

# Field Measurement Approach Standard



## Emissions Trading Scheme (Forestry)

ETSFMAS.04  
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### Authority

Regulation 7 of the Climate Change (Forestry Sector) Regulations 2008 authorises the Environmental Protection Authority (EPA), by notice in the *Gazette*, to issue Standards in relation to the information and data to be collected regarding allocation of permanent sample plots under regulation 22C, and the collection of information and data for those plots under regulation 22B. A participant who complies with a Standard that is issued under regulation 7 is to be treated as complying with the Regulations to which the Standard relates.

In this Standard, a reference to a section means that section in the Climate Change Response Act 2002 (“the Act”), and a reference to a regulation means that regulation in the Climate Change (Forestry Sector) Regulations 2008 (“the Regulations”).

### Scope

The Field Measurement Approach (FMA) is the process described in regulations 22A – 22O of the Climate Change (Forestry Sector) Regulations 2008. Under those regulations, a person who is a FMA participant must, in accordance with this Standard—

- (a) apply to the EPA for the allocation of a minimum number of permanent sample plots to be located on the participant’s registered post-1989 forest land, or for any greater number of plots that the participant would like; and
- (b) establish a permanent sample plot at each of the locations specified by the EPA; and
- (c) at least once in each mandatory emissions return period, collect and submit to the EPA the FMA information specified in this Standard for each permanent sample plot; and
- (d) if directed by the Regulations, use participant-specific tables produced from the FMA information by the EPA to calculate carbon stocks for the purpose of making emissions returns.

This Standard applies from 1 June 2016, and may be revised from time to time or revoked.

### Purpose

This document comprises the Standard that prescribes the manner in which permanent sample plots allocated by the EPA must be located and established. The Standard also specifies the detail of the FMA information, and of any other information that the EPA requires, that must be collected at and recorded for those plots. A FMA participant must comply with this Standard to meet the requirements of the Act and the Regulations.

In this Standard:

- (i) Part 1 provides definitions of special terms used.
- (ii) Part 2 specifies the minimum number of permanent sample plots to be allocated by the EPA, as a function of the area of registered post-1989 forest land or the area of forest land in an assigned Forest Class.
- (iii) Parts 3 and 4 specify the procedure for locating and establishing allocated permanent sample plots.
- (iv) Parts 5 and 6 specify the procedures for establishing, if required, sub-plots and/or sub-samples within permanent sample plots.
- (v) Part 7 specifies the requirements and options for collecting FMA information at permanent sample plots.
- (vi) Parts 8 and 9 specify the procedures for collecting, recording and submitting FMA information, and any additional information required by the EPA, in relation to trees and shrubs within permanent sample plots.

Guidance on practical implementation of this Standard can be obtained from ***A Guide to the Field Measurement Approach for the Emissions Trading Scheme***, available at: [www.mpi.govt.nz](http://www.mpi.govt.nz)

The form and format in which a FMA participant can receive an allocation of permanent sample plots from the EPA, or submit FMA information and additional information collected at those plots under the Regulations and this Standard to the EPA, is prescribed in the ***FMA Information Standard*** available at: [www.mpi.govt.nz](http://www.mpi.govt.nz)



(1) In this Standard, unless the context requires otherwise:

<b>Adverse event</b>	means any fire, or any event of natural cause, that results in the clearing of any trees within a permanent sample plot. Examples other than fire include, but are not limited to, wind, disease, pests and erosion.
<b>Altitude</b>	means the height above average sea level.
<b>Average maximum slope</b>	means for permanent sample plots, the average of two angles measured relative to a horizontal plane from the centre of the plot to the perimeter of the plot, where: (a) the first angle is measured in the direction of the steepest slope within the plot, and the second angle in the opposite direction; and (b) the first angle is taken as positive if above a horizontal plane or negative if below it; and (c) the second angle is taken as negative if above a horizontal plane and positive if below it.
<b>Average slope</b>	means for distances, the angle measured relative to a horizontal plane, taken from the current point to a point of interest.
<b>Breast height</b>	means a point on a standing tree stem that is: (a) 1.40 metres from ground level when measured parallel to the stem; and (b) if the stem is leaning, is measured from ground level on that side of the stem that makes an angle of less than 90 degrees to ground level; except (c) if the stem is on a slope, is measured from ground level on the uphill side of the stem.
<b>Collar diameter</b>	means the diameter over bark of a stem, measured at a point on a standing stem that is 0.1 metres from ground level with the point otherwise determined as for breast height.
<b>Crown cover</b>	means the proportion of an area covered by a projection of all live tree and/or shrub crowns (as applicable) within that area onto a horizontal plane, expressed as the horizontally-projected crown area per unit area (m <sup>2</sup> /m <sup>2</sup> ).
<b>Crown height</b>	means the height above ground level of the uppermost green foliage of a live tree or shrub (as applicable).
<b>Crown volume</b>	means the product of the average crown height of trees and/or shrubs (as applicable) within an area and the crown cover of trees and/or shrubs (as applicable) in that area.
<b>Diameter at breast height (DBH)</b>	means the diameter at breast height over bark of a standing stem.
<b>EPA</b>	means the Environmental Protection Authority, or the Chief Executive of that Authority, as applicable.
<b>Exotic shrub species</b>	means a shrub species that is not an indigenous shrub species.
<b>Forest stand</b>	means: (a) in relation to the location of a permanent sample plot allocated by the EPA, an area within a FMA participant's registered post-1989 forest land that has been defined as a single polygon under the <i>Geospatial Mapping Information Standard</i> published by the Environmental Protection Authority, and that has also been assigned to a Forest Class if Forest Class has been assigned; or (b) in a general forestry context, an area of trees (usually contiguous but not necessarily so) of the same age, species and silvicultural regime that is also commonly a unit of forest management and record.
<b>Global Positioning System (GPS)</b>	means the global satellite system that provides information from which the geographic coordinates of a location can be obtained by using a GPS receiver.
<b>Ground level</b>	means a horizontal plane coincident with the soil surface after woody debris has been removed, and in relation to determining the crown height or stem height of a tree or shrub is taken as being located on the uphill side of a tree or shrub stem if the tree or shrub is on a slope.
<b>Indigenous shrub species</b>	means a shrub species that occurs naturally in New Zealand or has arrived in New Zealand without human assistance.



<b>Intermingled trees</b>	<p>in relation to the trees in a permanent sample plot, means:</p> <p>(a) the trees present are:</p> <p style="margin-left: 20px;">(i) the same age but different species groups, or</p> <p style="margin-left: 20px;">(ii) different ages but the same species group; or</p> <p style="margin-left: 20px;">(iii) different ages and different species groups; and</p> <p>(b) the permanent sample plot cannot be readily subdivided in such a way as to form sub-plots having only trees of the same age and species group.</p> <p>For avoidance of doubt, when determining whether intermingled trees are present, the trees in a species group are considered to have:</p> <p>(a) if planted, the same age if all were planted during a given year; and</p> <p>(b) if regenerated, a single age equal to the age of the oldest trees.</p>
<b>Intended predominant forest species</b>	<p>in relation to an area of forest land, means the single forest species being grown or managed with the intention that it will have the greatest total basal area at the time of harvest, or at the time of maturity of the forest species if a non-harvest forest.</p>
<b>Permanent sample plot</b>	<p>means a bounded area, circular or square in shape, centred on a location specified by the EPA.</p>
<b>Polygon</b>	<p>means a closed shape bounded by sequentially-connected polylines that do not cross, such that the geographic coordinates of the end point of one polyline are the same as the coordinates of the start of the next polyline.</p>
<b>Polyline</b>	<p>means a continuous line composed of one or more line segments.</p>
<b>Pruned</b>	<p>in relation to trees, means that the trees are subject to a pruning regime that is expected to result in at least 50% of the stems present at the time of harvest having had branches removed to a height of at least 4.30 metres.</p>
<b>Residual stocking</b>	<p>means the stocking of live trees after trees have been thinned as part of silviculture or after an adverse event.</p>
<b>Shrub</b>	<p>means any woody-stemmed perennial species with a crown height of more than 0.3 metres that is not a forest species.</p>
<b>Silviculture</b>	<p>means the thinning and pruning regime applied to an area of forest.</p>
<b>Species group</b>	<p>means the forest species that belong to one of the following groups of single or multiple tree species: <i>Pinus radiata</i>, Douglas fir, Exotic Hardwoods, Exotic Softwoods, or Indigenous Species</p>
<b>Stem</b>	<p>means the main woody above-ground body (or bodies, if multi-stemmed) of a tree or shrub.</p>
<b>Stem height</b>	<p>means the length of a stem from ground level to the uppermost green foliage of a live stem, or of the top of the stem if a dead stem.</p>
<b>Stocking</b>	<p>in relation to a specified area, means the number of tree stems in that area.</p>
<b>Sub-plot</b>	<p>means a bounded area that is part of a permanent sample plot, that may be used in relation to collecting FMA information on trees.</p>
<b>Sub-sample</b>	<p>means a bounded area, circular in shape, within a permanent sample plot or sub-plot, that may be used in relation to collecting FMA information on trees, and has a location taken as the centre point of the sub-sample.</p>
<b>Witness tree</b>	<p>means a permanently marked tree expected to be remain present until the time of harvest, or until the time of maturity in a non-harvest forest, and located in a known position outside the perimeter of a permanent sample plot.</p>

- (1) Any word or expression defined in the Act or Regulations and used in this Standard has, unless the context requires otherwise, the same meaning as it has in the Act or Regulations.
- (2) In this Standard a reference to:
  - (a) a Part means a Part in this Standard; and
  - (b) a clause means a clause in a Part; and
  - (c) a paragraph or sub-paragraph means a paragraph or sub-paragraph in a clause.



