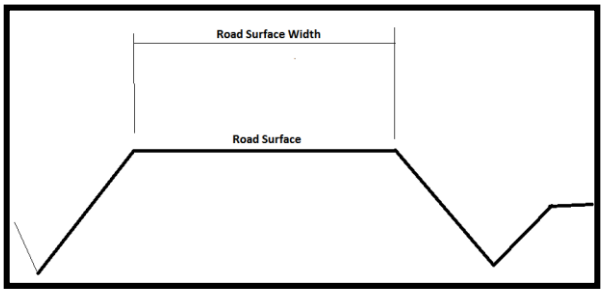
    a. Measure the road width (running track of the road) at various locations within the waste assessment area and calculate the average.

    b. Determine the length in metres of the constructed roads.

    c. Multiply the road length by the width to determine the net road surface area.

    d. Enter the NP area into the Waste System on the Waste102 page under Roads (NP/NF).

Figure 1 Diagram of Road Prism



3. The net waste area reported into the Waste System does not need to and usually will not reconcile with the cutblock net area in other reporting systems i.e. RESULTS, FTA etc.
4. Partial cut, machine free, riparian management zones etc. within the boundaries of the waste assessment area are assessed for waste material.
5. The combined sum of all sub-strata areas within a waste assessment area must equal the net waste area.

Refer to Appendix 6 for an example of a net waste area calculation.

7.3 Strata and Road Right of Way Areas

7.3.1 Strata Areas

Strata are defined as unique areas within the net waste assessment area that contain similar waste characteristics (volume per hectare, species, grade, etc.). The net waste area is segregated into unique stratum areas and the total of the stratum areas must equal the net waste assessment area.

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

Minimum plot requirements must be met within each unique stratum.

7.3.2 Road Right of Way Areas

Where a cutting authority is accessed by a scale based road permit, road permit segments external to, or contained within the cutting authority must be reported into the Waste System:

1. In a scale based cutting authority, report the road permit area as per section 7.4.1, or
2. In a cruise based cutting authority, report the road permit area using the applicable licence number and road permit timber mark.

The area of road right of way leading into the waste assessment area must be included in the net area of the waste assessment area unless the waste volume has been included in a previous waste survey.

External road right of way to be included in a waste assessment includes all access roads leading into the cutblock from the closest previously logged cutblock or the preceding road junction.

The area of the right of way is calculated by multiplying the road length by the right of way width. The right of way width is measured between the harvested right of way boundaries (from each clearing edge containing standing timber). The net area is the right of way width minus the road surface (NP) area.

Where the road has been debuilt and waste material is located on the road surface area, the road surface is not removed from the area calculation.

7.4 Multiple Timber Mark Waste Assessment Areas

Most waste assessment areas contain cutting permit and road permit marks. Where this situation occurs, each timber mark within the waste assessment area must be reported together into the Waste System.

Licensees must ensure the waste reported on the road rights of way is attributed to the correct timber mark or road permit mark as applicable.

The sum of all the mark areas must equal the net area of the waste assessment area entered on the Waste 102 – Block Details screen.

The waste volume for each timber mark is calculated by applying the waste assessment area average waste volume (m^3/ha) and grade breakdown to each mark.

7.4.1 Waste Assessment Areas Containing Road Permit Area

In the Waste System, the cutblock and road permit timber marks are submitted within a waste assessment area submission using the Waste 104 – Multiple Timber Marks screen.

In the Waste 104 – Multiple Timber Marks screen, enter the road permit timber mark that corresponds with the waste assessment area, along with the timber mark for the waste assessment area.

7.4.2 Cutblock Authorized Under Two or More Tenures

Where a cutblock is authorized under two or more tenures (i.e. Timber Licence, Tree Farm Licence), the waste assessment area is surveyed and reported in one waste submission.

In the Waste 104 – Multiple Timber Marks screen, enter the timber mark that corresponds with each tenure, along with each individual mark area.

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8. Waste Assessment Area Planning and Plot Layout

8.1 The Plot Sampling Process

The planning and implementation of plot sampling surveys involves either a single waste assessment area or a group of waste assessment areas within an aggregate. The following steps are required to complete a waste assessment.

Prepare the waste assessment area sample plan

Determine the number of plots required for each stratum within the population

Obtain the earliest Starting Point Interval Factor (SPIF) in the population

Determine the plot grid spacing within the waste assessment areas

Prepare and submit the waste assessment area survey map

Collect data from the sample in the field

Compile the survey results

Review and submit the data into the Waste System

8.2 Sampling Method

There are three assessment methods: Plot (P), 100% Measure (S), and Estimate Percent (E).

In all waste populations where plots are established, the waste volume in the dispersed and accumulation subpopulations is calculated based on fixed-area sample plots laid out systematically.

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 net area and number of plots determined for the subpopulation.

For the estimated or 100% piece scale subpopulations, waste volumes are either estimated or 100% measured for each specified stratum.

8.3 The Right-Hand Rule

The right-hand rule is an unbiased selection procedure where an action or a direction of travel is chosen by selecting the first option available from the right-hand side or direction.

The right-hand rule is used when determining accumulation (roadside stratum) plot locations for a waste assessment area survey map or when counting spot accumulations in the field.

8.4 Dispersed Strata Plot Layout

8.4.1 Plot Spacing (Grid Size)

Once the number of plots within each waste assessment area or aggregate population has been determined, the dispersed stratum inter-plot spacing (grid spacing) must be determined. The grid spacing is calculated using the formula:

$\sqrt{}$ (10,000 * (dispersed stratum area (ha) – external right of way) / # of plots).

The grid spacing calculation will generate a result to within one metre or less. This value should be used if the survey plan is generated using GIS software. If the survey plan will be produced by hand, the calculated grid spacing value must be rounded to the nearest 5 metre value (the smallest measurable measurement at 1: 5,000 scale).

If necessary when drawing the waste survey plan, after the grid spacing value is calculated, the grid spacing can be reduced or increased to generate the required number of plots within the waste assessment area.

Example: 30 plots required in a 122.0 ha waste assessment area will generate a GSD of 201.7m (202m)

- For survey plans drawn using GIS, use a 202m GSD
- For survey plans drawn by hand, use a 200m GSD
    - If the 200m GSD generates less than 29 plots, reduce the GSD to 190m
    - If the 200m GSD generates more than 31 plots, increase the GSD to 210m

Appendix 5 contains an example of a Grid Spacing Worksheet.

8.4.2 Plot Location

The steps required to locate dispersed plots on the waste assessment area survey map are as follows:

1. Compute the grid spacing distance (GSD) using the grid spacing worksheet or the procedure described in section 8.4.1.
2. Establish a local grid on the waste assessment area using the following procedure:
    a. Project a line due south from the most western point of the net merchantable area, and
    b. Project a second line due west from the most southern point of the net merchantable area for the cutblock. This line is the baseline.
3. Obtain the Starting Point Interval Factor (SPIF) from the Timber Pricing Branch website for the PLC month. The SPIF multiplied by the GSD will determine the horizontal distance from the point of intersection of the local grid to the initial strip (IS) location.

a. For aggregate populations use the earliest PLC in the sample plan to obtain the SPIF for calculating each cutblock's initial strip (IS) location. (The earliest PLC in the aggregate is applied to all cutblocks in the population.)

4. Starting at the point of intersection of the local grid, locate the IS at the SPIF distance. The IS must be oriented North/South.
5. Locate all remaining strips at the full GSD along the baseline from the IS and orient them North/South.
6. Number the strips:
    a. Sequentially from West to East.
    b. All strips that fall within the harvested area must be numbered.
7. Locating the plots:
    a. All plot locations that fall within the harvested area must be mapped.
    b. On odd numbered strips, locate the first plot at one half the GSD along the strip from the baseline. Locate the remaining plots at full GSD along the strip.
    c. 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.

    Occasionally the number of located plots on the map will not match the intended number of plots. This can be caused by two situations:

        i. The sample grid was not completed correctly (incorrect GSD, missed plot location, etc.), or
        ii. The configuration of the cutblock results in a reduced or increased number of sample points.

8. Adjust the GSD when:
    a. In a single waste assessment area, the number of plots is greater than plus or minus 1 plot from the intended number, or
    b. In aggregate populations, the located number of plots does not match the intended number from the sample plan.

    For survey plans drawn by hand, the grid is reduced or increased in 10 metre increments.

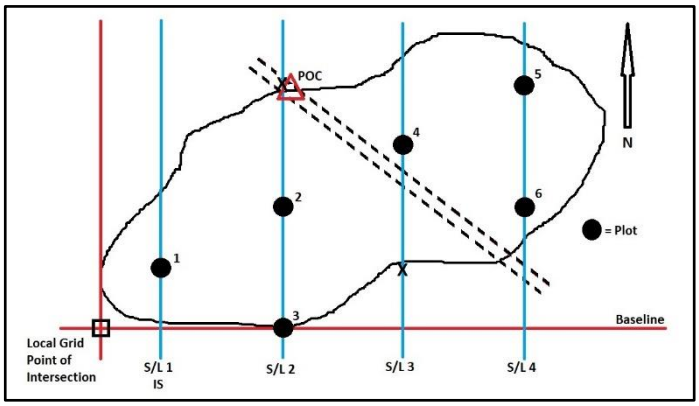
    For survey plans drawn using GIS, use the first grid spacing that will result in the required number of plots.

9. Number the plots. Each plot in the dispersed stratum must have a unique number identified on the survey plan map.
    a. Starting from strip 1, number the plots sequentially from north to south along each strip.

Figure 2 provides an example of the dispersed plot design.

Figure 2 Example Strip and Plot Placement Using a 50% SPIF

Figure 2 E



8.4.3 Plot Allocation

When, after adjusting the GSD, the required number of plots cannot be located on the survey map:

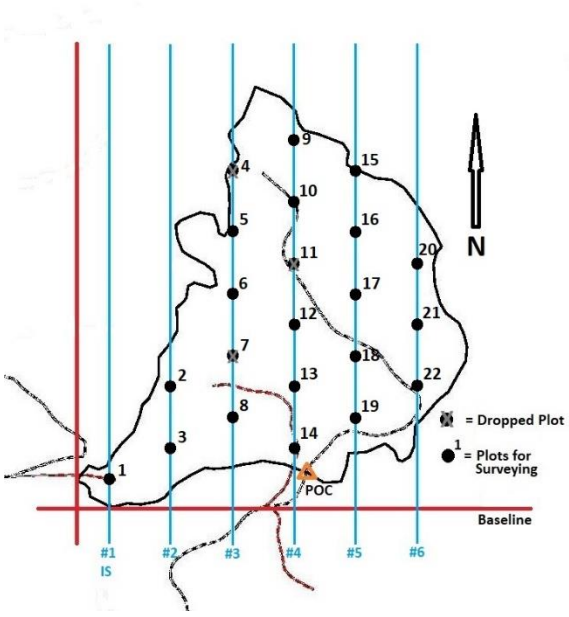
1. Adjust the GSD interval in ten (10) metre increments until the number of plots is greater than the number of plots required, and
2. Apply the following rules in order to reduce the number of plots until the desired number of plots is achieved.
    a. The first dropped plot will be determined by multiplying the total number of plots in the waste assessment area by the SPIF for the PLC month of the waste assessment area in a single block population or the earliest PLC month in an aggregate population.
    b. The second dropped plot will be determined by multiplying the total number of plots in the waste assessment area (prior to dropping any plots) by the previous month's SPIF.
    c. Continue using step b to determine further dropped plots until the desired number of plots is achieved.
    d. For each step, use the rounding rules as described in section 9.4.3.(1)(a).
    e. Renumber the remaining plots using the procedure in section 8.4.2.

Example:

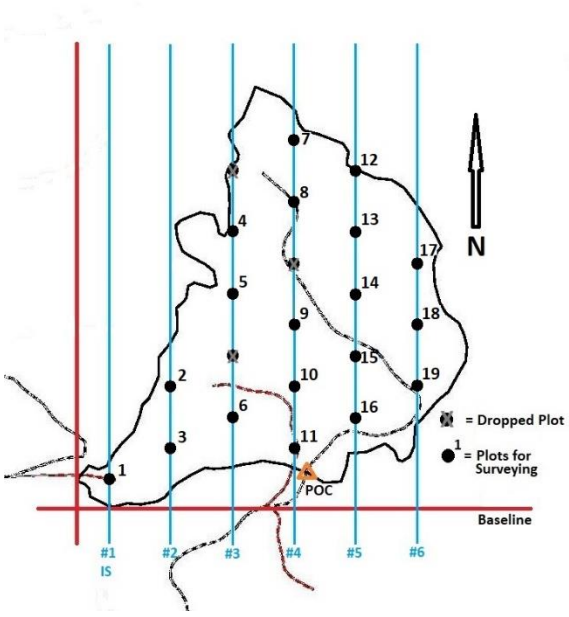
Waste assessment area with 22 plots on the map, and 19 plots are required. The earliest PLC date in the aggregate sample plan is October 20, 2020.

1. First dropped plot = 22 plots * October 2020 SPIF 50% = plot 11
2. Second dropped plot = 22 plots * September 2020 SPIF 30% = plot 7
3. Third dropped plot = 22 plots * August 2020 SPIF 20% = plot 4

Figure 3 Example of Aggregate Plot Allocation Process



Initial Layout



Sample Plan Map

8.5 Spot Accumulation Stratification and Plot Layout

8.5.1 Stratification

The options to stratify spot accumulations are:

1. Stratify piles occurring at roadside and throughout the dispersed as one stratum. (8.5.1.1), or
2. Stratify piles occurring at roadside as one stratum. (8.5.1.2), or
3. Stratify roadside spot accumulations and dispersed spot accumulations as two separate accumulation strata (8.5.1.3).

8.5.1.1 Roadside and Dispersed Spot Accumulations as One Stratum

If all of the spot accumulations are to be sampled as one stratum, the spot accumulations must be identified as a unique stratum and are defined using the following criteria:

1. The piles are located at roadside and throughout the dispersed.
2. All piles within the waste assessment area are counted.
3. The piles are stratified and sampled separately from the other strata.
4. The corresponding area of the spot accumulations must be removed from both the dispersed and roadside strata areas.

8.5.1.2 Roadside Spot Accumulations

If the roadside spot accumulations are to be sampled as one stratum, the roadside spot accumulations must be identified as a unique stratum and are defined using the following criteria:

1. The piles are located in receiving areas, such as landings and roadsides where trees have been forwarded and manufactured into logs.
2. All piles in receiving areas adjacent to landings and roadsides are counted.
3. The roadside piles must be stratified and sampled separately from the other strata.
4. The area of the spot accumulations must be removed from the other stratum area.

8.5.1.3 Dispersed Spot Accumulations

Dispersed spot accumulations may be identified as a unique stratum within the accumulation subpopulation and are defined using the following criteria:

1. The piles are located within in areas from which trees have been cut and forwarded away from the stump.
2. All piles in areas from which trees have been cut and forwarded away from the stump are

counted.

3. The piles are stratified and sampled separately from the dispersed stratum.
4. The area of the spot accumulations must be removed from the dispersed stratum area.

If the dispersed spot accumulations are not stratified as a unique stratum, any spot accumulations landing within a dispersed plot must be sampled and included in the dispersed subpopulation.

8.5.2 Sampling Dispersed Spot Accumulations

Dispersed spot accumulations found within a waste assessment area may be surveyed in one of two different ways – as part of the dispersed stratum or as a unique spot accumulation stratum.

1. Spot accumulations in the dispersed stratum, when not stratified are surveyed as part of the dispersed subpopulation. Dispersed stratum plots:
    a. Must include any piles or portions of piles contained within the plot boundary,
    b. Cannot be moved or altered to exclude piles or portions of piles,
    c. All accessible pieces that fall within the plot will be measured and recorded,
    d. A measure factor will be applied to account for inaccessible pieces.
2. If spot accumulations in the dispersed stratum are stratified, they are surveyed separately from the dispersed stratum:
    a. Dispersed plot centers must be offset away from all pile accumulations,
    b. The procedures in section 9.2.6 are used as required to avoid overlapping a spot accumulation stratum, and
    c. Dispersed plots must retain a 200 m^2 size.

8.5.3 Numbering Procedures

The selection of sample piles must be completed in a systematic and random manner. Pile numbers must be either marked on a minimum of 1 out of every 10 piles or in a method that provides for replication of sampling procedures for auditing purposes.

The numbering and selection of roadside sample piles utilizes the right-hand rule and must be completed using the one-sided method:

1. Starting at the POC (where the road enters the waste assessment area), number piles sequentially on the right-hand side of all roads.
2. Always stay to the right-hand side of the road in the direction of travel when numbering the piles. When coming to a branch or 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.

For piles that are stratified out under section 8.5.2(2) within the dispersed stratum, all piles must be identified and numbered sequentially throughout the waste assessment area.

In aggregate populations:

1. Pile numbering must restart at one (1) in each waste assessment area in the population, and
2. The pile plot numbers assigned must be established within the corresponding cutblocks exactly as they appear on the Aggregate Sample Plan.

8.5.4 Sampling Method and Procedures

For waste assessment areas that use simple random sampling (single waste assessment area SRS, or aggregate SRS sampling designs):

1. Count all piles and label them using the procedure outlined above,
2. Determine the number of sample piles required,
3. Identify the sample piles to be measured, and
4. Measure the required pile attributes for all sample piles.

For waste assessment areas that use ratio adjustment sampling (single waste assessment area ratio or aggregate ratio):

1. Count all piles and label them using the procedure outlined above,
2. Determine the number of sample piles required,
3. Identify the sample piles to be measured,
4. At each sample pile, complete the volume prediction (quick estimate of volumes without taking measurements),
5. When a prediction is confirmed in EForWasteBC, the program will determine by a random process if the sample pile must be measured, and
6. Measure the required pile attributes for the randomly selected samples.

In aggregate populations, the procedures listed above only apply to the waste assessment areas that are selected to be sampled.

For aggregate populations, the number of piles may be estimated or counted when completing the sample plan for the population. To estimate the number of piles, the Aggregate Sample Plan will

multiply the waste assessment area's net area by a factor of 1 pile per 0.9 hectare to obtain the estimate.

8.5.4.1 Sample Selection Process

1. Calculate the sample pile interval:
    a. Divide the number of piles by the planned number of samples.
    b. Round the result to the nearest non-zero whole number.

    Note: This will occasionally result in more samples than intended.

        i. In a single waste assessment area, establish the extra plot.
        ii. In an aggregate, only establish the required number of plots as specified on the Aggregate Sample Plan.
2. To select the piles to be sampled:
    a. Use the date that the first plot is established on the block (in any stratum) for each waste assessment area in the population. (E.g. Use "15" if surveyors established the first plot on the waste assessment area on June 15th.)
    b. The first sample pile is the pile with the same number as the survey date.
    c. Where the date is greater than the number of piles, use the last digit of the date.
    d. If the last digit of the date is greater than the number of piles, use the first number of the date.
    e. If this number is still greater than the number of piles, select the first pile as the first plot.

Example 1:

- 36 piles requiring 15 samples, surveyed on the 23rd of the month
- 36 piles / 15 samples = 2.40; survey every 2nd pile
- Select the following piles: 23, 25, 27, 29, 31, 33, 35, 1, 3, 5, 7, 9, 11, 13, 15

Example 2:

- 25 piles requiring 13 samples, surveyed on the 30th
- 25 piles / 13 samples = 1.92; survey every 2nd pile
- Select the following piles: 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 2

8.5.4.2 Plot Location Procedure

In spot accumulation strata, the plot is placed on the front for even numbered sample plots, and on the back for odd numbered sample plots. If it is not safe to work around the correct plot location, 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.

The plot size and shape to be used for pile plots is 50 m^2. When a rectangular (or other shape as necessitated by the shape of the pile) is used, the plot edges must be painted and clearly marked in the field using stakes or ribbon.

8.6 External Road Right of Way and Roadside Strata Plot Layout

8.6.1 Road Right of Way External to a Cutblock

Road rights of way containing merchantable timber must be reported in the Waste System.

8.6.1.1 Procedures

There are three options to account for external road right of way:

1. No plot sampling is required
    a. Include the area of the road right of way area with the dispersed subpopulation area of the waste assessment area, or
2. Sample with plots (50 m^2) in a separate roadside stratum
    a. Use the stratum code of OT0X, or
3. When a scale based road permit accesses a cruise based cutting authority:
    a. Sample with plots (50 m2), or
    b. Use the right of way survey information from another surveyed road permit area containing similar species composition and waste levels, or
    c. Use the procedures in section 4.3.2 for determining waste.

8.6.1.2 Plot Location Procedure

Right of way sampling is completed using rectangular 50 m^2 plots. Starting from the POC (where the road enters the waste assessment area), locate the plots covering the width of the area between the edge of the road and the edge of the timber using the right-hand rule.

