

Stand and Stock Reports

9

The stand and stock tables report stems per hectare, merchantable volume per hectare, and basal area per hectare by DBH class. The DBH classes are defined in Appendix 14.

Leave Tree tables will report the stems per hectare, merchantable volume per hectare, and basal area per hectare by DBH class of the stems not harvested in a reduction compilation. Please see chapter 5 for instructions on reduction compilations.

For Western Yew, report only the stems per hectare.

All species are to be included in columnar format, as depicted in the sample listings in Sections 9.1.2, 9.2.2, and 9.3.2.

Report the net merchantable volume based on merchantability. Some of the diameter classes have been removed from the sample listing (Figures 9.1, 9.2, and 9.3).

Each table except for a Leave Tree table is reported at the Block, Timber Type, and Cutting Permit levels. Leave Tree tables are reported at the Block and Treatment Unit within Block levels only.

Live stems are trees with tree class coded 1, 2, 5 or 8. *Snags* are trees with tree class coded either 4 or 6. *Dead potential stems* are trees with tree class coded 3, 7 or 9.

List of Reports

- (007A) - Block Stand Table (stems/hectare).
- (007B) - Block Stock Table (merchantable volume/hectare).
- (007C) - Block Basal Area (basal area/hectare).
- (007D) - Timber Type Stand Table (stems/hectare).
- (007E) - Timber Type Stock Table (merchantable volume/hectare).
- (007F) - Timber Type Basal Area (basal area/hectare).

- (007G) - Cutting Permit Stand Table (stems/hectare).
- (007H) - Cutting Permit Stock Table (merchantable volume/hectare).
- (007I) - Cutting Permit Basal Area (basal area/hectare).
- (007J) Block Leave Tree Stand Table (stems/hectare).
- (007K) Block Leave Tree Stock Table (merchantable volume/hectare).
- (007L) Block Leave Tree Basal Area (basal area/hectare).

For each of the reports listed above, there are six additional damage reports. For each of Blowdown, Fire, and Insect damage produce a Stand Table and a Stock Table at each of the three reporting levels. Basal area per hectare is not a required damage report. The damage reports are one species per table per damage type. Refer to Section 4.3 for a sample report format. Where multiple damage codes exist for a tree, its volume and basal area would only contribute to one damage type, as explained in Chapter 4.

No damage reports are required for the Leave Tree summaries.

Leave Tree summaries will have the words LEAVE TREE in upper case letters printed at the top.

9.1 Header Information - All Reports

Include the following header information on the stand, stock and basal area reports, including the damage reports. For damage reports, add the species and damage type, as shown in Chapter 4.

1. License from card type A.
2. Cutting Permit from card type A.
3. Block or Timber Type number, if the table is for a Block or Timber Type.
4. Silviculture Treatment Unit areas for the Block, Timber Type or Cutting Permit.
5. Message indicating whether compilation is for appraisals or not.
6. Method of calculation (Average Line or Block).
7. Merchantability requirements from card type B for each species on the report.
8. Special compilation messages for:
 - a. reduction compilation,
 - b. stump cruise compilation,
 - c. tree class combination - useless volumes are included or excluded,
 - d. from column 15 of card type B (0 or blank - snags excluded, 1 - snags included),
 - e. selective cut indicator - which trees to compile depends on column 12 of card type B (blank - include all trees, 'C' - include cut-indicated and non-indicated trees, 'L' - include leave-indicated trees), and
 - f. double sampling, if count plots are used
9. Compiler program name and version.
10. Compile date and time.
11. Page number.
12. Damage code - for damage reports only.

9.2 Stand Table

9.2.1 Stand Table - Detail Information

All of the stand table parameters described below are reported to 1 decimal place.

9.2.1.1 Live Stems per Hectare

The live stems per hectare calculations are based on trees for each species and for each diameter class. Use only tree classes 1, 2, 5, and 8.

9.2.1.1.1 Timber Type

The Type estimate is the average of the plot estimates from the Type.

$$S_{s,d,i} = \frac{\sum_{p=1}^{m_i} S_p}{m_i}, \text{ using tree classes 1, 2, 5 and 8 only}$$

9.2.1.1.2 Block - Average Line method

The Type estimates are weighted based on area of the Type within the Block.

$$S_{s,d,j} = \frac{\sum_{i=1}^{I_j} S_{s,d,i} * A_{i,j}}{A_j}$$

9.2.1.1.3 Block - Treatment Unit “Leave Tree” Summary

Only report those species within the Treatment Unit within the Block that have a percent reduction applied to them.

$$SLT_{u,s,d,i,j} = S_{u,s,d,i,j} * (PR_{u,s,d,i,j} \div 100)$$

Where:

$SLT_{u,s,d,i,j}$ = Stems per hectare estimate for Treatment Unit u, Species s, Diameter class d, Type i and Block j for stems not to be harvested (Leave Trees).

$S_{u,s,d,i,j}$ = Pre reduction stems per hectare estimate for Treatment Unit u, Species s, Diameter class d, Type i and Block j.