- (3) In this Standard, unless the context requires otherwise:
- (a) all lengths or distances given are those in a horizontal plane; and
  - (b) any lengths or distances required to be determined by a FMA participant in a horizontal plane, if not measured in such a plane, must be corrected to an equivalent horizontal length or distance using the formula:

$$D_H = D_S \cos(\Theta)$$

where:

$D_H$  is the equivalent horizontal length or distance

$D_S$  is the length or distance measured in a plane that is at an angle  $\Theta$  relative to a horizontal plane

$\cos$  is the cosine trigonometric function

$\Theta$  is the angle between the plane in which measurements are made and a horizontal plane, expressed in degrees or radians (as applicable)

## Part 2 Required Minimum Number of Permanent Sample Plots

- (1) Under regulation 22C(1), the required minimum number of permanent sample plots allocated to a FMA participant, where Forest Class has not been assigned, is:
- (a) 30 plots for 100 hectares of registered post-1989 forest land; or
  - (b) 200 plots for 10,000 hectares or more of registered post-1989 forest land; and
  - (c) a number determined on a sliding scale between 30 and 200 plots if the area of registered post-1989 forest land is between 100 and 10,000 hectares.
- (2) For the purposes of clause (1)(c), the minimum number of permanent sample plots in the right-hand column of the Table below are required for the area of registered post-1989 forest land in the left-hand column.

Area of registered post-1989 forest land (ha)	Minimum number of plots
150	34
200	37
300	42
500	50
700	56
1000	64
2000	84
3000	100
5000	129
6000	143
7000	157
8000	171
9000	186



- (3) If the EPA is allocating permanent sample plots for a FMA participant, and the participant has an area of registered post-1989 forest land that is not in the Table in clause (2), the minimum number of plots to be allocated will be determined by non-linear interpolation of the values in that Table. If the resultant interpolated value is not a whole number, it will be rounded to a whole number (0.5 and above rounded up).
- (4) If the FMA participant has assigned Forest Class to their registered post-1989 forest land, the minimum number of permanent sample plots to be allocated to the participant's land in that Forest Class must be determined under regulations 22C(1)(b) and 22C(1)(c) using as  $N_{P-TOTAL}$  the minimum number of plots given in clauses (1) to (3).

## Part 3 Procedure for Locating the Centre Point of Permanent Sample Plots

### *Information on Permanent Sample Plot Locations Provided to a FMA Participant*

- (1) The information defining the permanent sample plots allocated to a FMA participant by the EPA will comprise the following:
  - (a) the date on which the set of plots was allocated to the participant by the EPA; and
  - (b) for each plot:
    - (i) an identifier which must be recorded by the participant as the plot identifier when collecting, recording or submitting information in relation to the plot; and
    - (ii) a location that is a set of geographic coordinates that specify the location of the centre point of each plot, with the coordinates consisting of an Easting and Northing given in the New Zealand Transverse Mercator 2000 (NZTM2000) map projection, in relation to the New Zealand Geodetic Datum 2000 (NZGD2000) geodetic datum.

### *Determining the Location and Centre Point of a Permanent Sample Plot*

- (2) A FMA participant must determine the location of a permanent sample plot by:
  - (a) using a GPS receiver that has at least 10 channels, and is able to:
    - (i) set as the map projection, the NZTM2000 projection; and
    - (ii) set as the geodetic datum, the NZGD2000 datum or the World Geodetic System 1984 (WGS84) datum; and
    - (iii) be set to an averaging mode, and to report averaged geographic coordinates; and
  - (b) setting the GPS receiver to a map projection of NZTM2000 and a geodetic datum of NZGD2000, or if NZGD2000 is not available to a geodetic datum of WGS84; and
  - (c) navigating using the GPS receiver to a position that is at a distance of between 100 and 30 metres from the plot location specified by the EPA; and
  - (d) ensuring, as far as practicable, that the position navigated to has at least a partially unobstructed view of the sky; and
  - (e) at the position navigated to, setting the GPS receiver to a mode that determines averaged geographic coordinates; and
  - (f) determining the averaged Easting and Northing of the position navigated to as the geographic coordinates reported by the GPS receiver:
    - (i) at the end of the minimum averaging time, if the receiver automatically calculates and displays the minimum time to obtain a reliable set of averaged geographic coordinates; or
    - (ii) after averaging for at least 3 minutes, if the GPS receiver does not support automatic calculation of the necessary averaging time; and
  - (g) recording the identifier of the plot being located, and the averaged Easting and Northing of the position navigated to as determined under paragraph (f); and
  - (h) from the averaged Easting and Northing of the position and the geographic coordinates of the plot location specified by the EPA, determining the horizontal distance and true bearing to the plot location from the position navigated to; and
  - (i) navigating the remaining distance to the plot location using a lineal tape and compass, with the compass bearing corrected for local magnetic declination; and
  - (j) taking as the plot centre point the plot location navigated to under paragraph (i).



### **Marking the Centre Point of a Permanent Sample Plot**

- (3) A FMA participant must mark the centre point of a permanent sample plot:
- (a) by driving vertically into the ground a length of steel rod, of at least 25 centimetres length and 1 centimetre diameter, so that the top of the rod is not more than 25 centimetres below the ground surface; and
  - (b) by driving vertically into the ground to the true North of, and immediately beside, the steel rod a tanalised wooden peg approximately 50 millimetres square that extends not more than 50 centimetres above the ground surface; and
  - (c) if unable to comply with paragraphs (a) or (b) because of rocky or stony ground, by:
    - (i) temporarily marking the plot centre point; and
    - (ii) marking an alternative reference position according to paragraphs (a) and (b) that is as near to the plot centre point as possible; and
    - (iii) recording the distance from the centre point to the alternative marked reference position to within 1 centimetre; and
    - (iv) recording the bearing (relative to true North) from the centre point to the alternative marked reference position within  $\pm 1$  degree; and
    - (v) retaining as part of the participant's records the distance and bearing recorded under sub-paragraphs (iii) and (iv).
- (4) Once the centre point of the permanent sample plot has been marked in accordance with clause (3), a FMA participant must determine the geographic coordinates of the point independently using the GPS receiver by:
- (a) setting the GPS receiver to comply with clause (2)(b), and to a mode that determines averaged geographic coordinates; and
  - (b) placing the GPS receiver at the plot centre point; and
  - (c) determining the Easting, Northing and altitude of the plot centre point by:
    - (i) setting the GPS receiver to a mode that determines averaged geographic coordinates; and
    - (ii) obtaining averaged values of the Easting, Northing and altitude in the manner specified in clause (2)(f)(i) or (2)(f)(ii) (as applicable); and
    - (iii) completing sub-paragraph (ii) 3 times spread over the period during which FMA information is being collected at the plot; and
    - (iv) if the GPS receiver being used is capable of displaying the estimated positional accuracy of a set of averaged geographic coordinates, taking as the coordinates of the plot centre point the value obtained under paragraph (iii) with the highest positional accuracy; and
    - (v) if the GPS receiver is not capable of displaying the estimated positional accuracy, taking as the geographic coordinates of the plot centre point the average of the 3 sets of values obtained under paragraph (iii); and
  - (d) recording the:
    - (i) plot identifier; and
    - (ii) the Easting, Northing and altitude of the plot centre point determined under paragraph (c).
- (5) For each permanent sample plot a FMA participant must:
- (a) locate two "witness trees" that:
    - (i) are visible from the plot centre point but located outside of the plot perimeter; and
    - (ii) when viewed from the plot centre point, have bearings that are approximately 90 degrees apart; and
  - (b) permanently mark the witness trees; and
  - (c) record, and retain as part of the FMA participant's records, the:
    - (i) bearing (relative to true North) from the plot centre point as marked under clause (3) to the centre of the stem of each witness tree, to within  $\pm 1$  degrees; and
    - (ii) distance from the plot centre point to the centre of the stem of each witness tree as determined using a lineal tape, to within  $\pm 2$  centimetres; and



- (iii) vary the bearing and distance of witness trees from the plot centre point for successive plots, to avoid there being a predictable bearing and distance to such trees.

#### ***Identifying and Recording the Centre Point of a Permanent Sample Plot when Collecting FMA Information***

- (6) Whenever FMA information is collected at a permanent sample plot, a FMA participant must first identify the position of the plot centre point by:
  - (a) locating the wooden peg provided it is clear the peg has not been moved; and
  - (b) if the wooden peg is absent or may have been moved, locating the buried iron rod; and
  - (c) if the iron rod is also absent or may have been moved, using the bearings and distances from the plot centre point to the centre of the stems of the witness trees; and
  - (d) if an alternative reference position was marked under clause (3)(c)(ii) instead of the plot centre point, using the recorded distance and bearing from the reference position to the plot centre point to identify the position of the plot centre point; and
  - (e) if the witness trees are absent, using a GPS receiver to re-establish the plot-location by following the procedure given in clause (2); and
  - (f) if required to re-establish the plot location under paragraph (e), completing the re-establishment according to clauses (3) – (5), and recording that the plot location has been re-established because previous plot markings could not be found; and
  - (g) whenever the plot centre point is located in accordance with any of sub-clauses (a) – (d), a FMA participant:
    - (i) must comply with clause (4); and
    - (ii) must use information previously recorded in relation to the plot under clause (2)(g).