1. Determine the GSD between the plots. This is calculated by dividing the right of way length by the number of plots that are required.
2. Multiply the SPIF by the GSD to calculate the first plot location. For aggregate populations use the SPIF for the earliest PLC date in the sample plan.

To establish plots, follow the procedures below for roadside plot establishment.

8.6.2 Roadside Stratum Within a Waste Assessment Area

The roadside stratum is the area adjacent to a road and typically contains roadside piles and cold decks. If a decision is made to stratify out a roadside stratum, then the roadside stratum must be isolated from other strata found within it by removing the area of piles and cold decks. Roadside strata can contain heavier or lighter waste volume than the dispersed area.

A roadside stratum should only be identified where there is clear evidence of a difference in volume per hectare and the strata edges can be consistently identified across the population. If this cannot be determined, then the area should remain within the dispersed stratum.

This area is calculated by measuring the length, along the road of one-sided strata (occurs when a roadside stratum only exists on one side of the road) and/or two-sided strata (occurs when a roadside stratum that exists on both sides of the road). The length is multiplied by an average width for the strata (usually, but not restricted to 15 m). The number of plots required is based on the sample design and accumulation strata requirements in Chapter 5.

The plot location procedure is identified in the table below.

Table 8-1 Roadside Stratum Plot Location Procedure

<table>
<tr><th>One-sided or a mixture of one and two-sided strata</th><th>Two-sided strata</th></tr>
<tr><td>1. Start from the POC.
2. Measure the length of the one-sided strata and the length of the two-sided strata
3. Multiply the two-sided strata length by two.
4. Add the one-sided and two-sided strata together.</td><td>1. Start from the POC.
2. Measure the length of the strata and multiply it by two.
3. Determine width of roadside stratum.
4. Go to step 5</td></tr>
<tr><td colspan="2">5. Calculate the area of the stratum as follows:
Area (ha) = (length x width) / 10,000.
6. Look up the number of plots required.
7. Calculate the grid spacing distance (GSD) as follows:
Grid Spacing = length / number of plots required.</td></tr>
<tr><td>Example:
• Total length of one-sided strata= 1500 m
• Total length of two-sided strata= 750 m x 2 = 1500 m
• 1500 m + 1500 m = 3000 m
• Area= 3000 m x 15 m= 4.5 ha (10 plots in sample population)
• Grid Spacing Distance= 3000 /10=300 m</td><td>Example:
• Total length of roadside strata= 3000 m x 2 = 6000 m
• Width of roadside accumulation= 30 m (average 15 m on each side of the road)
• Area = 6000 m x 15 m=9 ha (10 plots in sample population)
• Grid Spacing Distance= 6000 / 10 = 600 m</td></tr>
</table>

8.6.2.1 Plot Layout

1. Start from the POC and follow the right-hand rule.
2. Using the SPIF, establish the first plot at the GSD times the SPIF. For aggregate populations, use the SPIF for the earliest PLC date in the sample plan.
3. For one-sided or a mixture of one and two-sided strata, locate a 50 m^2 plot on the right side of the road. For two-sided strata, locate a 50 m^2 plot on each side of the road.
4. If the stratum is sectioned along the road, stop measuring distance at the end of each strata section and resume measuring at the beginning of the next strata section until each GSD is located.
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 strata 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.
7. Number the plots starting from the POC using the right-hand rule.
8. Roadside strata must be marked on the waste survey map so the layout can be audited.

8.6.2.2 Establishing Plots

Plots located within a roadside stratum must be located in an unbiased and random manner. Plots must be located in such a way that all areas of the stratum are available for and have an equal probability of sampling.

In the field, plot centers are located alternately at 4 m for even numbered plots and 11 m for odd numbered plots from the road surface edge when a 15 metre wide roadside stratum is used. Either circular or rectangular plots are acceptable in these circumstances. If a different stratum width is used, the surveyor must ensure the plots cover the entire stratum width and may use a rectangular 50 m^2 plot where needed.

8.6.2.3 Variable or Fixed Roadside Strata Greater than 15 Metres Wide

For fixed width roadside stratums that are over 15 m wide, 50 m^2 rectangular plots must be used. 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).

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.

8.7 Strip Accumulations

If the roadside accumulations consist of strips (i.e. windrows), use:

1. A rectangular plot which covers the entire width of the strip, or
2. A 50 m^2 circular plot system with plot centers located alternatively at 4 m and 11 m from the strip accumulation edges, 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.

Plots are located using the procedure in section 8.6.1.2.

8.8 Landings

Landings contain accumulated material resulting from yarding or processing to a central location or spot accumulations.

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

Off-site landings must be stratified and sampled. Include their area in the waste assessment area net area.

Determine the number of plots for a landing stratum using the Other Accumulation Strata table in Appendix 4. If the landing contains spot accumulations, use the procedures in section 8.5.4 to sample the accumulations, otherwise, use the procedure in section 8.8.1.

8.8.1 Establishing Plots

When a landing contains accumulated material that has not been piled, landing plots are located on a line starting from the geographic center of the landing. A plot must be established at the first successful attempt using the sequence of steps listed below.

1. Mark the center of the landing (with ribbon or paint) so that the check surveyor will be able to find the P.O.C.
2. The first line is always run north from the P.O.C.
3. 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.
4. If a circular plot cannot be established on the North bearing, try East, then South, then West.
    a. If a circular plot cannot be established on these bearings try N45E, S45E, S45W and N45W consecutively.
    b. 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.
5. If a circular plot still cannot be established using the smallest plot size available (50 m^2 or 3.99 m radius):
    a. A rectangular plot can be established, or
    b. Measure 100% of the accumulation.

In waste assessment areas where there is only one landing or one landing that is safe to work on, the minimum number of plots must still be established. Therefore, a landing may have to have more than one plot established on it. In this case, distribute the plots as evenly as possible.

8.9 Debuilt Road

If a road has been debuilt, logs and stumps have been pulled back from the side-slopes and scattered over the top of the deactivated road. A debuilt road may be surveyed with the dispersed stratum or as a unique stratum.

8.9.1 Sample with the Dispersed Stratum

A debuilt road can be surveyed as part of the dispersed subpopulation. Any plots located on the debuilt portion are sampled where they are located using a circular plot. All pieces that fall within the plot will be measured and recorded.

Note: The road surface area for debuilt roads is added back into the net waste area of the waste assessment area.

8.9.2 Sample as a Unique Stratum

A debuilt road can be stratified from the dispersed subpopulation and surveyed as a unique stratum. The stratum code for debuilt roads is WB0X.

1. The minimum number of plots for an other accumulation stratum type must be established.
2. The stratum area is determined by the road surface width and length.
3. Locate 50 m^2 rectangular plots on the debuilt portion.
4. Plot dimensions will be 50 m^2 divided by the road width
    a. Determine the GSD between the plots (stratum length/number of plots).
    b. Apply the SPIF to the GSD to calculate the first plot location. For aggregate populations, use the earliest PLC date in the sample plan to determine the SPIF.
    c. Starting at the POC, proceed down the road the calculated distance to the first plot. This point (C1) establishes the center point of the first plot.
    d. From C1 locate a 50 m^2 plot on the debuilt road area.
    e. Establish the next plot by measuring the full GSD from C1 down the debuilt road to C1 of the next plot.

Example:

- Stratum area:
    - Road surface: 400 m, road width: 5 m
    - 400 m length * 5 m width = 2000 m^2 or 0.20 ha
- Plot dimensions:
    - 50 m^2 plot size / 5 m width = 10 m,
    - Establish a 5 metre by 10 metre plot.

8.10 Cold Decks

Log decks that remain on a waste assessment area and are to be removed and scaled at a scale site, or are field scaled, are not to be included in a waste assessment as the scale data will be reported in HBS. These decks must be clearly marked by the licensee.

All cold decks within a receiving area such as a roadside or landing must be stratified into an accumulation stratum and measured using the procedures in section 9.5.8.

Cold decks within the area where timber has been forwarded away from the stump may be surveyed in one of two different ways – as part of the dispersed stratum or as a unique deck accumulation stratum.

1. Surveyed as part of the dispersed stratum. Under this method:
    a. Dispersed plots established in the field will include all dispersed cold decks or portions thereof within the plot,
    b. All pieces that fall within the 200 m^2 dispersed plot will be measured and recorded, and
    c. Plots cannot be moved or altered to exclude decks or portions of decks contained within the plot boundary.
2. Surveyed as a deck accumulation stratum. Under this method:
    a. All decks within the dispersed stratum must be stratified separately from the dispersed, roadside, or landing strata,
    b. All decks must be identified and sampled throughout the population,
    c. The areas of the decks in both the accumulation and dispersed strata must be noted on the final map and the deck areas removed from their respective strata areas,
    d. Dispersed sample plot centers must be offset away from all decks, and
    e. Dispersed plots may be moved as per section 9.2.6 as required to avoid overlapping a deck stratum; however, must retain a 200 m^2 size.

The survey methodology for cold decks must be consistent within an entire aggregate population. Similar cold deck strata within multiple waste assessment areas in an aggregate population must be combined into a single cold deck stratum code.

8.11 Partial Cut (Variable Retention) Waste Assessment Areas

Partial cutting (variable retention) waste assessment areas 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). Stratum codes for variable retention waste assessment areas are "G" for group retention, and "D" for dispersed retention.

An accurate map showing the leave areas and corridors must be used as the waste assessment area survey map.

Leave areas and corridors must be stratified out and sampled accordingly.

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9. Field Procedures

9.1 Overview

This chapter assumes the waste surveyor is knowledgeable in the principles of sampling, forest surveying techniques, is competent with conventional field traverse procedures and equipment and is familiar with log scaling and grading procedures.

If there are uncertainties over any aspect of the field procedures, waste surveyors are encouraged to direct questions to the forest professional responsible for submitting the work.

9.2 Plot Establishment

Sample plots must be established at the location identified on the waste survey plan. Moving plot centers from the measured or traversed location presents significant bias and is only permitted in accordance with section 9.2.6 of this manual. If the plot cannot be completed safely, the procedures outlined in section 9.2.7 of the manual are to be used.

9.2.1 Plot Sizes

Plots in dispersed must be 200 m^2.

Plots in accumulations and roadside strata may be rectangular or circular, or other shapes as required and must be 50 m^2. External right of way areas must use 50 m^2 rectangular plots when sampled as a separate stratum (OT0X).

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.

The plot sizes and recommended shapes are as follows:

Open slash	200 m^2 round (radius = 7.98 m)
Felled and bucked	200 m^2 round (radius = 7.98 m) or 100% scale if area is small
Accumulation strata not listed below	50 m^2 round (radius = 3.99 m) or rectangular (i.e. 5 m x 10 m)
Roadside accumulations	50 m^2 rectangular (for strips 10 m wide or less). 50 m^2 circular (for a 15 m wide strip, locate plot centers alternatively at 4 m and 11 m from the roadside). 50 m^2 rectangular (for strips greater than 15 m wide).
Cold decks	100% scale or percent estimate.
Road deactivation Material	100% scale or percent estimate.

9.2.2 Locating Dispersed Plots Using Conventional Methods

To locate dispersed plots using conventional (hand survey) methods, determine the distance and bearing from a tie point on the survey plan map to a sample point. Using field traverse procedures, travel the required distance and bearing from the tie point to the plot location as indicated on the waste plan. When the required distance has been measured, a stake, pin or equally effective center point marker must be established at the plot center.

Tie points must be linked to the survey grid with a hand traverse that meets the standards in Chapter 9. All distances are to be corrected for slope and must be measured to the standards listed in this manual.

9.2.3 Establishing Dispersed Plots Using GPS Technology

Dispersed plots may be located with the use of GPS technology provided the following procedures are followed:

1. The survey plan map has been created using GIS software,
2. The plot location coordinates are generated through GIS software,
3. The plot locations are identified from 'system derived' X, Y coordinates with the coordinate in an attribute table,
4. The coordinate system used must be specified as either UTM or BC Albers,
5. Coordinates must be labeled to the plot number,
6. Plot coordinates must be transferred to the GPS unit via digital file, and
7. Plot coordinate and shape files must be provided to the Ministry upon request.

Procedures for establishing waste plots using GPS are described in detail in Appendix 11.

Georeferenced maps cannot be used for traversing to or establishing a waste plot location. An iPad, tablet, or cellular device cannot be used to create the final waste assessment area survey map.

9.2.4 Plot Establishment and Marking

All POCs and tie points must be clearly marked with aluminum tags or flagging ribbon and high-visibility paint and be easily observed from access roads. All plots must be established in EForWasteBC at the time of plot establishment in the field. (A plot prediction volume or other plot data must not be entered in EForWasteBC before arriving or after leaving the physical plot location.)

All tie points and plot centers, including prediction plot locations, are to be established with a sturdy stake driven well into the ground and made clearly visible with paint or surveyors flagging ribbon and labeled using a waterproof felt pen or other method (i.e. aluminum tags) that clearly identifies the plot number.

The plot center is the point at which the center stake enters the ground, not the top of the stake. If the plot center location is within a stump or other impenetrable object, mark the plot center with an "X" at the point on the object with paint and locate a plot center stake close to the indicated center point. Record the distance and bearing from the plot stake to the actual plot center on the field tally card.

Plot boundaries of measure plots are to be clearly marked on all borderline pieces with paint. Stakes may be used to define the plot boundaries on spot accumulations. Marking the entire plot radius is not required.

Recorded pieces are to be clearly numbered with tree marking paint. Paint must be log or tree-marking grade.

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 and plot radii are to be corrected for slope and must be measured to the standards listed in Chapter 9.

The formula used to correct for slope is:

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

The inverse (1/*x*) of this number is multiplied by the plot radius to obtain the corrected slope distance.

Example: Slope of 74% and plot radius of 7.98 m

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

0.8038 $^{-1}$ = 1.2441
1.2441 * 7.98 m = 9.93 m slope distance

Appendix 9 contains the corrected slope distances for a 7.98 m (200 m^2 plot) plot radius.

9.2.5 Piece Numbers

Waste pieces are to be clearly marked in such a manner as to allow identification of the piece for audit purposes. Mark all pieces measured in the plot clearly with the piece number, using tree marking paint.

Piece marking must be completed in a manner that retains the marking for up to six (6) months.

Waste pieces are usually assigned one piece number. However, some pieces contain both avoidable and unavoidable segments. In these situations, the segments are marked and recorded separately, each with its own piece number.

9.2.6 Establishing Border Plots or Moving Plots

The completion of all the sample points identified on the survey plan and the location of the sample point at, or very near its intended location, is a key principle of sampling. Sample points will occasionally fall outside or too close to the edge of the dispersed stratum due to map inaccuracies, acceptable location errors, obstructions (i.e. pile) or safety reasons (i.e. a wasp nest). When this occurs, two options are available - the completion of a border plot or moving the plot.

Prior to applying one of the two options the surveyor must:

1. Confirm the plot location procedures and sample plan map are correct,
2. Never move a plot center that falls completely within the stratum it was intended to sample, and
3. Follow the procedures in the order they are presented:
    a. Locate a border plot (only in the dispersed stratum), or, if that is not successful,
    b. Move the plot location using the method described in the manual.

9.2.6.1 Using Border Plots in a Dispersed Stratum

If the dispersed plot center falls within the stratum to be sampled but a 200 m^2 circular plot cannot be established because a portion of the plot falls outside the stratum, establish a 200 m^2 half circular plot (11.28 m radius).

To establish a plot, proceed the shortest possible distance to the edge of the stratum from the plot center point, measure 3.0 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, to determine the edge (straight line boundary) of the half-circle plot.

From plot center, travel the determined bearing 11.28 m and establish a ‘corner’ of the border plot. Establish the second corner of the border plot using opposite bearing of first plot. Proceed within the stratum locating the plot boundary using the 11.28 m radius. Plot corners must be clearly marked in the field.

If a 200 m^2 half-circle plot (11.28 m radius) cannot be established without sampling outside of the stratum, move the plot using the procedure described below.

Border plots cannot be used in an accumulation stratum.

9.2.6.2 Moving Dispersed or Accumulation Plots

Dispersed and accumulation plots that fall outside the type stratum they were intended to sample are to be moved in a consistent and therefore auditable manner.

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

The procedures for moving plots are as follows:

1. From the traversed plot location, move the plot center:
    a. In a dispersed stratum, North one plot radius (i.e. 8.0 m in a dispersed strata) to establish either a full circle plot or a half circle (border) plot. If this point does not result in a plot that remains entirely within the stratum it is meant to sample, attempt the same process East with the same distance and procedure, then South, then West.

    b. In a roadside stratum, for odd numbered plots, one plot radius in the direction towards the point of termination of the road being sampled. For even numbered plots, move the plot one plot radius towards the point of commencement of the road (0+000). If a full circular plot cannot be established, use a rectangular shape instead.
2. If the above fails, repeat the same procedure but increase the distance by increments of one plot radius.
3. If the plot cannot be located within one half (½) of the intended GSD using steps 1 and 2 above, in the dispersed strata, attempt to locate the plot moving North East, then North West, then South East, and then South West.
4. The plot may be dropped in a single waste assessment area if a plot cannot be located within one half of the intended GSD after using the steps outlined above.
   Note: a plot can only be excluded from sampling for this reason or as outlined in section 9.2.7.
5. In an aggregate sample plan, the plot cannot be dropped and must be established.
    a. In the dispersed strata, repeat steps 1-3 above; however, an irregular plot shape may be used. If a plot cannot be established, continue using increments of one plot radius until the plot can be located.
    b. In the roadside strata, continue using increments of one plot radius until the plot can be located.

A full or half circle (border) plot (only in dispersed strata) must be established at the first possible

location.

9.2.7 Waste Survey Safety Procedures

In accordance with WorkSafeBC 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 safety of the surveyor must always take precedence when estimating or measuring plots, including the wearing of proper safety equipment and footwear.

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

The procedures are intended to provide the surveyor with a set of procedures to follow in the order listed below that will provide the best available information and support the key principles of sampling while maintaining worker safety.

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 9.2.6.
3. When a plot must be dropped for safety, use replacement data of an existing plot from the same cutblock or licence that has similar waste levels, species, 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.
    a. If replacement data from another plot is used, ensure the volume is the same or less of the dropped plot
    b. 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 waste assessment area can be determined using the following alternate method:
    a. Within a single or aggregate sample plan, use the procedures in section 4.3.2 (district averages).

9.3 General Requirements

9.3.1 Material to be Measured

All waste volumes within the sample waste assessment area boundaries, external areas attributed to a cutblock and/or plots must be included in a waste assessment according to the timber merchantability specifications specified in this manual.

All coniferous and deciduous timber, except reserved timber which is within the specifications of timber merchantability described in this manual, must be included in a waste assessment.

9.3.2 Classifying Pieces

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

9.3.3 Avoidable and Unavoidable Waste Classification

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.

All waste pieces must be classified as either avoidable or unavoidable.

Unavoidable volumes are those which cannot be removed because of physical impediments, safety considerations, or environmental constraints. All other volumes are ***avoidable***.

9.3.3.1 Examples of Unavoidable Waste

1. Due to physical impediments:
    a. Logs wedged between boulders, or
    b. A log stranded on an inaccessible ledge.
2. Due to safety:
    a. 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 (see Figure 9),
    b. Logs with shards of 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,

c. Log pieces in hand falling cutblocks that were cut to create escape paths for the fallers. The pieces must be less than 35 cm in diameter and angle cut,

d. Bucking waste with severe deformities as outlined in bucking waste section, or

e. Logs or downed trees that are unsafe to remove due to site specific circumstances.

3. Due to environmental or stewardship requirements:

a. A log if removed will cause excessive site disturbance or soil degradations,

b. A log left bridging a class 4 stream,

c. Stub trees or high stumps left to protect reserve trees within a WTRA (where identified in a cutting authority and appraisal), or

d. Approved high stumps due to snowpack (section 9.5.4.8).

e. For stream cleanout conducted in accordance with the Riparian Management Area Guidebook, the waste classification procedures are as follows:

i. Where a log is left across a creek, classify the log as unavoidable for environmental reasons.

ii. If a creek was machine cleaned and it was reasonable to recover the log pieces, classify the pieces as avoidable.

iii. 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.

Figure 4 Example of Unavoidable Waste

9.3.3.2 Examples of Avoidable Waste

1. Stub trees that have not been identified in the cutting authority and appraisal or the retained volume was not accounted for in the appraisal of the cutting authority.
2. Chunks on a skidding trail used to support the machinery that resulted in the breakage of pieces greater than the minimum log length. Such pieces are classified as avoidable and are graded according to the characteristics of the whole original piece.
3. 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.
4. Pieces bucked from a log to 'zero' the processor.
5. Bucking waste cut from a log to remove a defect that extends beyond the effect of the defect.