$PR_{u,s,d,i,j}$ = Percent reduction value for Treatment Unit u, Species s, Diameter class d, Type I and Block j used in the Percent Reduction Worksheet (FS 221).

Example 9.1

The reduction value for Pine in the 20 cm class in Treatment Unit A is 45.

The Treatment Unit has 399.9 stems per hectare for Pine in the 20 cm class before reduction.

$$\begin{aligned} SLT_{u,s,d,i,j} &= 399.9 * (45 \div 100) \\ &= 179.9 \text{ stems per hectare} \end{aligned}$$

9.2.1.1.4 Block “Leave Tree” Summary

Weight the Treatment Unit Leave Tree stems per hectare by the area of the Treatment Unit within the Type within the Block, sum, divide by the area of the Block. For Treatment Units without a percent reduction the reduction value equals zero.

$$SLT_{s,d,j} = \frac{\sum_{u=1}^{Uj} SLT_{u,s,d,i,j} * A_{u,i,j}}{A_j}$$

Where:

$SLT_{s,d,j}$ = Stems per hectare estimate for Species s, Diameter class d and Block j for stems not harvested (Leave Trees).

A_j = Area of Block j.

$A_{u,i,j}$ = Area of Treatment Unit u within Type i within Block j.

U_j = Number of Treatment Units in Block j.

Example 9.2

There are 2 Treatment Units in Block X. The area of Block X is 10 hectares.

There are 2 types in the Block.

Treatment Unit A is 8 hectares, 7.5 hectares of Type 1 and .5 hectares of Type 2.

Treatment Unit B is 2.0 hectares, all in Type 2.

The reduction value for Pine in the 20 cm class in Type 1, Treatment Unit A is 45.

The reduction value for Pine in the 20 cm class in Type 2, Treatment Unit A is 35.

There is not a percent reduction for Pine in Treatment Unit B.

The Type 1 pre-reduction stand table for Pine shows 399.9 stems per hectare in the 20 cm class.

The Type 2 pre-reduction stand table for Pine shows 361.4 stems per hectare in the 20 cm class.

$$SLT_{A,P,20,1,X} * A_{A,1,X} = 399.9 * .45 * 7.5 = 1349.66$$

$$SLT_{A,P,20,2,X} * A_{A,2,X} = 361.4 * .35 * 0.5 = 63.25$$

$$SLT_{B,P,20,2,X} * A_{B,2,X} = 361.4 * .00 * 2.0 = 0.00$$

$$SLT_{P,20,X} = (1349.66 + 63.25 + 0) \div 10$$

$$= 141.3 \text{ stems per hectare}$$

9.2.1.1.5 Block - Block method

The Type within Block estimates must be calculated and weighted based on area of the Type within the Block. The Type within Block estimates use the Block Double Sampling Ratio and the plots from the Type within the Block.

$$S_{s,d,i,j} = \frac{\sum_{p=1}^{m_{i,j}} S_p}{m_{i,j}} - \text{intermediate calculation - not reported}$$

$$S_{s,d,j} = \frac{\sum_{i=1}^I S_{s,d,i,j} * A_{i,j}}{A_j}$$

9.2.1.2 Example 9.3

There are 2 Types in Block 1, each having 2.5 ha. In Block 1, there are 4 plots taken in Type 1 and 2 plots taken in Type 2.

The plot estimates for Cedar stems per hectare in Block 1 are:

Type 1	Type 2
50	40
0	40
25	
25	

(Assume these estimates are for a particular diameter class, d)

$$S_{c,d,1,1} = (50 + 0 + 25 + 25) / 4 = 25$$

$$S_{c,d,1,2} = (40 + 40) / 2 = 40$$

$$\text{Then } S_{c,d,1} = \frac{2.5 * 25 + 2.5 * 40}{5.0 \text{ total hectares}} = 32.5$$

9.2.1.2.1 Cutting Permit

The cutting permit estimate is the weighted average of the Type estimates based on the area of the Type within the Cutting Permit.

$$S_{s,d,cp} = \frac{\sum_{i=1}^I S_{s,d,i} * A_i}{A_{cp}}$$

Sum the Type, Block and Cutting Permit estimates by species and by diameter class (the examples below show the summations for the Timber Type only).

$$S_{s,i} = \sum_{d=1}^{34} S_{s,d,i}$$

$$S_{d,i} = \sum_{s=1}^{31} S_{s,d,i}$$

Sum either of the above estimates for the total stems per hectare for the Type, Block, and Cutting Permit (i.e., all Species and all Diameter Classes).

$$S_i = \sum_{d=1}^{34} S_{s,i}$$

Where:

$S_{s,d,i}$ = Stems per hectare estimate for species s, diameter class d and Timber Type i.

$S_{s,d,j}$ = Stems per hectare estimate for species s, diameter class d and Block j.

$S_{s,d,j,k}$ = Block method stems per hectare estimate for species s, diameter class d, Timber Type i within Block j - the Block method Double Sampling ratio would be used.