#### ***Circumstances Under which a Permanent Sample Plot May or Must be Relocated***

- (7) If when establishing a permanent sample plot in accordance with Part 4 of this Standard the plot perimeter extends beyond the boundary of the FMA participant's registered post-1989 forest land, a FMA participant:
  - (a) may relocate the plot centre point identified in clause (2) in accordance with clause (11), and if relocating the plot must record that the plot is an edge-plot that extends beyond the boundary of the forest land; or
  - (b) if the plot centre point is not relocated:
    - (i) must record that the plot is an edge-plot that extends beyond the boundary of the forest land; and
    - (ii) must record the area of the plot within the boundary of the forest land as a percentage of the total plot area; and
    - (iii) in the remainder of this Standard, must take any reference to a plot as meaning only that part of the plot within the boundary of the forest land; and
    - (iv) in the remainder of this Standard, must take any reference to the perimeter of a plot as meaning that part of the plot perimeter that is within the boundary of the forest land, with the remainder of the plot perimeter taken as being coincident with the boundary.
- (8) If when establishing a permanent sample plot in accordance with Part 4 of this Standard clause (7) does not apply, but the plot perimeter extends beyond a forest stand boundary into a stand assigned to a different Forest Class, a FMA participant must:
  - (a) relocate the plot centre point in accordance with clause (11); and
  - (b) record that the plot is an edge-plot that extends across forest stands assigned to different Forest Classes.
- (9) If when establishing a permanent sample plot in accordance with Part 4 of this Standard part of the area within the plot perimeter is subject to a silvicultural trial, or any other type of experimental trial, a FMA participant must:
  - (a) relocate the plot centre point in accordance with clause (11); and
  - (b) record that the plot was relocated due to the presence of an experimental trial.



- (10) If when establishing a permanent sample plot in accordance with Part 4 of this Standard there are any regenerated trees within the plot perimeter that are assessed as likely to have been present more than two years before the change in land management that initiated the conversion of the area to forest land from land, a FMA participant may:
- (a) exclude the older trees that regenerated prior to the land conversion from those trees in the plot for which any FMA information is collected; or
  - (b) relocate the plot centre point in accordance with clause (11), and record that the plot was relocated due to the presence of older trees that regenerated prior to the land conversion.
- (11) If when establishing a permanent sample plot clauses (7)(a), (8), (9) or (10) apply, a FMA participant must relocate the plot centre point determined under clause (2) by:
- (a) if clause (7)(a) applies, delineating in the field, in accordance with the *Geospatial Mapping Information Standard* published by the EPA, the local boundary of the participant's registered post-1989 forest land; and
  - (b) if clause (8) applies, delineating in the field the local boundary between the forest stands assigned to different Forest Classes as a polyline placed on average equidistant between the trees in the different forest stands; and
  - (c) if clause (9) applies, delineating in the field the local boundary of the area subject to the silvicultural or other experimental trial as a polyline placed on average equidistant between trees inside and outside of the trial area; and
  - (d) if clause (10)(b) applies, delineating in the field the local boundary of the area that includes the regenerated trees that were likely present more than two years before the change in land management that initiated the conversion of the area to forest land from land that was not forest land, as a polyline placed at the estimated edge of the canopy of those trees at maturity; and
  - (e) constructing a line that passes through the nearest point on the local boundary identified in paragraphs (a) – (d) and the plot centre point identified under clause (2)(j), and is within the participant's registered post-1989 forest land area; and
  - (f) selecting a point along that line as the plot centre point, such that:
    - (i) the part of the perimeter of the plot that formerly extended beyond the local boundary identified under paragraphs (a) – (d) is coincident with but does not extend beyond the local boundary; and
    - (ii) no other part of the plot perimeter extends beyond the boundary of the FMA participant's registered post-1989 forest land; and
    - (iii) the plot perimeter does not include any other part of an area subject to a silvicultural or other experimental trial; and
    - (iv) the plot perimeter does not include any regenerated tree or trees that were likely present more than two years before the change in land management that initiated the conversion of the area to forest land land; and
    - (v) if Forest Class has been assigned to the participant's registered post-1989 forest land, the plot perimeter does not include forest land assigned to more than one Forest Class and the Forest Class of the included land is the same as when the plot was allocated by the EPA ; and
    - (vi) the plot centre point is in the forest stand to which the plot was allocated by the EPA; and
  - (g) if unable to comply with paragraphs (f)(ii) –(vi), instead moving the plot centre point in whichever true Northerly, Southerly, Easterly or Westerly direction would result in:
    - (i) the plot centre point being closest to the plot location specified by the EPA; and
    - (ii) the plot perimeter lying completely within the boundary of the participant's registered post-1989 forest land; and
    - (iii) the plot perimeter not including any part of an area subject to a silvicultural or other experimental trial; and
    - (iv) the plot perimeter not including any regenerated tree or trees that were likely present more than two years before a change in land management that initiated the conversion of the area to forest land; and
    - (v) if Forest Class has been assigned to the participant's registered post-1989 forest land, the plot perimeter not including forest land assigned to more than one Forest Class, and the Forest Class of the included land is the same as that assigned to the land at the plot location allocated by the EPA; and
  - (h) completing the requirements in clauses (3) – (5) for the plot centre point determined in paragraphs (f) or (g).



## Part 4 Establishing a Permanent Sample Plot at a Plot Location

- (1) A FMA participant, unless subject to a waiver under regulation 22K:
  - (a) must establish in accordance with this Part of the Standard each permanent sample plot allocated by the EPA at a plot centre point identified under Part 3 of this Standard; and
  - (b) having established a permanent sample plot, may only change the shape or area of the plot when the trees on the plot are cleared and new trees have been planted or are regenerated.

### ***Determining the Shape and Area of a Permanent Sample Plot***

- (2) The shape selected for a permanent sample plot at the time of plot establishment must be.
  - (a) if the plot includes any planted trees, circular (hereafter a “circular plot”); or
  - (b) if the plot does not include any planted trees, either circular, or square (hereafter a “square plot”).
- (3) The area of a permanent sample plot that is to be established:
  - (a) must have an area that is:
    - (i) one of the following: 0.030, 0.040, 0.060, 0.080, 0.100, or 0.200 hectares; and
    - (ii) is the smallest area expected to include at least 20 and not more than 30 live tree stems for which DBH must be measured at the time of harvest, or at the time of maturity for a non-harvest forest; and
    - (iii) 0.200 hectares, if a plot area larger than 0.200 hectares is required to satisfy sub-paragraph (ii); and
    - (iv) if when establishing a plot there is an unstocked area within the plot perimeter, the area that would be selected if the unstocked area had the same stocking as the remainder of the plot; and
  - (b) despite paragraphs (a)(ii) to (a)(iv), may have an area of 0.04 hectares if the plot includes only naturally regenerated indigenous forest species.

### ***Determining the Position of the Perimeter of a Permanent Sample Plot***

- (4) The perimeter of a permanent sample plot in relation to the plot centre point must be determined as follows:
  - (a) For a plot laid out in a horizontal plane, the plot perimeter is coincident with:
    - (i) if a circular plot, the circumference of a circle of radius  $r_P$  (in metres) centred on the plot centre point, where:
$$r_P = \sqrt{A_P 10000 / \pi}$$
and:
      - $A_P$  is the area of the plot selected under clause (3)(a), in hectares
      - $\pi$  is the constant Pi (3.14159).
    - (ii) if a square plot, the perimeter of a square with sides of length  $l_P$  (in metres) centred on the plot centre point, where:
$$l_P = \sqrt{A_P 10000}$$
and:
      - $A_P$  is the area of the plot selected under clause (3)(a), in hectares.



(b) For a plot laid out in a plane parallel to the direction of the average maximum slope, the plot perimeter is coincident with:

(i) if a circular plot, the circumference of a circle of radius  $r_{P-S}$  (in metres) centred on the plot centre point, where:

$$r_{P-S} = r_P / \sqrt{\cos \theta_S}$$

and:

$$r_P = \sqrt{A_P 10000 / \pi}$$

$A_P$  is the area of the plot selected under clause (3)(a), in hectares

$\pi$  is the constant Pi (3.14159)

$\cos$  is the cosine trigonometric function

$\theta_S$  is the average maximum slope angle for the plot expressed in degrees or radians (as applicable).

(ii) if a square plot, the perimeter of a square with sides of length  $l_{P-S}$  (in metres) placed so that two sides are parallel to the direction of the average maximum slope, where:

$$l_{P-S} = l_P / \sqrt{\cos \theta_S}$$

and:

$$l_P = \sqrt{A_P 10000}$$

$A_P$  is the area of the plot selected under clause (3)(a), in hectares

$\cos$  is the cosine trigonometric function

$\theta_S$  is the average maximum slope angle for the plot expressed in degrees or radians (as applicable).

(5) The position of the perimeter of a permanent sample plot:

(a) must be determined by laying out the plot in a horizontal plane, using the dimensions given under clause (4)(a), if the slope measured from plot-edge to plot-edge at right angles to the direction of the average maximum slope, and along a line passing through the plot centre point, is 10 degrees or more; or

(b) must be determined by laying out the plot in a horizontal plane if practicable, using the dimensions given under clause (4)(a); or

(c) for plots for which the average maximum slope is less than 10 degrees, may be determined by:

(i) using the dimensions given under clauses (4)(a)(i) or (4)(a)(ii) as applicable; and

(ii) tracing the perimeter parallel to the slope of the land; or

(d) if not determined under paragraphs (a) to (c), must be determined by:

(i) using the dimensions given under clause (4)(b)(i) or (4)(b)(ii) as applicable; and

(ii) tracing the perimeter in the plane of the average maximum slope.

#### ***Recording Information on the Shape and Dimensions of a Permanent Sample Plot***

(6) When each permanent sample plot is established, the following information must be recorded:

(a) the identifier of the plot as supplied by the EPA; and

(b) the area of the plot (in hectares) selected under clause (3)(a) or (3)(b); and

(c) the shape selected for the plot under clause (2); and

(d) the average maximum slope for the plot (in degrees); and

(e) if the plot perimeter has been determined under:

(i) clauses (5)(a) to (5)(c), the plot dimensions  $r_P$  or  $l_P$  (in metres) determined under clause (4)(a); or

(ii) clause (5)(d), the plot dimensions  $r_{P-S}$ , or  $l_{P-S}$  (in metres) determined under clause (4)(b).



## Part 5 Establishing Sub-plots within a Permanent Sample Plot

- (1) In this Part of the Standard a reference to “shrubs” or “trees” means only those shrubs or trees for which a FMA participant must collect FMA information once the participant has selected options in relation to shrubs or trees under Part 3, clause (10); and Part 7; clauses (4), (5) and (6); as applicable.

### *Requirements for Creating Sub-plots in a Permanent Sample Plot*

- (2) A FMA participant, if required under this Part of the Standard must:
- (a) divide a permanent sample plot into sub-plots; and
  - (b) instead of collecting and recording FMA information for shrubs and trees in the plot, collect and record such information for each sub-plot.
- (3) A FMA participant must:
- (a) divide a permanent sample plot into sub-plots if there exist within the permanent sample plot discrete areas such that the trees in each area:
    - (i) belong to a different species group; or
    - (ii) belong to the same species group but have a different age, where age is calculated under regulation 22; and
  - (b) identify each discrete area that satisfies the conditions in paragraph (a) as a sub-plot.
- (4) If after identifying discrete areas as sub-plots under clause (3) there remain further discrete areas within a permanent sample plot which:
- (a) include intermingled trees, then each such area must be identified as a sub-plot; or
  - (b) are unstocked as a result of harvesting, then each such area:
    - (i) must be identified as a sub-plot; and
    - (ii) for the purposes of clause (5) be treated as if it is a fully-stocked area.

### *Determining the Position of the Perimeter of Sub-plot*

- (5) The perimeter of each discrete area identified as a sub-plot identified in clauses (3) or (4) must be defined by:
- (a) If the area extends to the perimeter of the permanent sample plot or is separated from the plot perimeter by a permanently unstocked area:
    - (i) identifying any polyline that can be placed so that it starts and ends on the plot perimeter, and within the plot is located on average equidistant from the stems of trees in adjacent areas identified as sub-plots; and
    - (ii) defining as non-overlapping polygons those areas with boundaries that can be formed from the intersection of the plot perimeter and the polylines identified in sub-paragraph (i).
  - (b) If the area is entirely within any polygon P1 defined under paragraph (a), then for each such area:
    - (i) identifying a polyline that starts and ends at the same point within the polygon P1, and within P1 is located on average equidistant from the stems of trees in adjacent areas identified as sub-plots; and
    - (ii) forming a polygon P2 from the polyline identified in sub-paragraph (i); and
    - (iii) re-defining the polygon P1 as a polygon having the perimeter of the original polygon P1 and an inner boundary coincident with the perimeter of the polygon P2; and
    - (iv) if within the polygon P2 there is a further discrete area identified as a sub-plot that is entirely within the polygon P2, repeating the steps in sub-paragraphs (i) – (iii) as if polygon P2 is the polygon P1.
  - (c) If paragraphs (a) and (b) do not apply, and a discrete area that has been identified as a sub-plot is entirely within the plot perimeter, then for each such area:
    - (i) forming a polygon P1 from a polyline that is coincident with the plot perimeter; and
    - (ii) completing the steps in paragraphs (b)(i) – (b)(iv).



### **Recording Information about Sub-plots**

- (6) For each sub-plot identified under clauses (2) – (5), A FMA participant must:
  - (a) record an identifier for the sub-plot; and
  - (b) record the estimated percentage area of the permanent sample plot occupied by the sub-plot; and
  - (c) retain as part of the FMA participant's records a diagram showing the boundary of the sub-plot within the permanent sample plot, and labelled with the identifier and estimated percentage area of the sub-plot.

## **Part 6 Establishing Sub-samples within a Permanent Sample Plot or Sub-plot**

- (1) In this Part of the Standard a reference to “trees” means those trees for which a FMA participant must collect FMA information once the participant has selected options in relation to trees under Part 3, clause (10), and Part 7, clauses (5) and (6), as applicable.
- (2) A FMA participant, if permitted under this Part of the Standard, may establish one or more sub-samples in a permanent sample plot or sub-plot and:
  - (a) if established, must instead of collecting and recording FMA information for trees in the plot or sub-plot, collect and record such information for the sub-samples in the plot or sub-plot; and
  - (b) for the avoidance of doubt, FMA information relating to shrubs must not be collected using sub-samples and may only be collected in respect of an entire permanent sample plot or sub-plot.

### **Requirements for Establishing Sub-samples**

- (3) When collecting FMA information in relation to trees in a permanent sample plot or sub-plot, sub-samples may be established when at the time FMA information is to be collected:
  - (a) if an entire permanent sample plot is to be sub-sampled, there are more than 30 live tree stems in the plot for which DBH must be measured; or
  - (b) if a sub-plot is to be sub-sampled, the number of live tree stems in the sub-plot for which DBH must be measured is more than 0.3 multiplied by the percentage area of the sub-plot recorded under Part 5, clause (6)(b).
- (4) If a permanent sample plot or a sub-plot is to be sub-sampled:
  - (a) each sub-sample must be circular in shape; and
  - (b) the radius of a sub-sample must be:
    - (i) at least 1.00 metre and not more than 20.0 metres; and
    - (ii) if more than 1.00 metre but less than or equal to 5.0 metres, any value that is an increment of 0.50 metres from 1.00 metre; and
    - (iii) if more than 5.0 metres but less than or equal to 10.0 metres, any value that is an increment of 1.00 metre from 5.0 metres; and
    - (iv) if more than 10 metres, any value that is an increment of 2.00 metres from 10 metres; and
  - (c) the position of the perimeter of a sub-sample must be determined as for a circular permanent sample plot under Part 4, clauses (4) or (5), except using as a value of  $r_P$  the radius selected under clause (4)(b); and
  - (d) if there is more than one sub-sample in an entire permanent sample plot, or in a sub-plot:
    - (i) all sub-samples must have the same area; and
    - (ii) the sub-samples must not overlap each other.



### ***Sub-sampling an Entire Permanent Sample Plot***

- (5) If an entire permanent sample plot is to be sub-sampled, a FMA participant at the time of collecting FMA information must:
- (a) if the plot includes any planted trees:
    - (i) establish a single sub-sample centred on the plot centre point; and
    - (ii) the perimeter of the sub-sample must not extend beyond the perimeter of the plot; and
    - (iii) select as the sub-sample radius a value under clause (4) such that the sub-sample includes at least 20 tree stems for which DBH must be measured; and
    - (iv) if sub-paragraph (iii) cannot be satisfied by selecting the largest sub-sample radius able to be selected under clause (4), not sub-sample the plot; and
    - (v) if the smallest sub-sample radius able to be selected under clause (4) results in a sub-sample that includes more than 30 live tree stems for which DBH must be measured, collect FMA information for either the entire sub-sample or for only that part of the sub-sample determined under the line-transect approach given in clause (7); and
    - (vi) if the plot includes any regenerated trees, ensure as far as practicable that the area from which FMA information is to be collected under sub-paragraph (v) is large enough to include stems with the range of DBHs that occur in the plot; and
    - (vii) record an identifier for the sub-sample, the radius of the sub-sample selected under sub-paragraph (iii), the average maximum slope for the sub-sample, and if sub-sampling is completed under clause (7) the distance  $D_{Line-transect}$ .
  - (b) if the plot includes only naturally regenerated trees, must:
    - (i) if a circular plot, divide the plot into quadrants formed by placing a pair of axes oriented true North-South and East-West; and
    - (ii) if a square plot, divide the plot into quadrats; and
    - (iii) locate one sub-sample at the centre point of the line that forms the common boundary of each quadrant or at the centre point of each quadrat; and
    - (iv) select as the sub-sample radius a value given under clause (4); and
    - (v) if any sub-sample overlaps the perimeter of the plot, consider the sub-sample to be invalid, and must not use the sub-sample when collecting FMA information; and
    - (vi) ensure those sub-samples in the plot that are valid include in total at least 20 tree stems for which DBH must be measured; and
    - (vii) if sub-paragraph (vi) cannot be satisfied by using the largest sub-sample radius able to be selected under in clause (4), not sub-sample the plot; and
    - (viii) if the smallest sub-sample radius able to be selected under clause (4) would result in there being more than 30 tree stems for which DBH must be measured for the set of valid sub-samples, collect FMA information for either the entire set of valid sub-samples or for only that part of each valid sub-sample determined under the line-transect method given in clause (7); and
    - (ix) if the plot includes any regenerated trees, must ensure as far as practicable that the area from which FMA information is to be collected under sub-paragraph (viii) is large enough to include stems with the range of DBHs that occur in the plot; and
    - (x) for each valid sub-sample, record an identifier for the sub-sample, the radius of the sub-sample selected under sub-paragraph (iv), the average maximum slope for the sub-sample, and if sub-sampling is completed under clause (7) the distance  $D_{Line-transect}$ .

### ***Sub-sampling a Sub-plot***

- (6) If a sub-plot within a permanent sample plot is to be sub-sampled, a FMA participant at the time of collecting FMA information must:
- (a) if a circular plot, divide the permanent sample plot into quadrants formed by placing a pair of axes oriented true North-South and East-West; and
  - (b) if a square plot, divide the permanent sample plot into quadrats; and



- (c) within the sub-plot perimeter, locate one sub-sample at the centre point of the line that forms the common boundary of each quadrant, or at the centre point of each quadrant; and
- (d) select as the sub-sample radius a value given under clause (4); and
- (e) if any sub-sample overlaps the perimeter of the sub-plot, consider the sub-sample to be invalid and must not use the sub-sample when collecting FMA information; and
- (f) ensure those sub-samples in the sub-plot that are valid include a total number of live tree stems for which DBH must be measured equal to at least 0.2 multiplied by the percentage area of the sub-plot recorded under Part 5, clause (6)(b); and
- (g) if paragraph (f) cannot be satisfied by using the largest sub-sample radius able to be selected under paragraph (d), not sub-sample the sub-plot; and
- (h) if the smallest sub-sample radius able to be selected under clause (4) would result in there being more than 30 live tree stems for which DBH must be measured for the set of valid sub-samples, collect FMA information for either the entire set of valid sub-samples or for only that part of each valid sub-sample determined under the line-transect method given in clause (7); and
- (i) if the plot includes any regenerated trees, must ensure as far as practicable that the area from which FMA information is to be collected under paragraph (h) is large enough to include stems with the range of DBHs that occur in the sub-plot; and
- (j) for each valid sub-sample, record an identifier for the sub-sample, the radius of the sub-sample selected under paragraph (d), the average maximum slope for the sub-sample, and if sub-sampling is completed under clause (7) the distance  $D_{\text{Line-transect}}$ .

### ***Sub-sampling Using a Line-transect Method***

- (7) If sub-sampling is to be performed using the line-transect method given in this clause, a FMA participant must:
  - (a) for each valid sub-sample identified under clauses (5) or (6), place a taut string-line so that it is as far as practicable a straight line, spans the sub-sample, passes through the sub-sample centre point, and is in the direction of the average maximum slope; and
  - (b) select for all sub-samples a single distance  $D_{\text{Line-transect}}$  to be measured at right-angles to, and on either side of, the string-line placed under paragraph (a); and
  - (c) consider the perimeter of each sub-sample to be temporarily redefined as a polygon formed by the intersection of:
    - (i) the perimeter of the sub-sample as identified under clause (4)(c); and
    - (ii) two lines placed at a distance  $D_{\text{Line-transect}}$  on either side of and parallel to the string-line placed under paragraph (a); and
  - (d) select the distance  $D_{\text{Line-transect}}$  such that within the perimeter temporarily redefined under paragraph (c) there are for a sub-sample, or for a set of valid sub-samples if applicable:
    - (i) at least 20 live tree stems for which DBH must be measured, if sub-sampling an entire permanent sample plot under clause (5)(a); or
    - (ii) at least 20 live tree stems for which DBH must be measured in the set of valid sub-samples, if sub-sampling an entire permanent sample plot under clause (5)(b); or
    - (iii) at least  $N_{\text{Sample}}$  live tree stems for which DBH must be measured in the set of valid sub-samples, if sub-sampling a sub-plot under clause (6), where the value of  $N_{\text{Sample}}$  is equal to 0.2 multiplied by the percentage area of the sub-plot as recorded under Part 5, clause (6)(b); and
  - (e) when collecting FMA information for a sub-sample, take as the perimeter of the sub-sample the perimeter temporarily redefined under paragraph (c) using the distance  $D_{\text{Line-transect}}$  selected under paragraph (d).

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*Note*

Diagrams in Appendix 1 illustrate the process of locating sub-samples in accordance with clauses (5), (6), and (7).



## Part 7 Requirements and Options for Collecting FMA Information at Permanent Sample Plots

- (1) Collection and recording of FMA information under Part 8 of this Standard must be completed in accordance with the requirements specified for, and options selected by, a FMA participant under this Part of the Standard.
- (2) FMA information must not be collected:
  - (a) when silvicultural operations are occurring sufficiently close to a permanent sample plot that the location of the plot would be readily apparent to the silvicultural crew; or
  - (b) until silvicultural operations have been completed, where those operations have temporarily ceased after affecting part of a permanent sample plot prior to collection of FMA information.
- (3) Collection of FMA information at any single permanent sample plot must be completed within one calendar month.

### ***Requirements for Collecting FMA Information in Relation to Shrubs***

- (4) A FMA participant that under regulation 22B(1)(c)(ii)(C) is collecting FMA information in relation to shrubs must identify each shrub with a live crown present in a permanent sample plot as belonging to one of the following shrub types:
  - (a) Manuka, if the shrub species is manuka and manuka is a shrub in the place that the plot is located; or
  - (b) Tauhinu, if the shrub species is tauhinu; or
  - (c) Indigenous Shrubs, if the shrub species is an indigenous shrub species other than manuka or tauhinu; or
  - (d) Gorse, if the shrub species is gorse; or
  - (e) Broom, if the shrub species is Scotch broom; or
  - (f) Exotic Shrubs, if the shrub species is an exotic shrub species other than gorse or Scotch broom.

### ***Options for Collecting FMA Information in Relation to Trees and Shrubs***

- (5) A FMA participant that under regulation 22B(1)(c) is collecting FMA information in relation to trees:
  - (a) must collect such information:
    - (i) for all trees; or
    - (ii) only for specific tree species nominated by the participant.
  - (b) for the trees selected under paragraph (a):
    - (i) must collect FMA information for live and standing dead tree stems with a DBH of 25 millimetres (mm) or more; and
    - (ii) may collect FMA information for live tree stems with a DBH of less than 25 mm provided the height of each stem for which FMA information is collected is at least 300 mm; and
    - (iii) must collect FMA information for the live tree stems in sub-paragraph (ii) if collecting FMA information in relation to shrubs under clause (4).
- (6) A FMA participant:
  - (a) for permanent sample plots located on forest land assigned to each Forest Class, or on all of their forest land if Forest Class has not been assigned, must choose:
    - (i) whether or not to collect FMA information in relation to shrubs; and
    - (ii) if not collecting FMA information in relation to shrubs, whether or not to collect FMA information in relation to trees with a DBH of less than 25 mm and a height that is at least 300 mm; and
    - (iii) whether to collect FMA information for all trees, or only for specific tree species nominated by the participant; and
  - (b) when first submitting FMA information for an area of registered post-1989 forest land, must notify the EPA of the choices made under paragraph (a) that are to be applied for the permanent sample plots on the forest land in each Forest Class, or for all of their forest land if Forest Class has not been assigned; and



- (c) having notified the EPA of the choices made under paragraph (a), may not change any of those choices except when receiving a new allocation of permanent sample plots under regulation 22F; and
  - (d) at the same time as requesting an allocation of new permanent sample plots under regulation 22F:
    - (i) may change the choices made under paragraphs (a)(i) and (a)(ii) only; and
    - (ii) must notify the EPA of all of the choices made in relation to paragraph (a) that are to be applied for the new permanent sample plots on the forest land in each Forest Class, or for all of their forest land if Forest Class has not been assigned.
- (7) When a FMA participant's registered forest land area increases as a result of the operation of sections 188 or 192 of the Act, and the forest land in a Carbon Accounting Area that has been added includes an area assigned to a new Forest Class, the participant must once permanent sample plots are allocated to land in the Carbon Accounting Area comply with clause (6) in relation to the plots on the land in that new Forest Class.

#### ***Nominating a Set of Tree Species in Relation to Collecting FMA Information***

- (8) If a FMA participant chooses under clause (6)(a)(iii) to collect FMA information at permanent sample plots in relation to specific tree species nominated by the participant, the participant:
- (a) must nominate the specific tree species from a list of tree species included in the *FMA Information Standard* published by the EPA; and
  - (b) must nominate sufficient tree species such that at the time of harvest, or at the time of maturity for a non-harvest forest, the species in total are expected to account for at least 85% of the crown cover on a FMA participant's registered post-1989 forest land; and
  - (c) before any FMA information in relation to any nominated tree species is submitted to the EPA, must notify the EPA in writing of the nominated tree species for which FMA information will be collected; and
  - (d) must collect and record FMA information in relation to each specific tree species that is a nominated tree species from the date on which the EPA is notified that the specific tree species is a nominated tree species; and
  - (e) may add a specific tree species to a set of previously notified nominated tree species, by notifying the EPA in writing of the additional specific tree species; and
  - (f) may not remove any tree species from the set of species nominated under paragraph (c), or added to the set of nominated species under paragraph (e); and
  - (g) may have one set of nominated tree species for the permanent sample plots located on:
    - (i) the participant's entire registered post-1989 forest land; or
    - (ii) the post-1989 forest land assigned to each Forest Class, if the participant has assigned Forest Class to their registered post-1989 forest land and is collecting FMA information for nominated tree species in relation to that Forest Class; and
  - (h) must treat as absent all tree species that are not included in a set or sets of nominated tree species when:
    - (i) determining the area of, or otherwise establishing, a permanent sample plot, sub-plot or sub-sample; and
    - (ii) collecting and recording FMA information in relation to trees.