9.3.4 Piece Estimates

Waste pieces are often partially obstructed by branches, soil and other loose debris. The correct measurement of waste pieces is dependent on the ability of the surveyor to view a piece and confidently measure dimensions and observe defects affecting volume and grade. Surveyors are expected to attempt to clear loose debris to facilitate measurement and classification of pieces.

A reasonable effort must be made to measure as much as possible. If one end of a piece is accessible, the piece must be considered. If enough attributes are visible to reasonably determine species, grade, kind, class, and size, the piece must be tallied.

9.3.5 Measure Factor

In strata where piling or deep accumulations exist, pieces in a plot may be unsafe to measure, obstructed, or inaccessible, therefore it may not be possible to measure or estimate each piece within a plot. Only in these cases, a measure factor can be applied to the plot. The measure factor adjusts the plot volume to account for pieces that were not measured or estimated by the surveyor within the plot.

In these cases:

1. Measure and/or estimate the waste material that is accessible. Measure as many pieces as possible, even when some dimensions of an individual piece must be estimated. All accessible pieces must be assessed. Failure to tally all accessible pieces will result in rejection of the survey. Only pieces that cannot be reasonably assessed can be included in the measure factor.
2. Plot placement on a pile must not be intentionally biased to impact plot volume.
3. Project the plot boundaries down to the ground and estimate what percentage of the volumes within the plot boundaries were measured. This is the measure factor for the plot.
4. In spot accumulation strata:

a. For piles equal to or greater than 50 m^2, record the measure factor on the plot tally card under "Measure %", or

b. For piles less than 50 m^2, adjust the measure factor to account for the area that is available for sampling using the following calculation:
(Area of the pile / Area of the plot) * measure factor of the pile.
Record this value on the plot tally card under "Measure %."

The measure factor is applied to measure and prediction plots.

When estimating the prediction plot volume in an accumulation stratum, the total plot volume must include all volume that is not visible or available to be measured. The value entered into EForwasteBC take into consideration the measure factor for the plot. The percent measure field in the prediction plot header must be set to 100%.

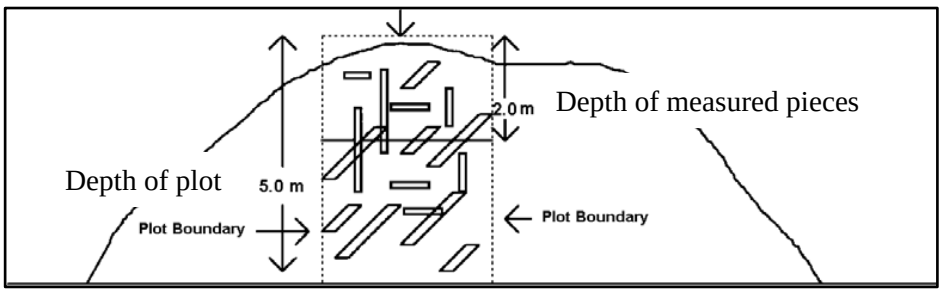
Example:

In the example below, if you were able to measure all the pieces down approximately 2 m, you would record a measure factor of 40% providing that the volumes of waste were spread evenly through the cylinder within the plot boundaries. The measure factor is derived from
2 m / 5 m * 100% = 40%.

In a prediction plot, if the volume within the plot is estimated at 2 m^3:

- To adjust by a measure factor, divide the measure factor percent by 100:
40 / 100 = 0.4
- Calculate the prediction plot value:
2 m^3 / 0.4 = 5 m^3
- Enter 5 m^3 into EForwasteBC

Figure 5 Measure Factor



9.4 Measurement Protocol and Standards

9.4.1 Measurement and Recording Standards

Waste material, logs, and trees are measured for volume and graded using the principles and procedures identified in the Ministry of Forests, Lands, Natural Resource Operations and Rural Development *Scaling Manual* except where otherwise described in this manual. Waste stumps and bucking waste are graded using the principles and procedures identified in this manual.

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.

Record the gross dimensions of each piece including rot or other defects. In addition, the waste surveyor calculates the volume deductions for any defects or missing wood and records the deduction equivalent under "Deduction for Rot/Holes" in rads and/or in metres as a length deduction, along with the most appropriate "decay type."

When netting down the dimensions of a log because of defect or missing wood, the gross length will be used to determine if the piece meets the 3.0 m minimum log length. Therefore, the net length of a log used for volume calculations can be less than 3 m. Both the gross length and deductions are always recorded.

Top measurements on logs which have very little taper must be made carefully due to the length of merchantable wood involved between radius classes.

1. For oversized tops, the top measurement is made at the last occurrence (i.e. at the uppermost point on the tree) of the applicable timber merchantability top dimension specification.
2. When using a scale stick, for a 10 cm top, it will be the midpoint of the 5 radius class. For a 15 cm top, it will be the line separating the 7 and the 8 radius class.

Recording the measurements of the portion of borderline pieces that are outside the plot is optional. 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.

Measurement of Grade 6 is required when specified in the cutting authority document. Do not tally Grade 6 unless utilization is mandatory. Measurement of Grade code Z logs is not required. Do not tally Grade Z.

9.4.2 Minimum Measurement Requirements

The minimum length requirement for measurement is 0.1 of a metre (10 cm). Pieces less than 0.10 of a metre (10 cm) at the midpoint of the diameter are not recorded.

All dead pieces greater than 50% sound that meet or exceed the TMS must be measured.

The minimum specifications for logs, trees, slabs, stumps, and bucking waste are outlined in section 9.5.

9.4.3 Lengths

1. Lengths will be recorded to the nearest tenth (0.1) of a metre
    a. Digits 0-4 are rounded down and 5-9 are rounded up
    b. Example:
        i. A log 4.24 m in length - record as 4.2 m
        ii. A log 4.26 m in length - record as 4.3 m
2. Logs broken at both ends are tallied only if they meet or exceed 3.0 m, TMS point to TMS point. Logs less than 3.0 m are breakage and are not tallied.
    a. Example A:
        i. A log 2.99 m in length - is breakage, do not tally
        ii. A log 3.0 m in length - is a log, tally as 3.0 m
        iii. A log 3.06 m in length - tally as 3.1 m
    b. Example B:
        i. A log 3.2 m from TMS to TMS with a 0.2 m length deduction at the top and a 0.1 length deduction at the butt is a log,
        ii. Tally as 3.2 m with 0.3 m length deduction
        iii. Do not tally as a log 2.90 m in length
3. Pieces less than 0.05 m in length (cookies) are not measured.
4. Pieces 0.05 m and greater are measured. Pieces 0.05 m to 0.1 m are recorded as 0.1 m.

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

9.4.3.1 Broken Tops

The length measurement procedure for broken tops is:

1. Locate the TMS diameter (must have minimum slab thickness of 5 rads) measured from the small end,
2. Locate the X Y line upon which the volume above the TMS diameter to the X Y line equals to the void of the missing wood, and
3. Record the length from the X Y line to the cut end.

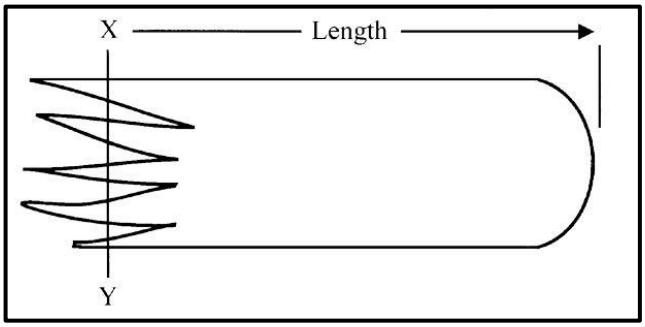
9.4.3.2 Shattered Ends

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

Pencil buck each finger to the TMS before folding as shown for broken tops.

Do not measure fractured pieces where little effort would be required to break the piece into numerous pieces all below the TMS.

Figure 6 Measuring Shattered Ends



9.4.4 Piece 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 centimeters, 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.

9.4.5 Deductions

It is a standard convention in the *Scaling Manual* 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.

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

For waste assessments, the length and/or diameter (rad) deductions must be recorded along with the gross dimensions of the piece. The compilation program will subtract the deduction values (if any) in the deduction columns for length, top and/or butt dimensions respectively. The resulting dimensions will then be used to calculate volume.

The values recorded in the deduction columns are not the actual dimensions of the decay or missing wood. The decay values represent the deduction equivalent in rads and/or metres, along with the most appropriate "decay type" to be applied to the gross piece dimensions as a result of the decay or missing wood.

Example: a log with gross dimensions of 4.2 m and 18 rad top / 20 rad butt with 0.6 m length deduction and a 2 rad top deduction would be calculated as a 3.6 m, 16 rad top / 20 rad butt.

9.4.6 Grading Pieces

All waste pieces must be measured and graded according to their condition (i.e. grade and decay) at the time the timber was felled. The effect of time and weather since the date the timber was felled (i.e. sun checking) is not taken into account when grading waste pieces, except when a wildfire affects the timber. If a licensee was responsible, or failed to comply with the Wildfire Act or Wildfire Regulations, this exception does not apply.

Bucking waste and stumps must be graded according to the rules in this manual.

Logs and trees 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 3.0 m (instead of 2.5 m in the *Scaling Manual*).

9.4.6.1 Summary of Grade Code 4 Grade Rule

All waste pieces graded as dead lumber reject (i.e. cut from trees which were dead when harvested) were previously identified as grade code 5. These pieces are to be recorded as grade 4.

9.4.6.2 Characteristics of Green and Dead Pieces

Dead pieces ***must*** have one or more of the following characteristics (indicators):

1. Deteriorated cambium,
2. Loose or shedding bark,
3. Sap rot,
4. Wood borers,
5. Deep checks (not weather checks).

Green pieces can display any of the following characteristics (contraindicators):

1. Curling bark (green bark that is curling or cupping due to the drying process),
2. Green needles,
3. Fresh cambium (sticky),
4. Mildew or mold on wood surface (except on windthrow),
5. Charred wood (recent fire kill),
6. Dark weathered ends (indicative of decked timber), or
7. 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.

9.5 Kind and Measurement of Material

9.5.1 Logs

A log is defined as:

1. Any near-round piece with more than half of its original diameter remaining,
2. A piece with a gross length of 3.0 metres or greater as measured between the utilization top and butt diameter, and
3. A piece that is broken or cut at each end.

9.5.1.1 Recording Logs

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).

Logs are measured and recorded as a single piece, they are never pencil bucked into multiple pieces to separate defects or waste class.

Record as "L" under "Kind of Material" on the plot tally card.

Figure 7 Example of a Log Measured as a Single Piece

9.5.2 Trees and Standing Waste

Trees that are unharvested and included in the final appraisal or reappraisal are considered as avoidable waste. There are reappraisal considerations, which supercede the treatment of waste, and the licensee must refer to the appropriate appraisal manual. Standing waste does not apply in non-appraised (tabular stumpage rate) cutting authorities.

The treatment of trees in a waste survey must align with their treatment in the final appraisal or reappraisal.

- If the harvest area is changed through a cutting authority amendment, timber that is amended out of the harvest area is not tallied as waste. A reappraisal may also be required by the appraisal manual, as a result of the change in harvest area.
- A reappraisal may be required by the appraisal manual, as a result of a change in the reserve areas or leave tree characteristics. Timber that is reserved in the final appraisal or reappraisal is not tallied as waste.

Since the final appraisal or reappraisal may not be available at the time of a waste survey, the licensee must provide a signed quality assurance statement, which is submitted as part of the waste survey. The statement specifies the treatment of remaining timber in the final appraisal or reappraisal and in the waste survey.

A quality assurance statement template is provided in Appendix 12.

The surveyor must reference appropriate documents such as the cutting authority, the appraisal, and maps as submitted into ECAS to determine the conifer and/or deciduous leave trees identified by species to be retained as reserved timber for the area being waste assessed.

9.5.2.1 Recording Trees

For standing trees, record as "T" under "Kind of Material" and classify the trees as avoidable. For downed trees, record “D” and classify the trees as either avoidable or unavoidable. Enter the dimensions for length, top and butt diameters, end codes, and assign a log grade.

9.5.2.2 Individual Tree Measurements

Tree length is determined using a tape/chain and a clinometer or an electronic measuring device such as a laser instrument. The waste surveyor estimates the location of the timber merchantability specification top diameter, and then measures the length from this point down to the timber merchantability stump height. To record as a piece, the tree must contain a 3 m log that meets the timber merchantability specifications.

Record the timber merchantability specification top diameter in rads as the top diameter. If the top is broken, estimate the diameter in rads at the break.

The butt diameter is the tree diameter at the timber merchantability specification stump height, accounting for flare (see *Scaling Manual* section 6.2.2).

Trees are measured, recorded, and graded as a single piece, they are never pencil bucked into multiple pieces.

9.5.2.3 Trees in Patches

For trees that were left in a patch where individual tree measurement is impractical, the waste surveyor will measure the precise area represented by the tree patch (i.e. perform a closed traverse or traverse using GPS). A patch is defined to be a grouping of trees occupying an area of equal to or greater than 0.05 hectare.

The volume may be determined by:

1. Using the cruise compilation information from the appraisal, or
2. Completing a cruise of the timber. The cruise must be completed to the standards contained within the *Cruising Manual*.

Use the procedures in 9.5.2.4 to determine the volume, species, and grade allocations for the waste submission.

9.5.2.4 Volume, Species, and Grade Allocations for Standing Timber

The cruise net volume per hectare (for the applicable timber type(s)) will be used to determine the volume of timber in unharvested tree patches or waste assessment areas.

To obtain the volumes, use the timber type summary report from the net cruise compilation report for the timber type corresponding to each of the patch location(s) or the block summary report when a patch covers multiple timber types.

The grade allocations for tree patches, are based on the historic billing grade profile of the timber mark for the cutting authority from the Harvest Billing System (HBS). The grade profile can be obtained in HBS by running the Mark Monthly Billing History Selection Report for a twelve-month period ending one month after the month primary logging was completed for the waste assessment area.

Only in the absence of the billing history records, the net cruise volume and species for the waste assessment area being surveyed are used. The grades default to sawlog except for dead potential volumes which are recorded as grade 4.

9.5.2.5 Partial Cut (Variable Retention)

Timber volume that is left in excess of the leave volume and is not included in a reappraisal of the cutting authority will be billed as waste subject to the application of the waste benchmarks.

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.

There are two methods for determining the unharvested standing tree volume in a partial cut – by re-cruising the waste assessment area or by tallying the standing timber in fixed area waste plots. Choose a method that is appropriate for the waste assessment area:

1. For a re-cruise, a licensee must put in a sufficient number of cruise plots that will either achieve the sampling error objective as stated in the *Cruising Manual*, or meet the conditions required to waive it.
    a. Once the unharvested standing tree volume has been derived, the timber scale grades will be assigned using the procedure described in section 9.5.2.4 to obtain the volume, species, and grade profile for the waste submission.
2. If waste plots are used, the plot size should be 200 m^2. Licensees are encouraged to use a higher sampling intensity than the minimum sampling requirements for the waste stratum.

The survey results for cutblocks that have been harvested using partial cut systems must be sponsored by an RPF or RFT. When there is no standing timber to report, an assurance statement must be submitted into the Waste System by a forest professional confirming that the partial cut timber harvesting requirements stated in the Schedule B or the Percent Reduction Report in the Appraisal Cruise Compilation Submission have been met.

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 re-cruise or resurvey the residual standing trees.

9.5.2.6 Unharvested Cutblocks

Unharvested timber or entire cutblocks in an expired, surrendered or cancelled cutting authority where harvest has occurred on the cutting authority may require a reappraisal. Timber that is removed from the appraisal of a cutting authority is not considered as waste.

Any remaining timber or cutblocks that are not removed from the appraisal of a cutting authority are considered as waste. Billing is based on the net cruise volume attributed to the unharvested cutblock.

The procedure described in section 9.5.2.4 will be used to obtain the volume, species, and grade profile for the waste submission.

9.5.3 Slabs

A slab is defined as any non-round piece with less than half (1/2) of its original diameter remaining, a minimum thickness of 5 rads (10 cm) and an average diameter equal to or larger than the timber merchantability specification diameter.

9.5.3.1 Recording Slabs

Slabs are measured, graded and recorded as a log (L) if greater than 3.0 m in length and have a minimum thickness of a least 5 rads (10 cm) for at least 3.0 m.

Slabs <3.0m in length are measured 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.

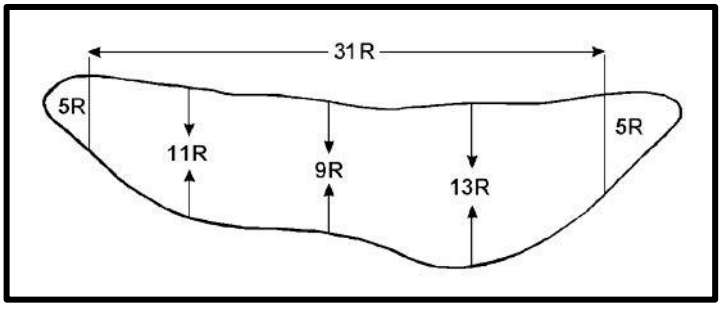
Bucking waste slabs with an average thickness less than 7.5 rads (15 cm) will be downgraded to Grade 4.

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

Using Figure 8, slab diameters are computed using the following steps:

1. Measure and average 3 thicknesses.
   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 8 Measuring Slabs



9.5.4 Stumps

A stump is defined as any piece with more than half (1/2) of its original diameter remaining, less than 3.3 m in length, and is still attached to the roots.

The length is to be measured from the high side of the stump. A stump that is equal to or greater than 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.

9.5.4.1 Recording Stumps

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

Stumps are not tallied if there is evidence a log equal to or exceeding the timber merchantability specifications did not exist. For example, a log cut from the stump is present and does not contain a 3 metre log.

If the stump has less than 50% firmwood volume due to decay, the stump is not recorded.

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.

9.5.4.2 Avoidable and Unavoidable Waste Class in Stumps

The surveyor should always view high stumps with consideration to safety. Physical obstructions are often moved away from stumps during harvesting operations. Look for unusual bark patterns that indicate the presence of a log or rock before falling.

Unless there are physical obstructions or safety precautions because of decayed wood, waste in stumps is classified as avoidable waste. All waste created by the limitations of a machine (i.e. waste that could have been avoided by using a hand faller) is classified as avoidable. Waste surveyors must assess each situation independently and determine the amount of avoidable waste based on where a hand faller could have safely made the falling cuts.

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

Guy line stumps are considered unavoidable if there is no unnecessary waste of wood. Any portion that is excessive waste must be classified as avoidable.

9.5.4.3 Stump Heights

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 avoided during the falling process. No consideration should be given to brush and undergrowth that should cut away before falling.

For raised stumps (nurse 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.

A minimum diameter at stump height (outside bark) is specified in the timber merchantability specification measured at a point 0.3 m above the high side of the stump. The minimum stump diameter must be obtained (without rounding up) or the stump is not tallied.

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.

Examples of Stump Heights:

1. Stump height 0.34 m - do not tally
2. Stump height 0.35 m - tally and record as 0.1 m
3. Stump height 0.36 m - tally and record as 0.1 m
4. Stump height 0.45 m - tally and record as 0.2 m

If the stump total height, including the TMS of 30 cm, is 1.3 m or less, 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.

Minimum stump height must be 35 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.

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

9.5.4.4 Stump Diameters

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. Butt dimensions are not required for stumps.

Measure from where the ground high side meets the base of the stem to the top of the felling cut (as shown in Figure below) to the nearest tenth (0.1) of a metre. The volume of an undercut is included in the measured stump volume. Deduct the stump height of 0.3 m and record the result under length on the plot tally card.

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 is not recorded.

All tallied stumps are measured and recorded using inside bark, therefore, it is possible to have a stump diameter which is less than the minimum stump cutting specification.

9.5.4.5 Grading Stumps

Stumps will default to sawlog grade unless decay is present. If the stump has greater than 50% and less than 75% firmwood volume it is Grade 4.

If the log from the stump is present, the stump is graded the same as the log.

9.5.4.6 Recording Stumps in Segments

Frequently, trees and snags with butt rot or obstructions are felled above the TMS stump height for safety reasons. Under these circumstances, a stump may have both avoidable and unavoidable components.

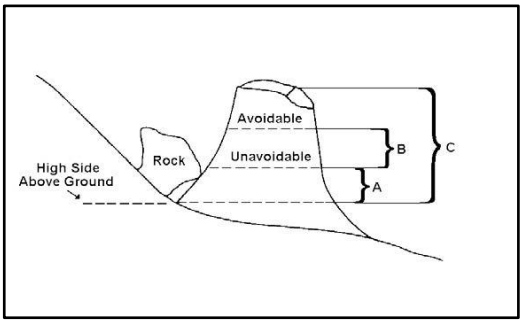
If there are both avoidable and unavoidable components of waste, the stump is recorded as two pieces each with its own piece number and record appropriate comment code such as MP on the Plot Tally Card to indicate multiple pieces.