$S_{s,d,cp}$ = Stems per hectare estimate for species s and diameter class d for the Cutting Permit.

$S_{s,i}$ = Total stems per hectare for a species, all 34 diameter classes.

$S_{d,i}$ = Total stems per hectare for a diameter class, all species.

S_i = Total stems per hectare for the Timber Type.

S_p = Stems per hectare estimate for plot p (refer to Section 8.1.3).

$A_{i,j}$ = Area of Type i within Block j to 1 decimal place.

A_i = Area of Type i to 1 decimal place.

A_j = Area of Block j to 1 decimal place.

A_{cp} = Area of Cutting Permit to 1 decimal place.

- I = Number of Types in the Cutting Permit.
- I_j = Number of Types in Block j.
- M_i = Number of measure plots in Timber Type i.
- m_{i,j} = Number of measure plots in Timber Type i within Block j.
- D = Diameter Class (refer to Appendix 14).

9.2.1.3 Useless Stems (snags) per Hectare

The Useless stems per hectare estimate are by Species (all Diameter Classes) and by Diameter Class (all Species). Only use tree classes 4 and 6.

Leave Tree tables use the same methodology as outlined for Live Stems per Hectare (Section 9.1.1.1).

9.2.1.3.1 Timber Type

$$SU_{s,i} = \frac{\sum_{d=1}^{34} \left(\sum_{p=1}^{m_i} S_p \right)}{m_i}, \text{ tree classes 4 and 6 only}$$

$$SU_{s,i} = \frac{\sum_{d=1}^{34} \left(\sum_{p=1}^{m_i} S_p \right)}{m_i}, \text{ tree classes 4 and 6 only}$$

$$SU_{d,i} = \frac{\sum_{s=1}^{31} \left(\sum_{p=1}^{m_i} S_p \right)}{m_i}$$

Where:

- SU_{s,i} = Useless stems per hectare estimate for species s, Timber Type i.
- SU_{d,i} = Useless stems per hectare estimate for diameter class d, Timber Type i.
- S_p = Stems per hectare estimate for plot p (refer to Section 8.1.3).

m_i = Number of measure plots in timber type i.

9.2.1.3.2 Block - Average Line Method

The Type estimates are weighted based on area of the Type within the Block. Use the same weighting method as for the live stems per hectare estimate.

The Type within Block estimates must be calculated and weighted based on area of the Type within the Block. The Type within Block estimates use the Block Double Sampling Ratio and the plots from the Type within the Block. Use the same weighting method as for the live stems per hectare estimate.

9.2.1.3.3 Cutting Permit

The cutting permit estimate is the weighted average of the Type estimates based on the area of the Type within the Cutting Permit. Use the same weighting method as for the live stems per hectare estimate.

9.2.1.4 Dead Potential Stems per Hectare

The Dead Potential Stems per hectare estimate are by Species (all Diameter Classes) and by Diameter Class (all Species). Only use tree classes 3, 7 and 9.

For Leave Tree tables use the same methodology as outlined for Live Stems per Hectare (Section 9.1.1.1).

9.2.1.4.1 Timber Type

$$SDP_{s,i} = \frac{\sum_{d=1}^{34} \left(\sum_{p=1}^{m_i} S_p \right)}{m_i} =, \text{ tree classes 3, 7 and 9 only}$$

$$SDP_{d,i} = \frac{\sum_{s=1}^{31} \left(\sum_{p=1}^{m_i} S_p \right)}{m_i} =, \text{ tree classes 3, 7 and 9 only}$$

Where

$SDP_{s,i}$ = Dead potential stems per hectare estimate for species s, Timber Type i.

S_p = Stems per hectare estimate for plot p (refer to Section 8.1.3).

m_i = Number of measure plots in timber type i.

9.2.1.5 Average DBH at Five Levels

The average DBH is also reported for five diameter levels:

Leave Tree summaries do not need to report these parameters.

1. DBH greater than 12.4 cm.
2. DBH greater than 17.4 cm.
3. DBH greater than 22.4 cm.
4. DBH greater than 27.4 cm.
5. DBH greater than 32.4 cm.

Separate trees by Tree Class (i.e., live trees, dead potential and useless) as above. Weight the parameters for Block and Cutting Permit as above.

9.2.1.5.1 Timber Type:

$$\bar{D}_{s,l,i} = 100 * 2 * \sqrt{\frac{BA_{s,l,i}}{\pi * S_{s,l,i}}}$$

Where:

$\bar{D}_{s,l,i}$ = Avg. diam. (cm) of trees with DBH lower limit l for Species s and type i.

$BA_{s,l,i}$ = Average basal area per hectare estimate of trees with DBH lower limit l for Species s and Type i.

$S_{s,l,i}$ = Stems (or snags) per hectare estimate of trees with DBH lower limit l for Species s and Type i.

$$\pi = 3.14159265.$$

9.2.1.6 Example 9.4

There are 2 plots in Type 1 each having 2 Hemlock stems. The BAF in each plot is 10.

