EXPLANATORY STATEMENT

Issued by the Authority of the Parliamentary Secretary for Climate Change, Industry and Innovation

Carbon Credits (Carbon Farming Initiative) Act 2011

Carbon Credits (Carbon Farming Initiative) (*Measurement Based Methods for New Farm Forestry Plantations) Methodology Determination 2014*

Background

The *Carbon Credits (Carbon Farming Initiative) Act 2011* (the Act) enables the crediting of greenhouse gas abatement in the land sector. Greenhouse gas abatement is achieved by either reducing or avoiding emissions or by removing carbon from the atmosphere and storing it in soil or trees.

Abatement activities are undertaken as offsets projects. The process involved in establishing an offsets project is set out in Part 3 of the Act. An offsets project must be covered by, and undertaken in accordance with, a methodology determination.

Subsection 106(1) of the Act empowers the Minister to make, by legislative instrument, a determination known as a methodology determination. The purpose of a methodology determination is to establish procedures for estimating abatement (emissions reductions and sequestration) and project rules for monitoring, record-keeping and reporting on abatement.

A methodology determination must meet the offsets integrity standards set out in section 133 of the Act and the other eligibility criteria set out in section 106 of the Act. The Minister cannot make a methodology determination unless the Domestic Offsets Integrity Committee (the DOIC) has endorsed the proposal for the methodology determination under section 112 of the Act and advised the Minister of the endorsement under section 113 of the Act. The DOIC is an independent expert panel established to evaluate proposals for methodology determinations.

Application of the Determination

The *Carbon Credits (Carbon Farming Initiative) (Measurement Based Methods for New Farm Forestry Plantations) Methodology Determination 2014* (the Determination) sets out the detailed rules for implementing and monitoring an offsets project under the Carbon Farming Initiative (CFI). The Determination applies to projects which sequester carbon by establishing and maintaining trees in any part of Australia where they have the potential to attain a height of at least 2 metres, and a crown cover of at least 20%, on land that has previously been used for certain agricultural purposes (grazing or cropping).

The Determination provides for the calculation of the net project abatement of greenhouse gases during a reporting period by estimating the carbon dioxide stored in the biomass of project trees, litter and fallen dead wood, known as 'project forest biomass'. Any carbon dioxide removed from the atmosphere and stored as carbon within project forest biomass at the time the project commences, and emissions of carbon dioxide, methane or nitrous oxide from fossil fuel use and fire events during the reporting period, are then subtracted from the project abatement.

The Determination differs from the similar *Carbon Credits (Carbon Farming Initiative) (Reforestation and Afforestation—1.2) Methodology Determination 2013* by:

- providing alternative methods for estimating root biomass;
- modifying plot requirements for sampling;
- refining the stratification and sampling requirements while maintaining consistency with the *Carbon Farming Initiative Sampling Guidelines* and the *CFI Mapping Guidelines*; and
- expanding the scope of eligible activities to include the harvesting of trees from new farm forestry plantations.

A project proponent wishing to implement the Determination must make an application to the Clean Energy Regulator (the Regulator) and meet the eligibility requirements for an offsets project set out in subsection 27(4) of the Act. These requirements include compliance with the rules set out in the Determination. It is also possible for already approved projects to apply to move to a new methodology determination under section 128 of the Act where their project is covered by that new determination.

Offsets projects that are undertaken in accordance with the Determination and approved by the Regulator can generate Australian carbon credit units (ACCUs) that can be sold to into relevant markets in order to generate a source of revenue for the project proponent.

Public consultation

The original methodology proposal 'Measurement Based Method for Reforestation Projects' (the proposal) was developed by the Future Farm Industries Cooperative Research Centre (the applicant) and submitted for the DOIC's consideration on 11 April 2012.

On 6 May 2012, the DOIC agreed to release the proposal for public consultation. Public consultation ran from 9 May to 18 June 2012, and four submissions were received. A technical assessment of the proposal undertaken on 29 August 2012 identified a number of issues which required resolution.

The applicant resubmitted the proposal on 27 March 2013. A second technical assessment of the proposal identified further technical issues.

On 15 May 2013 the applicant submitted a revised version of the proposal responding to the issues raised in the second technical assessment. The DOIC considered this proposal on 23 May 2013 and agreed to request further information from the applicant.

The DOIC considered the issues raised in the submissions during its assessment of the proposal as required under subsection 112(5) of the Act and requested further information from the applicant. The Department assisted the applicant in the subsequent versions of the methodology.

On 21 October 2013 the applicant submitted a new version of the proposal. This version contained the component of the original proposal relating to sequestration from a farm forestry planting (harvest plantations) and reintroduced a permanent plantings component with modified measurement and estimation requirements. The applicant also responded to the DOIC's comments and request for information.

At its 21 November 2013 meeting the DOIC considered the proposal and asked that the proponent revise the proposal to clarify the relationship between the for-harvest and permanent plantings components.

On 16 January 2014 the applicant resubmitted the proposal which was endorsed by the DOIC on 12 February 2014.

The applicant and the Regulator were consulted in the development of the Determination.

Determination details

The Determination is a legislative instrument within the meaning of the *Legislative Instruments Act 2003*.

The Determination commences the day after it is registered on the Federal Register of Legislative Instruments.

Details of the Determination are at Attachment A.

A Statement of Compatibility prepared in accordance with the *Human Rights (Parliamentary Scrutiny) Act 2011* is at Attachment B.

Attachment A

Details of the Determination

Documents incorporated by reference

The Determination incorporates a number of documents by reference as provided under subsection 106(8) of the Act. A description of these documents and their function under the Determination is provided below.

CFI Mapping Guidelines

The *CFI Mapping Guidelines* are designed to complement rules and regulations contained within the *Carbon Credits (Carbon Farming Initiative) Act 2011* (the Act), the *Carbon Credits (Carbon Farming Initiative) Regulations 2011* (the Regulations) and a number of the associated methodology determinations. It provides guidance to project proponents on how to prepare geospatial mapping for the purposes of:

- meeting scheme compliance obligations;
- providing information to the Clean Energy Regulator (the Regulator);
- defining the project area and strata; and
- estimating abatement.

These guidelines may be reviewed and updated as necessary and are currently published on the Department's website at: http://www.climatechange.gov.au/reducing-carbon/carbon-farming-initiative/methodologies/spatial-mapping-guidelines.

Guidance for using the Full Carbon Accounting Model in Carbon Farming Initiative Methodologies (FullCAM Guidelines)

The FullCAM Guidelines have been developed by the Department to assist project proponents to correctly use FullCAM when undertaking a CFI project under a number of methodology determinations.

The FullCAM Guidelines provide:

- an overview of FullCAM; and
- a step-by-step guide for using FullCAM that is consistent with the requirements of the Carbon Farming Initiative Measurement-Based Methods for Reforestation Projects methodology determination (the Determination).

FullCAM must be used to model carbon stock change and emissions for certain specified carbon pools under this Methodology Determination. The FullCAM Guidelines may be reviewed and updated as necessary and are currently published on the Department's website at: http://www.climatechange.gov.au/reducing-carbon/carbon-farming-initiative/methodologies/methodology-determinations/FullCAM.

Technical Reference Guide for the Carbon Credits (Carbon Farming Initiative) (Measurement Based Methods for New Farm Forestry Plantations) Methodology Determination 2014 (Technical Reference Guide)

The Technical Reference Guide provides detailed instructions for project proponents on the various techniques that are employed in order to successfully implement a CFI project under the Determination.

The Guide provides detailed instructions and procedural guidance in a technical format to assist project proponents to correctly undertake a permanent planting or new farm forestry project and meet the requirements of the Determination. The Guide includes information on the minimum standards for stratification, in-field data collection, sampling design and the development and validation of allometrics and is intended to assist project proponents meet the standards and conditions required by the Determination and the Clean Energy Regulator.

The Guide may be reviewed and minor updates made as necessary. For example, a minor update or amendment may make technical clarifications or simplify procedures where appropriate. If a substantial update to the Technical Reference Guide was needed, it would be implemented through a variation to the Determination. The Guide, including any minor amendments, is currently published on the Department's website at: http://www.climatechange.gov.au/reducing-carbon/carbon-farming-initiative/methodologies/methodology-determinations/ Measurement Based Methods for New Farm Forestry Plantations.

Part 1 Preliminary

Part 1 sets out the name of the Determination, which is the *Carbon Credits (Carbon Farming Initiative) (Measurement Based Methods for New Farm Forestry Plantations) Methodology Determination 2014* ***[Section 1.1]***.

This Determination is based on the *Carbon Credits (Carbon Farming Initiative) (Reforestation and Afforestation—1.2) Methodology Determination 2013*.

The Determination commences on the day after it is registered on the Federal Register of Legislative Instruments ***[Section 1.2]***.

While the Determination may apply to projects that were established prior to the commencement date, the project proponent can earn credits only for abatement which occurs from the commencement date. Subsection 27(15) of the Act prevents the crediting of abatement before this date.

A number of key terms used in the Determination are defined as follows ***[Section 1.3]*****:**

- 'allometric function', which refers to a regression function fitted to a scatter of data points that relate non-destructive measures of explanatory variables (predictor measures) to a measure of biomass within a tree. Under the Determination, allometric functions are species-specific, meaning that a unique regression equation is employed for each species of project tree that occurs within the project area.
- 'biomass components', which refers to sections of trees that are divided on the basis of structure or form, or both. Biomass components that are referred to in the Determination include stem, branches, crown, tap root or lignotuber, and lateral roots. Further subdivisions are also allowable under this definition.
- 'carbon inventory', which refers to the estimation of carbon stocks within a stratum under the Determination.
- 'commencement', which refers to the earliest time at which site preparation activities begin on land within a stratum. The site preparation activities can include on-site soil descriptions, cultivation, and weed control.
- 'crown', which refers to part of the above-ground structures of a tree. It includes non-woody elements involved in photosynthesis or supporting photosynthetic structures, such as twigs, petioles, and leaves. The crown connects to branches and does not include a distinct, thick bark layer.
- 'crown cover', which refers to the amount of land covered by the outer limits of the crown of a tree, or collection of trees, viewed as a horizontal cross-section. This can be expressed in a variety of ways, including absolute coverage (in either square metres or hectares), or proportional coverage of a defined land area (as a percentage).
- 'forest cover', which, unlike the term 'forest', refers to actual rather than potential tree height and crown cover.
- 'precision standard', refers to the precision that the carbon inventory sampling must achieve in estimating carbon stocks for the project, which is a probable limits of error

(PLE) of less than or equal to 10% for the estimate of the closing carbon stocks for a project.

- ‘probable limit of error’, which refers to the percentage of error at the 90% confidence level.

  Note For example, a probable limit of error of 10% indicates the estimated value, based on the population sample, will be within 10% of the true value for the population with 90% confidence.

- ‘project emissions’, which refers to greenhouse gas emissions that arise as a result of a project activity, and includes fire emissions and fuel emissions.
- ‘project tree’, which is a collective term that refers to trees that have been established within a stratum through undertaking project activities. Project trees can be live trees, live fire-affected trees, dead standing trees, and dead standing fire-affected trees.
- ‘regional function’, which refers to an allometric function that has been specifically developed for a project to which the Determination applies and that has an allometric domain that potentially extends across multiple strata. It is not necessary for the function to have been published in a peer-reviewed journal, noting that many functions are likely to have been developed by or for use by the project proponent rather than for research purposes.
- ‘Regulations’, which means the *Carbon Credits (Carbon Farming Initiative) Regulations 2011* as amended from time to time.
- ‘stratum’, which means a carbon estimation area that is located in the project area and that is determined to have common characteristics in accordance with the requirements of Part 3 of the Determination.
- ‘stratum-specific function’, which means an allometric function developed for a project to which the Determination applies. The function is developed from an allometric dataset collected exclusively from within a single stratum, to which the stratum-specific function is intended to be applied. It is not necessary for the function to have been published in a peer-reviewed journal, noting that many functions are likely to have been developed by or for use by the project proponent rather than for research purposes.
- ‘Technical Reference Guide’ which means the *Technical Reference Guide for the Carbon Credits (Carbon Farming Initiative) (Measurement Based Methods for New Farm Forestry Plantations) Methodology Determination 2014* developed for this methodology determination by the Department in conjunction with the methodology applicant. This document specifies how certain technical processes and procedures should be undertaken and the standard that they need to achieve when undertaken.
- ‘tree’, which has the same meaning as in the *Carbon Credits (Carbon Farming Initiative) Regulations 2011* (the Regulations).

Some terms that are not defined in the Determination have the meaning given by section 5 of the Act. The Act is available at www.comlaw.gov.au

> ***Note*** Under section 23 of the *Acts Interpretation Act 1901*, words in the Determination in the singular number include the plural and words in the plural number include the singular.

The kind of project to which the Determination applies

The effect of paragraph 106(1)(a) of the Act is that a methodology determination must specify the kind of offsets project to which it applies.

The kind of offsets projects to which the Determination applies is specified in section 1.4. These kinds of projects are 'specified' offsets projects as follows:

- the establishment of a permanent planting on or after 1 July 2007; or
- a forestry project accredited under the Commonwealth Government's Greenhouse Friendly™ initiative;
- a permanent planting accredited under:
  - the New South Wales Government's Greenhouse Gas Reduction Scheme; or
  - the Australian Capital Territory Government's Greenhouse Gas Abatement Scheme; or
- a permanent planting established before 1 July 2007 for which there is documentary evidence of a kind mentioned in subregulation 3.28(3) of the Regulations that demonstrates, to the satisfaction of the Regulator, that the primary purpose of the planting was generation of carbon offsets; or
- The establishment of a new farm forestry plantation.

When demonstrating that the primary purpose of the planting was generation of carbon offsets, the documentary evidence ***[Section 1.4]*** may include the contracts for the sale of offsets and must:

- be dated no later than 2 years after the date the plantings were established;
- show that the carbon rights had been registered for the plantings; and
- include a statutory declaration that the plantings were entirely privately-funded.

Part 2 Requirements for declaration as eligible project

Eligible projects

The effect of paragraph 106(1)(b) of the Act is that a methodology determination must set out requirements that must be met before a project can be an eligible offsets project.

To be declared an eligible offsets project, a project to which the Determination applies must meet the requirements specified in Part 2 of the Determination. These requirements are in addition to those set out in the Act and Regulations for applications for a declaration of an eligible offsets project.

The project area must be located in Australia but excludes Australia's external territories (such as Christmas Island and Norfolk Island) as the FullCAM model does not provide data on these areas ***[Section 2.2]***.

Project land characteristics

There are specific requirements that must be met for land in the project area where project activities will occur and project abatement will be estimated ***[Section 2.3]***. Areas of land which do not have project land characteristics, such as roads, water courses and large rock outcrops, are not counted when abatement is calculated.

Under the Determination, the project area must include land that has been used predominantly for grazing or cropping, and/or was fallow between those activities, for at least 5 years before project commencement. The term 'project commencement' means the earliest date for which there is documentary evidence that demonstrates, to the satisfaction of the Regulator, that planting has occurred in the project area. For the purposes of determining when the project commenced, evidence of any planting in a stratum in the project area is sufficient—the date when the planting started or finished does not have to be established.

Note that 'project commencement' is different from the term 'commencement' used elsewhere in the Determination. Used on its own, 'commencement' relates to a stratum and refers to the time that site preparation activities in the stratum began.

There are specified requirements for trees that will be planted within the project area. These trees are referred to in the Determination as 'project trees'. Regardless of species, project trees must have the potential to grow at least 2 metres tall and to cover with their crowns at least 20% of the area of the stratum in which they are located.

The potential of the project trees to achieve forest cover can be demonstrated by reference to the growth characteristics of the species to which the project trees belong and the planting density.

Table 1 shows an estimate of the minimum number of trees per hectare to achieve 20% crown cover in a stand of trees.

Table 1 – Guidance on the ratio of trees to crown cover for a given crown diameter

Mature crown diameter per tree (m)	**Crown area per tree at maturity (m^2)**	**Crown area per tree at maturity (ha)**	**Minimum number of trees per hectare required for 20% crown cover (trees/ha)** **(Crown cover of 20% (i.e. 0.2 ha) divided by crown area per tree at maturity)**
5.0	19.63	0.00196	102
4.5	15.90	0.00159	126
4.0	12.57	0.00126	159
3.5	9.62	0.00096	208
3.0	7.07	0.00071	283
2.5	4.91	0.00049	407
2.0	3.14	0.00031	637

Crown cover as a proportion can be estimated by multiplying planting density (trees per hectare) by crown area (in hectares). For example, a minimum density to achieve 20% crown cover with evenly distributed trees for a species with a crown diameter of 3.5 to 4 metres is about 150–200 trees per hectare.

Project proponents are encouraged to plant in a stratum more than the minimum number of trees to achieve greater than 20% crown cover, to allow a buffer for tree mortality.

Project mechanisms

The determination prescribes the project mechanisms of an eligible offsets project under the Determination. These project mechanisms are the means by which abatement is generated ***[Section 2.4]***.

The project must establish and maintain a tree planting which is one of the following:

- a permanent planting;
- a new farm forestry plantation; or
- a forestry project accredited under the Greenhouse Friendly™ initiative.

The proponent must advise the Regulator in writing of the applicable project mechanism for the purpose of determining the project type under section 2.5

If a project consists of permanent plantings that were also a forestry project accredited under the Commonwealth Government's Greenhouse Friendly™ initiative the proponent may advise which project mechanism is applicable for the purpose of determining the project type under section 2.5.

The planting must be planted with sufficient density for the trees to have the potential to achieve forest cover. 'Forest cover' is defined in section 1.3. Project trees may be planted in a belt or block configuration (or a combination of the two configurations) provided the project trees are able to achieve forest cover.

Project types

Under the determination, there are two project types into which the above tree plantings can be classified: permanent planting projects and harvest projects. The Regulator must be notified in writing of the project type being undertaken at the time of an application for a declaration of an eligible offsets project ***[Section 2.5]***.

If the project mechanism is identified as a permanent planting then the project type must be identified as a permanent planting project. Alternatively, if the project mechanism is a forestry project accredited under the Commonwealth Government's Greenhouse Friendly™ initiative or the establishment of a new farm forestry plantation, then the project must be identified as a harvest project.

If the project is identified as a harvest project, then the project proponent must include detailed information on the proposed management regime at the time of an application for declaration of an eligible offsets project.

A harvest project cannot be re-classified as a permanent planting project at a later time. This is because the scope of the determination does not include a mechanism to address the risk of over-crediting of abatement under these circumstances.

Note that Section 4.1 provides information on the ability to change a permanent planting project in to a harvest project if certain conditions are satisfied.

Identification of project area

Under the Act, the boundaries of the project area must be delineated in accordance with the CFI Mapping Guidelines and the Technical Reference Guide ***[Section 2.6]***.

Under the CFI scheme, project proponents of carbon sequestration projects can include their whole land title as their project area, even if the project is only being undertaken on a part of that land.

The boundaries of the project area of a project to which the Determination applies must be determined in accordance with the CFI Mapping Guidelines and the Technical Reference Guide.

Part 3 Delineating boundaries

The Determination creates sub-units, comprised of areas within a project area, for the purposes of abatement calculations ***[Section 3.1]***. These sub-units are referred to in the Determination as strata. Under the CFI scheme, strata may also be referred to as 'carbon estimation areas'.

Under the Determination, a stratum is the base land unit used to calculate changes in carbon stocks occurring within the project area.

Before submitting the first offsets report for the project, the project proponent must, in accordance with the CFI Mapping Guidelines and the Technical Reference Guide, define within the project area at least one stratum that meets the minimum requirements for a stratum.

Further strata can be defined at any time during the project. The new strata must have characteristics necessary to satisfy the minimum requirements for a stratum.

Because of the relationship between the area of a stratum and the amount of abatement it can generate, there are specific rules around creating new strata and how and when strata boundaries can be changed or redefined.

Requirements for strata

A stratum must consist of an area with at least one species of project tree ***[Section 3.2]***. In addition to the mandatory requirements the project proponent may choose to define strata on the basis of common characteristics other than species, including those set out in the note to subsection 3.2(1).

Measurement and modelling strata

There are two broad categories of strata that are required in order to estimate project abatement. The first category, called measurement strata, are strata established for field inventory using plot-based measurements of the physical characteristics of a representative sample of the population of trees within the strata.

The second category, called modelling strata, covers strata established for the purpose of modelling the long-term average carbon stocks for the strata and where the project proponent has opted to apply a root:shoot ratio to estimate the below-ground biomass of the trees.

Delineating stratum boundaries

The process for identifying strata is referred to as stratification. In general, stratification improves the precision of forest and forest-carbon measurements and allows project proponents to manage the inherent variability in the population of project trees being sampled. This gives confidence that the samples are an accurate representation of the population. For this reason, stratification must be carried out according to actual site characteristics that affect growth rates of trees ***[Section 3.3]***.

The first step in delineating stratum boundaries is generating a set of spatial coordinates in order to determine the geographic limits of the particular land area. The spatial coordinates can be generated by conducting an on-the-ground survey with a global positioning system, or by using ortho-rectified aerial imagery, or by a combination of these two methods.

Once the limits of the existing project forest area (for pre-existing permanent plantings) have been established the project proponent is required to use a geographic information system to generate spatial data files describing the strata boundaries and then apply a standard margin to the existing project forest boundary for the stratum. The standard margin must be applied to the stratum during the life of the project. There are 3 options provided for setting the standard margin distance.

Limits on stratum boundaries

When defining a stratum, the following kinds of land cannot be included in the stratum boundary:

- land outside of the project area as a whole; and
- land that is non-project forest.

If the stratum boundary lies within the geographic limits of another stratum, then the shared boundary must be drawn so that it is an equal distance from both strata.

The stratum boundary cannot exceed the project area boundary.

Use of ortho-rectified aerial imagery

Ortho-rectified aerial imagery captured over the land in the project area must meet the specified requirements before it can be used for the purposes set out in Part 3 ***[Section 3.4]***.

This imagery may also be used to:

- confirm the status or health of project trees within the stratum;
- map stratum area;
- assess crown cover; and
- confirm compliance with project requirements.

Dealing with growth disturbances

Disturbance events that affect the growth characteristics of project trees in a stratum must be monitored and specific actions taken to address their effect on abatement ***[Section 3.5]***. These ‘growth disturbances’ include events such as fires and outbreaks of disease. These events are important because they will have a long-term influence on carbon stocks.

The project proponent is required to delineate the boundaries of the area of land containing project trees affected by the disturbance. The boundaries must be delineated within 6 months after the occurrence of the growth disturbance.

If the growth disturbance has affected more than 10 hectares of project trees in a stratum, then the disturbance will likely affect a reasonable proportion of the carbon stock in the area, and the project proponent must revise the affected stratum. If an area of 10 hectares or less has been affected, this approach is optional. Where the approach is adopted, the revision must occur before the project proponent submits the offsets report that relates to the time when the disturbance happened.

Revision of stratum affected by growth disturbance

If the whole stratum has been affected by the disturbance, the stratum must be 'revised' by creating a new stratum identifier and labelling the new stratum as either a 'fire-affected' or 'disturbance-affected' stratum, depending on the nature of the disturbance ***[Section 3.6]***. Fire is identified as specific kind of disturbance as the methodology quantifies the emissions of methane and nitrous oxide that occur during a fire. These emissions would not have otherwise occurred if the project were not carried out and so must be accounted for.

There are also specific requirements for revising partially-affected strata. This process must be applied to affected areas of more than 10 hectares within a stratum, but is optional for affected areas of 10 or less hectares.

Partially-affected strata are revised by excising the affected area. The unaffected area is retained under its original stratum identifier. The new stratum that consists of the affected area must meet the minimum requirement for strata, and be labelled according to the nature of the disturbance.

For the purpose of estimating the effect on abatement, the initial carbon stocks and the standard error for initial carbon stocks must be assumed to be zero for disturbance-affected strata.

If a stratum has been revised due to the occurrence of fire, a carbon inventory must be undertaken in both the original stratum and the excised stratum within 12 months of the fire ***[Section 3.8]***. An estimate of the emissions of methane and nitrous oxide resulting from the fire, and the associated standard error, is also required to be calculated in accordance with the net abatement calculations and Equations 5.5 to 5.8 in Part 6.

Requirements for general revisions of strata boundaries

Due to the link between stratum area and accurate calculation of abatement, there are specific requirements that must be met when revising strata ***[Section 3.9]***. This may occur where, for example, project trees have died.

In these cases the project proponent may choose to continue to use the original stratum boundary as the basis for calculating carbon stocks, because the sampling approach specified in Part 5 will account for project tree losses.

In many cases, however, it will be in the interests of the project proponent to generate updated estimates of the stratum area and use these as the basis for defining the area over which measurement and calculation of carbon stocks will apply. This reduces between-plot sampling variation and improves measurement efficiency.

If the project proponent chooses to update estimates of the stratum area, the boundaries of the stratum can be revised, provided the revised boundaries comply with the delineation requirements set out in section 3.3.

If a stratum has been referred to in an offsets report and the stratum area is changed by more than 5% in a subsequent report, then a carbon inventory is required within the revised stratum at some point in the 6 months before that stratum is referred to in an offsets report.

However, if the stratum area is reduced to zero, a full inventory need not be conducted. In such as a case a zero carbon stock must be recorded for the stratum and reported in the next offsets report.

If the boundary of a stratum referred to in an offsets report changes by 5% or less, then the boundary does not have to be revised.

An adjustment limit of ±5% is considered adequate tolerance to account for any minor adjustments relating to, for example, amending mapping with reference to superior data sources (e.g. aerial imagery) so as to reflect stratum boundaries more accurately.

All stratum identifiers must continue to be reported in offsets reports even where the strata with which they are associated no longer exist for the reasons outlined above. The closing carbon stocks and associated standard error will be zero for the strata that no longer exist, and these zero values will be used when calculating the carbon stock change for the strata in accordance with Part 6.

Part 4 Project Operation

Part 4 of the Determination sets out general rules relating to the operation of offsets projects to which the Determination applies.

The note under the heading to the Part refers to section 27 of the Act, which sets out the criteria for declarations of eligible offsets projects. Paragraph 27(4)(c) of the Act specifies that projects must meet the requirements set out in the applicable methodology determination under paragraph 106(1)(b) of the Act. If paragraph 27(4)(c) is not complied with, the declaration can be revoked under regulation 3.26 of the Regulations (made pursuant to section 35 of the Act). Projects can also be audited to assess whether the project is operating in accordance with the section 27 declaration and the applicable methodology determination for the project (see regulation 1.12 of the Regulations).

Change of project type

A permanent planting project type may be changed to a harvest project type if the Regulator is satisfied that the permanent planting meets the requirements for a new farm forestry plantation and the total number of carbon credits that have been issued for the project is less than the predicted project average carbon stocks (PPACS) calculated for the project ***[Section 4.1]***.

A written request to change the project type must be provided to the Regulator with evidence demonstrating that the requirements above have been met.

The Regulator must provide written confirmation of the change of project type from a permanent planting project to a harvest project before any harvest activities are permitted to occur (subject to the exceptions in section 4.4).

Preparation burns

One preparation burn can be carried out within each stratum as part of pre-planting site preparation activities ***[Section 4.2]***. A burn in these circumstances could be carried out to reduce the cover of competing ground-level vegetation such as grasses, forbs and herbaceous species. Where the preparation burn is carried out as part of pre-planting preparations, the burn must comply with the restrictions on removing trees. The emissions from the fire during a preparation burn are not included in the greenhouse gas assessment boundary as the emissions are deemed to be the equivalent of what would occur under the baseline scenario. Further, under the prior land use for the project area, there will not be sufficient biomass to create significant emissions of methane and nitrous oxide as a result of the fire. This is not the case with a fire that occurs after the project trees have been established.

Removal of trees

As a general rule, native forest and other non-project trees must not be removed from the project area, or otherwise disturbed, for the purposes of undertaking project activities such as pre-planting preparations.

In addition to the general rule, paragraphs 3.36(e) and (f) of the Regulations provide that a project will be excluded if it involves the establishment of vegetation on land that has been subject to:

- unlawful clearing of a native forest; or
- lawful clearing of a native forest within:
  - 7 years; or
  - if there is a change in ownership of the land that constitutes the project area after the clearing—5 years;

  of the lodgement of an application for the project to be declared an eligible offsets project.

The Determination sets out exceptions to the general rule regarding the removal of non-project trees ***[Section 4.3]***. Non-project trees can be removed from the project area at any time if they are prescribed weeds of any height or crown coverage, or if the removal of the trees is otherwise required by law.

Non-project trees may also be removed if the trees do not meet the definition of 'native forest' set out in the Act, and if they are less than 2 metres in height at the time of their removal. Trees meeting these specifications may be removed or otherwise disturbed at any time from commencement to 6 months after planting, provided that the crown cover of the trees to be removed covers less than 5% of the stratum area at the time of commencement.

Project trees are allowed to be removed from the project area in certain limited circumstances. This includes the removal of project trees for biomass sampling or because of the occurrence, or to manage the risk, of a natural disturbance such as fire or disease. For example, project trees could be removed as a precautionary measure to mitigate the threat of bushfire or establish fire breaks. Project trees may also be removed where otherwise required or authorised by law, such as improving access along shared boundaries, or to manage risk, for example, removing trees growing near power lines..

Removal of project trees from a permanent planting project

The large-scale removal of project trees such as harvesting is prohibited under the Determination if the type of project being undertaken is a permanent planting ***[Section 4.4]***.

Large-scale removal of project trees such as harvesting is permitted under the Determination provided the type of project being undertaken is a harvest project and the removal is in accordance with the management regime for the project.

Specifying the management regime for a harvest project

For a harvest project type, the proposed management regime that the harvest forest will be managed in accordance with must be identified ***[Section 4.5]***.

If the proponent intends to change the management regime, they must confirm that the predicted project average carbon stock (PPACS) is more than the number of credits that have been issued for the project to date ***[Section 4.6]***. If the PPACS for the new management regime is less than the number of credits issued for the project, it would mean over-crediting would occur for the sequestration generated by the project if the new management regime were to be implemented. In such circumstances, the proponent may be required to relinquish credits before the new management regime could be accepted by the Regulator.

Removal of project tree biomass from a harvest project

Large-scale removal of project trees such as clearfelling and commercial thinning is permitted under the Determination provided the type of project being undertaken is a harvest project and the removal is in accordance with the management regime for the project ***[Section 4.7]***.

Requirements for operation of a harvest project

The management regime for a harvest project may involve thinning and clearfelling ***[Section 4.8]***. After any clearfelling event the proponent must re-establish the project trees by planting, seeding or coppice regrowth.

Where the management regime involves the clearfelling of project trees the period between clearfelling and re-establishment must not exceed the minimum period specified in paragraph 4.10(7)(b), currently set at 15 months.

After clearfelling, carbon stocks are not assumed to fall to zero as stocks of carbon remain in the roots of harvested trees, and any above-ground harvest residue left on site, such as branches, bark and leaves. These pools of dead biomass will decay over time as the next rotation is growing.

Project proponents must use the FullCAM Guidelines provided for this Methodology Determination to estimate the predicted project average carbon stocks (PPACS) ***[Section 4.9]***. This involves modelling the project management regime over a 100 year period called the modelling period. One hundred years is selected to allow for a reasonable period of time in which to run the modelling scenario. A project proponent must not claim credits for carbon stocks where this would result in the total credits received exceeding the most recently reported PPACS value.

If the project proponent changes the tree species within a modelling stratum, they must document the species being used and the species with the lower growth rate must be used to estimate the PPACS value ***[Section 4.10]***.

When modelling PPACS, it is a requirement that a minimum of 15 months is included in the modelling between harvesting the trees and re-establishing trees for the next rotation period.

Project proponents must re-calculate the PPACS value for each reporting period within 3 months prior to the submission of the offsets report using the latest publicly-available version of FullCAM. If any of the following events:

(a) a change in management practice;

(b) a natural disturbance event; or

(c) a variation of a modelling stratum boundary;

occurred during the reporting period they must be included in the FullCAM modelling for the re-calculation of the PPACS value.

Below, Figure 1 illustrates a typical carbon stock profile of a reforestation project which is under a management regime based on a 25-year rotation; clearfelled 25 years after planting and then replanted one year later. It is a simplified example where all planting, harvesting and replanting throughout the project is completed in the same year. A general estimate of the change in carbon stocks which could be credited from this example is presented in Table 1 below.

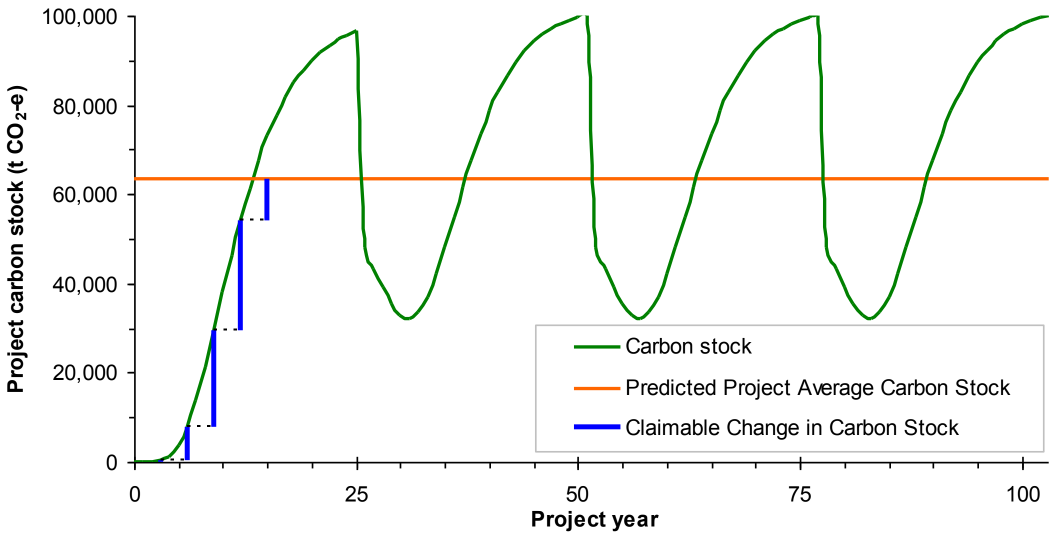

Figure 1: Example of a possible carbon stock profile over four rotations, showing the predicted project average carbon stock (PPACS) and an estimate of the change in carbon stocks which could be credited at three-yearly reporting intervals.

Table 1: The change in carbon stocks which could be credited from the example in Figure 1.

Project year	Change in carbon stocks (t CO_2-e)
3	275
6	7,616
9	21,521
12	24,661
15	9,411
18 - 100	0
Total (= PPACS)	**63,484**

In practice, harvesting at different ages is likely , for example, areas with fast growth would likely be harvested first and more frequently. Initial planting can also be progressed over many years. As a consequence, the project forest is likely to have a range of ages and growth and so the graph of the project carbon stocks profile would be smoother with less difference between the cyclical peaks and troughs.

Part 5 Methods for estimating net project abatement

A carbon inventory uses plot-based assessments of forest biomass to estimate carbon stocks . A carbon inventory involves the establishment and assessment of temporary sampling plots and/or permanent sample plots across strata. Individual project trees are measured from within plots and allometric functions are applied to estimate carbon stocks.

This Part of the Determination ***[Section 5.1]*** and Methods 5.1 and 5.2 of the Technical Reference Guide ***[Section 5.2]*** detail requirements to inventory carbon. The most recent map of a stratum and the most recent stratum area estimate generated in accordance with Part 3 must be used to conduct a carbon inventory.

A carbon inventory must be conducted for each stratum at the following times:

- no earlier than 6 months before the end of the first reporting period for the project;
- at least every 5 years from the first offsets report and any subsequent offsets report that calculates a carbon stock for the stratum;
- if a stratum is revised into a fire-affected stratum;
- upon the revision of a stratum's boundaries.

If a stratum has not experienced a disturbance event in the period since the last carbon inventory was undertaken, the project proponent may choose to report the carbon stocks and standard error values that were previously calculated for the stratum for the previous offsets report, for the current reporting period.

If the project is a harvest project, a carbon inventory is not required for a stratum once the carbon stock for the project has reached the PPACS value calculated for the project in accordance with section 4.9.

Sampling plans

A sampling plan is a document that identifies the quantity and location of TSPs, PSPs, and biomass sample trees within a stratum, or the geographic limits of an allometric domain.

The project proponent is required to develop and document a sampling plan for inventorying carbon or updating an allometric equation.

A sampling plan may document multiple activities conducted within a single stratum, such as validating an allometric function and inventorying carbon.

In all cases a sampling plan must include a description of the activity to which the sampling plan relates, including the dates during which the activity is to be conducted.

Plot establishment and Assessment

The location of plots within a stratum must be determined according to the points of intersection from a grid overlay. The process for establishing the grid overlay and selecting grid intersections as plot locations is described in detail in Methods 7 and 8.1 of the Technical Reference Guide. These Methods in the Technical Reference Guide also set out the options for treatment of plot location and configuration at the selected points of intersection and how differently-shaped plots may be established.

In addition each plot must meet the following requirements:

(a) the minimum size for a plot must be 0.02 hectares;

(b) each plot must be assigned a unique identifier; and

(c) all plots must be marked with a survey mark that is fire- and flood-resistant; and will allow for plot re-location for up to 5 years.

The location of plots within strata is designed to yield an unbiased representation of the trees being sampled.

Project proponents must follow the processes set out in Subdivision 5.1.2 and Methods 8.3 and 9 when assessing sample plots within a stratum during a carbon inventory.

Precision standard

The precision standard is the minimum precision that sampling to inventory carbon must achieve and is the probable limits of error (PLE) of less than or equal to 10% for the estimate of the closing carbon stocks for a project ***[Section 5.3]***. .

The PLE for the estimate of the closing carbon stocks for a project must be calculated using Equation 6.1 and in accordance with section 6.51 and must be calculated at the 90% confidence level. The minimum number of plots anticipated to be required to meet the precision standard must be established in accordance with Table 2 in Method 8 of the Technical Reference Guide. Note that more plots may be required to achieve the necessary precision standard for the estimate of project carbon stocks.

The carbon inventory must meet the requirements of the precision standard:

(a) in accordance with Method 8.2 of the Technical Reference Guide; and

(b) in a reporting period at least once every 5 years.

If the precision standard is not met a project proponent must undertake one of the following options:

Option 1—Calculate and report the estimate of project carbon stocks for the reporting period at the lower 90% confidence limit in accordance with Division 6.2; or

Option 2—Establish and assess more plots in accordance with Methods 7 to 9 of the Technical Reference Guide until the precision standard is met.

Option 1 above can only be undertaken if the calculated PLE is less than or equal to 20% for the estimate of the closing carbon stocks for a project. i.e. if the PLE is greater the ±20%, then the only option open to the proponent is to sample more plots.

Allometric functions

The use of allometric functions to account for biomass and carbon in forests is a well-established practice. Under the Determination, the biomass contained within a project tree is estimated by using an allometric function to convert measures of project tree dimensions into an estimate of the total biomass within the project tree ***[Section 5.4]***.

The project proponent is able to apply the following classes of allometric function to estimate the biomass within project trees:

- Stratum-specific function: an allometric function developed by the project proponent, which may or may not have been published in a peer-reviewed journal and has been developed from data collected exclusively from within a single stratum, the boundaries of which define the geographic limits of the allometric domain ***[Section 5.5]***.
- Regional function: an allometric function developed by the project proponent, which may or may not have been published in a peer-reviewed journal and has an allometric domain that extends across a relatively large geographic area that could include multiple strata ***[Section 5.6]***.
- CFI function: a stratum-specific or regional function developed and validated in compliance with an existing CFI methodology determination ***[Section 5.7]***.

In all cases, the use of an allometric function is only possible where the requirements detailed under Subdivisions 5.1.3 to 5.1.8 are met, particularly the compatibility and validation tests in Subdivision 5.1.4.

If a stratum-specific function is to be applied outside of the stratum from which the allometric dataset was collected, the allometric function must be treated as a regional function subject to the validation process set out in section 5.1.4 ***[Section 5.8]***.

An allometric function can only be applied to project trees that occur within the allometric domain (see below) for that allometric function.

Allometric domain

An allometric domain describes the specific conditions under which an allometric function is demonstrated to provide a statistically valid prediction for a given set of values of explanatory variables. The processes that the project proponent must undertake when determining the domain of an allometric function are detailed in Method 10.2 of the Technical Reference Guide ***[Section 5.9]***.

For each allometric function applied under the Determination, the project proponent must clearly define and document the allometric domain that relates to the allometric function in an allometric report.

Procedures used to assess predictor measures for the purposes of paragraph 5.9(1)(c) include, for example, using a hypsometer or a height pole. The procedures used must replicate the procedures used to measure predictor measures in developing the applicable allometric function. This avoids introducing error and bias into carbon stock estimation.

An allometric function must not be used if there is insufficient information to meet the requirements specified above.

Conducting regression analysis

The project proponent must undertake regression analyses to develop allometric functions ***[Section 5.10]***.

Allometric functions are only allowable under the Determination where they have been derived using regression analyses to relate measures of explanatory variables to biomass estimates from the same biomass sample trees (inclusive of above-ground and, optionally, below-ground components).

Basic concepts and approaches for regression analyses are detailed in the *National Carbon Accounting System Technical Report No. 31: Protocol for Sampling Tree and Stand Biomass,* Australian Greenhouse Office, 2002 (the Protocol for Sampling Tree and Stand Biomass). This Report is available on the website of the Department administering the Act.

If a single predictor measure such as tree height is to be considered, linear or non-linear regression techniques may be applied. Where multiple predictor measures such as tree height and diameter are to be considered, multiple linear or non-linear regression may be applied to develop a multivariate allometric function.

The weighted least squares method must be applied to estimate the line of best fit. The weighted least squares method weights the influence of each observation in the data set on the final parameter estimates.

In both cases, data must not be transformed but raw data values must be applied. While transforming data is common for developing allometric equations, some transformations such as logarithms can create bias when back-transformed. As this Determination does not provide corrections for such transformations, they cannot be used.

Minimum data requirements

The project proponent must satisfy the minimum data requirements for conducting regression analyses for the purpose of developing allometric functions as specified in Method 10.4 of the Technical Reference Guide ***[Section 5.11]***.

An allometric function can only be applied where the regression analyses used to develop the allometric function reference data collected from at least 20 individual biomass sample trees sampled from within the geographic limits of the allometric domain.

All biomass sample trees must be alive and unburnt, and have had the above-ground components directly assessed as part of the sampling process. Below-ground biomass components must have been either directly assessed as part of the sampling process, or determined through the use of the default root:shoot ratio.

Minimum regression fit requirements

For an allometric function to be considered acceptable for estimating biomass within a given allometric domain ***[Section 5.12]***, the requirements specified below must have been met:

- The regression relationship upon which the allometric function is based must be statistically significant, that is p is less than 0.05.
- Equation 7.7 must be used in accordance with section 6.60 actual (not weighted) data for the biomass sample trees to demonstrate that the mean of the residuals for the allometric function is not significantly less than zero, where: $p < 0.05$ from a one-tailed, one-sample, t-test. This test is important because it demonstrates that the allometric function is unlikely to overestimate tree biomass.
- The project proponent must demonstrate that there is no significant trend in the plot of residuals for the allometric function. Note that a trend in the plot of residuals is determined to be significant if a statistically significant, linear or non-linear regression can be fitted to the plot of residuals.

Where the requirements specified above are not met, one of the processes set out below may be applied to try to achieve the requirements:

- The allometric domain may be redefined so as to reduce variability or to remove bias. Separating the allometric dataset on the basis of geographic location, size, or growing conditions, and then applying regression analyses to data sub-sets. This would result in a more narrowly defined allometric domain. The minimum data requirements would still need to be met in this case;
- apply multiple-regression techniques with the application of multiple predictor measures to reduce variability and alleviate bias (i.e. develop a multivariate allometric function); or
- Undertake further sampling using the processes described at Subdivisions 5.1.3 to 5.1.6 and combine the data obtained with the original dataset then re-perform the regression analyses.

Allometric report

An allometric report must document the development of each allometric function applied to project trees in a project . The listed requirements apply to both stratum-specific and regional allometric functions and include any actions taken to achieve the minimum requirements to fit regressions ***[Section 5.13]***.

Applicability of allometric functions

An allometric function can only be applied to estimate biomass for project trees that fall within the domain of that allometric function ***[Section 5.14]***. The project proponent is required to check compatibility s on each occasion that an allometric function is applied to project trees within a stratum ***[Section 5.15]***. The outcomes of the checks must be documented in an offsets report.

In addition to the compatibility checks, the project proponent must perform the required validation test ***[Section 5.16]*** at the following times:

- for a regional function, during the first reporting period that the regional function is to be applied within the stratum;
- when a stratum-specific function is to be converted to a regional function; and
- during the last reporting period for the crediting period.

In all cases, testing must be part of a carbon inventory which includes the stratum in which the allometric is to be applied and must be documented in an offsets report.

The statistical tests specified in section 5.12 must be applied to the data to demonstrate that:

- the mean of the residuals for the allometric function is not significantly less than zero, where: $p < 0.05$ from a one-tailed, one-sample, t-test; and
- there is no significant trend in the plot of residuals for the allometric function. Note that a trend in the plot of residuals is determined to be significant if a statistically significant, linear or non-linear regression can be fitted to the plot of residuals.

If 5% or more of project trees in a stratum is comprised of dead or burnt trees a separate validation test must be applied to the allometric used to estimate carbon stocks in the dead and burnt trees for that stratum.

If a project proponent chooses to develop a stratum-specific function the data collected from the test trees may be included in developing the stratum-specific function, provided that at least:

- an additional 10 biomass sample trees are selected; and
- 20 biomass sample trees are selected in total.

The outcomes of all compatibility and validation tests set out in Subdivision 5.1.4 must be detailed in an offsets report. This includes any substitution or development of stratum-specific functions arising as a result of these tests ***[Section 5.17]***.

Allometric functions for live trees

Subdivision 5.1.5 describes the processes for developing stratum-specific functions, updating stratum-specific functions, and developing regional functions for live trees. A procedure for the treatment for dead or burnt trees is set out in Subdivision 5.1.7.

Details of all biomass sample site and tree selections must be documented in a sampling plan, including the requirements specified in Subdivision 5.1.3 ***[Section 5.18]***.

Developing stratum-specific functions

A stratum-specific function is developed as part of a carbon inventory, where TSPs have been established and assessed in accordance with the processes set out in Subdivisions 5.1.2 ***[Section 5.19]***.

The project proponent must undertake the specified process for selecting and assessing biomass sample trees from within TSPs for the relevant tree type.

The process includes the requirements for measuring the predictor measure values and ranking the measurements according to size. Then, the project trees with the smallest and largest measurements must be selected to delineate the maximum range of project tree sizes occurring within the TSPs during the full inventory to be represented in the allometric dataset. An additional 18 trees must be selected at a minimum by applying the specified selection process to achieve an unbiased sample of trees.

Project proponents must collect evidence which demonstrates the biomass sample trees have been properly selected.

Updating pre-existing stratum-specific functions

It is likely that project trees will grow beyond the allometric data range for a stratum-specific function from reporting period to reporting period. For this reason the Determination allows for an existing stratum-specific function to be updated in accordance with ***[Section 5.20]***. Updating uses the process specified for the selection of biomass sample trees except that a minimum of only 10 extra biomass sample trees – rather than 20 as required for developing a function – are required to be selected. This is because the data from the 10 extra trees is combined with the data from the original 20 trees to create a new allometric data set for the updated function.

Developing and updating regional functions

A regional function may be developed at any time from trees that occur inside or outside the project area, however the trees must be from sites that satisfy the description of the allometric domain for the tree type to be referenced by the regional function ***[Section 5.21]***. The sites must be mapped using a geographic information system.

Allometric domain for a regional function

A minimum of 10 locations must be selected for the establishment of biomass sample plots from within the biomass sample sites that were mapped using the process specified for preparing a sampling plan and establishing plots, subject to the following modifications:

- references to strata are to be replaced with references to biomass sample sites;
- references to PSP, TSP or plot are to be replaced with references to biomass sample plot; and
- references to probable limits of error are to be ignored.

Biomass sample plots must then be established using the processes specified for establishing and assessing PSP and TSP plots, subject to the following modifications:

- references to strata are to be replaced with references to biomass sample sites;
- references to PSP, TSP or plot are to be replaced with references to biomass sample plot;
- references to probable limits of error are to be ignored; and
- the minimum target plot size is to be 100 square metres (m^2), i.e. 0.01 hectares (ha).

The combination of biomass sample plot size and the number of biomass sample plots must be such that at least 100 trees of the tree type to be referenced by the regional function are included within the biomass sample plots. The biomass sample plot must be temporarily marked to allow for return visits to the plot within 12 months of assessment.

All occurrences of a tree type to be referenced by a regional function in a biomass sample plot must be identified and measures of candidate predictor measures must be collected from each tree.

At least 20 biomass sample trees must be selected in accordance with the process described for selecting project trees when developing a stratum-specific function, subject to the following modifications:

- references to TSPs are to be replaced with references to biomass sample plots; and
- references to 'project trees specified in paragraph (1)(c) are to be replaced with references to trees.

A regression function must then be fitted for the regional allometric and the subsequent analyses performed. The development of a regional function does not need to be linked to a carbon inventory.

Converting a stratum-specific function to a regional function

A stratum-specific function may be converted to a regional function if it has been validated for a stratum other than the stratum from which the function was originally developed. In this case, the geographic limit of the allometric domain may be redefined to include the limits of each stratum the original allometric has been validated in ***[Section 5.22]***.

Updating a CFI function

A CFI function may be updated by applying the procedure for updating a stratum-specific function or a regional function, depending on which one the CFI function is classed as ***[Section 5.23]***.

Subdivision 5.1.6 Measuring biomass sample trees

Measuring above-ground biomass of biomass sample trees

The project proponent must undertake the specified processes when assessing the above-ground biomass of a biomass sample tree as provided in Method 11.5 ***[Section 5.24]***.

The project proponent must measure the candidate predictor measures from the biomass sample trees.

The biomass sample tree must be cut at ground-level and separated into biomass components. Method 11.5 details the process for sampling tree biomass and for separating components to determine the dry-wet weight ratio and carbon content. As a minimum, the biomass components must include the stem, branches, crown and attached dead material associated with the biomass sample tree.

Definitions of 'stem' and 'crown' are set out in section 1.3.

'Dead material' means dead, project-tree derived material (for example, dead branches). The dead material must be attached to the tree and suspended above the ground, which may include dead material that is merely hanging from the tree.

It is important that sub-samples are collected and weighed as soon as possible after the wet weight of each biomass component is recorded so as to ensure the dry-wet weight ratio obtained for sub-samples remains applicable to the biomass component.

For each biomass sample tree, a minimum of three sub-samples should be collected from each biomass component, so as to allow for an estimate of the level of variation between sub-samples.

The project proponent is advised to consult the 'Complete Harvest Method' outlined in the Protocol for Sampling Tree and Stand Biomass for direction on selection of a representative sample of tree components for the purpose of estimating the dry-wet weight ratio.

An alternative, acceptable approach to sub-sampling is to record the wet weight and oven dry weight of the entire biomass component. This will generally only be feasible where biomass sample trees are small. Where the entire biomass component is used, there is no need to calculate the average of the dry-wet ratios, because a single value is returned.

Measuring below-ground biomass of biomass sample trees

Once the above-ground biomass components of a biomass sample tree have been sampled by applying the process above, the below-ground biomass of the same tree must be estimated ***[Section 5.25]***. The project proponent has a choice of two processes:

- a destructive sampling method; or
- application of a root:shoot biomass ratio.

Destructive sampling method

If the destructive sampling method is used the roots of each individual biomass sample tree must excavated. Roots less than 2 mm in diameter are not required to be excavated. This is due to the practicalities of excavation, and they are excluded from further processes under Method 11.6 of the Technical Reference Guide.

Once the root system is excavated and cleaned, it is divided into its separate biomass components which, at a minimum, must include the tap root or lignotuber, and the lateral roots. The project proponent may also elect to apply further separation, for example into root crown, coarse lateral roots and fine lateral roots down to the 2 mm diameter size restriction.

For each biomass sample tree, a minimum of three sub-samples should be collected from each biomass component, so as to allow for an estimate of the level of variation between sub-samples.

Similar to the above-ground biomass sampling, an alternative, acceptable approach to sub-sampling is to record the wet weight and oven dry weight of the entire biomass component. Where the entire biomass component is used, there is no need to calculate the average of the dry-wet ratios.

Root:shoot biomass ratio method

As an alternative to the destructive sampling method, a project proponent may apply a root:shoot ratio. If the project proponent chooses this approach, the allometric function used must be developed to predict only the above-ground biomass of project trees and sample trees and a root:shoot ratio must be applied in accordance with Method 11.7 of the Technical Reference Guide to estimate the root biomass of those trees.

Assessing carbon stocks in the roots of harvested trees for harvest projects

Assessing the carbon stocks in the roots of harvested trees is only relevant if the project is a harvest project and the project proponent chooses to account for the carbon stocks in the roots of the harvested project trees ***[Section 5.26]***.

Project proponents are required to re-establish the project trees in accordance with the management regime after a harvest has been undertaken. The two kinds of re-establishment systems considered under this Determination are:

- replant systems where project trees are re-established by planting or seeding; or
- coppice systems where project trees re-establish from the growth of new shoots arising from the stumps or lignotuber of harvested project trees.

Replant systems

For replant systems, the FullCAM Guidelines for this Determination provide a procedure for estimating the carbon stocks in the roots of harvested project trees or alternatively default dead root partitioning and decomposition rates must be applied as specified in Table 4 in Method 11.8 of the Technical Reference Guide in accordance with section 6.37.

Coppice systems

For coppice systems, the carbon stocks in the roots of harvested project trees must be estimated by applying Equation 4.12 in accordance with section 6.38.

Note that under a coppice system, an assumption is made that all the tree roots are taken to remain alive after harvest occurs, and that there is no change in root biomass after the first harvest.

Subdivision 5.1.7 Assessing carbon stocks in dead or burnt trees

Biomass prediction in dead or burnt trees

Under this Determination, it is optional to account for carbon stocks in dead or burnt trees. Where the project proponent chooses to account for carbon stocks in these kinds of trees, the following processes need to be undertaken ***[Section 5.27]***. To estimate the above-ground biomass the predictor measures must be measured and the relevant allometric function for the equivalent live or unburnt project tree must be applied. That is, the allometric function that would have been applied to the tree if it was not dead or had not been burnt is used to predict the above-ground biomass.

The fraction of above-ground biomass remaining in the tree (F_R) must be estimated, but must not exceed the limits specified in Table 5 in Method 12.1 of the Technical Reference Guide. For example, a fraction remaining estimate of 0.65 (FR = 0.65) indicates that the biomass is estimated to be 65% of what would be there if the tree was not dead or burnt.

If the root:shoot ratio method in section 5.25 is applied to estimate root biomass, then the same ratio that was calculated in section 5.25 for a live and unburnt project tree is taken to be applicable to the dead or burnt tree. The total biomass value of the dead or burnt tree must then be calculated using Equation 7.2 in section 6.54.

Testing for over prediction of a dead or burnt tree biomass

If 5% or more of project tree biomass in a stratum is contained in dead or burnt trees, then a t–test equivalent to that specified in subsection 5.12(3) must be applied to the allometric function from subsection 5.27(3) to test for over prediction ***[Section 5.28]***.

The proponent must select twenty or more dead or burnt trees from TSPs from the stratum using the process described at section 5.19. In applying Section 5.19 for the current purposes, the references to 'biomass sample trees' are replaced with 'dead or burnt sample trees'.

The values of predictor measures and fraction remaining (F_R) of the dead or burnt sample trees must be recorded. The proponent must then apply the maximum fraction remaining values from Table 5 in Method 12.1 of the Technical Reference Guide and the predicted biomass must be calculated using Equation 7.2 in accordance with section 6.54.

The actual biomass of the dead or burnt sample trees must be assessed by undertaking the processes specified in Subdivision 5.1.6. Then, the project proponent must apply the t-test that is specified in subsection 5.12(3) to the data to determine if there is a statistical difference between the measured and predicted value.

If the t-test result indicates over-prediction (i.e. the t-test does not demonstrate that $p<0.05$), the project proponent must proportionately adjust the maximum fraction remaining values for all cases in Table 5 in Method 12.1 of the Technical Reference Guide so that the mean of residuals is not less than zero. The adjusted maximum fraction remaining values must then be applied in all calculations of project carbon stocks for the stratum mentioned in subsection (1).

Subdivision 5.1.8 Assessing carbon stocks in coarse woody debris and litter

Assessing carbon stocks in coarse woody debris

Coarse woody debris is dead project tree derived biomass that occurs at ground level. It can include smaller woody components such as stem and branch material with cross-sectional diameter of greater than 25 millimetres. It is optional under the Determination for the project proponent to account for carbon in coarse woody debris ***[Section 5.29]***.

If the project proponent chooses to assess the carbon stock in coarse woody debris, the processes specified in Method 14 of the Technical Reference Guide must be followed. The project proponent must collect and record the evidence identified in Method 14 to be able to demonstrate to the Regulator that the processes have been undertaken in an objective and unbiased way. This involves using a transect through the plot and collecting samples for analysis.

The density of the samples is then calculated by measuring the oven-dried weight of the samples divided by their volume. The estimate of the carbon stock in the plot is then calculated using Equations 4.6 to 4.8

Assessing carbon stocks in litter

Litter is dead project tree-derived biomass that occurs at ground level. It can include bark, leaves, and smaller woody components such as stem material with cross-sectional diameter equal to or less than 25 millimetres. It is optional under the Determination for the project proponent to account for carbon in litter ***[Section 5.30]***.

If the project proponent chooses to assess the carbon stock in litter, the processes specified in Method 15 of the Technical Reference Guide must be followed. The project proponent must collect and record the evidence identified in Method 15 to be able to demonstrate to the Regulator that the processes have been undertaken in an objective and unbiased way. This involves collecting litter samples for analysis and developing an allometric function which enables prediction of equation the mass per unit area of litter from the depth of the litter. This approach is most appropriate where the litter depth is greater than 50 millimetres in depth.

Once the predictive equation has been developed, the same procedures for defining the allometric domain of the function, regression fitting and validation must be undertaken by applying the processes in Method 10 and Method 13 of the Technical Reference Guide.

Division 5.2 Calculating project emissions

Division 5.2 specifies the parts of the Determination that must be used to calculate fire and fuel emissions that occur as a result of project activities.

Calculating fuel emissions from project activities

The project proponent must calculate the fossil fuel emissions produced while conducting project activities in the project area. The project proponent must also calculate the fossil fuel emissions produced while conducting project activities for the project area outside of any actual stratum. An important exemption from this process is the fuel used in harvest operations, which is not required to be included in the calculation ***[Section 5.31]***.

Calculating fire emissions from a stratum

The project proponent must calculate the emissions of methane and nitrous oxide from any fire in the project area in accordance with sections 3.6 and 6.39 ***[Section 5.32]***.

Part 6 Calculating the carbon dioxide equivalent net abatement amount for a project in relation to a reporting period

Under the Determination, abatement is calculated as the net change in the amount of carbon stored in a project area resulting from the growth of trees and, optionally, the accumulation of biomass debris and tree litter minus the carbon stock losses and greenhouse gas emissions resulting from natural decay of biomass, disturbance events such as fire, pest, disease and storms and from fuel used to establish and maintain the project.

Division 6.1 Preliminary

The Division clarifies that all calculations are in respect of activities done or outcomes achieved during the reporting period for a project ***[Section 6.1]***.

6.2 Greenhouse gas assessment boundary

The greenhouse gas assessment boundary defines the greenhouse gas sources and sinks and relevant carbon pools that need to be assessed in order to determine the amount of carbon dioxide removed from the atmosphere when undertaking the project activity. The greenhouse gas assessment boundary includes the tree and, optionally, the debris carbon pools within the project area and the emissions of greenhouse gases from establishing and managing the project and from disturbance events ***[Section 6.2]***.

The carbon pools and emission sources that need to be taken into account when calculating abatement for the project are set out in Table 2 below, which also sets out emissions that are specifically excluded from the project.

Table 2 – Carbon pools and emission sources

Source		**Greenhouse gas/carbon pools**	**Included / excluded**	**Justification for exclusion**
Baseline	*Source 1*	CO_2, CH_4, N_2O, emissions from land management activities, including cropping & grazing.	Excluded	Exclusion is conservative.
	Source 2	CO_2, CH_4, N_2O arising from fire (prescribed & wild).	Excluded	Exclusion is conservative.
	Source 3	CH_4, N_2O arising from livestock grazing and fertiliser application.	Excluded	Exclusion is conservative.

Source		Greenhouse gas/carbon pools	Included / excluded	Justification for exclusion
	Sink 1	CO_2, above and below-ground non-tree vegetative biomass.	Excluded	Net removals assumed to be zero. Sequestration is unlikely to increase in the absence of the project activity. Biomass in this pool will likely be no greater than that under the project scenario, which also excludes this pool. This is a conservative assumption.
	Sink 2	CO_2, above and below-ground non-project tree biomass.	Excluded	Assumed to be zero. The eligibility conditions require that the project forest is established on cleared lands.
	Sink 3	CO_2, soil organic carbon.	Excluded	Under the baseline scenario, short-term fluxes in soil carbon stocks are likely to occur, but no long-term trend for increase is expected. Additionally, soil carbon stocks are excluded for the project scenario.
Project Activity	*Source 1a*	CO_2, CH_4, N_2O emissions arising from fuel use in relation to project forest establishment and management activities for specified carbon pools	Included for establishment, tending & monitoring activities. Excluded for PPACS calculations.	Excluded from PPACS calculations because: 1. No verifiable method of accounting for future emissions. 2. Accounting for emissions from harvest activities is not required and other emissions are likely to be small.
	Source 1b	CO_2, CH_4, N_2O emissions arising from fuel use in relation to harvest events	Excluded	Fuel emissions are likely to be immaterial in relation to the carbon stored in harvested wood products which is not accounted for (see HWP below).

Source		Greenhouse gas/carbon pools	Included / excluded	Justification for exclusion
	Source 2	CO_2, CH_4, N_2O arising from fires.	Included—CO_2 Included — CH_4 and N_2O where fire event affects >10 hectares of a stratum within a reporting period. Excluded from PPACS calculations and preparation burn.	CO_2 is accounted for through calculations of carbon stock changes. CH_4 and N_2O are included where fire event affects >10 hectares of a stratum. Inclusion is on the basis that these are potentially large emissions sources. Excluded from PPACS calculations and for preparation burns because: 1. No verifiable method of accounting for future emissions. 2. Emissions likely to be small.
	Source 3	N_2O arising from fertiliser use.	Excluded	The fertiliser application regime under the project activity is unlikely to exceed that of the baseline scenario.
	Sink 1	CO_2, above-ground and below-ground tree biomass including live, dead or burnt trees.	Included	This is the major carbon pool that arises as a direct result of the project activity. This pool is expected to increase over time and achieve abatement well in excess of the baseline scenario. For harvest projects there will be a net increase in carbon stocks over the life of a project.

Source		Greenhouse gas/carbon pools	Included / excluded	Justification for exclusion
	Sink 2	CO_2, biomass in roots of harvested trees	Optional	Under a re-plant system the roots of harvested trees die and decay over time. This pool will decline over time as the roots decay. Under a coppice system the roots of harvested trees remain alive. This pool is expected to increase over time but is conservatively estimated to not change after the first harvest.
	Sink 3	CO_2, ground-level litter and coarse woody debris.	Optional	These are carbon pools that arise as an indirect result of the project activity. This pool is expected to increase over time and achieve abatement in excess of the baseline scenario. Inclusion is optional on the basis that exclusion is conservative.
	Sink 4	CO_2, above-ground non-tree biomass.	Excluded	Exclusion is conservative. Sequestration is insignificant as compared to sequestration by project tree biomass. This pool is also excluded from the baseline scenario.
	Sink 5	CO_2, harvested wood products (HWP).	Excluded	Exclusion is conservative and accounting for carbon in HWP is beyond the scope of the project activity.
	Sink 6	CO_2, soil organic carbon.	Excluded	Exclusion is conservative because soil organic carbon increases, or decreases at a slower rate, under the project activity as compared with the baseline scenario. Any harvest events will tend to add to the soil organic carbon pools from the decay of harvest residues.

Calculating the baseline for the project

A calculation of the project baseline is required under paragraph 106(4)(f) of the Act.

The baseline scenario is continued management under a cleared agricultural regime, being a cropping regime, a grazing regime, or a combination of the two, and including any fallow periods, for at least 5 years before the project begins.

Under the Determination, it is conservatively assumed that emissions associated with the baseline scenario are zero. Baseline removals are also assumed to be zero ***[Section 6.3]***.

Requirements for calculating carbon dioxide equivalent net abatement

There are general requirements and timeframes that a project proponent must adhere to in order to correctly calculate the carbon dioxide equivalent net abatement for a reporting period ***[Section 6.4]***. The carbon dioxide equivalent net abatement must be calculated by subtracting the project emissions from project removals using Equation 1.1.

A project proponent must calculate project removals using data collected in accordance with the processes specified Division 5.1 after inventorying carbon as specified in Subdivision 5.1.2 and must calculate project emissions using data collected in accordance with Division 5.2.

The specified data collection and calculations must be carried out no earlier than 6 months before the end of the reporting period.

Division 6.2 Calculations

General

Paragraph 106(1)(c) of the Act requires the calculation for the carbon dioxide equivalent net abatement amount for a reporting period for an offsets project to which this Determination applies to be specified in the Determination. For the purpose of this requirement of the Act, a project proponent must calculate the carbon dioxide equivalent net abatement amount in accordance with this Division ***[Section 6.5]***.

The net greenhouse gas abatement for the project occurring within a given reporting period must be calculated using Equation 1.1—***[Section 6.6]***.

The 90% confidence interval for net greenhouse gas abatement for the project area must be calculated using Equation 1.2 ***[Section 6.7]***.

The standard error for net greenhouse gas abatement for the project area must be calculated using Equation 1.3 ***[Section 6.8]***.

The degrees of freedom for calculating the confidence interval for the net greenhouse gas abatement for the project area must be calculated using Equation 1.4 ***[Section 6.9]***.

Subdivision 6.2.3 Calculating carbon stocks for a project

For the first reporting period to reference the project, the change in carbon stocks occurring within the project to the end of the first reporting period must be calculated using Equation 2.1 ***[Section 6.10]***.

If an offsets report has been previously submitted (i.e. it is not the first reporting period for the project), the change in carbon stocks occurring within the project during the current reporting period must be calculated using Equation 2.2.

If the project is in the first reporting period, the standard error in change in carbon stocks occurring within the project to the end of the current reporting period must be calculated using Equation 2.3 ***[Section 6.11]***.

However, if an offsets report has been previously submitted (i.e. it is not the first reporting period), then the error in change in carbon stocks occurring within the project during the current reporting period must be calculated using Equation 2.4 ***[Section 6.12]***.

Calculating initial carbon stocks for the project

The initial carbon stocks for the project must be calculated using Equation 2.5 ***[Section 6.13]*** and the standard error for the initial carbon stocks for the project must be calculated using Equation 2.6 ***[Section 6.14]***.

Calculating closing carbon stocks for the project

The closing carbon stocks for the project must be calculated by applying the following tests and using the appropriate equation or procedure as follows ***[Section 6.15]***:

- If the closing carbon stocks for the project are less than the PPACS value, then Equation 2.7a must be used.
- If the closing carbon stocks for the project are equal to or greater than the PPACS value, then Equation 2.7b must be used.
- If the project proponent is applying Option 1 under subsection 5.3(6) then the lower confidence bound for closing carbon stocks must be calculated in accordance with section 6.17 and substituted for the closing carbon stocks for the project for the purpose of calculating the change in carbon stocks occurring within the project for the current reporting period.

The standard error for the closing carbon stocks for the project at the end of the reporting period must be calculated using Equation 2.8 ***[Section 6.16]***.

The lower confidence bound for closing carbon stocks in the project at the end of reporting period must be calculated using Equation 2.9 ***[Section 6.17]***. In order to calculate the degrees of freedom using Equation 1.4 in section 6.9, the project proponent must replace the term ($SE\Delta C_{Stratum,j,Ri}$) in Equation 1.4 with the term for the standard error for the closing carbon stocks for the project ($SECC_{Project,Ri}$) before making the calculation.

Calculating predicted average carbon stocks for the project and strata (PPACS and PSACS)

If the project is a harvest project:

- the predicted project average carbon stocks over the modelling period must be calculated using Equation 2.10 ***[Section 6.18]***;
- the predicted stratum average carbon stocks for the stratum over the modelling period must be calculated using Equation 2.11 ***[Section 6.19]***;
- the output variables $C_{tree,j,m}$ and $C_{debris,j,m}$, modelled using FullCAM must be converted to tonnes of carbon dioxide equivalent (t CO_2e) for the calculation of the Predicted Stratum carbon stocks using Equation 2.12 ***[Section 6.20]***.

Note that tonnes of carbon (tC) are converted by the equation into tonnes of carbon dioxide equivalent (t CO_2e) by multiplying by the conversion factor 44/12, where 44/12 is the ratio of the molecular weight of carbon dioxide (CO_2) to carbon (C).

Calculating initial carbon stocks for a stratum

If the project trees in the stratum were planted after the declaration date, initial carbon stocks for the stratum must be zero.

Subject to the above condition, if the project trees in the stratum were planted prior to the declaration date, the initial carbon stocks for the stratum must be calculated using Equation 3.1 ***[Section 6.21]***.

Calculating standard error for initial carbon stocks for a stratum

If all the project trees in the stratum were planted after the declaration date, the standard error for initial carbon stocks for the stratum is zero.

Subject to the above condition, if project trees were planted in the stratum prior to the declaration date, the standard error for initial carbon stocks for the stratum must be calculated using Equation 3.2 ***[Section 6.22]***.

Calculating closing carbon stocks for a stratum

The closing carbon stocks for the stratum to the end of reporting period must be calculated using Equation 3.3 ***[Section 6.23]*** and the standard error for closing carbon stocks for the stratum to the end of reporting period must be calculated using Equation 3.4 ***[Section 6.24]***.

Calculating mean plot carbon stocks for a stratum, plots and trees within plots

The mean plot carbon stocks for the stratum to the end of reporting period must be calculated using Equation 3.5 ***[Section 6.25]*** and the standard error for mean plot carbon stocks in stratum at the end of the reporting period must be calculated using Equation 3.6 ***[Section 6.26]***.

The carbon stocks in the carbon pools sampled within each plot assessed as part of a carbon inventory must be calculated using Equation 4.1 ***[Section 6.27]***.

The amount of carbon contained in the biomass of trees within a plot must be calculated using Equation 4.2 ***[Section 6.28]***.

Calculating carbon stocks in the roots of harvested trees for a harvest project

If the project is a harvest project and the project proponent opts to measure the carbon contained in roots of harvested trees for a plot the carbon dioxide equivalent of carbon contained in roots of harvested trees in the plot must be calculated using Equation 4.3 ***[Section 6.29]***.

Calculating carbon stocks in litter within a plot

If the project proponent opts to measure the carbon contained in the litter in a plot in accordance with section 5.30, then:

- the carbon dioxide equivalent of carbon stocks in the litter in the plot must be calculated using Equation 4.4 ***[Section 6.30]***; and
- the biomass of the litter in the plot must be calculated using Equation 4.5 ***[Section 6.31]***.

Calculating carbon stocks in coarse woody debris within a plot

If the project proponent opts to measure the carbon contained in the coarse woody debris (CWD) in a plot, then

- the carbon dioxide equivalent of carbon stocks in the CWD in the plot must be calculated using Equation 4.6 ***[Section 6.32]***;
- the carbon stocks in coarse woody debris within a decay class in the plot must be calculated using Equation 4.7 ***[Section 6.33]***; and
- the volume of CWD for each decay class, k, must be calculated using Equation 4.8 ***[Section 6.34]***.

Calculating biomass of project trees in a plot

The total biomass of project trees in a plot must be calculated using Equation 4.9 ***[Section 6.35]***.

Calculating biomass in the roots of harvested trees in a plot for a harvest project

If the project is a harvest project and the project proponent opts to estimate the carbon contained in roots of harvested trees for a plot then the total biomass contained in the roots of harvested trees in the plot must be calculated using Equation 4.10 ***[Section 6.36]***.

Calculating biomass in the roots of harvested trees under a replant system

If the project is a harvest project under a replant system and the project proponent opts to estimate the carbon contained in roots of harvested trees for a plot then the total biomass contained in the roots of harvested trees in the plot must be calculated using Equation 4.11 ***[Section 6.37]***.

Note that under a replant system, all tree roots are assumed to die at the time of harvest. Calculation of the residual biomass of the roots of harvested trees may be undertaken at any time after harvest by applying the specified decay function (Equation 4.11).

Calculating carbon stocks in the roots of harvested trees under a coppice system

If the project is a harvest project under a coppice system and the project proponent opts to measure the carbon contained in roots of harvested trees for a plot then the total biomass contained in the roots of harvested trees in the plot must be calculated using Equation 4.12 ***[Section 6.38]***.

Note that under a coppice system, all tree roots are taken to remain alive after harvest, but their biomass is taken not to change after the first harvest.

Subdivision 6.4.2 Calculating project emissions

Calculating project emissions for a reporting period

The emissions from fuel use as specified under section 5.31 and fire events as specified under section 5.32, during a reporting period must be calculated using Equation 5.1 ***[Section 6.39]***.

The standard error for project emissions must be calculated using Equation 5.2 ***[Section 6.40]***.

Note that in order to simplify the calculation, it is assumed that there is no error when estimating emissions from fossil fuel use. Therefore any error is only associated with estimates of carbon losses and greenhouse gas emissions due to fire.

The emissions from fuel use for the stratum for a reporting period must be calculated using Equation 5.3 ***[Section 6.41]***. The emissions of carbon dioxide, methane and nitrous oxide resulting from the type of fuel use for the stratum must be calculated using Equation 5.4 ***[Section 6.42]***.

Subdivision 6.2.5 Calculating fire emissions for a fire-affected stratum

Calculating emissions for a fire-affected stratum

The methane and nitrous oxide emissions from fire for a fire-affected stratum during a reporting period must be calculated using Equation 5.5 ***[Section 6.43]***.

Subject to section 6.46, the amount of methane emitted from a fire-affected stratum for a reporting period must be calculated using Equation 5.6 ***[Section 6.44]***, and the amount of nitrous oxide emitted from a fire-affected stratum for the reporting period must be calculated using Equation 5.7 ***[Section 6.45]***.

Calculating the weight of elemental carbon emitted from fire

If the mean plot carbon stocks for plots within non-fire-affected stratum at the end of the reporting period is less than the mean plot carbon stocks for plots within fire-affected stratum at the end of reporting period then methane and nitrous oxide emissions and the standard error for these values can be assumed to be zero. Refer to section 6.450, Equation 5.12 for the calculation of the standard error for elemental carbon emitted from fire ***[Section 6.46]***.

In all other cases the weight of elemental carbon emitted as a result of fire from a fire-affected stratum for reporting period must be calculated using Equation 5.8.

However if the entire stratum is fire -affected, then the mean plot carbon stocks for the stratum reported in the previous offsets report can be used for the value of the mean plot carbon stocks for plots within the fire-affected stratum at the end of the current reporting period in the calculation that uses Equation 5.8.

Calculating standard error for emissions from a fire-affected stratum

The standard error for the methane and nitrous oxide emissions from fire for a fire-affected stratum during a reporting period must be calculated using Equation 5.9 ***[Section 6.47]***.

The standard error for the amount of methane and nitrous oxide emitted from a fire-affected stratum for the reporting period must be calculated using Equation 5.10 ***[Section 6.48]*** and Equation 5.11 ***[Section 6.49]*** respectively.

Calculating standard error for the weight of elemental carbon emitted from fire

Subject to section 6.46, the standard error for the weight of elemental carbon emitted as a result of fire from a fire-affected stratum for a reporting period must be calculated using Equation 5.12 ***[Section 6.50]***.

Subdivision 6.2.6 Calculating probable limits of error

Calculating the probable limits of error for closing carbon stocks

The probable limits of error for the estimate of closing carbon stocks in a project at the end of a reporting period must be calculated using Equation 6.1 ***[Section 6.51]***.

In order to calculate the degrees of freedom, using Equation 1.4 in subsection 6.9, the project proponent must replace the term $SE\Delta C_{Stratum,j,Ri}$ in Equation 1.4 with the closing carbon stocks for the project before making the calculation.

Estimating number of plots required to meet the target probable limits of error

The number of plots required to meet the target probable limits of error as specified in section 5.3, may be estimated from Equation 6.2 ***[Section 6.52]***.

Note that if stratified sampling is applied, it is assumed that any increase in the number of plots will be applied proportionately across all strata. For example, if the number of plots in a project must be increased by 30% to meet the precision standard, then the number of plots in any stratum must also be increased by 30%. To safeguard against having insufficient plots to meet the precision standard, it is recommended that the number of plots be increased by > 30% in some or all strata.

Subdivision 6.2.7 Allometric equations

Form of allometric equations

Allometric equations must be in the form denoted by Equation 6.2 as follows ***[Section 6.53]***:

$$y = f(x_1, x_2, \ldots, x_n)$$

Where:

y	Response variable, For example: total tree biomass, above-ground biomass; kg or litter biomass
$x_1, x_2, \ldots, x_n$	≥ 1 predictor measure(s), e.g. stem diameter, crown volume index; various dimensions.

Total tree biomass or above-ground biomass for a dead or burnt tree

To estimate total tree biomass or above-ground biomass for a dead or burnt tree an additional factor 'fraction remaining' must be applied in the form of Equation 7.2 ***[Section 6.54]***.

The total biomass for a biomass sample tree or a test tree must be calculated using Equation 7.3 ***[Section 6.55]***.

Subdivision 6.2.8 Root biomass from a root:shoot ratio

Estimating root biomass from a root:shoot ratio

If the root biomass of a tree is a biomass component that has been estimated in accordance with section 5.25, then Equation 7.3 in section 6.55 must be used to calculate the total biomass for the tree ***[Section 6.56]***.

Alternatively, if the root biomass of a tree is estimated through the use of a root:shoot ratio calculated for the relevant modelling stratum in FullCAM according to section 5.25, then the project proponent must:

- add the dry weight of each above-ground biomass component (e.g. stem, crown, dead attached material) so as to estimate total above-ground biomass for a biomass sample tree or a test tree B_{AGB} using Equation 7.4;
- calculate the total root biomass for the biomass sample tree or the test tree using Equation 7.5; and
- calculate the sum of the output values from Equations 7.4 and 7.5 using Equation 7.3 by treating B_{AGB} and B_{Root} as two separate biomass components

Calculating above-ground biomass for a biomass sample tree, or test tree

The total above-ground biomass for a biomass sample tree or a test tree must be calculated using Equation 7.4 ***[Section 6.57]***.

Calculating the total root biomass of a tree

If a project tree has not been harvested, the root:shoot ratio has been estimated using FullCAM in accordance with section 5.25 and the above-ground biomass of the tree has been estimated from an allometric function using Equation 7.1 in accordance with section 6.53

then the total dry weight of all root biomass components must be calculated using the Equation 7.5 ***[Section 6.58]***.

Note that the root biomass components include the tap root or lignotuber and lateral roots.

Calculating the dry weight of biomass components of trees

The total biomass dry weight of the biomass component, k, of a biomass sample tree or test tree must be calculated using Equation 7.6 ***[Section 6.59]***.

Calculating the mean of residuals

The mean of residuals must be calculated using Equation 7.7 ***[Section 6.60]***.

Note that in Equation, 7.7 the mean of the residual biomass is calculated as the difference between the measured biomass of biomass sample trees or test trees and the biomass predicted from the allometric function.

Calculating the weighting factor for weighted least squares regression

A weighting factor must be calculated in in accordance with section 5.10. The weighting factor must be of the form of Equation 7.8 ***[Section 6.61]***.

Division 6.3 Data Collection

Greenhouse gas emissions from fuel

A project proponent must retain records that can be used to estimate the quantity of fuel, recorded in kilolitres (kL), for each fuel type combusted when undertaking project activities within a reporting period ***[Section 6.62]***.

Greenhouse gas emissions from fire

A project proponent must collect data relating to the occurrence of fire events in accordance with Part 3 ***[Section 6.62]***.

Data collection for project greenhouse gas sequestration

A project proponent must ascertain and record the listed items in the manner specified in the Technical Reference Guide where applicable, for the purposes of calculating project removals ***[Section 6.63]***.

Part 7 Monitoring, record-keeping and reporting requirements

Division 7.1 General

Application

The effect of subsection 106(3) of the Act is that a methodology determination may require the project proponent of an eligible offsets project to comply with specified monitoring, record-keeping and reporting requirements. Under Parts 17 and 21 of the Act, a failure to comply with these requirements may constitute a breach of a civil penalty provision, and a financial penalty may be payable.

The monitoring, record-keeping and reporting requirements specified in Part 7 of the Determination are in addition to any requirements specified in the Regulations ***[Section 7.1]***.

Division 7.2 Monitoring requirements

Project monitoring

The Determination ensures that, at a minimum, an in-field inspection and measurements will be made no later than every 5 years during the crediting period for the project. This involves the collection of measurements and other data that are needed to confirm that project requirements continue to be met during the crediting period ***[Section 7.2]***.

However if the end of the current crediting period is within 2 years of the date that the ortho-rectified aerial imagery must be sourced for a stratum, the project proponent is permitted to wait and source the imagery for the stratum at the end of the current crediting period.

Outside of the carbon inventory process, the project proponent can use a combination of on-ground surveys, field inspections and remote monitoring approaches, such as interpretation of aerial or satellite imagery, to monitor that the project continues to meet project eligibility requirements. Records relating to these and other relevant forest management activities should be retained and made available to the Regulator on request. Note that the Act includes additional requirements that must be met for the remainder of the maximum potential relinquishment period for the project.

The project proponent is also required to continue to monitor strata during the crediting period so as to confirm that there are no changes to stratum area and to record the occurrence and extent of any growth disturbance events. This monitoring activity can include in-field visits or remote monitoring approaches such as review of aerial imagery, or a combination of these activities.

If the monitoring specified above identifies that the height and crown cover requirements for project trees in a stratum as set out in section 2.3 are not met the non-compliant area must not be included in calculations for the stratum area and the project proponent must:

- deem the stratum area to be zero; and
- deem any carbon stocks in the stratum to be zero.

A project proponent may redefine the stratum boundaries in accordance with Part 3 so that land that does not meet the height and crown cover requirements is not included in the stratum area.

Division 7.3 Record-keeping requirements

Under paragraph 106(3)(c) of the Act, a methodology determination can require project proponents to comply with record-keeping requirements relating to the project. A project proponent who fails to comply with a record-keeping requirement relating to the project will have contravened a civil penalty provision under section 193 of the Act ***[Section 7.3]***.

Paragraph 17.1(2)(b) of the Regulations requires the project proponent to make a record of information that the applicable methodology determination requires to be recorded.

The Determination specifies that in order to satisfy paragraph 17.1(2)(b) of the Regulations, the project proponent must make a record of the information set out in Divisions 7.3 and 7.4 of the Determination ***[Sections 7.4 to 7.10]***.

Subregulation 17.1(1) of the Regulations requires project proponents to retain the specified records, or copies of the records, for 7 years after the records are made.

Division 7.4 Offsets report requirements

Subdivision 7.4.1 Information that must be included in the first offsets report

Subdivision 7.4.1 sets out the additional information that must be included in the first offsets report submitted for the project. General information that must be contained in all offsets reports is set out in Subdivision 7.4.2. Subsection 7.11(2) clarifies that the first report must also contain this general information ***[Sections 7.11 to 7.15]***.

Subdivision 7.4.2 Information that must be included in all offsets reports

Paragraph 6.2(j) of the Regulations requires that an offsets report must set out any information that has to be submitted in the report under the applicable methodology determination.

Subdivision 7.4.2 sets out the information that must be submitted in all offsets reports for the project. This includes the first and all subsequent reports ***[Sections 7.16 to 7.28]***.

Attachment B

Statement of Compatibility with Human Rights

Prepared in accordance with Part 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011*

Carbon Credits (Carbon Farming Initiative) (Measurement Based Methods for New Farm Forestry Plantations) Methodology Determination 2014 This legislative instrument is compatible with the human rights and freedoms recognised or declared in the international instruments listed in section 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011*.

Overview of the Legislative Instrument

The *Carbon Credits (Carbon Farming Initiative) (Measurement Based Methods for New Farm Forestry Plantations) Methodology Determination 2014* (the Determination) sets out detailed rules for implementing and monitoring projects under the Carbon Farming Initiative to sequester carbon by establishing and maintaining trees that have the potential to attain a height of at least 2 metres, and a crown cover of at least 20%, on land that has previously been used for agricultural purposes in any part of Australia.

The Determination provides for the calculation of the net project abatement of greenhouse gases during a reporting period by estimating the carbon dioxide stored in the biomass of project trees, litter and fallen dead wood, known as ‘project forest biomass’. Any carbon dioxide removed from the atmosphere and stored as carbon within project forest biomass at the time the project commences, and emissions of carbon dioxide, methane or nitrous oxide from fossil fuel use and fire events during the reporting period, are then subtracted from the project abatement.

Project proponents wishing to implement the Determination must make an application to the Clean Energy Regulator (Regulator) and meet the eligibility requirements set out under the *Carbon Credits (Carbon Farming Initiative) Act 2011*. Offsets projects that are approved by the Regulator can generate Australian carbon credit units that can be sold to businesses in Australia wanting to offset their own carbon pollution or participate in carbon markets.

Human rights implications

This legislative instrument does not engage any of the applicable rights or freedoms.

Conclusion

This legislative instrument is compatible with human rights as it does not raise any human rights issues.