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).

This situation is illustrated below.

Figure 9 Avoidable and Unavoidable Waste



Where:

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 – *Unavoidable stump height* is the height specified is 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.

9.5.4.7 Borderline Stumps

For borderline stumps, measure the horizontal distance from the plot center to the geometric center 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 center 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.

9.5.4.8 High Stump Exemptions

The District Manager may approve a higher allowed stump height on all or a portion of a cutblock where:

1. Higher stumps are required for safety reasons, or
2. Higher stumps are required for identified stewardship or environmental reasons (i.e. ecosystem-based management or Forest Stewardship Plan requirements, prescription from a registered professional) or,
3. Snow depth prevents access to the cutting authority TMS stump height or,
4. Higher stumps are required for retaining logs within the cutblock on very steep slopes.

Where an exemption for a portion of a cutblock is submitted the application must include a map and/or written description indicating the requested portions of the cutblock.

1. The exemption will specify a new maximum stump height.
2. Measurement of approved high stumps
    a. High stumps are always measured and recorded as waste.
    b. The portions of the stump between the TMS stump height and the approved exemption stump height is considered unavoidable waste and is recorded

appropriately.

c. The portion of the stump above the approved exemption stump height is considered avoidable waste and recorded appropriately.

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.

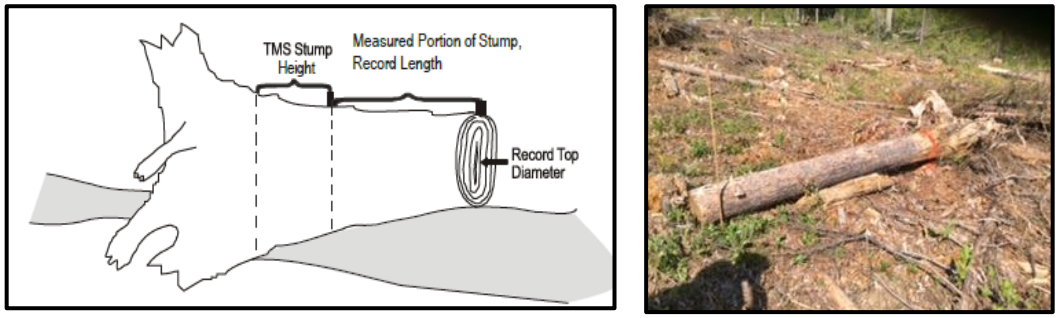
9.5.4.9 Windfall Stumps

High stumps often occur in areas damaged by wind or as single trees within a stand. Safety for the person cutting the log off a tree that has been blown over is the primary consideration when classifying these pieces.

Windfall stumps can typically be identified by the presence of the roots where the soil has fallen away. The stump and roots will appear weathered and or contain other plants growing perpendicular to the tree stem.

1. It is very difficult to determine if a stump is avoidable or unavoidable after the logging has been completed since the cause for the high stump (i.e. an obstruction) will likely be moved.
2. In some blowdown situations, there may be wind sheared trees resulting in high stumps that could not yield a minimum-length (3.0m) log. These stumps are classified as unavoidable.
3. In hand falling areas, for borderline calls, if there is any question as to whether the stump should be called avoidable or unavoidable the waste surveyor should give the licensee the benefit of the doubt and call the stump unavoidable.
4. In machine falling areas, the safety considerations are reduced therefore, stumps should not contain significant waste volumes.
5. In machine falling areas where there is evidence a machine was used to push over the tree or has damaged or broken the stem of the tree, the stumps will be measured from the TMS stump height.
6. 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.
7. Examples of unavoidable stumps:
    a. Other windfall trees obstruct the trunks of standing trees preventing lower cuts.
    b. Blowdown stumps which stand back up when the logs are bucked off.
    c. Blowdown stumps on a roadside or landing should be classified as unavoidable.
8. If a minimum length log (3.0m) is left attached to a windfall stumps, the volume above the TMS stump height is recorded.

Figure 10 Examples of Windfall Stumps



9.5.5 Bucking Waste

Bucking waste is defined as any piece:

1. That is 50% or more of the original log diameter and meets the TMS, except for slabs that are recorded as bucking waste (see section 9.5.3.1), and
2. With a gross length less than 3 m (originating from a log at least 3 m in length) that has been cut at the butt or at both ends.

A piece cut at the top and broken at the butt is:

- Not recorded in the dispersed subpopulation as it is breakage.
- Measured and recorded as bucking waste in accumulation subpopulations.

If the logging system was inappropriate or there was excessive breakage in the dispersed subpopulation then all pieces cut at the small end (top) and broken at the large end (butt) should be recorded as avoidable breakage.

Examples of bucking waste:

1. Tops bucked off at a diameter larger than the TMS diameter,
2. Long butts,
3. Pieces where the 0.1 m trim allowance has been exceeded, or
4. Pieces where decay has been bucked off a log and the remaining piece is more than 50% sound.

Examples of bucking waste that are not measured are:

1. Trim ends less than 50% sound which are less than the dimensions of a slab,
2. Trim ends which are heavily fractured,
3. Pieces less than 50% of its original log diameter (at the butt) with a broken end and a gross length of less than 0.4 metres.

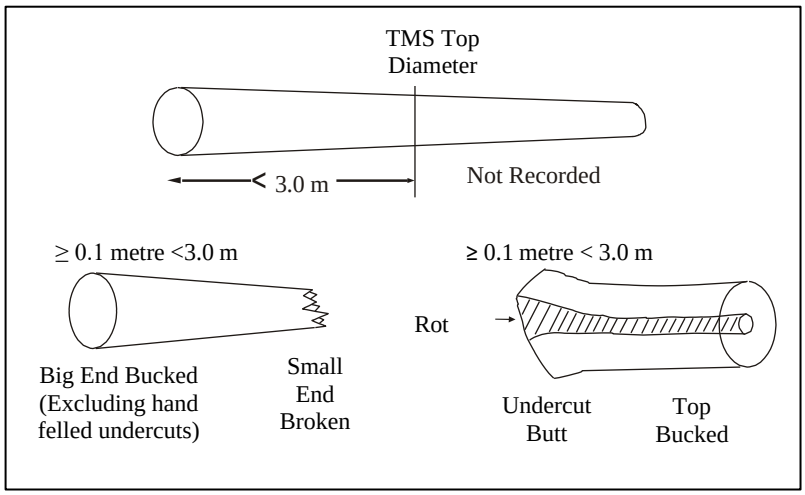
All three criteria must be met or the piece must be recorded. The piece cannot be folded (accounting for volume) to become less than 0.4 metres.

4. Pieces that physically meet the minimum requirements; however, contain severe shatter that extends through the entire piece and/or the piece would easily break apart into pieces less than the TMS.

Bucking waste is recorded as "W" under "Kind of Material" on the plot tally card.

The figure below shows several bucking waste pieces.

Figure 11 Examples of Bucking Waste



9.5.5.1 Bucking Waste Lengths

When cut at both ends, tally to the nearest tenth (0.1) of a metre regardless of length.

When cut at the large end, tally as waste if length meets or exceeds a tenth (0.1) of a metre.

Examples:

- 0.09 m in length - tally as 0.10m,
- 0.15m in length – tally as 0.20m.

9.5.5.2 Avoidable and Unavoidable Waste Class

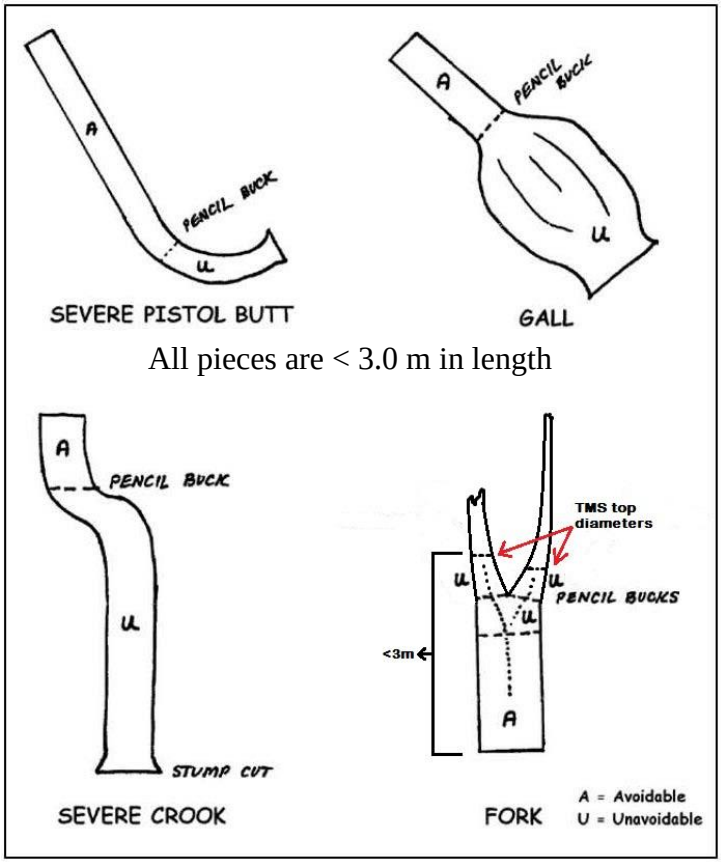
All bucking waste pieces are classified as avoidable or unavoidable.

Bucking waste is considered avoidable unless there is clear evidence that pieces were cut out for physical, environmental, or safety reasons during falling and bucking. Unavoidable bucking waste can usually be identified through on-site evidence and/or oblique cut angles required during hand bucking to create escape paths for fallers.

Some bucking waste pieces may contain sections of avoidable and unavoidable waste which must be tallied separately. Pieces may be pencil bucked and recorded as unique pieces to separate avoidable and unavoidable portions as shown in Figure 12 below. Segregations must be identified and tallied separately for any section greater than 0.10 m in length.

Severely deformed sections of logs must be removed because they cause difficulty (and in some instances a safety hazard) when the logs are processed, loaded and transported. Pieces with severe physical deformities such as forks, crooks, pistol butt, extreme sweep, galls or goitres can be pencil bucked and classified appropriately.

Figure 12 Examples of Severely Deformed Bucking Waste



9.5.5.3 Grading Bucking Waste

All bucking waste pieces must be assigned a grade code. Grading assigns the waste billing rate and the cut control attribution category for the piece.

The short lengths as well as field conditions that affect the measurement and classification of the pieces limit the amount of information available to correctly assign a grade code. Harvest methods, utilization standards, log quality, decay and many other factors influence how and why pieces of bucking waste are cut from logs.

In the Interior, bucking waste is graded using the grading matrix and field card contained in Appendix 10.

Waste grades are determined by the balance of probability based on the grade the piece would have been. Not all results will generate the correct grade on all pieces.

9.5.5.4 Sequential Pieces of Bucking Waste

Where a plot contains multiple pieces of bucking waste that are cut sequentially from the same log, the pieces may be tallied as a single piece. Sequential pieces exhibit consistent taper, matching cuts, and matching features amongst the pieces (i.e. species, shape, rot, and knot pattern).

To tally bucking waste as a single piece, determine the grade of each piece using the bucking card. Group sequential pieces with the same waste class and grade together and assign a piece number.

When a change of grade or class occurs, a new piece must be recorded.

Sequential pieces with a combined total length greater than or equal to 3 metres must be entered as kind “L” (log).

9.5.5.5 Charred Wood

The presence of charred wood affects lumber recovery and a small amount of char can contaminate pulp and paper products. Lumber recovery may also be affected by checking that is not visible due to the presence of charred wood.

Bucking waste with charred wood is graded using the grading matrix and field card contained in Appendix 10.

Scorching is superficial fire damage that affects the surface of the wood or the bark. It does not affect the visibility of checks. Scorching does not greatly affect lumber recovery because it can be removed during the debarking process.

Figure 13 Example of Charred Wood

Figure 14 Example of Scorched Wood

9.5.6 Forks

A fork is defined as a division of a log or bucking waste into two or more stems. If forks are found in logs (pieces greater than or equal to 3.0 m in length) no pencil bucking is permitted. If forks are found in bucking waste (pieces less than 3.0 m in length), forks can be pencil bucked and treated as separate pieces as per Figure 12.

The point at which the pith separates is the starting point of a fork.

If the diameter of a fork is 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.

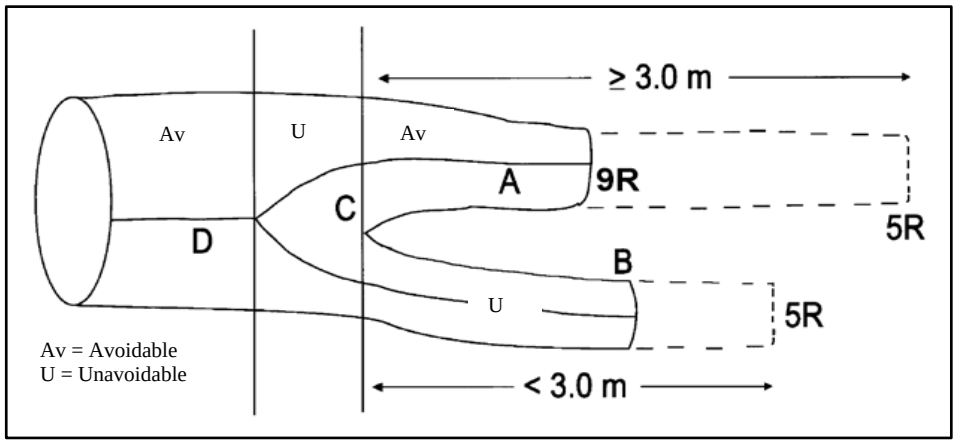
If the portion(s) of the tree, above the fork or crook, doesn't meet the minimum log length criteria

(3.0 m) to the TMS top diameter, it is not measured.

As demonstrated in Figure 13 (note: in this example, the total piece length is less than 3.0 m and is classified as bucking waste):

1. Segment A, if visually extended to the minimum top diameter (5 rads), would meet the minimum log length (3.0 m); therefore, is classified as avoidable waste.
2. Segment B, if visually extended to the minimum top diameter (5 rads), would not meet the minimum log length (3.0 m) and therefore is not measured.
3. Segment C is recorded as unavoidable waste for safety reasons. The length of segment C is determined by the separation point of the pith between segment C and D.
4. Segment D (with one pith showing) is recorded as avoidable waste.
5. Segments A, B, C and D are recorded as separate pieces on the plot tally card, each with its own piece number.
6. Use 'FK' as comment code to indicate the pieces belong to a fork and the reason for classification of piece C as unavoidable.

Figure 15 Example of Forked Bucking Waste



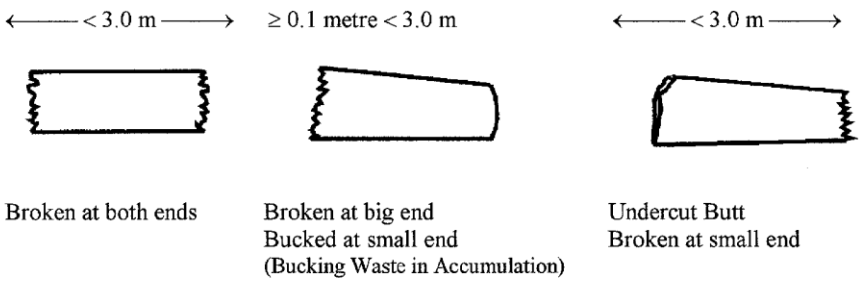
9.5.7 Breakage

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.

9.5.7.1 Examples of Breakage

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

Figure 16 Examples of Breakage



9.5.7.2 Recording Breakage

Breakage, if recorded, is tallied as "B" under "Kind of Material" on the Plot Tally Card.

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

Where breakage is considered excessive because of an inadequate harvesting method or was intentionally caused by the logging crew, it is considered avoidable waste (i.e. waste pieces crushed under the weight of a machine). These volumes will be included in the cut control volume.

A log lying in a dispersed area that is heavily fractured from being felled and would break into pieces less than 3.0 metres in length during yarding, should be classified as breakage and not recorded.

9.5.7.3 Grading Breakage

Where there is evidence of intentional or excessive breakage, classify as avoidable, and grade the piece as if it were a 3 metre long log.

9.5.8 Cold Decks

Cold decks are five or more grade 1, 2, 4 or 6 (when required to be measured) logs that are mechanically placed together in a deck.

Cold decks that are to be included in a waste assessment must be measured using a 100% scale or percent estimate method. Another acceptable estimation method is a top scale which is the determination of the average piece size multiplied by the number of pieces. Cold deck pieces are not limited to logs. All waste that falls within the cold deck stratum area must be tallied.

9.5.8.1 Road Deactivation Material

Road deactivation material is timber previously used in the construction of a culvert, bridge, other required structure.

At the time of a waste assessment, all road deactivation material that has not been previously scaled must be included in the waste assessment. All road material must be measured within a cold deck stratum using the 100% scale or percent estimate measurement methods, unless it is unsafe, then the volume may be estimated using an accepted method.

9.5.9 Coarse Woody Debris

Log pieces that may be required to meet coarse woody debris requirements are included in the waste benchmarks.

9.5.10 Special Cases

Waste surveyors often encounter pieces that are hard to classify as waste or breakage, or as avoidable or unavoidable. A few of these circumstances are listed here:

1. 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,
2. 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,
3. 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,
4. 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, or
5. 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.

9.6 Data Entry Requirements

The Waste System, EForwasteBC, and paper field tally cards can be used to collect survey information. The EForwasteBC application must be used for all ratio adjustment sampling projects and all small population (aggregate) sampling plans.

The following requirements outline the data recording format and requirements for the collection of this information. Failure to apply these requirements may result in data collection and compilation warnings or errors. The EForwasteBC user manual also provides a brief description of the data entry requirements.

9.6.1 Cutblock Header Information

The cutblock information data fields contain the general identification information for the waste assessment area.

Note: the fields shown below may vary depending on what method is used for data collection (i.e. FS 444 card versus EForwasteBC).

Table 9-1 Cutblock Header Data Format

Field	Data Requirement		Data Format	Comments
	Field	Compilation		
Forest District	Optional	Required	Alpha	Identifies the District office responsible for the administration of the block being sampled.
Reporting Unit	Optional	Required	Numeric	Created by the online Waste System.
Licence	Optional	Required	Alpha Numeric	The Licence number under which harvesting of the cutblock was authorized
Cutting Permit	Optional	Required	Alpha Numeric	The cutting permit number under which harvesting of the cutblock was authorized
Timber Mark	Optional	Required	Alpha Numeric	The timber mark used for the cutblock
Cutblock Name	Required	Required	Alpha Numeric	The cutblock being sampled

Field	Data Requirement		Data Format	Comments
	Field	Compilation		
Location	Optional	Optional	Alpha	
Logged From	Optional	Required	Numeric	The year primary logging started
Logged To	Optional	Required	Numeric	The year primary logging was completed
Logging Completion Date	Optional	Required	Date	PLC date
Survey Date	Required	Required	Date	The date the survey started
Net Area (ha)	Required	Required	Alpha, 2 decimals	Area, in hectares, of the total area of all stratum areas available for sampling and/or estimating.
NP/NF area	Optional	Optional	Alpha, 2 decimals	Area, in hectares, The total area of road surface or non-productive area.
Waste Benchmark Zone (Interior Site Code)	Required	Required	Numeric	Quantifies, in cubic metres per hectare of the avoidable waste threshold
Cruise Volume	Not required	Optional	Numeric	Quantifies, in cubic metres per hectare, the average cruise volume for the block. Data is available from cruise summaries.
Reason for Survey	Not required	Required	Alpha	

Field	Data Requirement		Data Format	Comments
	Field	Compilation		
Return Number	Required	Required	Numeric	Identifies the annual survey number of the waste surveyor responsible for the establishment of the plot. Return numbers will increment by one for each new waste assessment area sampled by the surveyor in a given year. It is the responsibility of each waste surveyor to keep track of their own return number.
Surveyor Licence	Required	Required	Alpha numeric	Identifies the certificate number of the waste surveyor responsible for the establishment of the plot. Those without a certificate number may use the following: Southern Forest Region =WASI Northern Forest Region =WANI
Waste Surveyor Name	Required	Required	Alpha	The name of the waste surveyor responsible for the establishment of the plot.
Professional Designation	Required If registered	Required If registered	Alpha	
Registration Number	Required If registered	Required If registered	Alpha	
Position	Optional	Optional	Alpha	
Notes	Optional	Optional	Alpha	General notes regarding the waste survey

9.6.2 Waste Stratum Codes

Identification of strata within a waste assessment area must be completed using the codes in tables below. Each stratum name is comprised of four characters: waste type, harvest method, plot size, and sub stratification variable. All strata must have unique stratum codes.