DBH	
Plot 1	Plot 2
58.8	42.6
42.5	51.1

Plot 1

$$BA = 2 * 10 = 20$$

$$SPH = \frac{10 (12732.39545)}{58.8^2} + \frac{10 (12732.39545)}{42.5^2} = 107.32$$

Plot 2

$$BA = 2 * 10 = 20$$

$$SPH = \frac{10 (12732.39545)}{42.6^2} + \frac{10 (12732.39545)}{51.1^2} = 118.92$$

$$\text{Sum of SPH} \quad 107.32 + 118.92 = 226.24$$

$$\text{Average Diameter Type 1 } 100 * 2 * \sqrt{\frac{40}{PI * 226.24}} = 47.4$$

9.2.2 Block Stand Table - Sample Listing - Block Method

Report 007A - required.

FOREST REVENUE BRANCH - 2001.0 NOT FOR APPRAISAL PURPOSES DUE TO NON-STANDARD UTILIZATION										BLOCK STAND TABLE (STEMS/HA)		(007A) PAGE 1	
LICENCE NO. CP7090										COMPUTED 2001-03-19 17:43:32		USELESS VOLUMES EXCLUDED	
CP NO. 000										TOTAL MERCH AREA		12.5	
BLOCK 001										BLOCK METHOD			
OCCUPANCY 5.0 SELECTIVE										PL		TOTAL USELESS	
F1 C H										S		DEAD P	
MIN DBH 12.5 12.5 12.5 12.5										12.5		12.5	
STUMP HT 30.0 30.0 30.0 30.0										30.0		30.0	
TOP DIA 10.0 10.0 10.0 10.0										10.0		10.0	
LOG LENGTH 5.0 5.0 5.0 5.0										5.0		5.0	
DBH CL													
5													
10													
15													
20													
25													
30													
35													
40													
45													
50													
55													
60													
65													
70													
75													
TOTAL	62.5	32.5	19.4	16.2	12.5	12.5	12.5	12.5	12.5	6.2	149.4	31.2	
USELESS													
DEAD P	6.2												
12.5 +	56.5	39.9	45.4	38.6	51.1	51.1	51.1	51.1	51.1	41.0	49.0	54.0	
17.5 +	56.5	39.9	45.4	38.6	51.1	51.1	51.1	51.1	51.1	41.0	49.0	54.0	
22.5 +	56.5	45.9	45.4	38.6	51.1	51.1	51.1	51.1	51.1	41.0	50.4	54.0	
27.5 +	56.5	45.9	45.4	38.6	51.1	51.1	51.1	51.1	51.1	41.0	50.4	54.0	

Figure 9.1 Block Stand Table - Sample Listing (Partial).

9.3 Stock Table

9.3.1 Stock Table - Detail Information

All of the stock table parameters described below are reported to 1 decimal place.

Report net merchantable volumes (i.e., gross less decay, waste, breakage). Refer to Section 8.1.3.

9.3.1.1 Net Merchantable Volume per Hectare

The volume per hectare calculation segregates trees for each species and for each diameter class. Use only tree classes 1, 2, 5 and 8.

9.3.1.1.1 Timber Type

The Type estimate is the average of the plot estimates from the Type.

$$V_{s,d,i} = \frac{\sum_{p=1}^{m_i} V_{p,s,d,i}}{m_i}, \text{ tree classes 1, 2, 5 and 8 only}$$

Refer to Example 9.4 for a sample Timber Type calculation.

9.3.1.1.2 Block - Average Line Method

The Type estimates are weighted based on area of the Type within the Block.

$$V_{s,d,j} = \frac{\sum_{i=1}^{I_j} V_{s,d,i} * A_{i,j}}{A_j}$$

Block Treatment Unit “Leave Tree” Summary

Only report those species within the Treatment Unit within the Block that have a percent reduction applied to them.

$$VLT_{u,s,d,i,j} = V_{u,s,d,i,j} * (PR_{u,s,d,i,j} \div 100)$$

Where:

$VLT_{u,s,d,i,j}$ = Net volume per hectare estimate for Treatment Unit u, Species s, Diameter class d, Type i and Block j for stems not to be harvested (Leave Trees).

$V_{u,s,d,i,j}$ = Pre reduction net volume per hectare estimate for Treatment Unit u, Species s, Diameter class d, Type i and Block j.

$PR_{u,s,d,i,j}$ = Percent reduction value for Treatment Unit u, Species s, Diameter class d, Type i and Block j used in the Percent Reduction Worksheet (FS 221).

Example 9.5

The reduction value for Pine in the 20 cm class in the Treatment Unit is 45.

The Treatment Unit net volume is 109.9 m³ per hectare for Pine in the 20 cm class before reduction.

$$\begin{aligned} VLT_{u,s,d,i,j} &= 109.9 * (45 \div 100) \\ &= 49.5 \text{ m}^3 \text{ per hectare} \end{aligned}$$

9.3.1.1.3 Block “Leave Tree” Summary

Weight the Treatment Unit Leave Tree net volume per hectare by the area of the Treatment Unit within the Type within the Block, sum, divide by the area of the Block. For Treatment Units without a percent reduction the reduction value equals zero.

$$VLT_{s,d,j} = \frac{\sum_{u=1}^{Uj} VLT_{u,s,d,i,j} * A_{u,i,j}}{A_j}$$

Where:

$VL_{T_{s,d,j}}$ = Net volume per hectare estimate for Species s, Diameter class d and Block j for stems not harvested (Leave Trees).

A_j = Area of Block j.

$A_{u,i,j}$ = Area of Treatment Unit u within Type i within Block j.

Example 9.6

There are 2 Treatment Units in Block X. The area of Block X is 10 hectares.

There are 2 types in the Block.

Treatment Unit A is 8 hectares, 7.5 hectares of Type 1 and .5 hectares of Type 2.

Treatment Unit B is 2.0 hectares, all in Type 2.

The reduction value for Pine in the 20 cm class in Type 1, Treatment Unit A is 45.

The reduction value for Pine in the 20 cm class in Type 2, Treatment Unit A is 35.

There is not a percent reduction for Pine in Treatment Unit B.

The Type 1 pre reduction stock table for Pine shows 109.9 m³ per hectare in the 20 cm class.

The Type 2 pre reduction stock table for Pine shows 84.0 m³ per hectare in the 20 cm class.

$$VL_{T_{A,P,20,1,X}} * A_{A,1,X} = 109.9 * .45 * 7.5 = 370.91$$

$$VL_{T_{A,P,20,2,X}} * A_{A,2,X} = 84.0 * .35 * 0.5 = 14.70$$

$$VL_{T_{B,P,20,2,X}} * A_{B,2,X} = 84.0 * .00 * 2.0 = 0.00$$

$$\begin{aligned} VL_{T_{P,20,X}} &= (370.91 + 14.70 + 0) \div 10 \\ &= 38.6 \text{ m}^3 \text{ per hectare} \end{aligned}$$

9.3.1.1.4 Block - Block Method

The Type within Block estimates must be calculated and weighted based on area of the Type within the Block. The Type within Block estimates use the Block Double Sampling Ratio, and the plots from the Type within the Block.

$$V_{s,d,i,j} = \frac{\sum_{p=1}^{m_{i,j}} V_{p,s,d,i,j}}{m_{i,j}} - \text{intermediate calculation - not reported}$$

$$V_{s,d,j} = \frac{\sum_{i=1}^{I_j} V_{s,d,i,j} * A_{i,j}}{A_j}$$

Refer to Example 9.3 for a sample Block calculation.

9.3.1.1.5 Cutting Permit

The cutting permit estimate is the weighted average of the Type estimates based on the area of the Type within the Cutting Permit.

$$V_{s,d,cp} = \frac{\sum_{i=1}^I V_{s,d,i} * A_i}{A_{cp}}$$

Report to two decimal places.

9.3.1.2 Example 9.7

There are two Types in the Cutting Permit. Type 1 has 5 ha and Type 2 has 7.5 ha. The Fir volume per hectare estimate in Type 1 is 238.18. The Fir volume per hectare estimate in Type 2 is 107.28.

$$V_{f,d,cp} = \frac{238.18 * 5 + 107.28 * 7.5}{12.5} = 159.64$$

Sum the Type, Block and Cutting Permit estimates by species and by diameter class (the examples below show the summations for the Timber Type only).

$$V_{s,i} = \sum_{d=1}^{34} V_{s,d,i}$$

$$V_{d,i} = \sum_{s=1}^{31} V_{s,d,i}$$

Sum either of the above estimates for the total volume per hectare for the Type, Block and Cutting Permit (i.e., all Species and all Diameter Classes).

$$V_i = \sum_{d=1}^{34} V_{s,i}$$

Where:

$V_{s,d,i}$ = Volume per hectare estimate for species s, diameter class d and Timber Type i.

$V_{s,d,j}$ = Volume per hectare estimate for species s, diameter class d and Block j.

$V_{s,d,i,j}$ = Block method volume per hectare estimate for species s, diameter class d, Timber Type i within Block j - the Block method Double Sampling ratio would be used.

$V_{s,d,cp}$ = Volume per hectare estimate for species s and diameter class d for the Cutting Permit.

$V_{s,i}$ = Total volume per hectare for a species, all 34 diameter classes.

$V_{d,i}$ = Total volume per hectare for a diameter class, all species.

V_i = Total volume per hectare for the Type i.

V_p = Volume per hectare estimate for plot p (refer to Section 8.1.3).

$A_{i,j}$	=	Area of Type i within Block j to 1 decimal place.
A_i	=	Area of Type i to 1 decimal place.
A_j	=	Area of Block j to 1 decimal place.
A_{cp}	=	Area of Cutting Permit to 1 decimal place.
I	=	Number of Types in the Cutting Permit.
I_j	=	Number of Types in Block j.
m_i	=	Number of measure plots in Timber Type i.
$m_{i,j}$	=	Number of measure plots in Timber Type i within Block j.
D	=	Diameter Class (refer to Appendix 14).