#### ***Identifying Shrubs and Trees for which FMA Information Must be Collected***

- (9) When collecting FMA information in relation to shrubs at a permanent sample plot or sub-plot, the information must be collected for:
- (a) all live shrubs for which the shrub crown is entirely within the plot or sub-plot perimeter; and
  - (b) that part of a live shrub crown that is within the plot or sub-plot perimeter, when the crown of a shrub overlaps the perimeter; and
  - (c) if the crown of a live shrub overlaps the plot or sub-plot perimeter:
    - (i) in relation to crown cover, the crown cover of only that part of the crown within the perimeter; and
    - (ii) in relation to crown height, the crown height of only that part of the crown within the perimeter.



- (10) When collecting FMA information in relation to trees in a permanent sample plot, sub-plot, or sub-sample, then once a FMA participant has selected options under clauses (5) and (6), and under Part 3 clause (10):
- (a) the participant must collect FMA information for those tree stems that are within the perimeter of the permanent sample plot, sub-plot or sub-sample (as applicable); and
  - (b) the stem of a tree is considered to be within the perimeter of a permanent sample plot, sub-plot or sub-sample (as applicable) when the centre of the stem:
    - (i) at breast height is within the perimeter if DBH is being measured, regardless of the orientation of the stem or the location of the base of the stem; or
    - (ii) at the height at which collar diameter is measured is within the perimeter if collar diameter is being measured, regardless of the orientation of the stem or the location of the base of the stem; and
  - (c) the stem of a tree must be confirmed as being within the perimeter of a plot, sub-plot or sub-sample (as applicable) when close to the perimeter, by:
    - (i) if an electronic distance measuring device is being used which places the centre of the stem within 25 centimetres of the perimeter, checking by using a lineal tape that the centre of the stem at breast height or the height at which collar diameter is measured is located within the perimeter; and
    - (ii) if the lineal tape shows that the centre of the stem is within 5 centimetres of the perimeter, checking using a lineal tape that the centre of the tree is within the perimeter on both sides of the tree where the perimeter intersects the stem, and only those stems that have both sides within the perimeter must be considered within the perimeter; and
  - (d) when confirming by measurement with a lineal tape under paragraph (c) that the stem of a tree is within the perimeter of a plot, sub-plot or sub-sample, a FMA participant must use distances adjusted for slope if the distance to a perimeter is being measured in other than a horizontal plane.

## Part 8 Collecting and Recording FMA Information for Permanent Sample Plots

- (1) When collecting FMA information under regulation 22B(1)(c) for the permanent sample plots allocated by the EPA to a FMA participant, the participant must comply with this Part of the Standard.
- (2) In this Part of the Standard:
  - (a) a reference to “trees” or “shrubs” means those trees or shrubs for which a FMA participant must collect FMA information once the participant has selected options in relation to trees and shrubs under Part 3, clause (10) and Part 7 clauses (5), (6) and (7), as applicable; and
  - (b) in relation to collecting FMA information for tree stems, a reference to “stem diameter” means:
    - (i) if the participant has elected to collect FMA information under Part 7, clause (5)(b)(i), the DBH; or
    - (ii) if the participant has elected to collect FMA information under Part 7, clause (5)(b)(ii), the DBH or the collar diameter (as applicable); and
  - (c) a reference to a “species group” means those species included in one of the following, as defined in the Regulations: *Pinus radiata*, Douglas fir, exotic hardwoods, exotic softwoods, or indigenous species; and
  - (d) if required to record the name of a tree species, the name must be:
    - (i) one of those in the FMA participant’s set or sets of nominated tree species, if the permanent sample plot is located on forest land for which a set of nominated tree species has been notified; or
    - (ii) selected from a list provided for that purpose in the *FMA Information Standard* published by the EPA.

### ***Identifying a FMA Participant and the FMA Options Selected***

- (3) When collecting FMA information, a FMA participant must:
  - (a) record information to identify:
    - (i) the FMA participant; and
    - (ii) the person that will submit the FMA information; and



- (iii) the personnel, and their company affiliations (if applicable), involved in collecting and recording the FMA information.
- (b) record the allocation date specified by the EPA for the set of permanent sample plots for which FMA information is being collected; and
- (c) record whether the FMA information being submitted includes:
  - (i) the full range of FMA information collected at permanent sample plots under regulation 22B(1)(c), or
  - (ii) only updated FMA information in relation to silviculture or adverse events under regulations 22E(4)(b), 22H(4)(b)(i), or 22L(2)(a)(i)(A); and
- (d) record:
  - (i) whether the FMA information includes information collected in relation to shrubs under regulation 22B(1)(c)(ii)(C), and
  - (ii) if shrubs are included, which options the FMA participant has selected under Part 7, clause (6)(a); and
  - (iii) the options selected under Part 7, clauses (5) and (6), in relation to collection of FMA information for trees.

***Recording Information in Relation to the Location of Permanent Sample Plots***

- (4) When collecting FMA information in relation to a permanent sample plot, a FMA participant must:
  - (a) include the information recorded under Part 4, clause (6); and
  - (b) include the information recorded in relation to the plot centre point as a result of (as applicable):
    - (i) locating the plot under Part 3, clause (4); and
    - (ii) re-establishing the centre point under Part 3, clause (6); and
    - (iii) re-locating the centre point under Part 3, clauses (7) – (10); and
  - (c) record the date at which collection of FMA information at the plot began, irrespective of whether the collection was for the entire plot, or sub-plots that are part of the plot, or sub-samples in either the plot or sub-plots.

***Collecting and Recording Information in Relation to Trees in a Permanent Sample Plot or Sub-plot***

- (5) When collecting FMA information in relation to the trees in an entire permanent sample plot, a FMA participant must:
  - (a) record the identifier of the plot; and
  - (b) determine whether:
    - (i) live or standing dead trees are present in the plot for which DBH must be measured; or
    - (ii) live trees are present in the plot for which the collar diameter may be measured or the average collar diameter may be estimated; and
  - (c) record whether trees that meet the conditions in paragraph (b), and in clause (2), are present or absent in the plot, and
  - (d) if trees are recorded as present under paragraph (c), but the number of live tree stems in the plot for which DBH must be measured is less than 20, record the reason that a lesser number of live stems is present.
  - (e) if any planted trees are included in those recorded as present under paragraph (c), record:
    - (i) the year, and month if known, of planting of those trees; and
    - (ii) an estimate of the planted stocking of those trees; and
  - (f) if any regenerated trees are included in those recorded as present under paragraph (c), record the year, and month if known, in which those trees first regenerated; and
  - (g) if trees are recorded as being absent in the plot under paragraph (c):
    - (i) record the reason for the absence; and
    - (ii) if the reason for the absence is that there are no trees present in the plot that have yet reached the required stem diameter and/or height thresholds elected under Part 7, clause (6); record the species group of the trees that are expected to be the predominant species in the plot once the diameter thresholds are reached by the trees that have yet to reach the stem diameter thresholds; and



- (iii) if a species group cannot be determined under sub-paragraph (ii), record the species group of the trees that are the predominant species on the forest land that is adjacent to the plot and in the same forest stand; and
  - (iv) if a species group cannot be determined under sub-paragraphs (ii) or (iii), record the species group of the intended predominant species on the forest land that is adjacent to the plot and in the same forest stand.
- (6) If the trees recorded as present under clause (5)(c) are intermingled trees, a FMA participant must:
- (a) record that intermingled trees are present; and
  - (b) identify the single tree species that is the intended predominant forest species; and
  - (c) record the intended predominant forest species; and
  - (d) record the information in clauses (5)(e) and/or (5)(f) for the trees identified as comprising the intended predominant forest species only but if the trees comprising the intended predominant forest species include exotic or indigenous trees planted in more than one year:
    - (i) record the information in clause (5)(e) for those trees planted in the earliest year of planting only, and
    - (ii) record that the information relates to the oldest planted trees only.
- (7) if the trees comprising the intended predominant species are not also the predominant forest species at the time of measurement:
- (a) identify the tree species that is the predominant forest species at the time of measurement; and
  - (b) record the name of the predominant forest species identified in subparagraph (a); and
  - (c) record the information in clause (5)(e) and/or (5)(f) for the trees identified as the predominant forest species at the time of measurement but if the trees comprising the predominant forest species at the time of measurement include trees planted in more than one year:
    - (i) record the information in clause (5)(e) for those trees planted in the earliest year of planting only; and
    - (ii) record that the information relates to the oldest planted trees only.
- (8) .When collecting FMA information in relation to trees in a sub-plot within a permanent sample plot, a FMA participant must:
- (a) include the information recorded for the sub-plot under Part 5, clause (6); and complete the requirements of clauses (5), (6) and (7) in relation to the trees in the sub-plot rather than to the trees in a permanent sample plot.
  - (b) if within the sub-plot the number of live tree stems for which DBH must be measured is less than 0.2 multiplied by the percentage area of the permanent sample plot occupied by the sub-plot as recorded under Part 5, clause (6)(b), record the reason that the lesser number of live stems is present.

### ***Collecting and Recording Information in Relation to Trees by Sub-sampling***

- (9) When collecting FMA information in relation to trees in an entire permanent sample plot by sub-sampling the plot, a FMA participant must:
- (a) if the plot includes any planted trees, include the information recorded for the sub-sample under Part 6, clause (5)(a)(vii); and
  - (b) if the plot includes only regenerated trees, include the information recorded for the sub-sample under Part 6, clause (5)(b)(x); and
  - (c) if the trees which are present in the plot and met the conditions in clause (5)(c) are absent in the sub-sample, record the reason for the absence.
- (10) When collecting FMA information in relation to trees in a sub-plot by sub-sampling a sub-plot, a FMA participant must:
- (a) include the information recorded for the sub-sample under Part 6, clause (6)(j); and
  - (b) if the trees which are present in the sub-plot and meet the conditions in clause (5)(c) are absent in the sub-sample, record the reason for the absence.



### ***Collecting and Recording Information in Relation to Tree Stems***

- (11) When collecting FMA information in relation to trees in a permanent sample plot or a sub-plot, or in a sub-sample located within a permanent sample plot or sub-plot, a FMA participant must:
- (a) record the identifier of the plot, sub-plot or sub-sample that FMA information is being collected for; and
  - (b) measure the DBH of all live or standing dead tree stems with a DBH of 25 mm or more; and
  - (c) if collecting the stem diameter of live stems with a DBH of less than 25 mm and a height that is at least 300 mm:
    - (i) choose whether to measure or estimate stem collar diameters; and
    - (ii) if collecting tree stem information by sub-sampling, determine stem collar diameters by the method selected under sub-paragraph (i) for all sub-samples in the permanent sample plot or sub-plot being sub-sampled.
- (12) If estimating the collar diameter of tree stems within a permanent sample plot, sub-plot, or sub-sample, a FMA participant must: identify the stems of the live planted and regenerated trees in each species group that have a DBH less than 25 mm and a height that is at least 300 mm, and for the live stems in each forest species :
- (a) record the species group; and
  - (b) record whether the majority of the stems are planted or regenerated; and
  - (c) record an estimate of the average collar diameter and stocking; and
  - (d) record an estimate of the average height for those stems with a collar diameter approximately equal to the average collar diameter; and not include the identified stems when recording FMA information under clause (14).
- (13) If the trees for which FMA information is being collected under clause (12) comprise intermingled trees, a FMA participant must:
- (a) collect the information separately for the trees in each species group that comprise:
    - (i) the intended predominant species; and
    - (ii) the predominant species at the time of measurement, if the trees comprising the intended predominant species are not also the predominant species at the time of measurement; and
    - (iii) all trees other than those for which information is collected under sub-paragraphs (i) and (ii); and
  - (b) record the species name of the trees for which information is collected separately under paragraphs (a)(i) and (a)(ii).
- (14) For each live or standing dead tree stem within the perimeter of a plot, sub-plot or sub-sample for which stem diameter is to be measured, a FMA participant must record:
- (a) an identifier for the stem; and
  - (b) whether the stem is planted or regenerated; and
  - (c) whether the stem is live or dead; and
  - (d) the species of the tree to which the stem belongs; and
  - (e) the stem diameter, and whether the stem diameter is a DBH or collar diameter; and
  - (f) whether the stem diameter is determined by direct measurement at the standard height, or is estimated for that height from measurements above and/or below the standard height, and if estimated the reason why estimation is necessary; and
  - (g) the estimated stem height of any stem that due to breakage is less than two-thirds its expected height in an unbroken state; and
  - (h) permanently mark the height at which DBH is measured for each tree stem:
    - (i) if the trees in the plot are subject to silviculture and all intended thinning has been completed; or
    - (ii) before the DBH of the stem exceeds 150 millimetres if the trees in the plot are not subject to silviculture.



### ***Collecting and Recording Information in Relation to a Sample of Tree Heights***

- (15) For the total live tree stems for which measured stem diameters have been recorded under clause (14) in relation to a permanent sample plot, including for those stems recorded in all sub-plots or sub-samples associated with the plot, a FMA participant:
- (a) must identify those stems that:
    - (i) belong to tree species that are tree ferns, nikau palms or cabbage trees; and
    - (ii) are broken-topped and have a height less than two-thirds their expected height in an unbroken state; and
    - (iii) record the height of all stems identified in sub-paragraphs (i) and (ii); and
  - (b) must identify those stems other than those identified in paragraph (a) that:
    - (i) are free from significant breakage or any other malformation likely to have significantly impacted height development; and
    - (ii) belong to a single species group; and
  - (c) for the stems identified in paragraph (b) that belong to each species group, must select 8 stems that:
    - (i) if the stem diameter measured under clause (14) was a DBH, have approximately the largest, smallest, and a range of 6 intermediate values of DBH; and
    - (ii) if the stem diameter measured under clause (14) was a collar diameter, have approximately the largest, smallest, and a range of 6 intermediate values of collar diameter; except
    - (iii) if there are less than 8 stems with a measured DBH, or with a measured collar diameter, for a given species group, must select all stems in that species group that satisfy sub-paragraphs (c)(i) or (c)(ii); and
    - (iv) if sub-paragraph (iii) applies, record that there are less than 8 stems present in a given species group that satisfy sub-paragraphs (c)(i) or (c)(ii); and
  - (d) when selecting the stems identified in paragraph (c) that belong to each species group, may select more than 8 stems if wished provided the stems selected cover a range of stem diameters between the largest and smallest values; and
  - (e) must record the height of each stem selected under paragraphs (c) to (e) as part of the FMA information recorded for that stem under clause (14).
- (16) If the total number of stems selected for height measurement under clauses (15)(c) to (15)(e) for each species group from all permanent sample plots for which FMA information is collected is less than 50, a FMA participant must for that species group:
- (a) select any remaining trees in that species group that were identified under clause (15)(b); and
  - (b) record the height of each stem selected under paragraph (a) as part of the FMA information recorded for that stem under clause (14).
- (17) Despite the requirements in clause (15) to determine the height of stems of particular tree species, or in clauses (15) and (16) to determine the heights of particular number of stems, a FMA participant:
- (a) may omit determination of the height of a specified tree stem if height determination would pose a health and safety hazard; and
  - (b) must if omitting determination of the height of a specified tree stem record the type of health and safety hazard present.

### ***Collecting and Recording Information in Relation to Silviculture***

- (18) When collecting FMA information in relation to silviculture for the trees in a permanent sample plot or sub-plot, a FMA participant must:
- (a) record the identifier of the plot or sub-plot; and
  - (b) record whether the trees in the plot or sub-plot:
    - (i) have been or are expected to be subject to thinning; and
    - (ii) have been or will be subject to a pruning regime which would classify them as pruned under the definition in this Standard; and



- (c) record for each thinning, if the trees in the plot or sub-plot have been or are expected to be subject to thinning:
  - (i) an identifier; and
  - (ii) if a previous thinning, the year, month if known, and residual stocking; and
  - (iii) if a future expected thinning, the year, month if known, and target residual stocking; and
  - (iv) whether the majority of tree stems thinned in a previous thinning remained on site or were removed; and
  - (v) whether the majority of tree stems to be thinned in a expected future thinning are expected to remain on site or be removed; and
- (d) when determining the residual stocking:
  - (i) if determined for the most recent thinning by counting the stems that currently remain within the perimeter of the plot or sub-plot, record that the residual stocking is counted; and
  - (ii) if determined for other than the most recent thinning by identifying and counting the stumps of cleared trees expected to have been within the perimeter of the plot or sub-plot at the time of the thinning, record that the residual stocking is counted; and
  - (iii) if not able to be determined under sub-paragraphs (i) or (ii) because there are no stumps visible, or the stumps are too decayed to associate uniquely with a particular thinning date, estimate the residual stocking and record the value estimated and the approach used for estimation; and
- (e) if the trees in the permanent sample plot or sub-plot consist of both planted and regenerated trees, record the information in paragraphs (b) to (d) for the planted trees only; and
- (f) if the planted trees in the permanent sample plot or sub-plot are intermingled trees record the information in paragraphs (b) to (d) for the trees comprising the intended predominant species only, but if the planted trees comprising the intended predominant species were planted in different years, record the information in paragraphs (b) to (d) for the trees planted in the earliest year only.

#### ***Collecting and Recording Information in Relation to Adverse Events***

- (19) When collecting FMA information in relation to adverse events for trees in a permanent sample plot or sub-plot, a FMA participant must:
  - (a) record the identifier of the plot or sub-plot; and
  - (b) record for each adverse event:
    - (i) an identifier; and
    - (ii) the type of adverse event selected from a list in the *FMA Information Standard* published by MPI; and
    - (iii) the year, month if known, and residual stocking after the adverse event; and
    - (iv) whether the majority of the tree stems cleared by the adverse event remained on site, or were removed; and
  - (c) when determining the residual stocking:
    - (i) if determined for the most recent adverse event by counting the stems that currently remain within the perimeter of the plot or sub-plot, record that the residual stocking is counted; and
    - (ii) if determined for other than the most recent adverse event by identifying and counting the stumps of cleared trees expected to have been within the perimeter of the plot or sub-plot at the time of the adverse event, record that the residual stocking is counted; and
    - (iii) if not able to be determined under sub-paragraphs (i) or (ii) because there are no stumps visible or the stumps are too decayed to associate uniquely with a particular adverse event, estimate the residual stocking and record the value estimated and the approach used for estimation; and
  - (d) if the trees in the permanent sample plot or sub-plot consist of both planted and regenerated trees, record the information in paragraphs (b) to (d) for the planted trees only; and
  - (e) if the planted trees in the permanent sample plot or sub-plot are intermingled trees, record the information in paragraphs (b) and (c) for the planted trees comprising the intended predominant species only but if the planted trees comprising the intended predominant species were planted in different years, record the information in paragraphs (b) and (c) for the trees planted in the earliest year only.



### **Requirements for Updating Silvicultural and Adverse Event Information Only**

- (20) A FMA participant that is required under the regulations to submit updated silvicultural or adverse event information to the EPA because the information has become incomplete or is no longer valid:
- (a) must comply with clauses (18) and/or (19); and
  - (b) must consider silvicultural or adverse event information to have become incomplete or to be no longer valid when:
    - (i) the year in which any thinning was previously expected to occur has changed; or
    - (ii) the residual stocking of any thinning that was previously expected to occur has changed by more than 10%; or
    - (iii) there has been a change in whether stems that were previously expected to be thinned would remain on site or be removed from the site; or
    - (iv) there has been one or more adverse events that are expected to have resulted in total in the clearing of more than 10% of the basal area of tree stems within the plot; and
  - (c) unless collecting any updated silvicultural or adverse event information under regulation 22B(1)(c):
    - (i) despite clauses (18)(d)(i), (18)(d)(ii), (19)(c)(i) and (19)(c)(ii), may estimate residual stocking; and
    - (ii) if estimating residual stocking, must record that the residual stocking was estimated.

### **Collecting and Recording Information in Relation to Shrubs**

- (21) When collecting FMA information in relation to shrubs in a permanent sample plot or sub-plot, a FMA participant must:
- (a) record:
    - (i) the identifier of the plot or sub-plot; and
    - (ii) whether shrubs are present or absent; and
  - (b) if shrubs are present, record an estimate of the year in which the shrubs first established if:
    - (i) it is recorded under clause (5)(c) that trees are absent; or
    - (ii) it is recorded under clause (5)(c) that trees are present, and it is likely that the shrubs first established more than two years before or after those trees; and
  - (c) record, for each shrub type present in the plot or sub-plot:
    - (i) an identifier; and
    - (ii) the shrub type; and
    - (iii) the estimated total crown cover within the plot perimeter from shrubs, expressed as a percentage of the area of the plot; and
    - (iv) the estimated average crown height of the crown cover within the plot perimeter from shrubs.
- (22) For avoidance of doubt, FMA information for shrubs must not be collected by sub-sampling, and may be collected only in relation to an entire permanent sample plot or sub-plot.

## **Part 9 Recording and Submitting Information**

- (1) All information collected under this Standard must when recorded comply with the specifications in the *FMA Information Standard* published by Environmental Protection Authority. The *FMA Information Standard* also prescribes the form and format in which information recorded under this Standard must be submitted to the EPA, and in which any information will be sent to a FMA participant by the EPA when the Regulations or this Standard require such information to be sent.



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## APPENDIX 1

### Establishing Sub-samples in Permanent Sample Plots and Sub-plots

- (1) Part 6 of this Standard provides procedures for establishing sub-samples in permanent sample plots or in sub-plots. This Appendix illustrates these procedures diagrammatically.
- (2) Figure 1 depicts sub-sampling in a permanent sample plot containing planted trees, in accordance with Part 6, clause (5)(a) of this Standard. For areas with planted trees, a circular plot must be used.

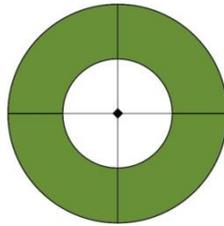


Figure 1: A sub-sample (the uncoloured area) is placed centred on the centre point of a circular permanent sample plot containing planted trees. The sub-sample must be large enough to include at least 20 tree stems for which DBH must be measured, otherwise the plot may not be sub-sampled.

- (3) Figure 2 depicts sub-sampling of permanent sample plots containing only regenerated trees, in accordance with Part 6, clause (5)(b) of this Standard. For areas with only regenerated trees, either circular plots or square plots may be used.

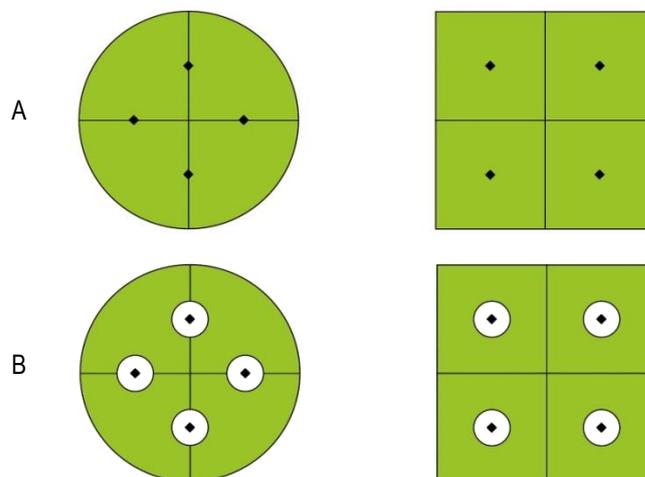


Figure 2: Sub-sampling a permanent sample plot containing regenerating trees only.  
A – dividing the plot into quadrants (if a circular plot) or quadrats (if a square plot). The positions of the centre-points of the sub-samples are shown at the centre of the line that forms the common boundary between each quadrant, or at the centre of each quadrat. B – sub-samples (the uncoloured areas) of equal area are placed at the centre points shown in A, and must not overlap. If the set of sub-samples in a plot does not in total include at least 20 tree stems for which DBH must be measured, the plot may not be sub-sampled.

- (4) Figure 3 depicts sub-sampling a sub-plot in permanent sample plots that have different shapes, in accordance with Part 6, clause (6) of this Standard.

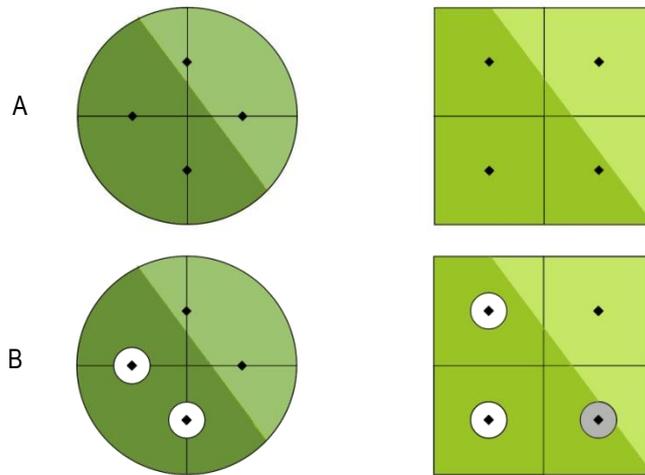


Figure 3: An example of sub-sampling a sub-plot when there are two sub-plots (shown as different shades of green) in a permanent sample plot. The sub-plot of interest in this example is the left-most area. A – dividing the permanent sample plot into quadrants (if a circular plot) or quadrats (if a square plot). The positions of the centre-points of the sub-samples are shown at the centre of the line that forms the common boundary between each quadrant, or at the centre of each quadrat. B – sub-samples of equal area are placed at each position within the sub-plot of interest, without overlapping. In the square permanent sample plot, one of the sub-samples (coloured grey) extends beyond the sub-plot boundary, and so is invalid. The sub-plot may not be sub-sampled if the number of tree stems in the valid sub-samples in the sub-plot for which DBH must be measured do not in total equal at least 0.2 multiplied by the percentage area of the permanent sample plot occupied by the sub-plot.

- (5) Figure 4 depicts the layout of a line-transect within a sub-sample, in accordance with Part 6, clause (7) of this Standard.

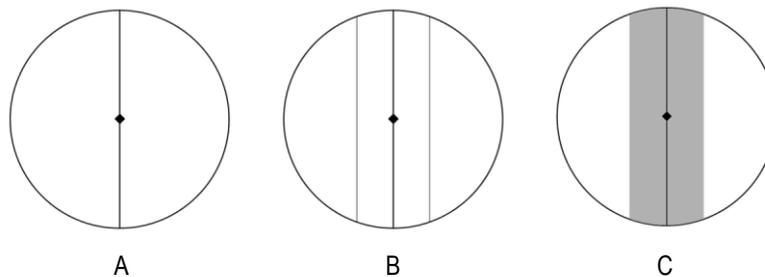


Figure 4: an example of the layout of a line-transect within a sub-sample. A – a string-line is laid out in the direction of the average maximum slope within the sub-sample (North in this example). B – a distance  $D_{\text{Line-transect}}$  is chosen and two notional lines placed at this distance parallel to the string-line on either side, where  $D_{\text{Line-transect}}$  is measured at right-angles to the string-line. C – a polygon, the shaded area shown, is formed by intersection of the sub-sample perimeter and the two notional lines. FMA information is collected from the shaded area only.