9.6.2.1 Dispersed and Accumulated Types and Codes

The FIRST character, (alpha) starting from the left identifies the waste type and defines a new stratum type. The recognized waste types and their codes are as follows:

Table 9-2 Waste Type Codes

	Waste Types	**Code**
1.	**Dispersed Types**	
	Dispersed Retention	D
	Felled and bucked	F
	Group Retention	G
	Historic Waste	H
	Open Slash/Clearcut	S
	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 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:

Table 9-3 Waste Stratum Harvest Method Codes

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

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 three assessment methods:

Table 9-4 Waste Stratum Assessment Method Codes

Code Position	Assessment Method	Code
3rd	Estimate Percent	E
	100% Measure	S
	Plot	*

*When plot method is used select code that corresponds with the plot in table below:

Table 9-5 Plot Size Codes

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 sub stratification of waste types within a predefined stratum within the waste assessment area.

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

Table 9-6 Waste Stratum Sub Stratification Codes

Code Position	**Sub Stratification**	**Code**
4^{th}	Not stratified	X
	Light	L
	Medium	M
	Heavy	H

If no sub stratification is done, or for 100% piece scales, record X under waste level.

Example: Stratum code SB2X

S= Open slash/clearcut dispersed waste type

B= Hoe chucking or machine yarding

2= 200 m^2 plot

X= Not stratified waste level

9.6.2.2 Standing Tree Stratum Codes

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

Table 9-7 Standing Tree Stratum Codes

STRS	Where 100% of standing trees are measured individually.
STRE	Where standing tree volumes in a patch are estimated using the estimate percent method.

9.6.3 Completion of the Plot Tally Card

Refer to Appendix 8 for example tally card.

A Plot Tally card must be completed for each plot established.

1. If a plot has no pieces, record Nil Plot in the notes section.
2. If using paper tally cards and more than one page is required
    a. Record the page number on all pages, and
    b. Fill out the header line on all individual plot cards so they can be identified and reunited should they become separated.

9.6.3.1 Plot Tally Card

The plot tally card data fields contain the general identification information for the waste assessment area.

Note: the fields shown below may vary depending on what method is used for data collection (i.e. FS 444 card versus EForwasteBC).

Table 9-8 Plot Tally Card Header Description

Field	Requirement	Format	Description
LICENCE	Required for aggregates	Alpha Numeric	The Licence number under which harvesting of the cutblock was authorized
CP	Required for aggregates	Alpha Numeric	The cutting permit number under which harvesting of the cutblock was authorized
BLOCK	Required for aggregates	Alpha Numeric	The cutblock being sampled
DATE	Required	Alpha Numeric	Identifies the year, month and day when the plot was established.
CERTIFICATE NUMBER	Required	Alpha Numeric	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: Southern Forest Region = WASI Northern Forest Region= WANI
RETURN NUMBER	Required	Numeric	Identifies the return number of the waste surveyor responsible for the establishment of the plot.
BASELINE	Optional	Alpha	Identifies the baseline the plot is tied to. Use codes such as “A” “B” “C” etc.
STRIP	Optional	Alpha Numeric	Identifies the strip number that plots are located on.
PLOT NO.	Required	Numeric	Identifies the plot number as identified on the waste survey plan.

Field	Requirement	Format	Description
PLOT SHAPE	Required	Alpha	Identifies the plot shape. Use codes "C" =Circular, "R" =Rectangular, "S" = Square. Must be blank for estimated plots and 100% measure plots.
MEASURE %	Required (default 100)	Numeric	Quantifies the percentage of the volume within the plot boundaries that has been measured and recorded.
TYPE STRATUM	Required	Alpha Numeric	Identifies the stratum the plot is located within.

9.6.3.2 Plot Tally Card Piece Descriptions

The piece dimensions recorded in this section are inclusive of decay (i.e. they are not reduced to account for the volume of decay) and only include the portion of the piece within the plot boundaries. The length is measured to the plot boundary and the diameter of that end is taken at that point.

Table 9-9 Plot Tally Card Piece Description

Tally Card Heading	Description	
PIECE NO**.**	The unique numeric identifier for each tally 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 in the comment column to indicate multiple pieces.	
BORDERLINE	Identifies pieces that lay across the plot boundary.	
	I	Piece completely inside plot.
	B	Borderline piece (measure inside portion only).
	X	Pieces that exceed the plot diameter.

<table>
<tr><td>Tally Card Heading</td><td colspan="4">Description</td></tr>
<tr><td>Tally Card Heading</td><td colspan="4">Description</td></tr>
<tr><td>SPECIES</td><td colspan="4">Identifies the species of the piece. Acceptable codes are as follows:</td></tr>
<tr><td></td><td>DOUGLAS FIR</td><td>FI</td><td>WHITEBARK PINE</td><td>WB</td></tr>
<tr><td></td><td>RED CEDAR</td><td>CE</td><td>CYPRESS</td><td>CY</td></tr>
<tr><td></td><td>WHITE PINE</td><td>WH</td><td>BIRCH or CHERRY</td><td>BI</td></tr>
<tr><td></td><td>YELLOW PINE</td><td>YE</td><td>LARCH</td><td>LA</td></tr>
<tr><td></td><td>ASPEN</td><td>AS</td><td>BALSAM</td><td>BA</td></tr>
<tr><td></td><td>COTTONWOOD</td><td>CO</td><td>SPRUCE</td><td>SP</td></tr>
<tr><td></td><td>LODGEPOLE PINE</td><td>LO</td><td>ALDER</td><td>AL</td></tr>
<tr><td></td><td>HEMLOCK</td><td>HE</td><td>MAPLE</td><td>MA</td></tr>
<tr><td></td><td>WILLOW</td><td>WI</td><td>PACIFIC YEW</td><td>UU</td></tr>
<tr><td></td><td>ARBUTUS</td><td>AR</td><td></td><td></td></tr>
<tr><td>KIND</td><td colspan="4">Identifies the nature or shape of the piece.</td></tr>
<tr><td></td><td>Logs (L)</td><td colspan="3">Includes all logs and slabs at least 3.0 m in length.</td></tr>
<tr><td></td><td>Down Trees (D)</td><td colspan="3">Includes all down trees exceeding the timber merchantability specification.</td></tr>
<tr><td></td><td>Standing Trees (T)</td><td colspan="3">Includes all standing trees exceeding the timber merchantability specifications.</td></tr>
<tr><td></td><td>Stumps (S)</td><td colspan="3">Includes all stumps greater than 0.3m above high side</td></tr>
<tr><td></td><td>Bucking Waste (W)</td><td colspan="3">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.</td></tr>
<tr><td></td><td>Special Products (X)</td><td colspan="3">Includes already manufactured products less than 3 m in length such as shake bolts or fence</td></tr>
</table>

Tally Card Heading	Description	
		posts that have been left on the cutblock.

Tally Card Heading	Description
WASTE CLASS	Identifies the waste class (avoidable/unavoidable) class of the piece. Acceptable codes: A, U
LENGTH (dm)	Quantifies in decimeters the "in plot" length of the piece.
TOP (R)	Quantifies in rads the gross diameter, inside bark, of the top (small) end.
TOP END	Describes the top end. Acceptable codes: natural (N), cut (C), broken (B) or buried (X).
BUTT (R)	Quantifies in rads the gross diameter, inside bark, of the butt (large) end.
BUTT END	Describes the butt end. Acceptable codes: undercut (U), cut (C), natural (N), broken (B) or buried (X).
GRADE	Identifies the grade of the piece regardless of the kind of wood or waste class. Acceptable codes: 1, 2, 4, 6, Z (Interior)
COMMENT CODE	Additional descriptive information that may be useful. Acceptable codes: Table 9-12

<table>
<tr><th>Tally Card Heading</th><th>Description</th></tr>
<tr><td>PIECE VOLUME</td><td>This column displays the net piece volume.

<table>
<tr><td colspan="3">A simple formula for computing volume with a pocket calculator is:</td></tr>
<tr><td colspan="3">VOLUME = [(t * t) + (b * b)] * L * K</td></tr>
<tr><td>Where</td><td>V =</td><td>volume in cubic metres</td></tr>
<tr><td></td><td>t =</td><td>top diameter in rads</td></tr>
<tr><td></td><td>B =</td><td>butt diameter in rads</td></tr>
<tr><td></td><td>L =</td><td>Length in metres</td></tr>
<tr><td></td><td>K =</td><td>0.0001571</td></tr>
</table>
</td></tr>
</table>

9.6.3.3 Deductions for Rot or Missing Wood

Waste surveyors must be able to calculate these deductions accurately and record them on the plot tally card.

Table 9-10 Deduction Descriptions

LENGTH	Quantifies the length deduction in tenths of metres.
TOP	Quantifies in rads the diameter deduction for the top end.
BUTT	Quantifies in rads the diameter deduction for the butt end.
D-DEFECT TYPE	Identifies the type of decay in the piece. Must be recorded whenever a deduction has been recorded.

9.6.3.4 Outside Plot Measurements

Outside plot measurements are optional to collect.

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

Table 9-11 Optional Outside Plot Measurement Descriptions

FAR END	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	Quantifies in metres the additional length of the piece that is outside the plot boundary. This length can be estimated.

9.6.3.5 Comment Codes

The comment codes are used to help explain a waste piece. A code is required for all unavoidable waste pieces. The acceptable codes are:

Table 9-12 Comment Codes

Code	Description	Code	Description
BK	Breakage	LB	Long butt
BN	Bunch knots	LN	Large knots
BR	Buried	MB	Machine breakage
CA	Candelabra	MP	Multiple part piece
CC	Creek cleaning	NP	Nil plot
CF	Cat face	OB	Obstructed
CK	Crook	ON	Oversize knots
CL	Culvert log	PR	Pocket rot
CP	Company piece	RE	Reconstructed
CR	Severe Crook	S1	Segment 1
DP	Dead potential	S2	Segment 2
DU	Dead useless	S3	Segment 3
FC	Frost crack	SA	Sapling
FK	Fork	SB	Shake block
FL	Fluted Butt	SH	Shatter
FP	Fence post	SL	Slab
FW	Firewood	ST	Standing tree
GL	Guy line stump	SW	Sweep
HK	Hooked	TR	Whole tree
HN	Heavy knots	US	Unsafe
HP	Helipad	WD	Coarse woody debris
HS	Holding stump	WF	Windfall
IN	Inaccessible	WS	Wind shear
KN	Knots		

9.7 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.

9.7.1 Field Equipment and Supplies

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

1. Hand compass
2. Clinometer
3. Submeter real time GPS
4. Hip chain or 50m chain
5. Logger's tape
6. BC metric scale stick
7. Axe
8. Tree marking paint
9. Flagging ribbons
10. Felt markers
11. Tally book with waterproof paper
12. iPad with EForwasteBC software

9.7.2 Field Survey Standards

When a field assessment requires traversing areas, standard field survey methods must be used including proper notes to support the area compilations. These notes will show:

1. The forward sighting of the bearings,
2. The slope in degrees or percent,
3. Slope distances in metres,
4. Horizontal distances in metres, and
5. Retain traverse notes with all other working papers for inspection by check survey or audit staff.

9.7.3 Partial Cutblock Waste Assessment Areas

A partial cutblock waste assessment area is required when a cutblock has not been fully harvested and harvesting has stopped for an extended period. A partial cutblock waste assessment area allows waste to be surveyed in a timely manner, despite a delay in harvest completion.

Eventually, when harvest of the remaining portion of the cutblock is done, the remaining partial cutblock must be surveyed and submitted in a separate sampling population. Both partial cutblock waste assessment areas have their own PLC dates.

A partial cutblock waste assessment area must not be used if harvesting will re-commence before the waste survey on the first portion of the cutblock is complete and an interim submission has been received by the district. If harvesting will re-commence before the waste survey can be completed, the cutblock is not PLC, and it cannot be waste surveyed until it is PLC.

Where a partial cutblock will be submitted in a waste assessment, the surveyed portion must be clearly identified in the field using flagging ribbon and on the waste survey plan map.

No area can be added or removed from a partial cutblock waste assessment area after submission of the sample plan.

A partial cutblock submission cannot be only one stratum.

10. Simplified Waste Survey

10.1 Simplified Waste Survey

10.1.1 Introduction

A simplified waste survey process may be used to report waste on eligible cutblocks. This process does not require field sampling and allows waste assessments to be calculated based on cruise and scale volumes.

Currently, this process is not available for single cutblocks within a multi-cutblock cutting authority. It can only be used where the entire cutting authority is eligible and none of the cutblocks are submitted late.

A worksheet provided by Timber Pricing Branch may be used to determine eligibility and waste assessment volumes.

10.1.2 Eligibility

The primary requirement for eligibility is determined by utilization levels and the volume delivered to a secondary fibre processing facility. The formula is calculated for an entire cutting authority containing one or more cutblocks. If all eligibility requirements are met, the simplified waste survey may be used for all cutblocks in the cutting authority.

If the difference of

Net Cruise Volume – Total Harvest Billing Volume

Is less than the sum of

Benchmark Volume + Volume Delivered to Secondary Fibre Facilities

Where

- Net Cruise Volume = the total net cruise volume for the cutting authority as submitted in ECAS in the Cutting Permit Summary cruise report. (For cutting authorities with reductions use the Percent Reduction compilation. Otherwise, use the Full volume compilation.)
- Total Harvest Billing Volume = the total scaled volume from the cutting authority as invoiced in the Mark Monthly Billing History Selection Report in HBS.
- Benchmark Volume = the benchmark volume (m^3/ha) X net merchantable area (ha) of the cutting authority.
- Volume Delivered to Secondary Fibre Facilities = the total scaled volume delivered to a pulp mill, chip plant, pellet plant, or bioenergy plant and processed as one of these products. Deliveries to a secondary fibre facility are not mandatory. A value of zero is used if there are no such deliveries.

Then the remaining waste assessment areas may be eligible for the simplified waste survey subject

to further conditions below.

The following additional requirements must be met to use the simplified waste survey:

1. The cutblock must be within a cutting authority that was cruised with a sampling error of 15.0% or less.
2. All cutblocks in the cutting authority are PLC at the time of waste assessment calculation.
3. This method cannot be used if any cutblock within the cutting authority has an outstanding late waste assessment or the waste submission has been submitted later than the date required in this manual.

10.1.3 Waste Volume Calculation

The total waste assessment volume is determined for the cutblock as follows:

The difference of

Net Cruise Volume – Total Harvest Billing Volume

Where

Net Cruise Volume = (the total net cruise volume for the cutting authority as submitted in ECAS) * (the net merchantable area of the cutblock) / (the net merchantable area of the cutting authority)

Total Harvest Billing Volume = the total scaled volume from the cutting authority as invoiced in HBS * (the net merchantable area of the cutblock) / (the net merchantable area of the cutting authority)

If this calculation results in a waste volume less than 1.0 m^3/ha, the simplified waste survey volume is submitted as 1.0 m^3/ha.

10.1.4 Species, Grade, and Classification

The species distribution is calculated using the percentage breakdown that is reported for the cutting authority in the Cutting Permit Summary of the full volume cruise as submitted in ECAS.

The grade distribution is calculated using the district average waste reports produced by Timber Pricing Branch. For each species, three categories must be reported:

1. Avoidable Sawlog waste m^3/ha
2. Avoidable Grade 4 waste m^3/ha
3. Unavoidable waste m^3/ha

10.1.5 Population, Subpopulation, and Stratum

The population size is reported as the net merchantable area of the cutblock as submitted in ECAS. Where applicable, road permit area is included in the area.

The entire survey volume may be reported in one dispersed subpopulation and one dispersed stratum. This will allow simplified data entry.

10.1.6 Reporting

The following files must be attached to the WASTE submission for a simplified waste survey:

1. A worksheet with values and calculations to determine eligibility and waste assessment volumes.
2. A map of the cutblock and road permit area.
3. HBS Cut to Cruise Comparison Report.
4. HBS scale reports (Mark Monthly Billing History Selection Report) showing total harvest volume delivered secondary fibre facilities, if applicable.
5. Cutting Permit Summary of the full volume cruise as submitted in ECAS.

11. Quality Assurance

11.1 Check Surveys

11.1.1 Introduction

Timber Pricing Branch is responsible for setting the standards for waste surveys, while licensees are responsible to meet these standards.

The Ministry audits waste survey information to ensure the standards within this Manual are achieved. Quality assurance audits support the principles of the Take or Pay Policy, revenue control, cut control, and ensure the consistent application of waste information in the billing process.

11.1.2 Objectives

The objectives of quality assurance are to ensure:

1. The integrity of the sample design by assessing the accuracy and completeness of:
    a. The sampling plan, and
    b. The waste assessment area survey map.
2. Waste measurements, classifications, and procedures were carried out as described in this Manual,
3. The survey has been completed within the net volume and value and individual parameters identified in this section,
4. Field assessments and reports were completed and submitted on time, and
5. The reports generated from the HRC are consistent with the survey plan and reflect the data collected in the field.

If any of the preceding components of the survey are not acceptable, the Licensee must undertake corrective actions to ensure the survey meets the minimum Ministry standards.

Timber Pricing Branch may consider exceptions to these standards in extenuating circumstances on a case by case basis.

11.1.3 Check Survey Timing

It is the Ministry prerogative to conduct a check survey at any time.

Post harvest treatments cannot commence until the waste survey audits have been completed, audited, and approved in the Waste System.

11.2 Check Survey Standards and Procedures

Check surveys verify that the sampling plan was developed according to the standards and that the field measurements were collected and recorded correctly.

Check surveys may be comprised of office checks of the survey planning process or checking of the field survey work and data submitted to the Waste System.

Field checking may constitute audits of plot location, waste assessment area strata delineation, piece data audits, or a combination of all.

The check survey requires remeasurement of attributes that were measured in the original survey. The full survey or parts of a survey of a waste assessment area or a reporting unit can be accepted or rejected based on the results of the check survey.

Field Services 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).

When requested by the Ministry, the licensee must submit the original waste survey data in the format it was collected (either digital format or paper tally cards), a copy of the final survey plan map, area calculations, and any notes related to the survey. Digital plot data must be submitted in a standard, accepted format.

11.2.1 Field Check Requirements

The required number of plots required in an audit are:

1. Single or Aggregate Populations
    a. In each accumulation stratum, at least 10% of the measure plots, or a minimum of two plots, whichever is greater, and
    b. In each dispersed stratum, at least 10% of the measure plots, or a minimum of five plots, whichever is greater.

An audit of an aggregate population may include plots from more than one cutblock to meet the requirements above. In an aggregate population, the minimum number of plots to be checked is based on the number of plots from the sample plan and any other strata that exist within the waste assessment area being checked. Prediction plots may be checked at the discretion of the auditor. To reject a survey based on prediction plot volumes, at least 10% of the prediction plots, or a minimum of five, whichever is greater, must be checked.

In order to reject a waste survey on the basis net volume and value, the auditor will audit the number of measure plots specified above within the sample population.

Otherwise, to reject a survey based on the individual parameters, the minimum number of check plots will include both prediction and measure plots. If fewer plots have been audited and there is mutual agreement between the waste surveyor or licensee representative and the auditor, the survey may be rejected.

11.2.2 Field Checking Standards

11.2.2.1 Maximum Allowable Errors

Measurement of a random selection of samples within a waste assessment area is used to assess the acceptability of the survey results. The items to be checked and their acceptable limits of errors are specified below.

11.2.2.2 Net Volume and Value

Exceeding the parameter for either the net volume or net value of waste (avoidable and unavoidable) of the audited plots is grounds for rejection of the survey.

Table 11-1 Net Volume and Value

Net Volume	The net volume of waste within a waste assessment area or aggregate population must not vary by 10.0% from the net volume of waste determined by the check surveyor.
Net Value	The net value of waste within a waste assessment area or aggregate population must not vary by 10.0% from the net value of the waste determined by the check surveyor. The net value is derived by multiplying the volume of each species/grade combination by the applicable waste rate.

11.2.2.3 Individual Parameters

Although the net volume and net value are the main determining factors for accepting or rejecting a survey, a survey may be rejected if any of the individual parameters identified below have been exceeded. Additionally, even when the volume and value standards have been achieved within a waste assessment area, if continuous or repeated errors are identified, the District Manager may order a resurvey.

Table 11-2 Individual Parameters

Attribute	Standard
Conifer/deciduous identification	Plus or minus 2.0% of all pieces
Species identification	Plus or minus 5.0% of all pieces
Area (stratum)	A survey may be rejected if stratum areas are incorrect.
Strata identification	No variation allowed
Measure percent	Plus or minus 10.0% percent.
Plot boundary marking	Plus or minus 0.10m (10 cm) when measured on borderline pieces.
Location of plots	No variation allowed (plots must be located in the stratum they were meant to sample)
Count of waste piles	Less than twenty (20) check piles – no variation allowed. Greater than or equal to twenty (20) piles - the count must be within 5.0% of the checked number.