9.3.1.3 Useless Volume per Hectare

Only report useless volume per hectare if the Tree Class Combination coded on card type B is set to 1. The Useless Stems per hectare estimate are by Species (all Diameter Classes) and by Diameter Class (all Species). Only use tree classes 4 and 6.

For Leave Tree tables use the same methodology as outlined for Live Net Merchantable Volume per Hectare (Section 9.2.1.1).

9.3.1.3.1 Timber Type

$$VU_{s,i} = \frac{\sum_{d=1}^{34} \left(\sum_{p=1}^{m_i} S_p \right)}{m_i}, \text{ tree classes 4 and 6 only}$$

$$VU_{d,i} = \frac{\sum_{s=1}^{31} \left(\sum_{p=1}^{m_i} S_p \right)}{m_i}, \text{ tree classes 4 and 6 only}$$

Where:

$VU_{s,i}$ = Useless volume per hectare estimate for species s, Timber Type i.

- $VU_{d,i}$ = Useless volume per hectare estimate for diameter class d, Timber Type i.
 V_p = Volume per hectare estimate for plot p (refer to Section 8.1.3).
 m_i = Number of measure plots in timber type i.
 D = Diameter Class (refer to Appendix 14).

9.3.1.3.2 Block - Average Line Method

The Type estimates are weighted based on area of the Type within the Block. Use the same weighting method as for the volume per hectare estimate.

9.3.1.3.3 Block - Block Method

The Type within Block estimates must be calculated and weighted based on area of the Type within the Block. The Type within Block estimates use the Block Double Sampling Ratio, and the plots from the Type within the Block. Use the same weighting method as for the volume per hectare estimate.

9.3.1.3.4 Cutting Permit

The cutting permit estimate is the weighted average of the Type estimates based on the area of the Type within the Cutting Permit. Use the same weighting method as for the volume per hectare estimate.

9.3.1.4 Dead Potential Volume per Hectare

The Dead Potential volume per hectare estimates are segregated by Species (all Diameter Classes) and by Diameter Class (all Species). Only use tree classes 3, 7 and 9.

For Leave Tree tables use the same methodology as outlined for Live Net Merchantable Volume per Hectare (Section 9.2.1.1).

9.3.1.4.1 Timber Type

$$VDP_{s,i} = \frac{\sum_{d=1}^{34} \left(\sum_{p=1}^{m_i} V_{p,s,i} \right)}{m_i}, \text{ tree classes 3, 7 and 9 only}$$

$$VDP_{d,i} = \frac{\sum_{s=1}^{31} \left(\sum_{p=1}^{m_i} V_p \right)}{m_i}, \text{ tree classes 3, 7 and 9 only}$$

Where

$VDP_{s,i}$ = Dead potential volume per hectare estimate for species s, Timber Type i.

V_p = Volume per hectare estimate for plot p (refer to Section 8.1.3).

m_i = Number of measure plots in timber type i.

d = Diameter Class.

9.3.1.5 Total Volume per Hectare at Seven Levels

The total volume per hectare is also reported for seven diameter levels:

Leave Tree summaries do not need to report these parameters.

1. DBH greater than 17.4 cm.
2. DBH greater than 22.4 cm.
3. DBH greater than 27.4 cm.
4. DBH greater than 32.4 cm.
5. DBH greater than 37.4 cm.
6. DBH greater than 42.4 cm.
7. DBH greater than 47.4 cm.

Separate trees by Tree Class (i.e., live trees, dead potential and useless) as above. Only report Useless volume if the Tree Class Combination from card type B is coded 1.

Weight the parameters for Block and Cutting Permit as above.

9.3.1.5.1 Timber Type

$$VT_{s,l,i} = \sum_{d=l+2}^{34} V_{s,d,i} Y$$

Where:

$VT_{s,l,i}$ = Total volume for Species s at level l in Timber Type i.

$V_{s,d,i}$ = Volume per hectare estimate for species s, diameter class d and Timber Type i.

l = DBH lower limit level (1-7).

d = Diameter Class (refer to Appendix 14).

Report 007h - required.

[illegible]

Figure 9.2 Cutting Permit Stock Table - Sample Listing (Partial).

9.4 Basal Area Table

9.4.1 Basal Area Table - Detail Information

All of the basal area table parameters described below are reported to one decimal place.

9.4.1.1 Basal Area per Hectare

The basal area per hectare calculations are segregated by species and diameter class. Use only tree classes 1, 2, 5 and 8.

9.4.1.1.1 Timber Type

The Type estimate is the average of the plot estimates from the Type.

$$BA_{s,d,i} = \frac{\sum_{p=1}^{m_i} BA_p}{m_i}, \text{ tree classes 1, 2, 5 and 8 only}$$

9.4.1.2 Example 9.8

There are 4 plots in Type 1. The basal area per hectare estimates from these plots are 20, 30, 30 and 50 respectively. Assume that the estimates are based on a particular diameter class, d.

$$BA_{s,d,i} = (20 + 30 + 30 + 50) / 4 = 32.5$$

9.4.1.2.1 Block - Average Line Method

The Type estimates are weighted based on area of the Type within the Block.

$$BA_{s,d,j} = \frac{\sum_{i=1}^{I_j} BA_{s,d,i} * A_{i,j}}{A_j}$$

9.4.1.2.2 Block - Treatment Unit “Leave Tree” Summary

Only report those species within the Treatment Unit within the Block that have a percent reduction applied to them.

$$BALT_{u,s,d,i,j} = BA_{u,s,d,i,j} * (PR_{u,s,d,i,j} \div 100)$$

Where:

$BALT_{u,s,d,i,j}$ = Basal Area per hectare estimate for Treatment Unit u, Species s, Diameter class d, Type i and Block j for stems not to be harvested (Leave Trees).

$BA_{u,s,d,i,j}$ = Pre reduction basal area per hectare estimate for Treatment Unit u, Species s, Diameter class d, Type i and Block j.

$PR_{u,s,d,i,j}$ = Percent reduction value for Treatment Unit u, Species s, Diameter class d, Type i and Block j used in the Percent Reduction Worksheet (FS 221).

Example 9.9

The reduction value for Pine in the 20 cm class in the Treatment Unit is 45.

The Treatment Unit has a basal area of 14.0 m² per hectare for Pine in the 20 cm class before reduction.

$$\begin{aligned} BALT_{u,s,d,i,j} &= 14.0 * (45 \div 100) \\ &= 6.3 \text{ m}^2 \text{ per hectare} \end{aligned}$$

Block “Leave Tree” Summary

Weight the Treatment Unit “Leave Tree” basal area per hectare by the area of the Treatment Unit within the Type within the Block, sum, divide by the area of the Block. For Treatment Units without a percent reduction the reduction value equals zero.

$$BALT_{s,d,j} = \frac{\sum_{u=1}^{U_j} BALT_{u,s,d,i,j} * A_{u,i,j}}{A_j}$$

Where:

$BALT_{s,d,j}$ = Basal area per hectare estimate for Species s, Diameter class d and Block j for stems not harvested (Leave Trees).

A_j = Area of Block j.

$A_{u,i,j}$ = Area of Treatment Unit u within Type i within Block j.

Example 9.10

There are 2 Treatment Units in Block X. The area of Block X is 10 hectares.

There are 2 types in the Block.

Treatment Unit A is 8 hectares, 7.5 hectares of Type 1 and .5 hectares of Type 2.

Treatment Unit B is 2.0 hectares, all in Type 2.

The reduction value for Pine in the 20 cm class in Type 1, Treatment Unit A is 45.

The reduction value for Pine in the 20 cm class in Type 2, Treatment Unit A is 35.

There is not a percent reduction for Pine in Treatment Unit B.

The Type 1 pre reduction basal area table for Pine shows 14.0 m² per hectare in the 20 cm class.

The Type 2 pre reduction basal area table for Pine shows 10.5 m² per hectare in the 20 cm class.

$$BALT_{A,P,20,I,X} * A_{A,I,X} = 14.0 * .45 * 7.5 = 47.25$$

$$BALT_{A,P,20,2,X} * A_{A,2,X} = 10.5 * .35 * 0.5 = 1.84$$

$$BALT_{B,P,20,2,X} * A_{B,2,X} = 10.5 * .00 * 2.0 = 0.00$$

$$BALT_{P,20,X} = (47.25 + 1.84 + 0) \div 10$$

$$= 4.9 \text{ m}^2 \text{ per hectare}$$

9.4.1.2.3 Block - Block method

The Type within Block estimates must be calculated and weighted based on area of the Type within the Block. The Type within Block estimates use the Block Double Sampling Ratio and the plots from the Type within the Block.

$$BA_{s,d,i,j} = \frac{\sum_{p=1}^{m_{i,j}} BA_p}{m_{i,j}} - \text{intermediate calculation - not reported}$$

$$BA_{s,d,j} = \frac{\sum_{i=1}^{I_j} BA_{s,d,i,j} * A_{i,j}}{A_j}$$

Refer to Example 9.3 for Block level calculations.

9.4.1.2.4 Cutting Permit

The cutting permit estimate is the weighted average of the Type estimates based on the a

$$BA_{s,d,cp} = \frac{\sum_{i=1}^I BA_{s,d,i} * A_i}{A_{cp}}$$

Sum the Type, Block and Cutting Permit estimates by species and by diameter class (the examples below show the summations for the Timber Type only).

$$BA_{s,i} = \sum_{d=1}^{34} BA_{s,d,i}$$

$$BA_{d,i} = \sum_{s=1}^{31} BA_{s,d,i}$$

Refer to Example 9.7 for Cutting Permit level calculations.

Sum either of the above estimates for the total basal area per hectare for the Type, Block and Cutting Permit.

$$BA_i = \sum_{d=1}^{34} BA_{s,i}$$

Where:

$BA_{s,d,i}$ = Basal area per hectare estimate for species s, diameter class d and Timber Type i.