Failure to follow the procedures specified throughout this manual may result in rejection of the survey. Some examples are:

1. Incorrect location of plots (not using the correct POC and Grid Spacing Distance),
2. Establishing more plots or less plots than required from the pre-determined sampling intensity,
3. Establishing a plot which samples outside the stratum it is located in,
4. Check surveyor is unable to audit the layout of the plots,
5. Check surveyor is unable to audit the plots and pieces due to poor marking,
6. Using an incorrect method of selecting the piles to be sampled, and
7. Using an incorrect or biased method of determining the prediction volumes.

11.2.2.4 Plot Location Standards

Plot establishment audits will be conducted using the same form of survey equipment used to establish the plots. Where hand traverse methods are used field audits will be completed with hand traverse equipment of equal or higher quality. Where GPS plot location methods are used submeter real time GPS data collectors will be used to audit the work.

11.2.2.5 Hand Traverse Plot Location

Hand traverse plot locations will be audited using hand compass, tight chain and Suunto. Traverse auditing will follow the same direction of travel as the original survey. Audit standards will be calculated by totaling the cumulative survey distance divided by the cumulative audit distance.

Table 11-3 Hand Traverse Plot Location Standards

Attribute	Standard
Horizontal Distance	Plus or minus 2.0% (2.0 m per 100m).
Bearings	Plus or minus 2.0 degrees (+/- 3.5 m per 100m).

Note: Plus or minus 2 degrees translates to 3.5 m in 100 m using the formula:

(100 (tan 2 degrees)) = 3.49%, therefore,
3.49% * 100 m = 3.49 m (rounds to 3.5m)

11.2.2.6 GPS Plot Location for Auditors

1. Submeter real time GPS data collectors must be used to audit the work.
2. The auditor will travel to the surveyed plot location and collect a GPS data point, a minimum of 50 GPS data points will be required to collect a point.
3. In order for a survey to be rejected for waste plot location, either both of the first two standards (a and b) must be exceeded, or the last standard (c), when a Plot Reference Point (PRP) is used, must be exceeded:
    a. The average variation of all waste plot locations checked must be within 3.0m of the check survey plot locations.
    b. Individual variations between the check survey plot locations and the original plot locations must be within 5.0m. A tolerance of one plot location outside of 5.0m will be allowed for every ten (or less) plots checked.

c. The distance and bearing between the waste surveyor's PRP (if established) and waste plot must meet the same standards as those for hand traverse methods:

    i. Horizontal distance: plus or minus 2.0%

    ii. Bearing: plus or minus 2.0 degrees

4. In order to require a resurvey based on these standards, a minimum of 5 measure plot locations, or 10% of the measure plot locations, whichever is greater, must be checked.

11.2.3 Acceptability of Check Survey Results

If the net value and volume of the checked plots falls within the specified variance, then the survey is deemed to be acceptable unless the procedures specified in the manual were not adhered to (i.e., incorrect area used, log decks not included in the survey). Any obvious bias in volumes, grades and/or waste class which affect monetary billing will also result in rejection of the survey.

If the net volume or value parameters are 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 two check surveys or 20% of the checked waste assessment areas within a reporting unit or sampling plan are rejected, the District Manager may order that all the waste assessment areas within that reporting unit or sampling plan be resurveyed. However, if continuous or repeated errors are identified, the District Manager may order a resurvey of the reporting unit or sampling plan after one check survey.

11.2.4 Non-Compliance with Check Survey Standards

If the survey work is rejected after a check survey, the District Manager may order the licensee to resurvey the entire waste assessment area or those portions of the original survey that do not meet the standards. The resurvey must be completed prior to any post harvest treatment occurring and/or within 60 days of the District Manager's notification.

The licensee will be responsible for any costs they incur in the resurvey.

A full or partial resurvey may be subject to a second check survey carried out at the District Manager's discretion.

11.2.5 Dispute Resolution

A licensee who has been ordered to perform a resurvey may request a second check survey in writing to the District Manager.

The District Manager may have a second check survey performed using ministry personnel that were not involved in the first check survey. The second check survey will be completed within 30 days of the original survey rejection, or on another date as determined by the District Manager depending on staff availability and the accessibility of the waste assessment area.

If the second check survey:

1. Finds the original survey in non-compliance with check survey standards:
    a. The licensee will perform a resurvey to replace the original survey at their expense, and
    b. The licensee who requested the second check survey must pay to the government the charges, costs and expenses incurred by the government in respect of conducting the second check survey.
2. Finds the original survey in compliance with check survey standards:
    a. The original survey will be accepted as submitted, and
    b. No charges, costs, and expenses in respect of the second check survey will be charged.

11.2.6 Dispute Resolution (BCTS)

Where there are billable waste volumes on a Timber Sale Licence, Forestry Licence to Cut or permit issued by BCTS following a waste assessment conducted by BCTS, the Timber Sales Manager may notify the TSL holder about the waste assessment results. In the event that the TSL holder disputes the waste assessment results, the holder may submit a letter in writing specifying the grounds of dispute to the TSM within thirty (30) days of receiving the assessment results.

If the TSL holder is notified of the assessment results and no letter of dispute is received by the TSM, the TSL holder is deemed to have accepted the waste assessment results.

Once the TSM has forwarded the TSL waste assessments to the District Manager, subject to the field check that may be carried out by the district staff, the results are deemed to be final.

Any disputes relating to the check surveys and waste billing rates should be directed to the District Manager.

11.3 Waste Submission Review

The Ministry staff will review all data submitted to the Waste System and/or the District and either approve or reject the waste assessment(s).

11.3.1 Office Review Standards

Table 11-4 Office Review Standards

Attribute	Standard
Final sample plan configuration	Completed in accordance with section 6.3
Final aggregate sample plan configuration	No variation of waste assessment areas allowed
Net waste area (strata or waste assessment area)	A survey may be rejected if areas are incorrect.
Multiple mark identification	No variation allowed
Multi mark area	A survey may be rejected if areas are incorrect.
Number of plots	Plus or minus one (1), except in aggregate populations where no variation is allowed
Grid spacing distance	Plus or minus 2.0 %
SPIF	Plots must be located in accordance with the assigned SPIF
Waste survey map	Completed in accordance with section 6.8.1
Site Type	No variation
Benchmark value	No variation

11.3.2 Processing Waste Volume Estimates

Once checking is completed, the Ministry will:

1. Process the submission and forward to HBS for billing or,
2. Advise the licensee if the submission has been rejected.

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12. Appendices

Appendix 1 Glossary

Words and expressions used but not defined in this Manual, unless the context otherwise requires, have the same meaning as in the Forest Act.

"**AAC**" means Allowable Annual Cut as defined in the *Forest Act*;

"**Act**" means *Forest Act*;

"Aggregate Waste Submission" means a waste submission relating to two (2) or more waste assessment areas and a total population net waste area not exceeding 3,000 ha;

"**Agreement**" means a form of agreement referred to in section 12 of the *Act*, or a pulpwood agreement;

"Avoidable Waste" means wood material that meets or exceeds the Timber Merchantability Specifications that does not fall within the definition of unavoidable waste;

"**Batch**" means a grouping of one or more waste assessment areas selected from a population that have been selected to be surveyed;

"**BCTS**" means BCTS as defined in the *Forest Act*;

"**Bernoulli selection process**" means to sample cutblocks where each cutblock is selected individually for inclusion into the sample, using the same selection probability as in previous batches;

"**Breakage**" means any piece of a tree, meeting the minimum diameter set by the TMS, which has a gross length shorter than 3.0 m in length and is broken at the large end or broken at both ends. This definition is not consistent with the inventory definition of breakage nor is it intended to be;

"**Bucking Waste**" means a portion of a tree or log greater than the top diameter set by the TMS that is less than 3.0 m in length and which has been cut at the large or both ends. To be measured as bucking waste the piece must have originated from a tree or log at least 3.0 m in length;

"**Cardinal direction**" means North, South, East and West. All references to azimuths or bearings mean the "true" value;

"**Char**" or "**Charred Wood**" means wood (not bark) that has been reduced or severely weakened by combustion or extreme heat. Char has a broken or cracked appearance resembling alligator skin;

"**Cold deck**" means five or more grade 1, 2, 4 or 6 (grade 6 is only counted when required to be measured under the cutting authority document) logs that are mechanically placed together in a deck;

"**Conventional**" means any harvest method that does not use a helicopter;

"**Cruise Based**" means a cutting authority where under section 106 of the *Act* the stumpage payable is calculated using information provided by a cruise of the timber conducted before the timber is cut;

"**Cutblock**" means an area that meets the cutblock requirements as specified in the Interior Appraisal Manual;

"**Cutting Authority**" means:

1. A cutting permit issued under a Forest Licence, Timber Sale Licence, a Timber Licence, a Tree Farm Licence, a Community Salvage Licence, a Master Licence to Cut, a Forestry Licence to Cut, or a First Nation Woodland Licence;
2. A Timber Sale Licence that does not provide for the issuance of a cutting permit;
3. All other Licences to Cut; or
4. A Road Permit;

"**Cutting Authority Area**" means the area where timber may be harvested under the cutting authority being appraised, and which has a unique timber mark;

"**Deciduous Timber**" means timber that is not of a coniferous species;

"**Decked Timber**" has the same meaning as a cold deck;

"**Director**" means the Director of Timber Pricing Branch of the Ministry of Forests, Lands and Natural Resource Operations and Rural Development;

"**Firmwood**" means the amount of solid wood within a log or waste piece after accounting for rot, hole, char and missing wood.

"**Forest Professional**" means a Registered Professional Forester (RPF), a Registered Forest Technologist (RFT) or a special permit holder acting within the scope of their permit, registered and in good standing with the Association of BC Forest Professionals;

"GPS (Global Positioning System)" means a method of determining or relocating a ground position using the signal from several satellites simultaneously. A small portable computer evaluates the time for each signal to reach it and then computes a three-dimensional location;

"**GIS Software**" means a Geographic Information System designed to capture, store, manipulate, analyze, manage, and present geographical data;

"Harvest" means to cut, cut and remove, or remove timber from a cutting authority, other than on road permit areas within a cutblock;

"Harvest Residue Compiler" means a data compilation software application used to create sample populations and to calculate waste data for input into the Waste system;

"HBS" means the Harvest Billing System administered by the Ministry;

"HDOP" means horizontal dilution of precision, which is a measure of the precision of GPS results related to the satellite positions. As HDOP decreases, the level of precision increases;

"**Licensee**" means the holder of a cutting authority;

"**Log**" means any near-round piece with more than half of its original diameter remaining and with an average diameter equal to or larger than the timber merchantability specification diameter for at least 3.0m of length;

"**Manual**" means the Provincial Logging Waste and Measurement Procedures Manual-Interior Version;

"**Merchantable Timber**" means timber that meets or exceeds the timber merchantability specifications that are described in Table 3-1 in this Manual. Timber that is graded 6 or Z (Interior) is not merchantable;

"**Minister**" means the Minister of Forests, Lands, Natural Resource Operations and Rural Development;

"**Ministry**" means the Ministry of Forests, Lands, Natural Resource Operations and Rural Development;

"Net Waste Area" means the area of a waste assessment area in hectares reported in a waste submission;

"**North Area**" means Northeast, Omineca, and Skeena Regions excluding that portion that lies geographically within the North Coast Timber Supply Area;

"Number of Samples" means the number of samples of either waste assessment areas or plots in a waste survey;

"Other related sections" in the context of the *Forest Act*, means sections 13(3)(b)(ii), 14(1)(d)(ii), 20(3)(b)(ii), 22(f)(ii), 30(f)(ii), 33(5)(b)(ii), 35(1)(c)(ii), 43.3(1)(d)(ii), 43.55(1)(d)(ii), 43.7(2)(e)(ii), 43.8(e)(ii), 45(1)(d)(ii), 47.5(1)(a)(ii), 47.5(2)(b)(ii), 47.7(f)(ii), 118(1)(c)(ii);

"Partial cutblock" means a portion of a cutblock that is to be surveyed as a distinct submission;

"PDOP" means positional (3D) dilution of precision, which is a measure of the precision of GPS results related to the satellite positions. As PDOP decreases, the level of precision increases;

"Pencil Buck" means the act of recording bucking waste or stumps as two or more pieces of waste material. Surveyors will divide (pencil buck) the piece of waste at the point where the waste class changes from avoidable to unavoidable waste as a result of a defect in the piece;

"Pile" means an accumulation of woody material created by a machine that contains one or more pieces of waste;

1. Roadside Pile means a pile in which the majority of the pile area (footprint) is located adjacent to and within 20 metres of a road edge.

2. Dispersed Pile means a pile in which the majority of the pile area (footprint) is located greater than 20 metres from the road edge.

"POC" means 'Point of Commencement' – a point in or near a cutblock used to locate sample plots or to start a sampling procedure;

"Population" means a single item or group of items for which an estimate through the sampling process is made including but not limited to an estimate for a group of cutblocks, sample cutblocks, plots or waste pieces;

"**Primary Logging**" the cutting of timber and the yarding of that timber to a central landing, road side, or drop area in a logging operation;

"PLC" or "Primary Logging Completion Date" the earlier of the date on which:

- the yarding of all the timber that is cut in a cutblock to a central landing, roadside, or drop area in a logging operation is completed; or
- one month after the date in which the yarding of all the timber that is cut in a cutblock to a central landing, roadside, or drop area in a logging operation is completed for waste assessment areas authorized under the Concurrent Residual Harvest System.
- The date that the cutting authority authorizing harvest expires, is suspended or otherwise terminated;
- It is synonymous with "ready-for-survey".

"**Reporting Unit**" means a tracking mechanism to store, track and report waste information;

"**Regulations**" means regulations under the *Act*;

"**Ready for Survey**" means the earlier of:

1. The primary logging complete date, or
2. The date that the cutting authority authorizing harvest expires, is suspended or otherwise terminated;

"Reserved Timber" means merchantable standing timber left after completion of primary logging within the cutting authority area that is intentionally retained for silviculture, riparian management, biodiversity or forest management reasons. It must be identified as:

1. Areas reserved from harvest on a map submitted by the licensee for waste assessment purposes, and/or
2. Standing timber retained in accordance with a partial cutting regime, or otherwise reserved from cutting, when identified in the cutting authority and appraisal;

"Residue" means timber, whether standing or felled, except timber reserved from harvest, which does not meet or exceed the timber merchantability specifications described in this Manual that was not removed from the cutting authority area;

"**Road Permit**" means road permit as defined in the *Forest Act*;

"Sampling Plan" contains the waste assessment areas to be reported, the sampling methodology, and the other criteria that will be used to define the sample size;

"Sample size" means the number of samples included in a waste survey to meet the objectives of the Sample Plan;

"**Scale Based**" means a cutting authority where the stumpage payable is calculated using a scale of the timber;

"**Scorch**" or **"Scorched Wood"** means wood that is discoloured but wood fibres are smooth and there is little burn penetration into the wood. Scorch may also be used to describe fire damage where the bark is burnt but not the underlying wood;

"**SPIF**" (**S**tarting **P**oint **I**nterval **F**actor) means a value determined on a monthly basis by the Ministry to be used by agreement holders to generate a random starting point for sampling grids. The SPIF will be randomly determined at 10% intervals ranging from 10 to 90%;

"Slab" means any non-round piece of timber that has fractured along a plane roughly parallel to the longitudinal axis of the original log that has a minimum thickness of 10 cm for at least 3.0m of its length and an average diameter equal to or larger than the TMS diameter;

"**South Area**" means Cariboo, Kootenay-Boundary and Thompson-Okanagan Regions;

"Standing trees" means trees authorized for harvest under the cutting authority (excepting reserved trees) but at the discretion of the licence holder are not cut and removed.

"**Stub (Stubbed) trees**" means the practice of harvesting or removing a portion of the tree so that part of the bole (stem) above stump height remains;

"**Stump"** means any piece of timber in which more than one half (1/2) of its original diameter is remaining, is less than 3.30 m in length and which has a cut top and is still attached to the roots;

"**Survey date"** means the date the field survey started on a waste assessment area.

"Tie point" means a falling corner. A specific point on the ground whose location is readily identifiable on a digital image, aerial photograph or map (i.e. road intersection, corner of a field or swamp, field located station) may be used if agreed to by the District and surveyor;

"Timber Merchantability Specifications or TMS" means the stump height and diameter, log top diameter, slab thickness and log length specified in this Manual;

"**Timber Pricing Branch or TPB**" means the Timber Pricing Branch of the Ministry;

"**Timber Pricing Branch website**" is:
https://www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/timber-pricing/forest-residue-waste

"**Timber Sales Manager or TSM**" means the Timber Sales Manager or the Timber Sales Manager's designate;

"Tree" means any live or dead piece of a tree still attached to its roots having an average diameter equal to or larger than the TMS diameter for at least 3.0m of its length;

"Unavoidable Waste" means waste that meets or exceeds the Timber Merchantability Specifications that:

1. Is inaccessible or physically obstructed;
2. Could not be felled, bucked or removed due to safety reasons;
3. Could not be felled, bucked or removed due to physical, or environmental reasons;

"Unharvested" means a cutblock where:

- no timber is cut, or
- the timber is cut and not removed to a scale site.

"Volume Estimate" means the determination of a volume of material using sampling principles and measurements in accordance with this Manual;

"Volume Prediction" means a forecast of waste volume at the waste assessment areas or plot level;

"Waste" means timber, whether standing or felled, except timber reserved from cutting, which meets or exceeds the Timber Merchantability Specifications described in this Manual that was not removed from the cutting authority area by the agreement holder;

"Waste Assessment" means an assessment conducted in accordance with the procedures set out in the Manual for determining the volumes of Waste and Residue left on a harvested area following completion of harvesting operations;

"Waste Assessment Area" means a cutblock or a partial cutblock, which requires a waste assessment under the Forest Act and the agreement under which authority to cut timber is granted;

"Waste Benchmark" means the volume of avoidable waste, expressed in cubic metres per hectare that can be left on a harvested area without being subject to a monetary waste assessment;

"**Waste System**" means the online Waste System;

"**WMRF**" (waste monetary reduction factor) means a factor applied to the waste rate to generate a waste billing rate.

Appendix 2 WMRF and Billing Calculations

BRITISH COLUMBIA

INTERIOR

Worksheet for Waste Billing Against Benchmarks

Ministry of Forests

To be Completed by by Licensees

Licence No.		CP No.	Cut Block
Timber Mark		Reporting Unit No.	
Primary Logging Completion Date		Cut Block Net Area	ha
Location		Stand/Site Type	

Calculations

Avoidable waste conifer sawlog (grades 1 and 2) _____ M^3/ha..... (A)

Established benchmark = _____ M^3/ha..... (B)

(A) - (B) = _____ M^3/ha..... (C)

If (C) < or = 0.0000, stop

If (C) > 0.0000, proceed as follows:

Waste Monetary Reduction Factor (WMRF) = (C)/(A) = _____ .....(D)
(to four decimals)

To be Completed by Forest Service

Processing

If (C) is < or = 0.0000, on FS 702, code:

Avoidable all species sawlogs (grades 1 and 2):	$0.00/$m^3$
Avoidable all species grade 4:	$0.25/$m^3$
Unavoidable all species all grades:	$0.00/$m^3$

If (C) is > 0.0000, request average sawlog rate from HBS

Average coniferous sawlog rate (HBS) =	$ _____ /m^3	.....(E)
Deciduous sawlog rate =	$ _____ /m^3	.....(F)

On FS 702, code

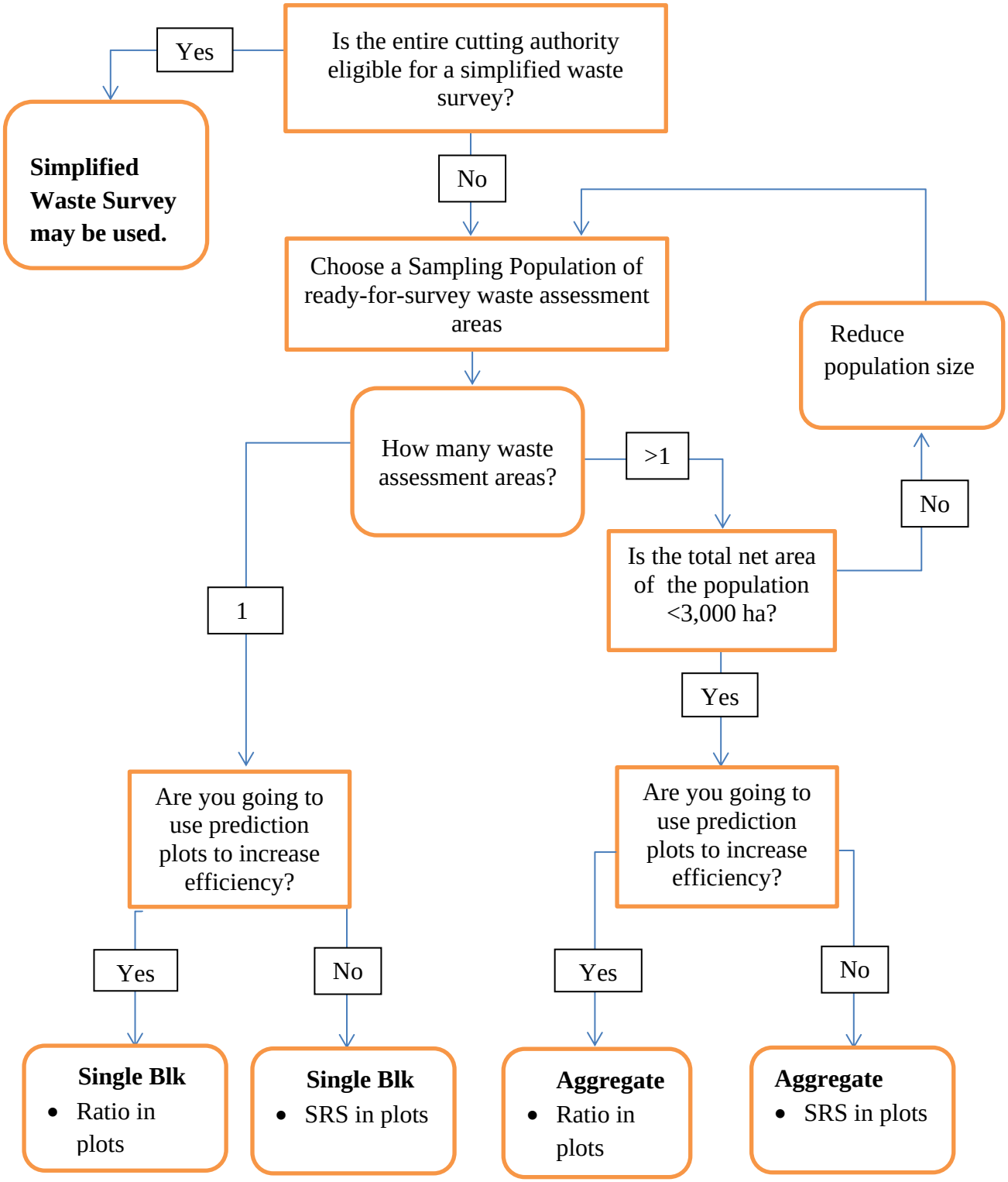
Avoidable coniferous species sawlogs (D x E) =	$ _____ /m^3
Avoidable deciduous species sawlogs: (F) =	$ _____ /m^3

Avoidable all species grade 4: $0.25/$m^3$

Unavoidable all species all grades: $0.00/$m^3$

Approved by Forest Officer (signature)	Date

Appendix 3 Sampling Population Flowchart



Appendix 4 Plot Planning Tables for Single and Aggregate Populations

Dispersed Strata - Minimum # of Plots			
Total Stratum Area (ha) (greater than or equal to)	**# of Measure Plots for SRS**	**# of Prediction Plots for Ratio**	**# of Measure Plots for Ratio**
0.01	3	4	2
2.00	10	9	3
10.50	11	18	6
11.50	12	18	6
12.50	13	18	6
13.50	14	18	6
14.50	15	18	6
15.50	16	18	6
16.50	17	18	6
17.50	18	18	6
18.50	19	18	6
19.50	20	18	6
20.10	20	24	8
20.50	21	25	8
21.50	22	26	9
22.50	23	28	9
23.50	24	29	10
24.50	25	30	10
25.50	26	31	10
26.50	27	32	11
27.50	28	34	11
28.50	29	35	12
29.50	30	36	12
33.50	31	37	12
40.50	32	38	13
47.50	33	40	13
54.50	34	41	14
61.50	35	42	14
68.50	36	43	14
75.50	37	44	15
82.50	38	46	15
89.50	39	47	16
96.50	40	48	16
103.50	41	49	16
110.50	42	50	17
117.50	43	52	17
124.50	44	53	18
131.50	45	54	18
138.50	46	55	18
145.50	47	56	19
152.50	48	58	19
159.50	49	59	20
166.50	50	60	20

After the stratum size for the population reaches 166.50ha the rate of sampling will increase by 1 measure plot for every additional 30.00ha for SRS surveys and 1 prediction plot for every additional 30.00ha for Ratio surveys. Ratio survey measure plots will increase at a rate of 1 measure plot for every 3 prediction plots (rounded to the nearest whole number).

For Example:

Total Stratum Area (ha)	# of Measure Plots for SRS	# of Prediction Plots for Ratio	# of Measure Plots for Ratio
298.51	54	64	21

Traditional Spot Accumulation (Pile) Stratums - Minimum # of Plots			
Total Number of Piles (greater than or equal to)	**# of Measure Plots for SRS**	**# of Prediction Plots for Ratio**	**# of Measure Plots for Ratio**
1	1	1	1
2	2	2	2
3	3	3	2
4	4	4	2
5	5	5	2
6	6	6	2
7	7	7	2
8	8	8	3
9	9	9	3
10	10	10	3
11	10	11	4
12	10	12	4
13	11	12	4
15	11	13	4
18	12	13	4
20	12	14	5
23	13	14	5
25	13	15	5
28	14	15	5
30	14	16	5
33	15	16	5
35	15	17	6
38	16	17	6
40	16	18	6
43	17	18	6
45	17	19	6
48	18	19	6
50	18	20	7
53	19	20	7
55	19	21	7
58	20	21	7
60	20	22	7
63	21	22	7
65	21	23	8
68	22	23	8
70	22	24	8
75	23	25	8
78	24	25	8
80	24	26	9
83	25	26	9
85	25	27	9
88	26	27	9
90	26	28	9
93	27	28	9
95	27	29	10
98	28	29	10
100	28	30	10
103	29	30	10
108	30	30	10

After the stratum size for the population reaches 108 piles the rate of sampling will increase by 1 measure plot for every 30 additional piles for SRS surveys and 1 prediction plot for every 30 additional piles for Ratio surveys. Ratio survey measure plots will increase at a rate of 1 measure plot for every 3 prediction plots (rounded to the nearest whole number).

For Example:

Total Number of Piles	# of Measure Plots for SRS	# of Prediction Plots for Ratio	# of Measure Plots for Ratio
475	42	42	14

Other Accumulation Stratums (ie. Roadside) - Minimum # of Plots			
Total Stratum Area (ha) (greater than or equal to)	**# of Measure Plots for SRS**	**# of Prediction Plots for Ratio**	**# of Measure Plots for Ratio**
0.01	2	3	2
1.00	5	6	2
2.00	10	12	4
12.50	11	12	4
14.50	11	13	4
17.50	12	13	4
19.50	12	14	5
22.50	13	14	5
24.50	13	15	5
27.50	14	15	5
29.50	14	16	5
32.50	15	16	5
34.50	15	17	6
37.50	16	17	6
39.50	16	18	6
42.50	17	18	6
44.50	17	19	6
47.50	18	19	6
49.50	18	20	7
52.50	19	20	7
54.50	19	21	7
57.50	20	21	7
59.50	20	22	7
62.50	21	22	7
64.50	21	23	8
67.50	22	23	8
69.50	22	24	8
72.50	23	24	8
74.50	23	25	8
77.50	24	25	8
79.50	24	26	9
82.50	25	26	9
84.50	25	27	9
89.50	26	28	9
92.50	27	28	9
94.50	27	29	10
97.50	28	29	10
99.50	28	30	10
102.50	29	30	10
107.50	30	30	10

After the stratum size for the population reaches 107.50ha the rate of sampling will increase by 1 measure plot for every additional 30.00ha for SRS surveys and 1 prediction plot for every additional 30.00ha for Ratio surveys. Ratio survey measure plots will increase at a rate of 1 measure plot for every 3 prediction plots (rounded to the nearest whole number).

For Example:

Total Stratum Area (ha)	# of Measure Plots for SRS	# of Prediction Plots for Ratio	# of Measure Plots for Ratio
168.92	32	32	12

Appendix 5 Dispersed Stratum Grid Spacing Worksheet

Waste Grid Spacing Worksheet				
Sample Plan:		Aggregate Ratio Example		
Required Plots in Sample Plan:		44		
Plot Grid Formula:		SQRT(10000 * (Dispersed Stratum Area - External RoW) / # of plots)		
Cublock ID	**Cutblock's Dispersed Stratum Area (ha) Excluding External RoW**	**Plots Required in Sample Plan**	**Calculated GIS Grid Spacing (m) Using Formula**	**Adjusted Grid Spacing (m) for Mapping by Hand**
1	10.00	6	129	130
2	5.00	2	158	160
3	15.00	8	137	135
4	20.00	11	135	135
5	30.00	17	133	135
Totals	**80**	**44**		

Appendix 6 Net Waste Area Example Calculation

This example of waste area calculations is based on the following map of A92837 Cutblock 2.

1. Assumptions
    a. Right of way width 20 m
    b. Road surface width 5 m
    c. Roads marked to RP20172
2. Cutblock harvested area calculation

a. Cutblock Area (from ECAS/Cruise) =		17.31 ha
b. WTRA (from map) =		3.62 ha
c. Net harvested =		13.69 ha

3. Add external roads (20m Right of way)

a. Spur A 0 m-430 m	= 430 m * 20 m	= 8600 m^2 (0.86 ha)
b. Spur B 0m-200 m	= 200 m * 20 m	= 4000 m^2 (0.40 ha)
c. Spur C 425 m-625 m	= 200 m * 20 m	= 4000 m^2 (0.40 ha)
a. 735 m-800 m	= 65 m * 20 m	= 1300 m^2 (0.13 ha)
d. Spur D 10 m-091 m	= 81 m * 20 m	= 1620 m^2 (0.16 ha)
a. 166 m-213 m	= 47 m * 20 m	= 940 m^2 (0.09 ha)
e. Total Roads		= 20460 m^2 (2.05 ha)

4. Subtract non-productive (road surface) areas (Road surface 5 m width):

a. Spur A 0 m-564 m	= 564 m * 5 m	= 2820 m^2 (0.28 ha)
b. Spur B 0 m-1200 m	= 1200 m* 5 m	= 6000 m^2 (0.60 ha)
c. Spur C 425 m-925 m	= 500 m * 5 m	= 2500 m^2 (0.25 ha)
d. Spur D 0 m-250 m	= 250 m * 5 m	= 1250 m^2 (0.13 ha)
e. Total Roads	= 2514 m	= 12570 m^2 (1.26 ha)

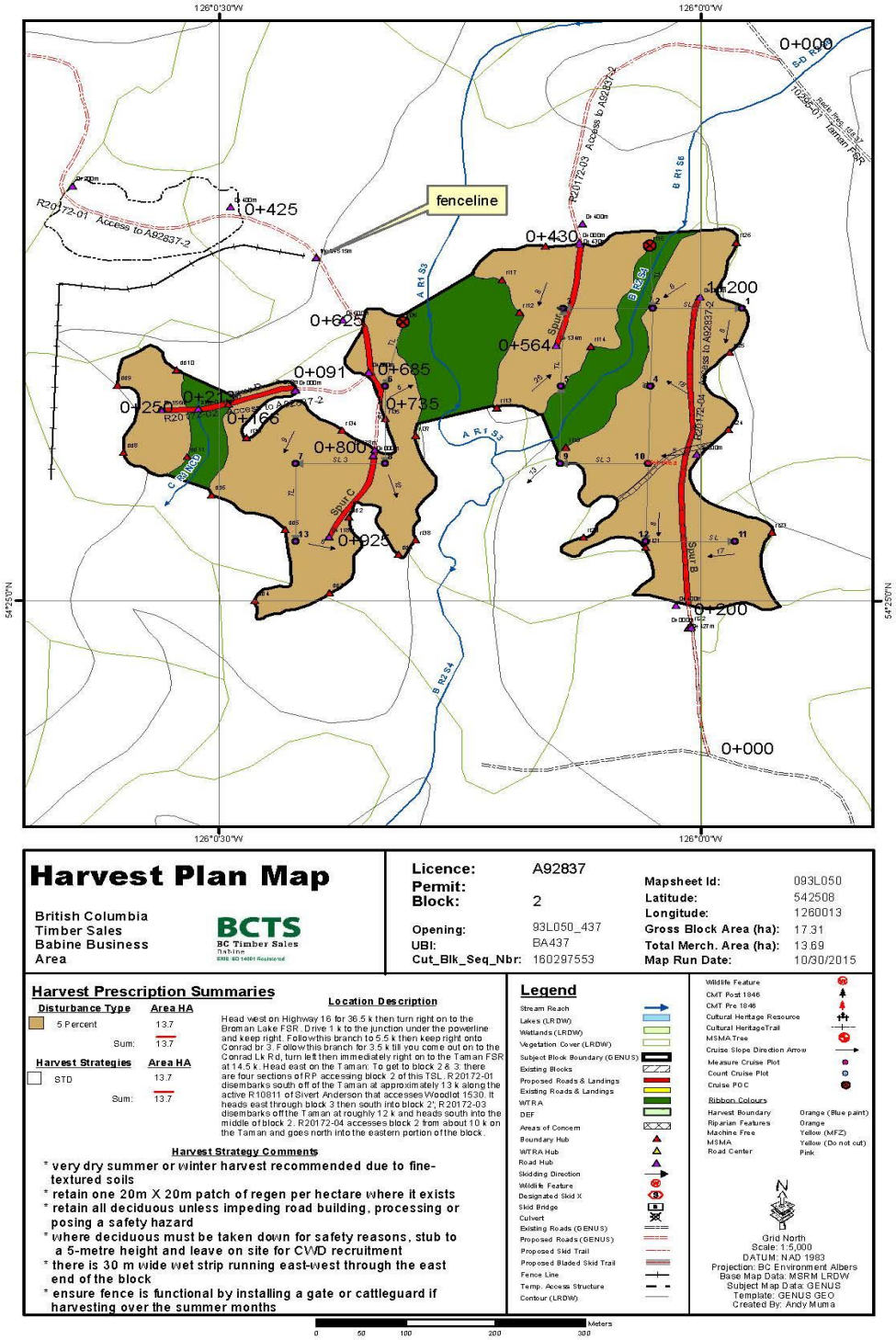
5. Cutblock Net Waste Area

a. Cutblock Net Harvested area	13.69 ha
i. + External Roads	2.05 ha
ii. - Non-Productive	1.26 ha
b. Cutblock Net Waste Area	14.48 ha

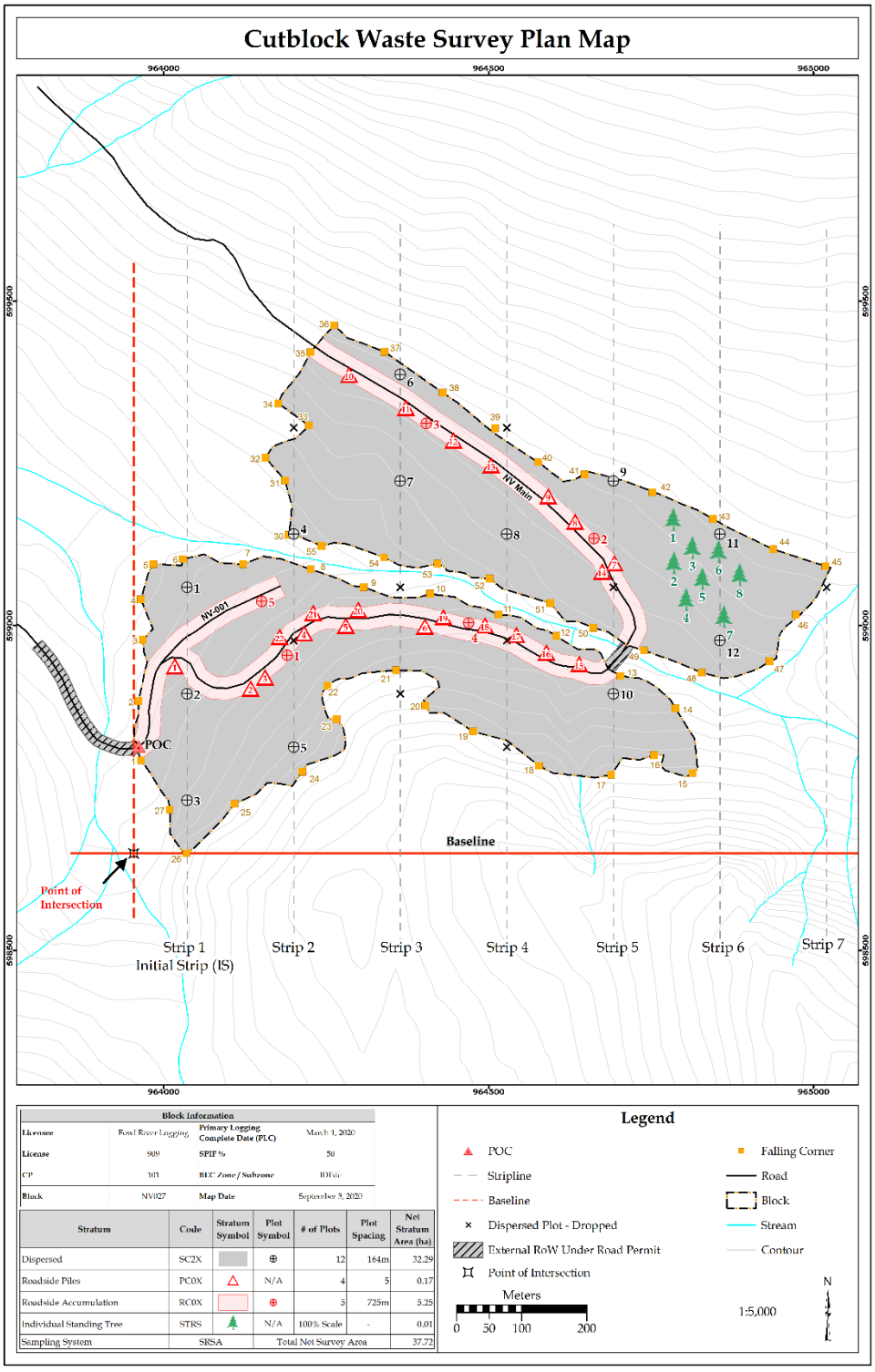
6. Timber Mark Area (Multi Mark Submission)

a.	Road Permit Mark:	- Total Road Length of 2514 m * 15 m*	= 3.77 ha
b.	Primary CP Mark:	14.48 ha -3.77	= 10.71 ha
c.	Total		= 14.48 ha

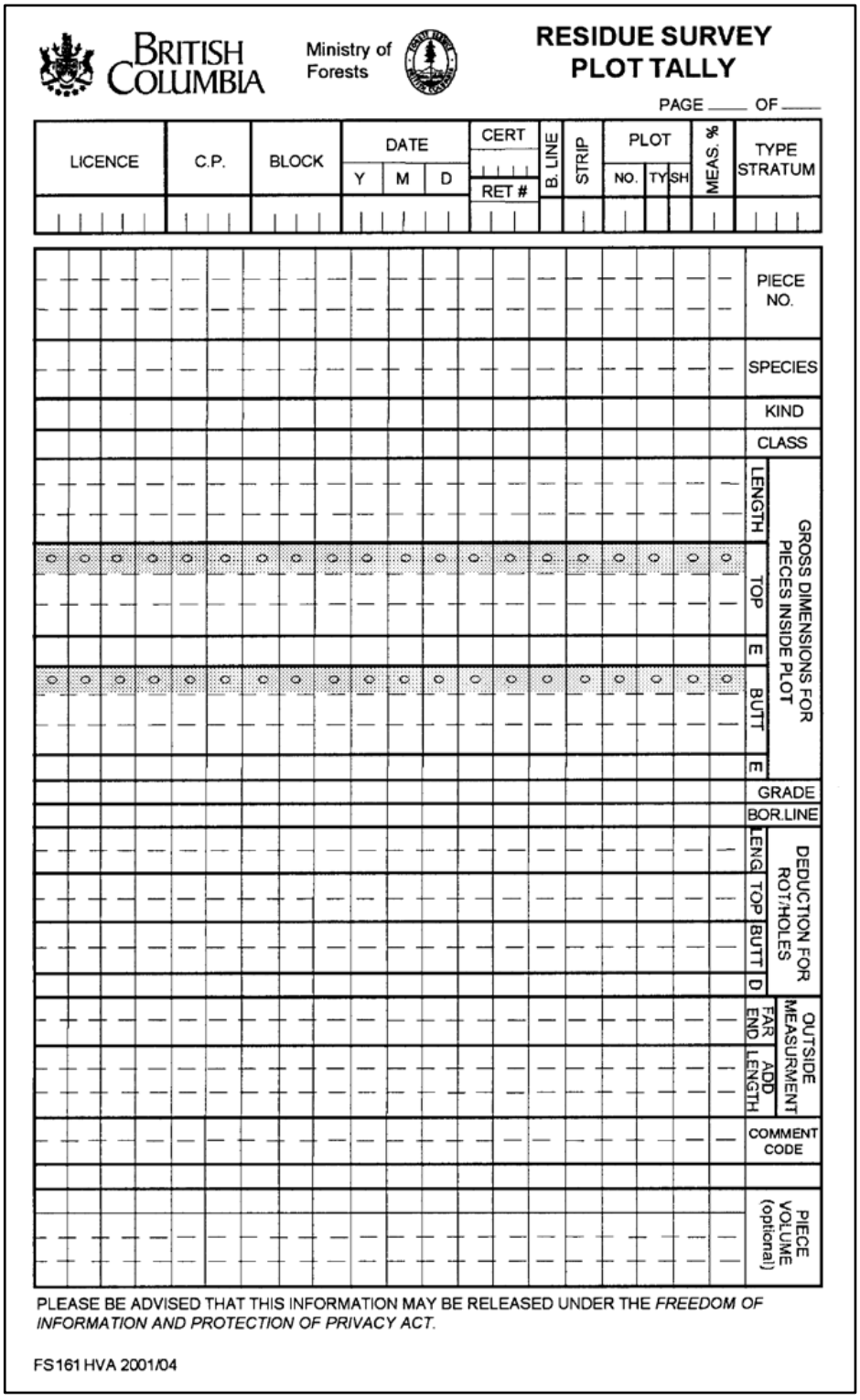
* Road permit width is 20 m R/W – 5m road surface = 15 m.