$S_{s,d,j}$ = Basal area per hectare estimate for species s, diameter class d & Block j.

$BA_{s,d,i,j}$ = Block method basal area per hectare estimate for species s, diameter class d, Timber Type i within Block j - the Block method Double Sampling ratio would be used.

$BA_{s,d,cp}$ = Basal area per hectare estimate for species s and diameter class d for the Cutting Permit.

$BA_{s,i}$ = Total basal area per hectare for a species, all 34 diameter classes.

$BA_{d,i}$ = Total basal area per hectare for a diameter class, all species.

BA_i = Total basal area per hectare for the Timber Type.

BA_p = Basal area per hectare estimate for plot p (refer to Section 8.1.3).

$A_{i,j}$	=	Area of Type i within Block j to 1 decimal place.
A_i	=	Area of Type i to 1 decimal place.
A_j	=	Area of Block j to 1 decimal place.
A_{cp}	=	Area of Cutting Permit to 1 decimal place.
I	=	Number of Types in the Cutting Permit.
I_j	=	Number of Types in Block j.
m_i	=	Number of measure plots in Timber Type i.
$m_{i,j}$	=	Number or measure plots in Timber Type i within Block j.
d	=	Diameter Class (refer to Appendix 14).

9.4.1.3 Useless Basal Area per Hectare

The Useless basal area per hectare estimates are by Species (all Diameter Classes) and by Diameter Class (all Species). Only use tree classes 4 and 6.

For Leave Tree tables use the same methodology as outlined for Live Net Merchantable Volume per Hectare (Section 9.3.1.1).

9.4.1.3.1 Timber Type

$$BAU_{s,i} = \frac{\sum_{d=1}^{34} \left(\sum_{p=1}^{m_i} BA_{p,s,i} \right)}{m_i}$$

$$BAU_{d,i} = \frac{\sum_{s=1}^{31} \left(\sum_{p=1}^{m_i} BA_{p,d,i} \right)}{m_i}$$

Where:

- $BAU_{s,i}$ = Useless basal area per hectare estimate for species s, Timber Type i.
- $BAU_{d,i}$ = Useless basal area per hectare estimate for diameter class d, Timber Type i.
- BA_p = Basal area per hectare estimate for plot p (refer to Section 8.1.3).
- m_i = Number of measure plots in timber type i.
- d = Diameter class (refer to Appendix 14).

9.4.1.3.2 Block - Average Line Method

The Type estimates are weighted based on area of the Type within the Block. Use the same weighting method as for the basal area per hectare estimate.

9.4.1.3.3 Block - Block Method

The Type within Block estimates must be calculated and weighted based on area of the Type within the Block. The Type within Block estimates use the Block Double Sampling Ratio and the plots from the Type within the Block. Use the same weighting method as for the basal area per hectare estimate.

9.4.1.3.4 Cutting Permit

The cutting permit estimate is the weighted average of the Type estimates based on the area of the Type within the Cutting Permit. Use the same weighting method as for the basal area per hectare estimate.

9.4.1.4 Dead Potential Stems per Hectare

The Dead Potential Stems per hectare estimate are by Species (all Diameter Classes) and by Diameter Class (all Species). Only use tree classes 3, 7 and 9.

For Leave Tree tables use the same methodology as outlined for Live Net Merchantable Volume per Hectare (Section 9.3.1.1).

9.4.1.4.1 Timber Type

$$BADP_{s,i} = \frac{\sum_{d=1}^{34} \left(\sum_{p=1}^{m_i} BA_p \right)}{m_i}$$

$$BADP_{d,i} = \frac{\sum_{s=1}^{31} \left(\sum_{p=1}^{m_i} BA_p \right)}{m_i}$$

Where:

$BADP_{s,i}$ = Dead potential basal area per hectare estimate for species s, Timber Type i.

BA_p = Basal area per hectare estimate for plot p (refer to Section 8.1.3).

m_i = Number of measure plots in Timber Type i.

d = Diameter class (refer to Appendix 14)

9.4.1.5 Total Basal Area per Hectare at Five Levels

The total basal area per hectare is also reported for 5 diameter levels:

Leave Tree reports do not need to report these parameters.

1. DBH greater than 12.4 cm.
2. DBH greater than 17.4 cm.
3. DBH greater than 22.4 cm.
4. DBH greater than 27.4 cm.
5. DBH greater than 32.4 cm.

Separate trees by Tree Class (i.e., Live trees, Dead potential and Useless) as above.
Weight the parameters for Block and Cutting Permit as above.

9.4.1.5.1 Timber Type

$$\text{BAT}_{s,l,i} = \sum_{d=l+2}^{34} \text{BA}_{s,d,i}$$

Where:

$BAT_{s,l,i}$ = Total basal area per hectare for Species s at level l in Timber Type i .

$BA_{s,d,i}$ = Basal area per hectare estimate for species s , diameter class d and Timber Type i .

1 = DBH lower limit level (1-7).

Report 007F - required.

Figure 9.3 Timber Type Basal Area.

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