126°0'30"W
126°00'"W
54°25'0"N
fenceline
0+000
0+425
0+430
0+200
0+625
0+564
0+091
0+685
0+735
0+255
0+668
0+800
0+925
0+200
0+000
R20172-01 Access to A92837-2
R20172-03 Access to A92837-2
R20172-04 Access to A92837-2
Spur A
Spur B
Spur C
A R1 S3
B R2 S4
B R1 S6
C R3 S3
Harvest Plan Map
British Columbia Timber Sales Babine Business Area
BCTS
BC Timber Sales Babine
Licence: A92837
Permit:
Block: 2
Opening: 93L050_437
UBI: BA437
Cut_Blk_Seq_Nbr: 160297553
Mapsheet Id: 093L050
Latitude: 542508
Longitude: 1260013
Gross Block Area (ha): 17.31
Total Merch. Area (ha): 13.69
Map Run Date: 10/30/2015
Harvest Prescription Summaries
Disturbance Type Area HA
5 Percent 13.7
Sum: 13.7
Harvest Strategies Area HA
STD 13.7
Sum: 13.7
Location Description
Head west on Highway 16 for 36.5 k then turn right on to the Broman Lake FSR. Drive 1 k to the junction under the powerline and keep right. Follow this branch to 5.5 k then keep right onto Conrad br 3. Follow this branch for 3.5 k till you come out on to the Conrad Lk Rd, turn left then immediately right on to the Taman FSR at 14.5 k. Head east on the Taman. To get to block 2 & 3: there are four sections of RP accessing block 2 of this TSL. R20172-01 disembarks south off of the Taman at approximately 13 k along the active R10811 of Sivert Anderson that accesses Woodlot 1530. It heads east through block 3 then south into block 2; R20172-03 disembarks off the Taman at roughly 12 k and heads south into the middle of block 2. R20172-04 accesses block 2 from about 10 k on the Taman and goes north into the eastern portion of the block.
Harvest Strategy Comments
* very dry summer or winter harvest recommended due to fine-textured soils
* retain one 20m X 20m patch of regen per hectare where it exists
* retain all deciduous unless impeding road building, processing or posing a safety hazard
* where deciduous must be taken down for safety reasons, stub to a 5-metre height and leave on site for CWD recruitment
* there is 30 m wide wet strip running east-west through the east end of the block
* ensure fence is functional by installing a gate or cattleguard if harvesting over the summer months
Legend
Stream Reach
Lakes (LRDW)
Wetlands (LRDW)
Vegetation Cover (LRDW)
Subject Block Boundary (GENUS)
Existing Blocks
Proposed Roads & Landings
Existing Roads & Landings
WTRA
DEF
Areas of Concern
Boundary Hub
WTRA Hub
Road Hub
Skidding Direction
Wildlife Feature
Designated Skid X
Skid Bridge
Culvert
Existing Roads (GENUS)
Proposed Roads (GENUS)
Proposed Skid Trail
Proposed Bladed Skid Trail
Fence Line
Temp. Access Structure
Contour (LRDW)
Wildlife Feature
CMT Post 1846
CMT Pre 1846
Cultural Heritage Resource
Cultural HeritageTrail
MSMA Tree
Cruise Slope Direction Arrow
Measure Cruise Plot
Count Cruise Plot
Cruise POC
Ribbon Colours
Harvest Boundary Orange (Blue paint)
Riparian Features Orange
Machine Free Yellow (MFZ)
MSMA Yellow (Do not cut)
Road Center Pink
Grid North
Scale: 1:5,000
DATUM: NAD 1983
Projection: BC Environment Albers
Base Map Data: MSRM LRDW
Subject Map Data: GENUS
Template: GENUS GEO
Created By: Andy Mumia
Meters
0 50 100 200 300

Appendix 7 Example Waste Assessment Area Survey Map



Appendix 8 Waste Survey Plot Tally Card



BRITISH COLUMBIA — Ministry of Forests

RESIDUE SURVEY PLOT TALLY

PAGE ____ OF ____

LICENCE	C.P.	BLOCK	DATE Y	DATE M	DATE D	CERT / RET #	B. LINE	STRIP	PLOT NO.	PLOT TY	PLOT SH	MEAS. %	TYPE STRATUM

PIECE NO.	SPECIES	KIND	CLASS	GROSS DIMENSIONS FOR PIECES INSIDE PLOT: LENGTH	TOP E	BUTT E	GRADE	BOR.LINE	DEDUCTION FOR ROT/HOLES: LENG	TOP	BUTT	D	OUTSIDE MEASURMENT: FAR END	ADD LENGTH	COMMENT CODE	PIECE VOLUME (optional)
					0	0										

PLEASE BE ADVISED THAT THIS INFORMATION MAY BE RELEASED UNDER THE *FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY ACT*.

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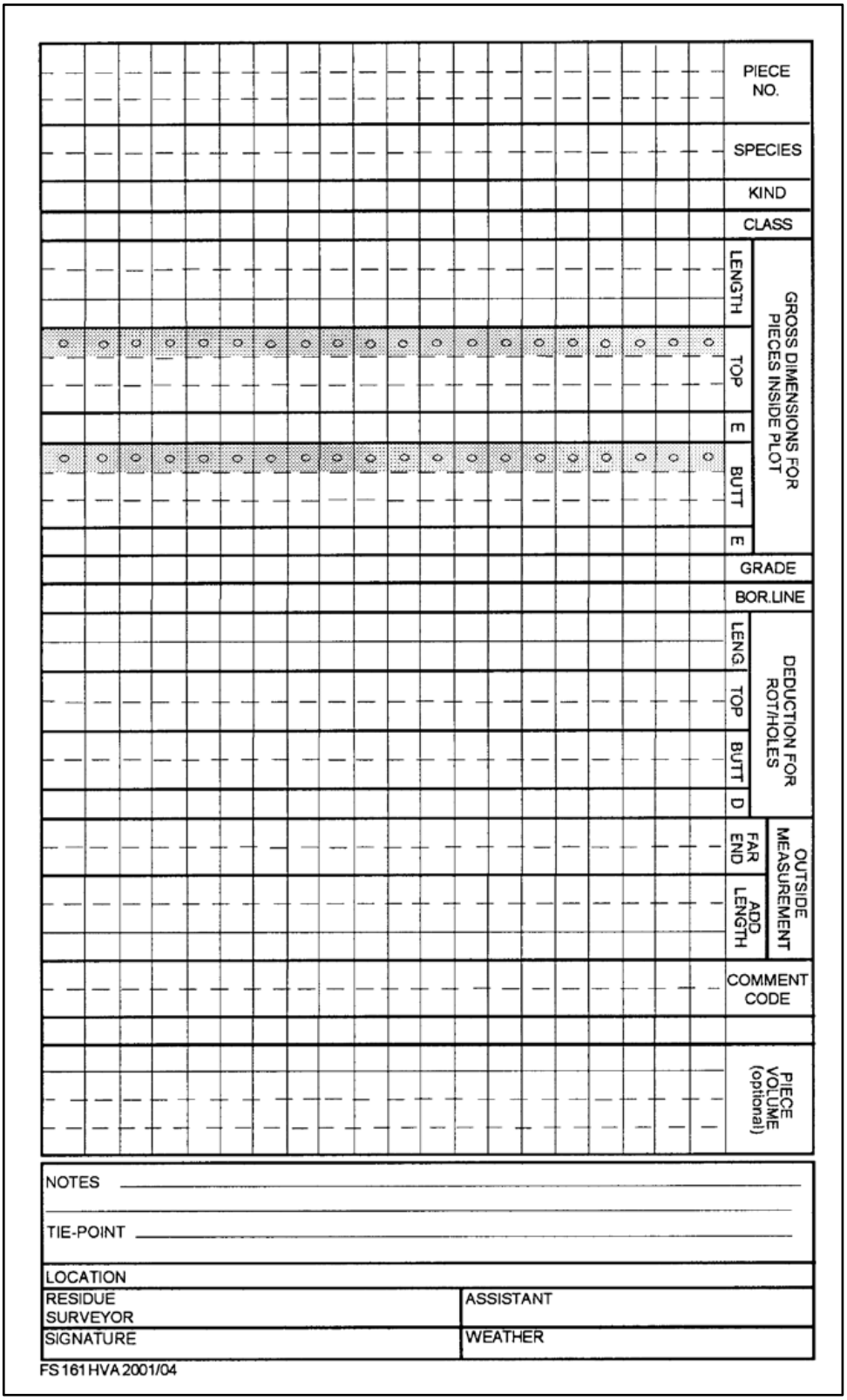
PIECE NO.
SPECIES
KIND
CLASS
GROSS DIMENSIONS FOR PIECES INSIDE PLOT
LENGTH
TOP
E
BUTT
E
GRADE
BOR.LINE
DEDUCTION FOR ROT/HOLES
LENG.
TOP
BUTT
D
OUTSIDE MEASUREMENT
FAR END
ADD LENGTH
COMMENT CODE
PIECE VOLUME (optional)
NOTES
TIE-POINT
LOCATION
RESIDUE SURVEYOR
ASSISTANT
SIGNATURE
WEATHER
FS 161 HVA 2001/04

Appendix 9 Slope Distances for 7.98m plot radius

Slope distances for 7.98m Plot Radius					
Slope %	**Plot Radius**	**Slope %**	**Plot Radius**	**Slope %**	**Plot Radius**
5	7.99	39	8.57	73	9.88
6	7.99	40	8.59	74	9.93
7	8.00	41	8.62	75	9.98
8	8.01	42	8.66	76	10.02
9	8.01	43	8.69	77	10.07
10	8.02	44	8.72	78	10.12
11	8.03	45	8.75	79	10.17
12	8.04	46	8.78	80	10.22
13	8.05	47	8.82	81	10.27
14	8.06	48	8.85	82	10.32
15	8.07	49	8.89	83	10.37
16	8.08	50	8.92	84	10.42
17	8.09	51	8.96	85	10.47
18	8.11	52	8.99	86	10.53
19	8.12	53	9.03	87	10.58
20	8.14	54	9.07	88	10.63
21	8.15	55	9.11	89	10.68
22	8.17	56	9.15	90	10.74
23	8.19	57	9.19	91	10.79
24	8.21	58	9.23	92	10.84
25	8.23	59	9.27	93	10.90
26	8.25	60	9.31	94	10.95
27	8.27	61	9.35	95	11.01
28	8.29	62	9.39	96	11.06
29	8.31	63	9.43	97	11.12
30	8.33	64	9.47	98	11.17
31	8.35	65	9.52	99	11.23
32	8.38	66	9.56	100	11.29
33	8.40	67	9.61	110	11.86
34	8.43	68	9.65	120	12.47
35	8.45	69	9.70	130	13.09
36	8.48	70	9.74	140	13.73
37	8.51	71	9.79	150	14.39
38	8.54	72	9.83	160	15.06

Appendix 10 Bucking Waste Grading Matrix and Field Card

Bucking Waste Grading Matrix

1. **Pieces Less than 50% Sound**
    a. Must meet Z Grade criteria as per the *Scaling Manual* section 9.5
    b. Measurement is not required.
2. **Pieces Greater than 50% Sound**
    a. Grade 6
        i. Must meet Grade 6 requirements of the *Scaling Manual* section 9.1.3
        ii. Measurement is **required** when specified in a cutting authority.
    b. Avoidable pieces

    Avoidable pieces are classified by the location in the tree they were cut from: the top, the middle, or butt.

        i. **Top** – Pieces cut from the top of the tree with a cut butt greater than 5 rads (10 cm) and extend to the maximum utilization point 5 rads (10 cm).
            1. **Grade 4**:
                a. Any piece with 1 or more checks to the heart, or
                b. One or more oversize knots, or
                c. Greater than 4 cm Spiral Grain, or
                d. Greater than 25% of the length contains char.
        ii. **Middle** – Pieces cut from the middle portions of the tree. No evidence of the felling cut or utilization top exist. The top must be greater than 6 rads (12 cm).
            1. **Grade 4**:
                a. Any piece with 2 or more 4 cm deep checks, or
                b. 3 or more oversize knots, or
                c. Severe shatter, or
                d. Greater than 15% Spiral Grain, or
                e. Greater than 25% of the length contains char.
        iii. **Butt** – Pieces cut from the base of the tree which must include evidence of the felling cut.
            1. **Grade 4**:
                a. Any piece with 3 or more 4 cm checks, or

b. Severe shatter, or

c. Greater than 15% spiral grain, or

d. Catface, or

e. 25-50% heart rot, or

f. Greater than 25% of the length contains char.

Note: checks on green pieces can only be considered when present on a dead or dry side of the piece.

All pieces that are better than the top, middle, butt requirements are assigned Grade 1 or 2 as per the bucking card.

Bucking Waste Grading Field Card

	Waste Class	Piece Grade			Description
<50%	A/U	Grade Z			No tally. *Scaling Manual* Section 9.5, must show rot at both ends. Contains 3/4 or 4/4 through running heart rot or hole.
>50%	A/U	Grade 6			Must contain evidence of felling cut. Lodgepole 15 cm (7.5R), other species <20 cm (10R) at 15 cm from the felling cut
	U	Grade 1,2			Class auditable, grade not auditable, non billable
		Grade 4			Grade defined as below, non billable
	A	SL (1,2)			Sound/round, no severe defect or deformity, <3 checks, butt rot must be conical shape, slabs >7.5R
		Top	**Middle**	**Butt**	
		4			1 or more checks to heart, >1 OS knots, >4 cm SG, >25% of the length contains char
			4		2 or more checks >4 cm, >3 OS knots, severe shatter, >15% SG, >25% of the length contains char
				4	Shatter, >3 4 cm checks, >15% SG, catface, 25-50% heart rot, >25% of the length contains char
Piece Type		Top = cut butt extending to utilization or broken top (<5R) Middle = cut or broken with no evidence of utilization top or felling cut Butt = piece includes evidence of felling cut			

Appendix 11 Best Practices for Establishing Plots Using GPS

1. Use the GPS to navigate to the waste plot.
2. When you are within 20 metres of the waste plot location, locate a suitable PRP (Plot Reference Point). The most suitable location for the PRP is generally the least obstructed or most open location.
    a. Note: the PRP must be a fixed feature that cannot be moved by hand, such as: a cut stump, small standing tree (<3m tall), etc. Trees that may be large enough to incur deflection and interference of GPS signals are not acceptable.
3. Review the data displayed on the GPS receiver screen. When the number of satellites (PDOP/HDOP) and Mean Difference of Hits are within tolerances establish the PRP using the GPS receiver and software. Collect a minimum of 50 hits or coordinates and record the required data in the PRP table.
4. If the default tolerances have been exceeded, the PRP must be relocated. Where GPS coverage is poor or a PRP cannot be established, the waste plot must be located using conventional methods (i.e. chain and compass) from an existing tie point or waste plot location.
5. Once the PRP has been established, calculate the final horizontal distance and bearing to plot center. Flag the PRP well and label it with the bearing and distance to the waste plot.
6. Use conventional methods (i.e. chain and compass) to navigate to the waste plot from the PRP.

In order to use GPS technology to establish waste plots, the GPS receiver must meet the following standards:

- Able to achieve submeter accuracy under ideal conditions (i.e. open area, not interference, good satellite coverage)
- Real time correction system with external antenna
- Minimum satellite elevation angle/mask is 15 degrees above the horizon
- RMS (Root Mean Square) minimum rating of 100 cm

If GPS is used to establish waste and residue plots, the following data must be submitted to the Ministry in a Plot Reference Point (PRP) table (if requested):

- Cutblock
- Stratum type
- Waste plot number
- Horizontal distance (m) from PRP to waste plot

- Calculated bearing (degrees) from PRP to waste plot
- Average PDOP – maximum of 6.0
- Average HDOP – maximum of 4.0
- Number of satellites when establishing PRP – *minimum of 4*
- Number of hits received when establishing PRP – *minimum of 50 hits*
- Mean difference of hits in metre (MDH) – *maximum of 1.0*
- Time of PRP establishment – *Local date and time*
- PRP coordinates – specify UTM of BC Albers*
- Waste plot coordinates – specify UTM or BC Albers*

*The map projection system used (i.e. BC Albers or UTM.) must be consistent with the waste plan.

An example of a PRP table is shown below.

Sample PRP Table

CB	Str. Type	Plot	HD (m)	BRG	PDOP	HDOP	# SAT	# HITS	MDH (m)	Local Date, Time	PRP Easting (UTM)	PRP Northing (UTM)	PT Easting (UTM)	PT Northing (UTM)
7	SC2X	1	16.6	110	3.4	1.9	6	50	0.3	13:52:23 8/16/2019	683417.473	5657508.768	683433.292	5657503.723
7	SC2X	2	2.2	329	3.9	2.3	8	50	0.1	14:12:29 8/16/2019	682934.854	5657577.685	682929.529	5657585.834
7	SC2X	3	9.7	157	2.3	2.9	8	50	0.5	15:23:58 8/16/2019	683125.834	5657600.981	683129.624	5657592.922
7	SC2X	4	8.9	111	2.0	1.7	9	50	0.4	16:02:41 8/16/2019	683219.529	5657590.781	683229.672	5657596.466
7	SC2X	5	4.6	278	2.0	2.2	9	50	0.2	16:51:13 8/16/2019	683332.437	5657588.624	683329.720	5657600.010

Appendix 12 Waste and Residue Post Harvest Certification - Interior

Date:

Cutblock:

Reporting Unit:

Primary Timber Mark:

Y ☐ N ☐	Is the waste assessment area within a fully appraised adjustable rate cutting authority?

If Yes: Changed circumstance requirements apply. Proceed to next question.
If No: Timber is tallied as standing waste (e.g. BCTS) Standing waste is not tallied on tabular rate cutting authorities.

Y ☐ N ☐	Is there an approved amendment to the cutting authority harvest area?

If Yes: Timber that is amended out of the harvest area will not be tallied as waste. A changed circumstance reappraisal is required if the threshold is exceeded. Refer to the IAM for specific requirements.
If No: Therefore, standing timber is reserved. Proceed to the next question.

Y ☐ N ☐	Is there an absolute change in the reserve area(s), (for a waste assessment area within a cutting authority issued July 1, 2019 or later)?
Y ☐ N ☐	Is there a change in the leave tree characteristics, (for a waste assessment area within a cutting authority issued May 1, 2020 or later)?

If Yes for either of the questions above: A changed circumstance reappraisal is required. Refer to the IAM for specific requirements. Timber that is reserved in the reappraisal will not be tallied as waste.
If No for both questions above but unreserved timber remains (CP was issued before these dates): Timber is tallied as standing waste.

Description and location of standing timber (maps and tables attached as needed):

I certify the following regarding this waste assessment area:

Y ☐ N ☐ A changed circumstance reappraisal is required in relation to the information above.

Y ☐ N ☐ Timber remains that must be tallied as standing waste.

Name of Forest Professional:

ABCFP Professional Designation and Registration Number:

Signature: