

REPLACEMENT EXPLANATORY STATEMENT

Issued by the Authority of the Minister for Climate Change and Energy

Carbon Credits (Carbon Farming Initiative) Act 2011

Carbon Credits (Carbon Farming Initiative— Estimation of Soil Organic Carbon Sequestration using Measurement and Models) Methodology Determination 2021

Purpose

The *Carbon Credits (Carbon Farming Initiative—Estimation of Soil Organic Carbon Sequestration using Measurement and Models) Methodology Determination 2021*

(the Determination) credits projects that store carbon in agricultural soils by undertaking new, eligible management activities.

The Determination sets out the rules for calculating, crediting and reporting the net soil carbon sequestration from projects undertaking such activities for the purpose of creating Australian carbon credit units (ACCUs). It also sets out the rules for eligibility of projects to be credited for soil carbon sequestration, and specific notification and monitoring requirements.

Background to the Emissions Reduction Fund

The *Carbon Credits (Carbon Farming Initiative) Act 2011* (the Act) enables the crediting of greenhouse gas abatement from emissions reduction activities across the economy.

Greenhouse gas abatement is achieved either by reducing or avoiding emissions or by removing carbon dioxide from the atmosphere and storing it in soil, biomass or organic matter.

In 2014, the Australian Parliament passed the *Carbon Farming Initiative Amendment Act 2014*, which established the Emissions Reduction Fund (ERF). Further information on the ERF is available at: <https://www.dcceew.gov.au/climate-change/emissions-reduction/emissions-reduction-fund> or <https://www.cleanenergyregulator.gov.au/ERF>.

Emissions reduction 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 a methodology determination by legislative instrument. The purpose of a methodology determination is to establish

procedures for estimating abatement (through emissions avoidance or sequestration) from eligible projects and rules for monitoring, record-keeping and reporting. These determinations will ensure that emissions reductions are genuine—that they are both real and additional to business as usual (BAU).

In deciding to make a methodology determination, the Minister must have regard to the advice of the Emissions Reduction Assurance Committee (ERAC), an independent expert panel established to advise the Minister on proposals for methodology determinations. The Minister must not make or vary a methodology if the ERAC has advised that the instrument or variation to be made would not comply with the offsets integrity standards, which are set out in section 133 of the Act. The Minister must also consider any adverse environmental, economic or social impacts likely to arise as a result of projects to which a methodology determination applies.

Offsets projects undertaken in accordance with a methodology determination and approved by the Clean Energy Regulator (the Regulator) can generate ACCUs that represent greenhouse gas abatement achieved by the project.

Background to the Determination

In September 2020 the Australian Government's first *Low Emissions Technology Statement – 2020* (the Statement) identified soil carbon as one of Australia's priority low emissions technologies, setting a stretch goal of reducing the cost of soil carbon measurement to under \$3 per hectare per year. The Statement also noted that reducing the cost of soil carbon measurements has the potential to unlock soil carbon sequestration on a broad scale and improve farm productivity, including enhanced crop and pasture yields and boosted resilience to drought and erosion. Subsequently, in December 2020, a new soil carbon methodology determination was announced as one of 5 priority ERF methods to be developed in 2021.

The Determination aims to support greater uptake of soil carbon projects by overcoming barriers to participating in the ERF by reducing costs and introducing new activities to store carbon. For the first time it will allow modelled estimates of soil carbon change to be used, in combination with measurement approaches, which is expected to significantly reduce costs over time.

The Determination sets out the rules for calculating, reporting and crediting the soil carbon sequestration from projects undertaking new eligible management activities for the purpose of creating ACCUs.

The key features of the Determination are:

- Project proponents must conduct at least one new or materially different eligible management activity on land that was used for pasture, cropping or was bare fallow for at least the five years immediately before the project registration application was submitted.
- Project proponents must not conduct prohibited activities, and must conduct restricted activities only in accordance with the method.
- Project proponents can estimate carbon stocks at intervals of one to five years using one of the following approaches:
 - use soil core samples only to estimate soil carbon (*measurement-only or measurement-based estimates*);
 - use models **with** soil core samples (*model-assisted estimates*) to reduce the sampling density required to obtain precise estimates of soil carbon (and to validate the modelled estimates to support the *model-only estimates* approach);
 - use models **without** soil core samples (*model-only estimates*) using validated model carbon stock estimates—this approach cannot be used for the baseline estimate and must be complemented with one of the other two approaches at least once every 10 years to ensure estimates are aligned with the abatement occurring in the relevant carbon estimation area (CEA).
- The Determination applies a statistical approach for adjusting estimates of soil carbon change to account for the possibility that observed changes are the result of sampling noise rather than management actions. This is referred to in the Determination as the ‘specified probability of exceedance’ approach. The percentage at which the probability of exceedance is set is contained in the Supplement—for Estimation of Soil Organic Carbon Sequestration Using Measurement and Models (referred to as (the **Supplement**) in the Determination (the Supplement).
- If claiming credits after only undertaking two sampling rounds or estimation events (including your baseline sampling round or first estimation event), 25% of the resulting creditable abatement (after the specified probability of exceedance approach and permanence discounts are applied) will be withheld until three

sampling rounds or estimation events have been reported and the soil carbon increases are maintained.

Legislative authority for making the Determination

The Determination is made under subsection 106(1) of the Act, which gives the Minister the power to make a methodology determination by legislative instrument.

Application of the Determination

The requirements set out in the Determination were designed to reflect the requirements of the offsets integrity standards and to ensure that credited emissions reductions are real and additional to BAU. The offsets integrity standards require that the application of the method specified in the Determination to a soil carbon project that is an eligible project results in carbon abatement that:

- is unlikely to occur in the ordinary course of events; and
- is eligible carbon abatement under the Act.

Additionally, the offsets integrity standards require that:

- carbon abatement amounts are measurable and capable of being verified; and
- the method specified in the Determination to ascertain the amount of greenhouse gas abatement attained by an eligible offsets project, is supported by clear and convincing evidence; and
- material emissions that are a direct consequence of an eligible offsets project are deducted; and
- estimates, assumptions or projections used in the method specified in the Determination should be conservative.

Persons wishing to implement projects under the Determination must make an application to the Regulator under section 22 of the Act. They must also meet the general eligibility requirements for an offsets project set out in subsection 27(4) of the Act, which include compliance with the requirements set out in the Determination, and the additionality requirements in subsection 27(4A) of the Act. The additionality requirements are:

- the newness requirement;

- the regulatory additionality requirement; and
- the government program requirement.

The Determination specifies a requirement in lieu of the newness requirement (see section 16 of the Determination) under subparagraph 27(4A)(a)(ii) of the Act. The purpose of the in lieu of the newness requirement is to allow projects to prepare a land management strategy before commencing the eligible management activity, and conduct baseline sampling before the project is declared an eligible offsets projects by the Regulator, but after providing a sampling plan for the baseline sampling round and an application for declaration of an eligible offsets project for the project to the Regulator.

Documents incorporated by reference

The Determination incorporates four documents by referring to the documents in several provisions, instead of reproducing the text and content of the incorporated documents in those provisions.

The Determination incorporates the second edition of the Australian Soil Classification, which was published in 2016 by the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The other three documents, namely The Supplement—for Estimation of Soil Organic Carbon Sequestration Using Measurement and Models, the Bureau of Meteorology’s 24-month recent and historical rainfall map and the National Greenhouse Accounts Factors (NGA Factors), are incorporated as in force from time to time. This means that if any of the other three documents changes, the changes will automatically be taken to be incorporated into the relevant provisions of the Determination, without the need to amend the Determination to refer to the new version of the document.

Some references to documents are required to be read with subsection 6(1) of the Determination. That subsection provides that if a calculation includes a factor that is defined or calculated by reference to another document, the factor to be used for a reporting period for a soil carbon factor period is the factor referred to in or calculated by reference to the document as in force at the end of the reporting period for the project.

The following table describes the documents that are incorporated by reference and the relevant provisions of the Determination. The table also describes how the documents can be obtained. As they are all available on the internet, all can be freely accessed by the public at no cost.

Name of document	Description of document	Manner of document's incorporation and legislative authority for incorporating document	Operation of provisions that incorporate the document by reference	Where document may be obtained, and freely accessed and used by public
Australian Soil Classification (Second Edition)	This document is prepared by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and provides a framework for organising knowledge about Australian soils by describing and classifying them.	The definition of <i>hypersulfidic material</i> in section 5 of the Determination refers to the second edition of the Australian Soil Classification, which was published in 2016. That version is incorporated, even though there are and may in future be subsequent editions of the document. This manner of incorporating this document in the Determination is authorised by subsection 106(8) of the Act.	The Australian Soil Classification is referred to in the definition of <i>hypersulfidic material</i> in section 5 of the Determination, which provides that in the Determination that term has the same meaning as in that document.	When this Replacement Explanatory Statement was made the Australian Soil Classification could be freely accessed and used at http://www.clw.csiro.au/aclep/asc_re_on_line_V2/soilglos.htm#br .
Supplement— for Estimation of Soil Organic Carbon Sequestration Using Measurement and Models (referred to as the <i>Supplement</i> in the Determination)	The Supplement sets out additional detail to be used in the application of the Determination.	The Supplement is incorporated as in force from time to time (see the definition of <i>Supplement</i> in section 5 of the Determination). Incorporating a document in this manner is authorised by subsection 106(8) of the Act.	Parts 1, 3, 4, 5 and 7 of, and Schedules 1 and 2 to, the Determination contain requirements that need to be met with reference to the Supplement, as in force from time to time.	When this Replacement Explanatory Statement was made, the Supplement could be viewed on the Regulator's website (https://www.cleanenergyregulator.gov.au).
Bureau of Meteorology's 24-month recent and historical rainfall map	The document is prepared by the Bureau of Meteorology and includes Australian rainfall maps and data from 1900 to now. The maps are organised in such a way that the maps that relate to a particular date or period may be selected.	The document is incorporated as it exists from time to time. This is not expressly stated, however the Determination at subsection 11(7) sets out that the document is used to determine a period based on when land is recorded as having specified rainfall percentiles. Incorporating a document in this manner is authorised by subsection 106(8) of the Act.	The document is referred to in the definition of <i>relevant drought period</i> in subsection 11(7). The relevant drought period is defined as beginning when land is shown as mapped in a specified way on the map and ending when the land is no longer shown as mapped within the region. Section 11(2) prevents the destocking of land under pasture and paragraph 11(2)(b) excludes from that prohibition de-stocking when the de-stocking period is within the relevant drought period for the land as defined in subsection 11(7).	When this Replacement Explanatory Statement was made, the document was available at http://www.bom.gov.au/climate/maps/rainfall/?variable=rainfall&map=drought&period=24month&region=nat&year=2021&month=09&day=30 .
National Greenhouse	The NGA Factors document is	The document is incorporated as in force	The NGA Factors document is referred to in two provisions of	When this Replacement

Name of document	Description of document	Manner of document's incorporation and legislative authority for incorporating document	Operation of provisions that incorporate the document by reference	Where document may be obtained, and freely accessed and used by public
Accounts Factors (referred to as the <i>NGA Factors document</i> in the Determination)	prepared by the Department (previously by the Department of Industry, Science, Energy and Resources). The document provides methods that help companies and individuals to estimate greenhouse gas emissions.	from time to time (see the definition of <i>NGA Factors document</i> in section 45 of the Determination). Incorporating a document in this manner is authorised by subsection 106(8) of the Act.	the Determination, which require any relevant emissions factors set out in the NGA Factors document to be used in the calculation of irrigation energy emissions (section 53) and residue, tillage and soil landscape modification emissions (see section 58).	Explanatory Statement was made, the document could be accessed on the website of the Department of Industry, Science, Energy and Resources at https://www.industry.gov.au .

Permanence period and discounts

Section 23 of the Act provides that, if a project is a sequestration offsets project, an application to the Regulator under section 22 must include a request that the project be subject to either a 100-year or 25-year permanence period. Then, if the Regulator declares that the project is an eligible offsets project, the Regulator will declare that the project is subject to a 100-year or 25-year permanence period. Section 31A of the Act provides that once declared, the permanence period is fixed and it will not be possible for projects to “move between” permanence periods.

If the project proponent elects a 25-year permanence period, a permanence discount applies in accordance with section 16 of the Act. The permanence discount is 20% of the net abatement number unless another percentage is specified in the legislative rules.

As they are sequestration offsets projects under section 54 of the Act, projects undertaken in accordance with the Determination are subject to a risk of reversal buffer, as provided by section 16 of the Act. The risk of reversal buffer number is 5% unless another percentage is specified in the legislative rules.

Public consultation

The Determination was developed by the Regulator through a co-design process with industry, potential end-users, scientists and technical experts, and the ERAC. The co-design process involved workshops, bilateral stakeholder consultation, and technical reviews.

An exposure draft of the Determination was published on the website of the Department of Industry, Science, Energy and Resources for public consultation from 30 August 2021 to 27 September 2021. Forty submissions were received. In general, they indicated support for the proposed 2021 soil carbon method and in particular for the increased flexibility and reduced barriers that the method brings, as well as for the introduction of the hybrid measure-model-measure approach as a means to deliver a more cost-effective method.

Details of the non-confidential submissions received during public consultation are provided on the Department of Industry, Science and Resources' website, <https://www.industry.gov.au/>.

Determination details

Details of the Determination are at Attachment A. Numbered sections in this explanatory statement align with the relevant sections of the Determination. The definition of terms highlighted in ***bold italics*** can be found in the Determination.

For the purposes of subsections 106(4), (4A) and (4B) of the Act, in making the Determination the Minister has had regard to, and agrees with, the advice of the ERAC that the Determination complies with the offsets integrity standards and that the Determination should be made. The Minister is satisfied that the carbon abatement used in ascertaining the carbon dioxide equivalent net abatement amount for a project is eligible carbon abatement from the project. The Minister has also had regard to whether any adverse environmental, economic or social impacts are likely to arise from the carrying out of the kind of project to which the Determination applies, and to other relevant considerations.

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

Details of the Determination

Part 1 - Preliminary

1 Name

Section 1 sets out the full name of the Determination, which is the *Carbon Credits (Carbon Farming Initiative—Estimation of Soil Organic Carbon Sequestration using Measurement and Models) Methodology Determination 2021*.

2 Commencement

Section 2 provides that the Determination commences on the day after it is registered on the Federal Register of Legislation.

3 Authority

Section 3 provides that the Determination is made under subsection 106(1) of the Act.

4 Duration

Section 4 sets out the period during which the Determination is in force.

Under subparagraph 122(1)(b)(i) of the Act, a methodology determination remains in force for the period specified in the Determination. The Determination will remain in force for the duration set out in section 4 unless sooner revoked in accordance with section 123 of the Act or section 42 of the *Legislation Act 2003*.

Paragraph 4(a) provides that the Determination begins on commencement (as set out in section 2).

Paragraph 4(b) provides that, unless sooner revoked, the Determination ends on the day before it would otherwise be repealed under subsection 50(1) of the *Legislation Act 2003*.

Instruments are repealed under that provision on 1 April or 1 October following the tenth anniversary of registration on the Federal Register of Legislation. Paragraph 4(b) ensures that the Determination will expire in accordance with subparagraph 122(1)(b)(i) of the Act.

If the Determination expires in accordance with section 122 of the Act or is revoked under section 123 of the Act during a crediting period for a project to which the Determination

applies, the Determination will continue to apply to the project during the remainder of the crediting period under subsections 125(2) and 127(2) of the Act. Project proponents may apply to the Regulator during a reporting period to have a different methodology determination apply to their projects from the start of that reporting period (see subsection 128(1) of the Act).

5 Definitions

Section 5 defines terms used in the Determination. Generally, where terms are not defined in the Determination, they have the meaning given by section 5 of the Act.

Under section 23 of the *Acts Interpretation Act 1901*, words in a legislative instrument in the singular number include the plural and words in the plural number include the singular.

The following terms used in the Determination are particularly important because they help specify the project requirements in Parts 2 and 3.

The definition of ***bare fallow*** informs whether a management activity is an eligible management activity under section 7(2) of the Determination, and whether land is eligible land under section 9 of the Determination. The term in relation to land, means land that is not seeded and has less than 40% ground cover for 3 months or longer.

The definition of ***baseline nominated soil depth*** informs the sampling requirements. The term means the nominated depth of soil in the baseline sampling round sample under subsection 7(1) of Schedule 1 or, as applicable pursuant to section 15, subsection 8(1) of Schedule 2.

The ***baseline period*** informs the length of time prior to registering a soil carbon project, or adding an area of land to a project, which is relevant for assessing whether eligible management activities are new, calculating the net abatement amount, and calculating the change in emissions in a reporting period. This period of time is five years before making the application to register an ERF project or add land to the project.

The ***baseline sampling round*** is the sampling round that must be conducted under both Schedule 1 and Schedule 2 before the end of the first reporting period against which changes in carbon stock are compared.

The definition of ***biochar*** informs what organic material can be added to the soil in land, that is, or is to be, part of a CEA. The term refers to organic material (such as animal manure,

human effluent, plant residue and woody waste) that has undergone a pyrolysis or gasification process, and specifically excludes tyres and other rubber products.

The definition of **clearing** informs whether land is eligible under the Determination. The term means the conversion of land with forest cover to land without forest cover through the destruction of trees or saplings by intentional burning, mechanical or chemical means.

The definition of **cover crop** informs whether a management activity is an eligible management activity under the Determination. The term means a crop that is planted for the purposes of improving the soil by providing ground cover. It can be grazed by livestock.

The definition of **cropping** informs whether land is eligible under the Determination. The term means land that is used to grow agricultural crops for commercial purposes. This includes woody horticulture such as vines in vineyards, but explicitly excludes plantation forestry.

The definition of a **designated waste-stream** informs the use of non-synthetic fertilizer and biochar under the Determination. The term means an organic waste-stream from one of the following:

- (a) intensive animal production;
- (b) food processing;
- (c) manufacturing;
- (d) sawmill residue; or
- (e) municipal or commercial waste collection processes. This includes restaurant and supermarket waste and human effluent waste streams.

The definition of **de-stocked** informs what activities may or must be conducted on land that is pasture. An area of land under pasture is considered destocked if land which is permanent pasture, or pasture for a period of at least two years, is never grazed, nor intended to be grazed, by production livestock.

The definition of **fertiliser** informs whether a management activity is an eligible management activity under the Determination. The term means any synthetic or non-synthetic substance that supplies key chemical elements to plants and soils to enhance plant growth and the fertility of soils.

The definitions of **forest cover** and **forest potential** inform how soil carbon projects interact with projects registered under other sequestration methods. An area of land will be classified as land with forest cover where trees have a height of at least 2 metres, crown canopy cover of at least 20% and cover at least 0.2 of a hectare. An area of land will be classified as land with forest potential if: the land has an area of at least 0.2 of a hectare, and the land has trees that, having regard to the location and characteristics of the land, are reasonably likely to reach 2 metres or more in height, and provide crown canopy cover of at least 20% of the land. This definition is consistent with the definition used by Australia in meeting international reporting obligations.

The definition of **gypsum** informs whether a management activity is an eligible management activity under the Determination. The term means a product which is mainly composed of calcium sulfate dihydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) and is used to manage soil sodicity or magnesian properties, or improve the structure of sodic clay soils.

The definition of **hypersulfidic material** informs land management activities that are not to be conducted on land that is, or is to be, part of a CEA. The meaning of **hypersulfidic material** is given by the second edition of the Australian Soil Classification published by the Commonwealth Scientific and Industrial Research Organisation in 2016. While there may be subsequent editions of the Australian Soil Classification, the hypersulfidic definition as applied to the Determination, will remain as the definition used in the second edition. In 2021, the second edition of the Australian Soil Classification could be accessed from <http://www.clw.csiro.au/> with the glossary available at http://www.clw.csiro.au/aclep/asc_re_on_line_V2/soilglos.htm#br

The definition of **lime** informs whether a management activity is an eligible management activity under the Determination. The term means a product which is mainly comprised of calcium carbonate (CaCO_3) or calcium magnesium carbonate (commonly known as dolomite) ($\text{CaMg}(\text{CO}_3)_2$), or both, and which is used to manage acidity in agricultural soils.

The definition of **maintain** informs project proponents obligations' to conduct eligible management activities. The term includes the circumstance where a completed land management activity has a continuing impact on the storage of additional soil organic carbon in the land. For example, water ponding or incorporation of clay may only be carried out once, but is reasonably expected to continue to impact on the storage of additional carbon after the activity is completed.

The definition of ***material deficiency*** informs whether a management activity is an eligible management activity under the Determination. The term is defined as a concentration or availability of one or more nutrients in the soil, where the concentration or availability limits plant growth to materially less than could otherwise have been achieved in that location.

The definition of ***irrigation efficiency savings*** informs whether a management activity is an eligible management activity or a restricted activity under the Determination. The term means improvements to the efficiency of irrigated water that result from improving the efficiency of on-farm irrigation infrastructure or management practices or both. If the section 27 declaration of the project was made after 30 August 2021, the irrigation infrastructure and management practices must occur within the project area. This ensures the irrigation efficiency savings are obtained from within the project for new projects while grandfathering the previous eligibility requirements for transferring projects.

The definition of ***new irrigation*** informs whether a management activity is an eligible management activity or a restricted activity under the Determination. The term means new or additional irrigation applied to land in a project area for a project using water obtained through irrigation efficiency savings made after the date on which the section 27 declaration of the project was made.

The definition of ***non-synthetic fertiliser*** informs whether a management activity is an eligible management activity or a restricted activity under the Determination. The carbon content of any fertiliser that meets the definition of non-synthetic fertiliser that was applied to the project within two years of sampling must be accounted for under Part 4 of the Determination. Non-synthetic fertiliser means any biologically-derived solid or liquid substance that is used to supply nutrients to plants and soils, enhance plant growth and soil fertility or add or stimulate microbial or other life in soils. Non-synthetic fertiliser must contain at least 5% organic matter by weight. If it contains less than 5% organic matter it is classified as synthetic fertiliser. It must be applied in accordance with the laws and regulations of the relevant State, Territory or local government. Non-synthetic fertiliser does not include non-biodegradable substances, such as plastics, rubber or coatings and also does not include biochar.

The definition of ***nutrient*** informs whether a management activity is an eligible management activity under the Determination. The term includes trace minerals, macro-nutrients (such as nitrogen, phosphorus, potassium and sulphur) and micro-nutrients.

The definition of ***organosol*** informs whether land is eligible under the Determination. The term means soil containing more than 10% organic carbon within the upper 30 centimetres (cms) of the soil profile.

The definition of ***pasture*** informs whether land is eligible under the Determination. The term means land that is under any combination of perennial grasses, annual grasses, or legumes, and on which production livestock is raised.

The definition of ***permanence obligation period*** informs project proponents of the length of time eligible management activities must be conducted for, and the length of time for which excluded activities under section 11, or restricted activities under section 12, must not be conducted. The term, in relation to a soil carbon project, means the period from the date on which the project was declared until the last day the Regulator could issue a notice to relinquish ACCUs under Division 3 of Part 7 of the Act.

The definition of ***permanent pasture*** informs the timing for implementing the first eligible management activity in the context of project declaration, sampling and reporting. Permanent pasture means agricultural land that is continuously under pasture, including perennials and annual grasses and legumes, not bare fallowed.

The definition of ***restricted non-synthetic fertiliser*** informs to what extent non-synthetic fertiliser can be applied to soil within a CEA. The term means a non-synthetic fertiliser that includes more than 5% organic matter that did not previously form part of a designated waste stream or was not sourced from within a CEA that is part of the project.

The definition of **relevant landholder** is relevant for meeting the requirements of the land management strategy. The term means any person other than the project proponent who, whether by reason of ownership or otherwise, has operational control of land that is covered by the land management strategy. Operational control refers to having the ability to control the management of land for agricultural uses and its management during periods when it is not being used for agricultural uses.

The definition of **sampling round** is relevant for determining net abatement. The term means soil sampling conducted during a finite period to develop an estimate of soil organic carbon stocks at a particular point in time.

The definition of **soil amendment** informs whether materials can be added to soil that is, or is to be, part of a CEA. The term means a substance to improve the health or quality of soil, such as fertiliser, recycled organic materials, lime or gypsum.

The definition of **soil core** informs the information required for each sampling round conducted during the reporting period. The term means a discrete portion of soil that has been extracted with a coring device, and includes the gravel and fine fraction.

The definition of **stubble** informs whether a management activity is an eligible management activity. The term means the residue remaining on the soil surface after a crop has been harvested and prior to application of any management practice that incorporates the residues into the soil.

The definition of **structure** informs whether land is eligible under the Determination. The term is defined as an object that is made of several parts, that prevents pasture or cropping from occurring underneath more than 5% of the ground area of the object. This definition is intended to omit solar panels or other structures under which agricultural activities may still occur.

The definition of **synthetic fertiliser** informs the treatment of fertiliser under the Determination. The term means any synthetic substance that is used to supply nutrients to plants and soils to enhance plant growth and the fertility of soils; and does not include biochar or more than 5% organic matter by weight. Fertiliser that includes more than 5% organic matter is non-synthetic fertiliser under the Determination. Synthetic fertiliser must be used in accordance with any relevant laws of the relevant State, Territory or local government.

The definition of **thinning** informs what activities can be conducted under section 12 of the Determination on land, that is, or is to be, part of a CEA. The term means the removal of woody biomass (whether dead or alive) from the land.

The definition of **tillage** informs whether a management activity is an eligible management activity under the Determination. The term means any form of mechanical preparation of the soil.

The definition of **wetlands** informs whether land is eligible under the Determination. The word has the meaning given in the CFI Regulations.

6 References to factors and parameters from external sources

Section 6 refers to factors or parameters used in calculations that are derived from external sources. Factors or parameters used in this Determination are derived from the National Inventory Report (that contains national greenhouse gas emission estimates from 1990 to the current year of reporting and is available on the Department of Industry, Science and Resources' website), the Supplement, the NGA Factors document and the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (the NGER (Measurement) Determination) which is made under subsection 10(3) of the *National Greenhouse and Energy Reporting Act 2007*.

The effect of subsection 6(1) is that if those instruments are amended during a project's reporting period, then the project proponent will be required to use the factor or parameter prescribed in the instrument that is in force at the end of the reporting period.

Paragraph 6(2)(a) provides that subsection 6(1) does not apply if the Determination sets out other requirements.

Paragraph 6(2)(b) provides that subsection 6(1) does not apply where it is not possible to apply a factor or parameter in an instrument that is in force at the end of the reporting period. An example of circumstances where this may occur is where the monitoring approach defined in an external source is amended to require additional or different monitoring practices after the reporting period has commenced. In this circumstance it is not possible to retrospectively undertake monitoring activities in accordance with the new requirement.

As provided for by section 10 of the *Acts Interpretation Act 1901* and section 13 of the *Legislation Act 2003*, references to external documents which are legislative instruments

(such as the NGER (Measurement) Determination) are references to versions of those instruments as in force from time to time. In circumstances where paragraph 6(2)(b) applies, it is expected that project proponents will use the version of instruments in force at the time at which monitoring or other actions were conducted.

Part 2 - Soil carbon projects

7 Soil carbon projects

The effect of paragraph 27(4)(b) and 106(1)(a) of the Act is that a project must be covered by a methodology determination, and that the methodology determination must specify the kind of offsets project to which it applies.

Section 7 of the Determination specifies the high-level features of soil carbon projects that distinguish them from other kinds of offsets projects. Subsection 7(1) states that the Determination applies to projects that sequester carbon in soils in an agricultural system within Australia, excluding the external territories, through carrying out one or more eligible management activities.

Subsection 7(2) sets out a list of eligible management activities for the purposes of the Determination.

The following should be noted about the eligible management activity at subparagraph 7(2)(a)(v): Re-establishing or rejuvenating a pasture by seeding or pasture cropping. This process may aim to improve existing areas of pasture by activities that include, but are not limited to, attempting to increase ground cover, diversity of species types or establishing species with complementary seasonal and growth phases. Re-establishing or rejuvenating a pasture could involve pasture cropping, where planting of different plant types, such as cereals, sub-clover and ryegrass may complement different seasonal growth patterns and improve productivity.

Proponents may implement other management activities, provided they are not covered in section 11 and on the condition that they are carried out in accordance with any applicable criteria specified in section 12 of the Determination. This provides proponents with the flexibility to respond to market forces, participate in the ERF and continue to make land management decisions enabling them to meet their broader business objectives. The list of eligible management activities does not restrict the undertaking of innovative activities that are outside of the listed activities that are also aimed at improving carbon stocks. However, these additional activities will not be eligible activities within the meaning of section 7.

Paragraph 7(2)(b) requires that for an eligible management activity to support project registration it must be demonstrated that the activity is a new activity or materially different from the land management activities conducted during the baseline period and can reasonably be expected to sequester more carbon than would otherwise occur. This means that for mixed farming enterprises (e.g. cropping and pasture) there must be an eligible management activity that is new or materially different being carried out or maintained for each farming enterprise type. For example, if there are cropping and pasture phases in the baseline period, in both phases during the project's permanence period, a new, eligible management activity must be undertaken or maintained (unless a single eligible management activity is applicable to both cropping and pasture).

Project eligibility requirements are defined more extensively in Part 3 of the Determination.

Part 3 - Project Requirements

Division 1- General

8 General

Section 8 indicates that Part 3 of the Determination specifies requirements that must be met in order for a soil carbon project to be an eligible offsets project.

The effect of paragraph 106(1)(b) of the Act is that a methodology determination must set out requirements that must be met for a project to be an eligible offsets project. Under paragraph 27(4)(c) of the Act, the Regulator must not declare that a project is an eligible offsets project unless the Regulator is satisfied that the project meets these requirements. Further, if a soil carbon project which has been declared as an eligible offsets project fails to meet any of these requirements, then pursuant to item 3 of subsection 32(1) of the *Carbon Credits (Carbon Farming Initiative) Rule 2015* made for the purposes of subsection 35(1) of the Act, the Regulator may revoke the declaration of the project as an eligible offsets project.

9 Project area and eligible land

Eligible land

Section 9 provides that a project area must include eligible land. Land that is not eligible land can still be part of a project area, as either an exclusion zone or an emissions accounting area.

Subsection 9(1) sets out the requirements for land to be eligible land.

The effect of paragraph 9(1)(a) is that to be eligible land, during the five year baseline period the land must have been used for one of the following agricultural uses: pasture used for grazing, cropping, bare fallow, or any combination of grazing, cropping or bare fallow, provided one or more applied at all times during the baseline period. Plantation forestry is not considered to be an eligible type of land use.

The effect of paragraph 9(1)(b) is that land is not eligible land if there are dwellings or other structures on it. Other structures includes sheds, roads, dams, stock yards, bores and aerial or wind towers. It does not include fences, solar panels or other structures under which agricultural activities may still occur and soil sampling can take place.

Paragraph 9(1)(c) clarifies that in order for land to be eligible land it must have soil organic carbon sequestration potential given the eligible management activities proposed.

Paragraph 9(1)(d) requires that for land to be eligible land it must be possible to sample the land in a way that is consistent with the requirements of the Determination. An example of where it is not possible to sample the land in a way that is consistent with the requirements of the Determination is where obstructions, such as rocks, would consistently prevent extraction of soil cores. Assuming the land is used for agricultural production and cannot be sampled in a way that is consistent with the requirements of the Determination, this land would be classified as an emissions accounting area under section 5 of Schedule 1 and section 6 of Schedule 2.

Subsection 9(2) sets out the circumstances under which land would not be eligible land.

The effect of paragraph 9(2)(a) is that land is ineligible if it is or becomes a project area or part of a project area of another eligible offsets project that is a sequestration offsets project and it has forest cover or forest potential. This is not intended to prevent the overlap of project areas (where vegetation and soil carbon projects are occurring on the same property), but is in place to prevent the overlap of CEAs across two methods.

The intent of paragraph 9(2)(b) is to prevent the clearing of native forest and draining of wetlands on eligible land, or land intended to be eligible. Such events could result in increases in emissions as a result of implementing the soil carbon project, which would not be accounted for in this Determination.

The intent of paragraph 9(2)(c) is to prevent the disturbance of land containing organosol (for example, peatland), which could lead to significant losses of carbon and release nitrogen into the atmosphere.

Varying project areas

The intent of subsection 9(4) is to define the circumstances under which the project area, as defined at project registration, may be varied (as provided for under section 29 of the Act) and remain as an eligible offsets project. This is to ensure that project area variations do not lead to emissions that are not accounted for in net abatement calculations.

Under some circumstances a project area may need to be varied to remove some land from the project. A project area variation is not subject to method restrictions where the first offsets report has not been submitted, or the land to be removed is an exclusion zone or an emissions accounting area, or the land to be removed is the entire project area.

Subparagraph 9(4)(d)(i) sets further conditions that allow one or more whole CEAs to be removed after the first offsets report has been submitted.

Under sub subparagraph 9(4)(d)(i)(A), a project proponent may remove one or more whole CEAs after the first offsets report has been submitted provided the combined sequestration value for all CEAs to be removed is positive. This allows project proponents to remove poor performing CEAs provided that the sum of all CEAs to be removed has an overall net positive value, as calculated in equation 69 or equation 116. This mitigates the risk that project proponents may seek to game the method by removing one or more poor performing CEAs for the purpose of increasing the credits they are eligible to receive under the Act, while maintaining some flexibility for landholders who may need to remove CEAs after the first offsets report.

Under subsubparagraph 9(4)(d)(i)(B), project proponents can also remove one or more whole CEAs after the first offsets report has been submitted regardless of their sequestration value, if removal is not for the purpose of increasing the credits issued under the Act. This could include division of a property for sale for reasons where ACCUs are immaterial to the circumstances of the sale, or where some sampling strata were unintentionally placed outside of cadastral boundaries. ACCUs issued for any CEAs that are removed from the scheme (after first being transferred to another sequestration offsets project which is subsequently revoked on the basis of a voluntary revocation application) would need to be relinquished to the Regulator.

Subparagraph 9(4)(d)(ii) needs to be considered when removing one or more whole CEAs. The subparagraph provides that when removing one or more whole CEAs from which carbon has been moved to another CEA, then the CEA that has received the carbon must also be removed. This means that if soil or vegetation (e.g. crop residue) is redistributed from one CEA to another then both the source and destination CEAs must be removed. This is to prevent crediting for non-genuine abatement that is a result of moving carbon around a project.

Varying a project area is less straightforward when a part of a project area to be removed from a project does not constitute an entire CEA. Examples of this include the sale of a paddock where CEA boundaries are defined across separate land titles to be retained or sold. In this circumstance, a split of the CEAs on the basis of land titles may allow the areas to be

sold to be removed and the other areas to be retained, consistent with any requirements in the Supplement. If this is not possible, the whole CEA would need to be removed.

The intent of subsection 9(5) is to ensure that land that was eligible under a previous soil carbon method remains eligible under this Determination.

10 Activities to be conducted

Subsection 10(1) specifies the requirement to conduct or maintain at least one eligible management activity within all areas of land in CEAs until the end of the permanence obligation period for the project. The eligible management activity may change for an area of land over time, so long as, for the duration of the project's permanence period, at least one of the activities listed in section 7 is conducted or maintained. This allows for once-off activities that have continuing impacts for the duration of the permanence period (e.g. water-ponding).

Subsection 10(2) describes the timing for implementing the first eligible management activity in the context of project declaration, sampling and reporting.

To prevent potential leakage of emissions as a result of implementing the project by shifting livestock production to areas not covered by the soil carbon project, subsection 10(3) requires that land used as permanent pastures or pasture for a period of at least two years within a CEA must be grazed by production livestock at least once during a two year period unless subsection 11(2) applies. There is no minimum requirement for how long the pasture needs to remain grazed.

Subsection 10(4) allows for management activities other than those defined as eligible management activities under section 7 to be undertaken. The exception to this is activities excluded under section 11 or activities outside of the criteria stated under section 12.

11 Activities not to be conducted

Section 11 excludes certain activities being carried out between the application for declaration of the project and the end of the permanence obligation period for the project on land that is or is to be, part of a CEA. The intention of section 11 is to manage the risks of leakage, the crediting of non-genuine abatement and adverse impacts arising as a result of the project. Leakage occurs when activities undertaken within the project area result in carbon losses outside of the project area, which reduces the net environmental benefit of the project.

Section 11(2) prevents the destocking of land as defined in section 5 of the Determination. Under paragraph 11(2)(a), this excludes land that is to be converted to a cropping system. Under paragraph 11(2)(b), this excludes de-stocking when the de-stocking period is within the relevant drought period for the land as defined in subsection 11(7).

Under paragraph 11(2)(c), de-stocking of land is allowed if the Regulator agrees in writing that exceptional circumstances exist that require the landholder to de-stock the land. The exclusions to the destocking prohibition are intended to provide landholders the flexibility to de-stock their properties in circumstances such as drought, a disease outbreak among livestock or extenuating financial circumstances.

Subsection 11(3) requires that, after the baseline sampling round, land management activities do not disturb the soil below the baseline nominated sampling depth, and pyrolysed material that is not biochar must not be applied. Preventing activities that disturb the soil below the baseline nominated sampling depth is to allow for one-off activities such as water ponding and clay incorporation to be undertaken, but to prevent introduction of carbon from below the baseline nominated sampling depth and artificially increasing net abatement.

Under subsection 11(4) land management activities on hypersulfidic soils that result in the application of lime, drainage or physical disturbance, are not to be conducted. These activities would likely increase nitrous oxide emissions from these soils and reduce the net environmental benefit from the project.

Subsection 11(5) provides that an activity notified under subsection 11(6) by the Regulator to the project proponent cannot be conducted. Under subsection 11(6) the Regulator may notify a project proponent of activities that must not be undertaken. This is to control for activities that have not been accounted for in sections 10, 11 or 12 and are expected to result in the crediting of non-genuine carbon abatement. This may include activities that distort sampling analysis, artificially inflate soil organic carbon analysis or result in the production of material emissions that are not accounted for in the net abatement calculations. The Regulator must consult a project proponent on the need to make such a notification, before making the notification.

12 Restricted activities

Activities restricted by this section may only be conducted on land that is, or is to be, part of a CEA in the period commencing on the date of the section 22 application for the project and ending at the end of the permanence obligation period for the project, according to the specified requirements in this section. Similarly to section 11, these restrictions are intended to manage the risks of leakage, the crediting of non-genuine abatement and adverse impacts arising as a result of the project.

Woody vegetation may only be cleared and land may only be thinned if the requirements in subsection 12(2) and 12(3) respectively are met. This is because clearing of woody vegetation and thinning of land results in the removal of carbon sequestered in the vegetation biomass. If the clearing of woody vegetation and thinning of land occurred as a result of the project, this release of carbon could reduce the carbon benefit of the project.

Paragraph 12(2)(a) requires that any clearing of woody vegetation and thinning of land must be undertaken in accordance with any applicable regional natural resource management plans, and Commonwealth, State, Territory or local government environmental and planning laws.

In addition, clearing must meet at least one of the conditions outlined in subparagraphs 12(2)(b)(i) to 12(2)(b)(v).

Paragraph 12(3)(a) permits thinning that must be undertaken to meet the requirements of Commonwealth, State, Territory or local government environmental and planning laws.

Additional circumstances under which thinning is permitted are outlined in paragraphs 12(3)(b) and (c).

Subsection 12(4) restricts the implementation of activities that involve the addition or redistribution of soil using mechanical means (including clay delving, clay spreading or water ponding) unless the requirements of each of the paragraphs of that subsection are satisfied.

Paragraph 12(4)(a) permits the adding or redistribution of soil using mechanical means if the soil comes from CEAs that are part of the project. This ensures the carbon content of the soil being added or redistributed is accounted for and leakage is avoided.

To prevent bias in the results of soil organic carbon analysis, paragraph 12(4)(b) requires the sampling depth to be greater than the depth of soil sourced for the land management activities. This ensures that any losses from redistributing the soil from one area to another are accounted for.

Paragraph 12(4)(c) requires that a site where soil is removed must be remediated as soon as practical. This could involve returning the sandy topsoil to a clay pit immediately after the clay is extracted. The remediated land is part of a CEA and as such, is subject to the requirements of section 10, in that the project proponent must carry out or maintain at least

one eligible management activity until the end of the permanence obligation period for the project.

Subsection 12(5) provides restrictions for adding soil amendments containing biochar. Paragraph 12(5)(b) requires that soil amendments containing biochar that have not been sourced or created from CEAs that are part of the project, or organic matter that previously formed part of a designated waste stream, are only applied at a rate lower than 100kg of carbon per hectare per calendar year or another default carbon content specified in the Supplement. Designated waste streams are defined in section 5. This is intended to provide landholders with flexibility in regard to their management actions, but not incentivise the use of products that would result in leakage, or losses of biomass or carbon not accounted for.

Subsections 12(6) and 12(7) require that restricted non-synthetic fertilisers and soil amendments containing coal are only applied at a rate lower than 100kg of carbon per hectare per calendar year or another default carbon content specified in the Supplement. This threshold ensures that only immaterial amounts of these products are used and is not intended to incentivise broad scale use of these products.

Subsection 12(8) limits the application of material additional irrigation water beyond the levels applied in the baseline period. This is intended to manage the risk of leakage. In some instances, if a proponent sources additional water by securing newly acquired water from an in-stream water or groundwater access entitlement or irrigation right, rather than irrigation efficiency savings, a potential carbon leakage risk arises. For example, in fully allocated catchments, the entitlement may have been acquired from another irrigator resulting in displaced biomass growth from other irrigators' land. Although the project area in which the management action is undertaken will experience an increase in soil organic carbon, a different area of land outside of that project area may no longer be used to grow irrigated crops or pasture—potentially leading to a reduction in soil organic carbon that could offset the sequestration in the project to some extent.

Given the difficulty of quantifying the magnitude of the leakage risk, and the fact that the likelihood of leakage occurring can vary considerably depending on the catchment in which the project is operating, subsection 12(8) limits additional irrigation to the quantity used during the baseline period, within a margin of error, to control for increases in irrigation, unless it meets the definition of 'new irrigation' in section 5.

Paragraph 12(8)(a) allows for irrigation where the annual level for a project area or the CEAs within the project area is no more than 20% greater than the highest annual level of irrigation in the baseline period, and paragraph 12(8)(b) allows for irrigation where the five-yearly level of irrigation for a project area or CEAs within the project area is not more than 20% greater than the five-yearly total level of irrigation in the baseline period. The requirements of both paragraphs must be satisfied. Where projects have not applied irrigation during the baseline period, irrigation cannot subsequently be applied to a CEA during the project's permanence period. The baseline irrigation level is project area- or CEA-specific and cannot be applied to other project areas or CEAs.

13 Land management strategy

Section 13 establishes the requirement for a qualified person to prepare, or review and revise if necessary, a land management strategy. The land management strategy is intended to provide an ongoing assessment of possible risks, ongoing monitoring, and improvements to management activities, and to account for site and business specifics of each project. The purposes of the land management strategy in this method is to help:

- manage proponents' expectations about the potential to increase soil organic carbon for their project site. This is important as the list of eligible management activities in paragraph 7(2)(a) are potential new management actions that can build soil organic carbon, but need to be considered in the context of a range of site conditions; and
- ensure alignment between long-term farm business objectives and a soil carbon project, particularly given the permanence obligations on the landholder; and
- ensure all relevant parties are aware of the risks and their obligations in undertaking a project.

It should be noted that, while a land management strategy requires ongoing reviews, the work required to revise a strategy will be dependent on the extent of any changes that may be required. For example, if land management activities are not changing in a project area, then it is likely that a review will not identify any required changes and may not require revision.

Subsection 13(1) creates a requirement for a qualified person to prepare or review one or more written land management strategies. The requirement for a land management strategy to be prepared or reviewed by a qualified person ensures landholders are provided with advice tailored to their specific business and environmental context and the specific risks

(e.g. the likelihood of sequestering carbon, suitability to the landholder's business) in undertaking a project under this Determination. This provides landholders with information required to make decisions to meet their broader business objectives while participating in the ERF.

The land management strategy must cover the implementation of all eligible management activities and consideration of all other land management activities to be carried out in the soil carbon project until the end of the permanence obligation period. Where implementation of management activities deviate from the land management strategy, the strategy should be updated and the Regulator notified.

Subparagraph 13(1)(a)(i) requires that the land management strategy must ensure that each CEA has at least one eligible management activity carried out or maintained from when the first eligible management activity must be implemented by (see Figure 2) until the end of the permanence obligation period for the project.

Under Subparagraph 13(1)(a)(ii), consideration should be given to the influence of environmental and land management factors that may be incompatible with increasing carbon stocks and steps should be taken to address such incompatibility. These factors may include soil sodicity, soil structure, environmental factors and micronutrients.

Under Subparagraph 13(1)(a)(iii), consideration should be given to the influence of environmental and land management factors that may present risks to maintaining soil organic carbon stocks and steps should be taken to address such risks. Environmental factors may include changes in rainfall and temperature impacting the project area.

Subparagraph 13(1)(a)(iv) states that the land management strategy should contain information that demonstrates that the overall impact of all land management activities conducted in the project area could reasonably be expected to improve soil organic carbon stocks over time.

Paragraph 13(1)(b) requires the land management strategy to include a statement which confirms that the activities specified under section 11 are not being carried out or proposed to be carried out, and that the activities specified under section 12 are not being carried out or proposed to be carried out unless in accordance with section 12.

Subparagraph 13(1)(c)(i) requires the land management strategy to specify whether the project proponent is planning to use soil amendments containing biochar and/or products

containing human effluent in their project as the use of these products may have risks associated with it.

Subparagraphs 13(1)(c)(ii) and 13(1)(c)(iii) require that the land management strategy specifies the steps the project proponent needs to take to monitor the project's progress, and the records required to verify that the objectives of the land management strategy are being achieved.

Subsection 13(2) requires that all CEAs within a project must be covered by a land management strategy, but this can be either in a single strategy or multiple strategies for a project. All land within a given CEA must be covered by a single strategy.

Subsection 13(3) specifies timings for the submission of the initial land management strategy. Paragraph 13(3)(a) applies to projects that transition onto this method via an application under section 128 of the Act and requires them to submit a land management strategy before submitting the first offsets report after making that application. Paragraph 13(3)(b) requires that otherwise projects must submit their land management strategy before submitting an application under section 22.

Subsection 13(4) specifies requirements for when a project area is added to an existing project. Where this occurs, either one or more strategies must be revised to cover the additional area, or one or more new strategies must be prepared to cover the additional project area. One of these must occur before the section 29 application is submitted to vary the project area through the addition of the new project area.

Subsection 13(5) places obligations on the project proponent and each relevant landholder in relation to the land management strategy. They are required to provide a signed statement that they have read each of the land management strategies and agree to implement or oversee implementation of each land management strategy. In the case that the project proponent and the relevant landholder are the same person, then they will only need to sign and agree once.

Each land management strategy must be reviewed, and if necessary revised, as required by subsection 13(6). A qualified person is to review, and if necessary, revise, each land management strategy at least once every five years until the end of the crediting period. After the end of the crediting period, the land management strategy must be reviewed, and if necessary revised, by a qualified person, at least every 10 years until the end of the

permanence obligation period for the project. Paragraph 13(6)(c) requires an additional review for each time land management activities being conducted are materially changed from those outlined in the applicable land management strategy. This is not restricted to eligible management activities, and will apply to all land management activities being carried out. Paragraph 13(6)(d) provides for the Regulator to notify a project proponent that a particular issue needs to be addressed in the land management strategy. The Regulator must give the project proponent at least three months to address an issue.

Subsection 13(8) specifies who is a ‘qualified person’ for the purposes of preparing a land management strategy. In addition to the requirements in the subsection, paragraph 13(8)(d) specifies that any requirements included in the Supplement must also be met. There is no requirement for the qualified person to hold a formal qualification. This is to allow for those who may have adequate expertise without having formal training, and is also due to the large number of possible qualifications that may provide a person with the required knowledge.

14 Information to be included in applications relating to the project

Subsection 14(1) provides that, when applying for declaration as an eligible offsets project under section 22 of the Act, or applying to vary the project area (as provided for under section 29 of the Act) or approval to transition from another methodology determination to the Determination (as provided for under section 128 of the Act) a project proponent must include:

- a description of the land management activities that were carried out during the baseline period;
- evidence that all of the land included, or to be included, in a CEA is eligible land; and
- if the project proponent wishes to undertake baseline sampling prior to the project being declared an eligible offsets project—a sampling plan for the baseline sampling round, prepared in accordance with the Supplement.

Subsection 14(2) requires that applications for:

- a declaration as an eligible offsets project under section 22 of the Act;
- a variation of the project area (as provided by section 29 of the Act); or
- a transition to the Determination under section 128,

include copies of the land management strategies prepared for the project. Under subsection 14(3), the land management strategies must meet the requirements of section 13.

15 Operation of soil carbon projects

Schedule 1 and Schedule 2 each contain an approach to estimating soil organic carbon sequestration. Schedule 1 contains the measurement-only approach to estimating soil organic carbon sequestration and Schedule 2 contains the hybrid approach to estimating soil organic carbon sequestration. The hybrid approach also provides for a measurement-based approach to estimating soil organic carbon sequestration. Project areas and CEAs that apply Schedule 1 in a reporting period can apply Schedule 2 in subsequent reporting periods. However, once Schedule 2 has been applied to a project area or CEA, there are restrictions on applying Schedule 1 to that project area or CEA.

Subsection 15(1) specifies that each project area and CEA of a soil carbon project must be operated (including in relation to sampling and sampling design for the project area or CEA) in accordance with either the requirements of Division 2 of Schedule 1 or the requirements of Division 2 of Schedule 2. The effect of subsection 15(2) is that if a project area or CEA of the project is operated in accordance with the measurement-assisted approach or model-only approach of Schedule 2 in a reporting period, then the project area or CEA of the project must continue to be operated in accordance with Schedule 2 (which includes the measurement-based approach) for all subsequent reporting periods.

The effect of subsection 15(3) is that depending upon which Schedule is applied to a project, requirements relating to sample analysis in Schedules 1 or 2 are project eligibility requirements.

Subsection 15(4) requires that net abatement for a CEA is either worked out using Schedule 1 or Schedule 2.

The effect of subsection 15(5) is that if net abatement for a CEA is worked out using Schedule 2 in a reporting period, net abatement for the CEA must be calculated using Schedule 2 (which includes a measurement-based approach consistent with Schedule 1) for all subsequent reporting periods. The requirement to continue to use Schedule 2 is to ensure that the best available estimates of carbon stock are used to calculate net abatement, including model-assisted estimates for the first estimation events where they have higher precision than a measurement-based estimate.

Division 2—Additionality

16 Newness requirement

Section 16 sets out substitute newness requirements provided for by subparagraph 27(4A)(a)(ii) of the Act.

Paragraph 16(a) clarifies that the newness requirement is not breached where a land management strategy is prepared before the commencement of an eligible management activity.

Paragraph 16(b) clarifies that the newness requirement is not breached where baseline sampling is undertaken before the project was declared an eligible offsets project by the Regulator, provided that the baseline sampling occurred after the Regulator received a sampling plan for the baseline sampling round, and after the submission of an application for the declaration of an eligible offsets project.

The purpose of this approach is to allow for certain project requirements to be conducted prior to project registration, as they require the involvement of a qualified or independent person and their availability may be limited.

Part 4 - Net abatement amount

Division 1 - Preliminary

17 Operation of this Part

Section 17 sets out that Part 4 of the Determination contains formulae to calculate net abatement. Paragraph 106(1)(c) of the Act provides that a methodology determination must specify how to calculate the carbon dioxide equivalent (CO₂-e) net abatement amount for an eligible offsets project in relation to a reporting period.

18 Overview of gases accounted for in abatement calculations

Section 18 sets out the emissions sources and relevant carbon pools that are assessed to determine the net abatement amount. The net abatement includes the soil organic carbon pool within the CEAs and other emissions sources within the project area that may be directly or indirectly affected by the project. The carbon pools and emission sources include:

- soil organic carbon;
- livestock;
- synthetic fertiliser;
- lime;
- tillage events
- soil landscape modification activities
- residues;
- irrigation energy; and
- biochar.

The rationale for including carbon pools and emission sources in the net abatement calculations is outlined below.

Soil organic carbon

This is the primary carbon pool within the project and the basis for crediting under the Determination.

Livestock

Livestock numbers are considered to be the primary driver of livestock emissions (enteric fermentation, dung and urine). Proponents must work out changes in emissions resulting from increases or decreases in stocking rates compared to historic levels using techniques outlined in the Determination and Supplement, which are derived from the National Inventory Report.

Synthetic fertiliser

Several management actions (for example, nutrient management and pasture rejuvenation) may result in increased applications of synthetic fertiliser compared to a BAU scenario.

In accordance with the National Inventory Report, emissions of nitrous oxide from the application of synthetic fertiliser containing nitrogen (and also of carbon dioxide from the application of urea) must be accounted for. Proponents must estimate changes in nitrous oxide emissions and carbon dioxide resulting from increases in synthetic fertiliser application compared to historic levels using methods derived from the National Inventory Report.

Lime

Several project management activities (for example, soil acidity management and pasture rejuvenation) may result in increased applications of lime compared to a BAU scenario. The National Inventory Report accounts for the carbon dioxide emissions that result from applications of either magnesium carbonate or calcium carbonate to agricultural soils. These emissions must be accounted for in the Determination using the conservative default emission factors derived from the National Inventory Report.

Soil landscape modification activities

Undertaking soil landscape management activities may involve a material increase in emissions due to diesel fuel use. Examples of these activities include clay delving and water ponding.

These activities are likely to involve the use of machinery to undertake significant earthworks. This could include excavation and haulage of material within CEAs. Fuel use for these activities must be accounted for in net abatement calculations.

Residues

Residues from crops or pasture result in the release of nitrous oxide emissions when they are tilled into the soil. Some project management activities and management actions are expected to increase emissions from residues, such as: use of irrigation water on crops, rejuvenation of pastures, and tillage of crops. The Determination uses default factors and processes derived from the National Inventory Report to calculate changes in emissions from residues.

Irrigation energy and tillage

Irrigation uses significant amounts of electricity or fuel for pumping; consequently, increases in irrigation or the introduction of irrigation into areas that were not previously irrigated can materially increase project emissions. These emissions are worked out by measuring the total water used for each reporting period and comparing that to the baseline values. Similarly, increased fuel use associated with additional tillage is accounted for by recording the total tilled area and applying the appropriate residue factor.

Division 2 - Calculation of net abatement amount- general

19 Overview

This section summarises how carbon dioxide removed from the atmosphere and sequestered in soils is credited. Project emissions above and beyond the baseline are considered excess emissions and are deducted from the net abatement to ensure any emissions occurring as a result of the project are accounted for in the net abatement calculations.

20 The net abatement amount, A

This section outlines the abatement for a project in a given reporting period by summing the abatement for all project areas in the project.

21 The net abatement amount for a project area for a non-transferring project, A_{PA}

This section outlines the net abatement amount for a given reporting period for a given project area for a non-transferring project. The net abatement amount is adjusted by E_{net} , $A_{PA,RP}$, RC and D .

E_{net} is a measure of excess emissions due to the project. It is assumed that any net increase in emissions in the reporting period compared to the emissions in the baseline period are excess emissions.

$A_{PA,RP}$ represents previous abatement credited for each previous reporting period under this Determination. The reason that previous crediting must be deducted is because the equations calculate the abatement with reference to the baseline sampling round or first estimation event.

RC is the total number of ACCUs issued, before the end of the reporting period, in relation to each CEA that was removed from the project area before that time and relinquished in relation to each CEA in the project area before the end of the reporting period. RC is included to balance the equation in the case that ACCUs have been relinquished or CEAs were removed. As the equations reference the baseline and current carbon stocks and then deduct previous abatement, the absence of RC would have the effect of double-penalising projects for CEA removals, the provision of false or misleading information or reversals of sequestration.

D is the aggregate of the permanence period discount number and the risk of reversal buffer number under section 16 of the Act that was applied to determine the ACCUs included in RC . The value for $\frac{RC}{D}$ must be worked out separately for each issue or relinquishment of ACCUs included in RC , and all such values must be aggregated to work out the value for $\frac{RC}{D}$ in equation 2.

The change in soil organic carbon is multiplied by 44/12 to convert the mass of carbon sequestered in tonnes calculated in equation 6 into tonnes of carbon dioxide equivalent.

22 The net abatement amount for a project area for a transferring project, A_{PA}

This section outlines the net abatement amount for a given reporting period for a given project area for a transferring project. The difference between the net abatement amount for a non-transferring and transferring project is that the net abatement amount for a transferring project is adjusted by the previous abatement credited for a previous reporting period under the 2014 and 2015 methodology determinations.

23 Accounting for abatement recorded under the 2014 methodology determination

This section outlines how to account for previous abatement that was credited for a previous reporting period under the 2014 methodology determination.

24 Accounting for abatement recorded under the 2015 methodology determination

This section outlines how to account for previous abatement that was credited for a previous reporting period under the 2015 methodology determination.

The approach ensures the different approaches taken to estimate abatement under the 2021 and 2015 methods do not lead to an over crediting risk when projects transfer from the 2015 to the 2021 method.

25 Change in soil organic carbon stock for a project area for a reporting period

This section outlines how to derive the change in soil organic carbon stock for a project area for a reporting period. The change in soil organic carbon stock is derived by summing the measured or estimated change in soil organic carbon stocks for each CEA ($\Delta SOC_{PoE,CEA_i}$) and subtracting the carbon added to the CEA in the form of biochar (Q_{B,CEA_i}) and non-synthetic fertiliser Q_{NSF,CEA_i} . Although carbon additions for biochar must be deducted for the lifetime of the project, only synthetic fertiliser that was applied in the two years prior to sampling is required to be accounted for. This creates a temporary withholding of carbon attributable to non-synthetic fertiliser and is intended to cover the degradation period for the majority of non-synthetic fertilisers under most environmental and agricultural conditions.

26 The total emissions for a project area for a project, E_{net}

This section outlines how to determine the total excess emissions for a project area for a reporting period E_{net} . The total excess emissions for a project area for a reporting period must be greater than or equal to zero.

Part 5 - Reporting, record-keeping, notification and monitoring requirements

Subsection 106(3) of the Act outlines that a methodology determination may subject the project proponent of an eligible offsets project to specified reporting, notification, record-keeping and monitoring requirements.

Under Parts 6, 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.

Any reporting, notification, record-keeping and monitoring requirements specified in Part 5 of the Determination are in addition to any requirements specified in the Act, the regulations or the legislative rules.

Division 1 - Offsets report requirements

Part 5, Division 1, sets out information that must be included in an offsets report for a soil carbon project that is an eligible offsets project.

31 Operation of this Division

The effect of paragraph 106(3)(a) of the Act is that a methodology determination may set out requirements to be included in each offsets report. Section 31 notes that Division 1 of Part 5 sets out offsets report requirements for the purposes of that paragraph.

32 Information that must be included in offsets reports

Section 32 sets out additional information that must be included in an offsets report for a reporting period for a soil carbon project during the crediting period. (Section 70 of the *Carbon Credits (Carbon Farming Initiative) Rule 2015* sets out the information that must be included for all ERF projects in a reporting period.)

Subsection 32(1) sets out information that must be included in all offsets reports for the project. Under paragraph 32(1)(i), the Supplement may also specify additional reporting requirements.

Subsection 32(2) sets out the information that must be included in an offsets report for the first reporting period for the project.

Paragraph 32(2)(c) requires that if any clearing or thinning has been conducted in a project area since submission of a project registration application, evidence is required to

demonstrate that the clearing is not in breach of subsection 12(2) and the thinning is not in breach of subsection 12(3). This requirement ensures that subsection 12(2) and 12(3) are adhered to in the intervening period between the submission of the project registration application and the beginning of the first reporting period.

Paragraph 32(2)(d) requires additional evidence to be included in the first offsets report where livestock emissions are recorded during the baseline period and the historical stocking rate data is unknown.

Paragraph 32(3) specifies the additional evidence to be included under paragraph 32(2)(d).

Subsection 32(4) sets out the information that must be included in an offsets report for the first reporting period for the project after an area was added to the project area.

Where the method specifies that certain information is only required in particular reports (for example, the first offsets report), it is not required to be provided in other reports.

Division 2 - Notification requirements

33 Operation of this Division

The effect of paragraph 106(3)(b) of the Act is that a methodology determination may set out requirements to notify the Regulator of certain matters relating to a soil carbon project.

Section 33 notes that Division 2 of Part 5 sets out the notification requirements for the purposes of that paragraph.

34 Notification requirements

Section 34 sets out the specified notification requirements for soil carbon projects.

Subsection 34(2) requires project proponents to notify the Regulator within 60 days if a land management strategy changes and provide a copy of the new land management strategy to the Regulator within 9 months. This is to ensure the Regulator is aware of changes in activity that represent a risk to existing carbon stocks.

Subsection 34(3) requires project proponents to notify the Regulator within 60 days if land management activities materially change after the end of the first reporting period. This is to ensure the Regulator is aware of changes in activity that represent a risk to existing carbon stocks.

Subsection 34(4) requires that the project proponent must notify the Regulator of the intended sampling location points, prior to the start of the sampling round.

Division 3 - Record-keeping requirements

35 Operation of this Division

The effect of paragraph 106(3)(c) of the Act is that a methodology determination may set out requirements for the project proponent of an eligible offsets project to comply with specified record-keeping requirements. Section 35 notes that Division 3 of Part 5 sets out the record-keeping requirements for the purposes of that paragraph.

36 Record-keeping requirements

Section 36 sets out specified record-keeping requirements for soil carbon projects. At a high level the record-keeping requirements relate to records which demonstrate that the requirements of the Determination and Supplement have been met. More specifically, they relate to the land management strategy, eligible management activities, soil sampling and net abatement calculations. This information does not need to be included in offsets reports but may be requested at any time by the Regulator.

Division 4 - Monitoring requirements

37 Operation of this Division

The effect of paragraph 106(3)(d) of the Act is that a methodology determination may provide specified requirements to monitor the project. Section 37 notes that Division 4 of Part 5 specifies requirements for the purposes of that paragraph.

38 Monitoring requirements

Section 38 sets out the specified monitoring requirements for soil carbon projects for the baseline emissions period and each reporting period.

Proponents may use zero as the value for any or all emissions sources from monitoring for the baseline emissions period, in which case the process does not apply for the baseline emissions period. Evidence must be provided regarding any assumption or zero value made for any emissions source.

Section 38 provides that the processes for monitoring certain emissions sources are contained in the Supplement. These are annual carrying capacity, stocking rates, the tilled area for

pasture renovation and establishment, and the default factors for the quantity of carbon in biochar and non-synthetic fertiliser.

39 Project monitoring—livestock

Section 39 sets out monitoring requirements for livestock so that changes in emissions from this source can be calculated in accordance with Part 4.

40 Project monitoring—assumed baseline for livestock

Section 40 provides an alternative approach to estimate baseline emissions for livestock emissions if the monitoring requirements in Section 39 have not been met so that changes in emissions from livestock can be calculated in accordance with Part 4. An assessment of carrying capacity for the relevant project area must be obtained or calculated as set out in the Supplement.

41 Project monitoring—land management strategy

Section 41 sets out monitoring requirements for the implementation of the land management strategy. If a land management strategy specifies additional monitoring requirements, those requirements must be met.

42 Consequences of not meeting requirement to monitor certain emissions sources

Compliance with requirements for monitoring of emissions sources is important to ensure that abatement credited by the project is calculated correctly. Monitoring requirements imposed by section 38 include the process for monitoring.

In some cases, a project may be unable or fail to monitor an emissions source using the process specified. When this occurs, section 42 requires that no net abatement be recorded for the reporting period unless the failure to monitor the parameter is likely to have only a minor or trivial impact on net abatement, or the project proponent has used alternative means to calculate a conservative estimate of the emissions source and is taking steps to monitor the emissions source consistently with the monitoring requirements in subsequent reporting periods.

Subsections 42(3) and 42(4) clarify that project proponents must seek to minimise the period during which emissions sources are not monitored using the process specified, and that

section 42 does not prevent the Regulator from taking action in relation to a project proponent's failure to appropriately monitor an emissions source.

Part 6 - Partial reporting

43 Partial reporting

Section 77A of the Act provides that a project may be divided into two or more specified parts for the purpose of reporting.

Section 43 of the Determination specifies that if a project is divided, this cannot involve the division of a project area. This is because the impact of management activities on soil organic carbon stocks and project emissions are accounted for at the project area level.

Part 7 – Calculation of Emissions

Division 1—Preliminary

44 Simplified outline of this Part

Section 44 sets out that Part 7 of the Determination contains formulae to calculate the change in emissions in a reporting period from the average annual baseline emissions. It first calculates the annual average emissions in the baseline period and compares that to the emissions in the reporting period. If the project area is varied between reporting periods, average annual baseline emissions will need to be recalculated for the new project area. The impact of the emissions on the net abatement amount is outlined in Division 2 of Part 4 of this Explanatory Statement. Section 18 of the Determination provides an overview of the emissions sources which are accounted for in the net abatement calculation.

A number of emission sources are excluded from the abatement calculations under the Determination.

Organic Fertiliser emissions

Emissions associated with the application of organic fertiliser to land, any processing of feedstocks to form the value-added organic fertiliser (such as compost), and the subsequent decomposition of the fertiliser would likely be less than or equal to the emissions from the feedstock in the absence of the project. Accordingly, emissions from organic fertiliser are not accounted for.

Other fuel use emissions

Fuel use emissions, other than for tillage events, are likely to be immaterial in projects to which the Determination applies and so are not accounted for.

Vegetation and woody biomass

Emissions or removals of greenhouse gases from vegetation and woody biomass are not likely to change as a result of the project and so are not accounted for within the greenhouse gas assessment boundary.

Feed supplements

Feed supplements are excluded as a potential emissions source on the grounds that it is conservative to do so.

Wildfire and hazard reduction burning emissions

It is unlikely that project management activities will lead to an increase in the frequency or intensity (and hence emissions from) wildfire events or hazard reduction burning. Therefore, this source is excluded.

45 Definitions

Section 45 sets out definitions that apply to Part 7 of the Determination. The definition of the ‘NGA Factors document’ is the ‘National Greenhouse Accounts Factors’ published by the Department as in force from time to time. This is available from the Department’s website: <https://www.dcceew.gov.au>. It contains the emissions intensity of various grids in Australia and is used across the scheme to assess the emissions related to electricity use.

46 Application of this Part to CEAs and emissions accounting areas in a project area

Section 46 specifies that the change in emissions must be determined for the project area, including all CEAs and emissions accounting areas in that area at the end of the reporting period. The change in emissions is not determined for any exclusion areas in the project area.

Division 2 sets out the calculations for the average annual baseline emissions for a project area. The baseline period is the five years immediately before the application to register a project or add a project area. Total emissions for the baseline period are calculated individually for each emissions source and then summed together. The gross baseline emissions are converted to average annual emissions by dividing by five (as there are five years in the baseline period). This ensures that baseline and project emissions can later be compared on an annualised basis.

48 and 49 Livestock Emissions

Sections 48 and 49 set out two alternative approaches to calculate livestock emissions in the baseline period. If the project proponent has access to historical stocking rates, section 48 (equation 13 and 14) applies. However, if evidence of historical stocking rates is not known, then section 49 (equations 15 and 16) applies.

50 Synthetic fertiliser emissions

Section 50 sets out the approach to calculate emissions from the application of synthetic fertiliser and urea in the baseline period. Emissions from the application of synthetic fertiliser and urea are worked out using default emissions factors set out in the Supplement and quantity of product used (in tonnes), as recorded in receipts or farm management records.

51 Lime emissions

Section 51 sets out the approach to calculate emissions from the application of lime in the baseline period. Emissions from the application of lime are worked out using default emissions factors set out in the Supplement and quantity of product used (in tonnes), as recorded in receipts or farm management records.

52 Residue, tillage and soil landscape modification emissions

Section 52 sets out the approach to calculate emissions from residue decomposition and burning, tillage and soil landscape modification in the baseline period. Emissions from residue are worked out from default emissions factors and quantity of crop harvested or assumed yields for pastures or cover crops (if harvest data is not available). Tillage emissions are estimated from the total tilled area and landscape modification emissions are calculated from fuel usage records.

53 Irrigation energy emissions

Section 53 sets out the approach to calculate emissions from irrigation in the baseline period.

Increases in irrigation or the introduction of irrigation into areas that were not previously irrigated can materially increase project emissions. Therefore, emissions due to irrigation are worked out from fuel and electricity usage in the baseline period. These usage values are multiplied by default emissions factors to give final emissions estimates.

As the electricity grid undergoes a transition to lower emissions generation, it is expected that the emissions intensity will continue to decrease. Therefore, equation 31 must be recalculated with an updated electricity factor at the end of each reporting period.

Division 3 sets out the calculations for the average annual emissions for a project area, for a given reporting period. Total emissions for the reporting period are calculated individually for each emissions source. The emissions sources for the reporting period are the same as for the baseline, as outlined in Division 2 of this Part. To accurately compare the project

emissions with the baseline emissions, gross emissions for the baseline and reporting periods are annualised. To annualise the emissions for a reporting period, emissions from each source are summed and divided by the number of years in the reporting period.

Division 4 sets out the calculations for the change in emissions between baseline emissions and a reporting period. The average annual baseline emissions (calculated using Division 2) are subtracted from the average annual project emissions (calculated for the reporting period using Division 3) and the result is multiplied by the number of years in the reporting period. This is used in the calculation of net abatement, which is described in further detail in Division 2 of Part 4 of this Explanatory Statement.

Schedule 1 – Measurement-only approach to estimating soil organic carbon sequestration

Division 1 – Preliminary

Schedule 1, Division 1, provides a simplified outline of, and definitions relevant to, Schedule 1.

1 Simplified outline of this Schedule

Section 1 provides a simplified outline of Schedule 1.

Schedule 1 sets out the measurement-only approach to estimating the change in soil organic carbon sequestration for a CEA between the baseline sampling round and a subsequent sampling round. The change in soil organic carbon sequestration is determined by collecting and analysing samples of soil (Division 2), calculating the soil organic carbon stock and sampling variance in the CEA (Division 4) and then calculating the change in soil organic carbon stock for the CEA from the baseline sampling round (Division 5). Divisions 2 and 3 require the sampling, analysis and calculations of Schedule 1 to be conducted separately for the upper soil layer (first 30cm) and the entire soil profile (0-x cm). Data on the upper soil layer is included in offsets reporting to help Australia report its removal of greenhouse gases in its National Inventory Report.

The measurement-only approach under Schedule 1 is consistent with soil organic carbon stock estimations made under Subdivision 2 of Division 4 in Schedule 2 – allowing transition of previously measurement-only projects to use models to estimate their soil organic carbon stocks in the future. However, if models are used to estimate soil organic carbon stocks in a CEA in a reporting period under Schedule 2, then it is not possible to transition to a measurement-only approach under Schedule 1 in subsequent reporting periods. This is to ensure that, if a model-assisted estimate was used to determine baseline carbon stocks, it continues to be used for the baseline. However, Schedule 2 also includes a measurement-based approach and it is possible to transition from a model-only or model-assisted approach to a measurement-based approach within Schedule 2.

2 Definitions

Generally, where terms are not defined in the Determination, they have the meaning given by section 5 of the Act.

The following terms used in Schedule 1 are particularly important because they help explain how the measurement-only approach to estimating soil organic carbon sequestration operates.

The definition of a **layer** is a 0-30cm layer, 30 – xcm layer or a 0– xcm layer. A **0–30cm layer** of soil means the soil layer measured from the soil surface to a soil depth of 30 cm. A **0–xcm layer** of soil means the soil layer measured from the soil surface to a soil depth greater than 30 cm referred to as x. A **30–xcm layer** of soil means the soil layer measured from a soil depth of 30 cm to the soil depth greater than 30 cm referred to as x. A **sub-layer** refers to a depth of soil within a layer that is less than the layer.

The definition of a **stratum** means an area in a CEA.

The definition of **whole soil** is all material contained within a soil layer including gravel and fine earth. **Fine earth** refers to soil material having a particle size less than or equal to 2 mm, while **gravel** refers to soil material having a particle size greater than 2 mm.

3 What is a sample?

This section provides the definition of a sample in Schedule 1.

The definition of **a sample** is an individual sample taken from a particular location, or a composite sample which combines samples taken from a number of locations into a single sample consistent with any requirements in the Supplement. A sample must be obtained and analysed in accordance with the requirements of Division 2 in this Schedule.

Division 2 – Operation of a soil carbon project using a measurement-only approach under this Schedule

4 Steps involved in accounting for a soil carbon project

Section 4 sets out the steps involved in accounting for a soil carbon project.

The project area must be mapped into CEAs, emissions accounting areas and exclusion areas, as specified by section 5 of this Schedule. Sampling is not conducted on exclusion areas or emissions accounting areas.

Subsection 4(1) outlines when the baseline and subsequent sampling rounds of carbon stocks must occur for a CEA.

The purpose of paragraphs 4(1)(b)(i and ii) is to ensure that for every CEA the baseline sampling round occurs prior to the end of the reporting period when the project was

registered, or the project area was included in the project. While it can be assumed to be generally disadvantageous for participants to delay baselining for a CEA once project activities have commenced (as any increases in soil organic carbon stocks from the project activity before baselining occurred would not be reflected in net abatement), it is necessary to have a timeframe for when the baseline sampling round must occur to avoid selective baselining when estimates are likely to be unrepresentatively low estimates of baseline soil carbon levels (e.g. during drought events).

The purpose of paragraph 4(1)(c) is to ensure that sampling occurs in each CEA at least once every five years to enable net abatement to be determined. Differences in when CEAs are added to a project and when baseline sampling rounds occur may mean that some CEAs will contribute to net abatement and others will only have baseline sampling conducted in the first reporting period.

Under subsection 4(2), a subsequent sampling round is not required to be conducted for a CEA of a transferring project during the reporting period for which the project proponent may submit a transitional offsets report. This allows projects that were registered under previous soil carbon methods to transfer to the 2021 soil carbon method and report the abatement associated with sampling under the previous method.

Subsection 4(4) requires that for each sampling round for a CEA, the CEA must be divided into strata consistent with the requirements in the Supplement. The Supplement may provide a number of requirements and recommendations for stratifying CEAs.

While not all CEAs need to have a sampling round conducted in order to report on a project area, the results of any CEAs which have a subsequent sampling round undertaken must be reported (under subsection 4(5)). This ensures that if CEAs are negatively performing (where carbon stocks decline below baseline or previously credited amounts), they reduce the abatement achieved by the positively performing CEAs. Note that after the first reporting period resulting in ACCUs, not estimating abatement in all CEAs in the project area may make it difficult to receive ACCUs in subsequent reporting periods as previous net abatement for any CEA in the project area is subtracted from the abatement of CEAs reported on in subsequent reporting periods. Irrespective of the flexibility provided by subsection 4(5), an estimate of carbon stocks must be provided for each CEA at least every five years under paragraph 4(1)(c).

Subsection 4(6) allows a project proponent to apply to the Regulator to seek an extension of time to carry out a subsequent sampling round if exceptional circumstances prevent sampling within the timing requirements specified in the Supplement. Otherwise, the section specifies that the timeframes within the Supplement apply.

Examples of exceptional circumstances may include environmental limitations on sampling, such as soil moisture levels being too low or too high to enable accurate sampling, weather events such as heavy rain or fire inhibiting access to the site, or unexpected circumstances rendering soil sampling technicians unavailable. Exceptional circumstances may also extend to personal circumstances.

Evidence may be provided to the Regulator in support of an application for an extension of time. The evidence could include a statutory declaration from the soil sampling technician stating that the conditions are unsuitable for soil sampling, photos of the flooded area or weather reports.

5 CEAs, exclusion areas and emissions accounting areas

Section 5 set out the requirements for mapping project areas for the purposes of Subsection 4(1).

Subsection 5(1) requires that CEAs are areas of eligible land where project activities will be carried out until the end of the permanence obligation period for the project. Cessation of eligible management activities (noting that they can be changed) during the permanence period would require removal of the CEA consistent with subsection 9(4) of the Determination. Eligible management activities must be continued beyond the crediting period to avoid the loss of carbon sequestered during the crediting period. CEAs must have identical responsible landholders. Having different responsible landholders could cause the actions of one landholder to have significant implications for others (such as the cessation of eligible management activities in part of a CEA leading to the removal of the entire CEA). CEAs must be entirely located within a single State or Territory to enable the use of State or Territory specific factors to determine project emissions.

The furthest boundaries of non-contiguous parts of a CEA are also required to be located within 10 kilometres (km) of each other under subsection 5(2). This is anticipated to be a theoretical maximum as the practical size of CEAs would likely be smaller to reduce the variance associated with soil sampling. The size constraint also helps to manage the risk that

eligible management activities may cease in a part of a CEA – leading to the removal of the entire CEA.

Subsection 5(3) permits CEAs to be merged or split in accordance with the Supplement. This anticipates that CEAs, particularly those stratified under previous methods, could benefit from being merged to reduce the sampling density required to get precise soil organic carbon stock estimates. Merging and splitting CEAs may also be desirable to achieve as close as possible to the equivalent soil mass (ESM) (see Section 12) in the resulting CEAs so that changes in soil organic carbon stocks can be estimated across a constant soil mass.

Subsection 5(4) requires that the project proponent must not remove project areas which would remove part of a CEA. This does not limit the above subsection to split or merge CEAs prior to removal – but whole CEAs must be removed unless the Supplement provides for the removal of part of a CEA.

Ineligible land included at the start of a project must either be mapped as an exclusion area, as required by subsections 5(5), or an emissions accounting area, as required by subsection 5(6). Where an area of land less than 1% or 50 hectares or whichever is smaller becomes ineligible after the time of stratification, subsection 5(8) allows it to remain as part of an unchanged CEA.

Not all areas for which land management or agricultural activities are to be conducted in the project area will be able to be sampled. Such areas within the project are required to be mapped as emissions accounting areas under subsection 5(6). This accounts for increases in emissions as a result of the project in these areas. Areas which are not subject to land management or agricultural activities may be mapped as exclusion areas under subsection 5(5) – for which neither soil organic carbon stocks nor project emissions are relevant to calculating the net abatement for the project.

Subsection 5(9) requires land in a CEA that is ineligible land be removed from the project area, unless subsections 5(8) or 5(10) apply. The removal of the ineligible land from the project area will trigger relinquishment obligations for the ACCUs issued in relation to that land. Note that under the Act and Rules, ineligible land for which ACCUs have been issued can be removed from the project area by transferring it to another sequestration offsets ERF project which in turn must be revoked in its entirety to trigger the relinquishment obligations.

Subsection 5(8) allows dwellings or structures to be constructed on CEAs without requiring the removal of the area from the project if the dwellings or structures are the smaller of 1% or 5 hectares of the area of the CEA. CEAs must not contain dwellings or structures at the time of stratification, however, land may remain in the CEA if dwellings or other structures are constructed on it after stratification in accordance with subsection 5(7).

Subsection 5(10) allows ineligible land to remain in a CEA, where the Regulator determines that the continued mapping as a CEA is unlikely to result in the crediting of non-genuine carbon abatement, having regard to all the circumstances.

Subsections 5(11) and 5(12) require that land in a CEA with forest cover or forest potential that becomes part of a project area of a project registered under another methodology determination that is not a soil carbon method is removed from the project area. This avoids CEAs of soil carbon projects overlapping with CEAs of projects registered under vegetation methods under the ERF, such as the *Carbon Credits (Carbon Farming Initiative) (Human-Induced Regeneration of a Permanent Even-Aged Native Forest—1.1) Methodology Determination 2013*.

Subsection 5(13) requires that CEAs, exclusion areas and emissions avoidance areas are mapped in accordance with the Supplement, which provides detail such as the required geospatial attributes of the mapping.

6 Sampling design

This section sets out the requirements for the sampling design. Subsection (6)(1) specifies that each CEA is required to be divided into three or more strata (*strata* are subdivisions of a CEA). At least three samples must be taken in each stratum. This requires at least nine samples to be collected from each CEA. This may equate to less than 9 sets of analysis of soil organic carbon if across strata compositing is used prior to analysis (a sample analysis approach that may be permitted by the Supplement).

The total number of samples the project proponent should take each sampling round to minimise sampling variability will depend on how variable the soil and management activities are across the project and the project proponent's willingness to pay for additional samples.

Paragraph (6)(2) requires that any sampling design meets the requirements included in the Supplement.

Paragraph (6)(3) specifies that for each sampling round, the project proponent must submit to the Regulator, prior to undertaking any sampling, a sampling plan for each CEA meeting any requirements included in the Supplement.

7 Sampling

The baseline sampling round must attempt to sample to at least 30 cm under subsection 7(1). The results of this sampling will set the ESM under section 12. Thereafter the sampling depth must attempt to attain the ESM (subsection 7(2)). A failure to collect the equivalent soil mass may result in lower carbon stock estimates in subsequent sampling rounds. There is no need to mandate the nominated soil depth be attempted in subsequent rounds as compaction of soil may mean that shallower sampling depths are suitable and capable of attaining the ESM. Obtaining more soil than the ESM could also be sub-optimal as the carbon concentrations might be diluted by the increased soil in the sample (assuming that soil organic carbon concentration declines with depth – this risk may be mitigated if sublayers are analysed).

Paragraph 7(2)(b) requires that when the sampling depth (xcm) is greater than 30cm, analysis must be undertaken separately for the 0-30cm and the 30-xcm depth layers. This allows results to inform Australia's National Inventory Reports (which report soil organic carbon stock change to a depth of 30cm).

Paragraph 7(2)(c) requires that an independent person undertake the sampling and sets out who can be considered an independent person for the purposes of sampling. One of these requirements is that the independent person cannot be the same person who prepares or reviews the land management strategy. The independent person cannot have a financial interest in the project (besides being paid to undertake the sampling). The person undertaking the sampling must provide a statement in a form approved by the Regulator that they have no financial interest in the project and were not influenced in any way to adjust the sampling (see paragraph 32(1)(k) of the Determination).

The independent person requirements for this section are different to the requirements to be considered a qualified person for preparing a land management strategy under section 13 of the Determination.

Paragraphs 7(2)(e) and (d) require that sampling take into account any recommendations and meet any requirements included in the Supplement.

8 Sample analysis

Subsection 8(1) requires the preparation and analysis of soil samples to meet any relevant requirements and take into account any relevant recommendations included in the Supplement.

The Supplement outlines a number of approaches to prepare and analyse soil samples. The requirements and recommendations in the Supplement will differ from project to project depending on the approach used and in turn which parts of the Supplement are applicable to the approach chosen.

Subsection 8(2) avoids any ambiguity around who can prepare soil samples, clarifying that a person (who may be the sampler) with the competencies listed in subparagraphs 7(2)(c)(ii) to (iv), must prepare the soil samples.

Division 3 – Working out the change in soil organic carbon stock for a CEA

9 Working out the change in soil organic carbon stock for a CEA

Subsection (1) requires that if Schedule 1 is to be applied to determine the change in soil organic carbon stock for a CEA in a reporting period, then that change must be worked out using Equation 69.

Subsection (2) requires that where sampling occurs to a depth greater than 30cm, the change in soil organic carbon stock for a CEA may need to be determined twice:

1. once for the 0-xcm layer, which is used to calculate net abatement of the project (under paragraph 9(2)(c)); and
2. once for the 0-30cm layer, which must be calculated separately to allow for project results to inform Australia's National Inventory Reports (which report soil organic carbon stock change to a depth of 30cm).

The effect of paragraph 9(2)(b) is that it is not necessary to determine change in soil organic carbon stock for a CEA beyond the 30cm layer. This approach recognises that sampling to a depth greater than 30cm, to 100cm for example, can introduce significant variance into the calculations of soil organic carbon stocks for a CEA which reduces net abatement if soil organic carbon increases have concentrated in the upper (0-30cm) layer. Particularly earlier in the crediting period, carbon stock changes are expected to occur in the top layer of soil

with changes in the deeper layer (e.g 30-100cm layer) expected to be relatively delayed. The option to exclude the 30-xcm layer from accounting, but continue to sample and analyse this layer, allows the deeper layer to be monitored without reducing the abatement observed in the upper layer. Significantly positive changes in the deeper layer can then be reported if observed (assuming baseline sampling also occurred to this depth) thus incentivising management activities that are also able to achieve soil organic carbon stock increases in the deeper layer.

However, paragraph 9(2)(b) provides that it is necessary to determine the change in soil organic carbon stock for a CEA beyond the 30cm layer, where:

1. soil management activities disturb the soil deeper than 20cm (as sampling must occur 10cm deeper than disturbance). In these circumstances, it is a requirement to account for the soil to the depth of disturbance plus a 10cm buffer to reflect the possibility that the disturbance has had an influence beyond the depth of disturbance. This ensures that where management activities may have shifted concentrations of soil organic carbon within the soil profile, these impacts are accounted for; or
2. the project proponent elects to determine the change in soil organic carbon stock for the CEA beyond the 30cm layer; or
3. the change in soil organic carbon stocks for the 30-xcm layer with the specified probability of exceedance is negative. This is intended to avoid carbon stock reversals in the deeper layer being omitted from net abatement calculations.

Subsection 9(4) clarifies that the change in soil organic carbon stock with the probability of exceedance specified in the Supplement for a reporting period for a CEA which has not undergone a subsequent sampling round in the reporting period is zero.

Division 4 - Working out the soil organic carbon stock and sampling variance for a CEA

Division 4 of Schedule 1 works out the soil organic carbon stock and sampling variance for a sampling round. It is applied to the first sampling round in a CEA and the subsequent sampling round in a reporting period. The results for the first sampling round may differ between reporting periods if there have been changes to the CEA boundaries or adjustments to the depth accounted for (the 0-30cm or 0-xcm layers).

10 Working out the soil organic carbon stock for a CEA and sampling variance

The soil organic carbon stock and the sampling variance for a CEA must be worked out in accordance with Subdivision 2 of this Division where both compositing of cores across strata and equal area stratification are used. In all other circumstances, Subdivision 3 of this Division must be used.

11 Steps for working out the soil organic carbon stock in a sample

The soil organic carbon stock of a sample contained within an individual or composite soil sample must be worked out for each sample taken in a sampling round in accordance with this Division.

12 Determining ESM from the sampled soil masses derived during the baseline sampling round

When comparing soil organic carbon stocks between the baseline and a subsequent sampling round, it is necessary to adjust for changes in soil carbon mass to prevent crediting for changes in the soil mass that is sampled rather than changes in soil organic carbon concentration in that soil. Soils cannot be reliably sampled to the same mass for a number of reasons:

1. Soil bulk density varies within CEAs due to factors such as parent material, topography, soil moisture, management, tillage and soil organic carbon content resulting in different soil masses being collected to the same depth of sampling.
2. The area within a CEA may contain obstructions such as bedrock which prevent sampling to a constant depth. Variations in soil moisture conditions within a CEA can also affect the depth to which soil can be sampled using agronomic coring equipment (particularly in dry, high clay soils).

The ESM is the mass to which all soil organic carbon stock estimates across all estimation events are adjusted in the CEA. It is set to a specified percentile of the masses of the samples collected for the baseline sampling round in the CEA. This percentile is set out in the Supplement. In response to new data being collected, the percentile may be revised over time (either up or down) to ensure it results in both an accurate and conservative estimation of change between sample rounds over time.

To determine the ESM for a CEA:

- the mass of each sample in the CEA is determined in accordance with the Supplement, which may include provisions to adjust the mass of each sample by removing sub-layers;
- the ESM must be determined for each layer (0-30cm, 0-xcm) in accordance with subsection 9(2);
- the samples for the CEA for the baseline sampling round must be collected at a consistent nominated depth.

The ESM for a CEA may change if CEA boundaries change or if the ESM percentile in the Supplement is changed.

13 Working out the soil organic carbon stock of each sample in each layer

This section adjusts the carbon stock of each layer of a sample to the ESM when converted to the tonnes of oven dry whole soil per hectare in accordance with the Supplement.

If a soil sample's layer mass exceeds the ESM, the approach aligns the carbon stock to the ESM by reducing the carbon stock in proportion to the amount by which the mass exceeds the ESM (which is achieved more precisely if sublayers have been analysed). If a soil sample has been divided into sublayers for analysis of carbon stock, the carbon stock of each sublayer is summed, progressing incrementally down from the soil surface to the depth required to produce a mass that is equal to or exceeds the ESM. In the sublayer where ESM is met or exceeded, the contribution to the carbon stock of the estimate is proportional to the fraction of the soil mass of the sublayer required to achieve the ESM of the soil layer.

If a soil layer's mass is less than the ESM, only the carbon stock in the soil layer's mass can contribute to the estimate. It would not be appropriate to apply the soil organic carbon concentration of the soil layer to the higher mass of the ESM – as soil carbon concentration is assumed to decline with depth and the possibility that there is no soil beneath the depth reached.

Subdivision 2—Working out the soil organic carbon stock and sampling variance for a CEA where both compositing of cores across strata and equal area stratification are used

14 Application of this Subdivision

This Subdivision applies to sampling which involves compositing of cores across strata that are equal in area within a CEA.

15 Mean soil organic carbon stock in a CEA

This section calculates the mean soil organic carbon stock for each CEA based on the soil organic carbon stocks of each sample collected from the CEA.

16 Sampling variance of the mean soil organic carbon stock within a CEA

This section calculates the sampling variance of the mean soil organic carbon stock for each CEA using the statistical formula for sampling variance (not population variance).

17 Total soil organic carbon stock for a CEA

This section calculates the total soil organic carbon stock for a CEA by multiplying the mean soil organic carbon stock in the CEA by the area of the CEA.

18 Sampling variance of the total soil organic carbon stock for a CEA

This section calculates sampling variance of the total soil organic carbon for the CEA by multiplying the sampling variance of the mean soil organic carbon stock for the CEA by the square of the area of the CEA.

Subdivision 3—Working out the soil organic carbon stock and sampling variance for a CEA in all circumstances other than when compositing of cores is across equal area strata

19 Application of this Subdivision

This Subdivision applies to circumstances where Subdivision 2 does not apply.

20 Mean soil organic carbon stock in a stratum

This section calculates the mean soil organic carbon stock for each stratum in the CEA based on the samples from that stratum using the statistical formula for the mean.

21 Sampling variance of the mean soil organic carbon stock within a stratum

This section calculates the sampling variance of the mean soil organic carbon stock for each stratum in the CEA using the statistical formula for sampling variance (not population variance).

22 Mean soil organic carbon stock in a CEA

This section calculates the mean soil organic carbon stock in a CEA based on an area-weighted average of the mean soil organic stock of each stratum in that CEA.

23 Sampling variance of the mean soil organic carbon stock within a CEA

This section calculates sampling variance of the mean soil organic carbon stock for the CEA based on an area weighted (using the square of the area because variance is a squared variable) summation of the sampling variances of the mean soil organic carbon stock for each stratum within the CEA.

24 Total soil organic carbon stock for a CEA

The section calculates the total soil organic carbon stock for a CEA by multiplying the mean soil organic carbon stock for the CEA by the area of the CEA.

25 Sampling variance of the soil organic carbon stock for a CEA

This section calculates sampling variance of the soil organic carbon for the CEA by multiplying the sampling variance of the mean of the soil organic carbon in the CEA by the square of the area of the CEA.

Division 5 - Working out the creditable change in soil organic carbon stock for a CEA

26 Working out the creditable change in soil organic carbon stock in a CEA for a reporting period

This Division calculates the creditable change in soil organic carbon in each CEA associated with the specified probability of exceedance for a reporting period between the baseline sampling round in the CEA and the subsequent sampling round in the reporting period.

27 Change in carbon stock between the sampling rounds

This section calculates the difference between the carbon stocks in the CEA between the baseline sampling round and the last subsequent sampling round in the reporting period.

28 Standard error for change in soil organic carbon stock

This section calculates the standard error of the mean difference between total soil organic carbon stock for the CEA between the baseline sampling round and subsequent sampling round in the reporting period based on the sampling variance of the carbon stock estimate for the baseline and subsequent sampling round.

29 Degrees of freedom for a CEA between sampling rounds

This section calculates the degrees of freedom (df) to use in equation 69 for the CEA. This approach uses the Satterthwaite Approximation as the variances of the carbon stock estimate for the baseline and subsequent sampling round are not assumed to be equal.

30 Degrees of freedom associated with a sampling round (t_x) for a CEA where composite samples were collected across equal area strata

This section calculates the degrees of freedom for a sampling round where composite samples were collected across equal area strata based on the number of samples collected.

31 Degrees of freedom associated with a sampling round (t_x) for all other cases

This section calculates the degrees of freedom for a sampling round where individual or within-strata composite samples were used in the sampling round based on the area-weighted sampling variances and sample numbers associated with each stratum.

32 Change in soil organic carbon stock in the CEA with the specified probability of exceedance for a reporting period

This section calculates the change in soil organic carbon stock for a CEA for a reporting period between the baseline sampling round and the last subsequent sampling round in the reporting period associated with the probability of exceedance specified in the Supplement. The specified probability of exceedance needs to be conservative, without precluding reasonable rates of soil organic carbon stock change being recognised.

A one-tailed student's t-test is used, as it is generally used in the scientific literature for comparing the difference in soil organic carbon across two time periods.

The equation applies a temporary discount of 0.25 to the creditable amount of change in soil organic carbon stock where only 2 sampling rounds have occurred in the CEA. This reduces the potential for credits to be issued for increases in carbon stocks that may not be maintained

over time. This is because the effect of climatic influences relative to management-induced changes is assumed to be more influential in the early stages of the project. After three or more sampling rounds, creditable abatement withheld due to the discount will be returned if carbon increases are maintained.

Schedule 2—Hybrid approach to estimating soil organic carbon sequestration

Division 1—Preliminary

Division 1 of Schedule 2 provides a simplified outline of, and definitions relevant to, Schedule 2.

1 Simplified outline of this Schedule

Section 1 provides a simplified outline of Schedule 2.

Schedule 2 sets out three alternative approaches to estimate carbon stocks. The first approach is referred to as measurement-based (Subdivision 2 of Division 4) and is consistent with Schedule 1. The second approach is referred to as model-only (Subdivision 3 of Division 4) using models that have been validated in other CEAs in accordance with the requirements of the Supplement. The third approach is referred to as model-assisted (Subdivision 4 of Division 4) where modelled estimates are used in conjunction with measured estimates from soil samples which are collected within the CEA after the modelled estimates have been provided to the Regulator. The model-only approach relies upon validation statistics being available for the modelled carbon stock estimates in accordance with the Supplement – which are calculated using a process set out in the Supplement from other CEAs utilising model-assisted estimates (where both sampling and modelled carbon stock estimates have been applied).

The measurement-based approach allows projects that have previously estimated carbon stocks using the measurement-only approach in Schedule 1 to transition to a model-only or model-assisted approach during their crediting periods. However, if the change in soil organic carbon stocks for a CEA has been calculated using model-only or model-assisted estimates under Schedule 2, Schedule 2 must be used to calculate change in soil organic carbon stocks for the CEA for the remainder of the project's crediting period.

As per Schedule 1, the quantification of soil organic carbon stock change under all approaches in Schedule 2 is calculated with the specified probability of exceedance in tonnes of soil organic carbon in the CEA. The values of the changes in soil organic carbon stocks in all CEAs inform the net abatement amount for the project area in Part 4 of the Determination.

2 Definitions

Section 2 defines terms used in Schedule 2. Generally, where terms are not defined in the Determination, they have the meaning given by section 5 of the Act.

Under section 23 of the *Acts Interpretation Act 1901*, words in a legislative instrument in the singular number include the plural and words in the plural number include the singular.

The following terms used in Schedule 2 are particularly important because they help explain how the new hybrid approach to estimating soil organic carbon sequestration operates.

The definition of **estimation event** is a point in time for which carbon stocks are estimated in a CEA in accordance with section 5 of this Schedule. Schedule 2 differs from Schedule 1 in that it does not necessarily use the median day of the sampling rounds as the point in time for which carbon stocks are estimated as per Schedule 1, as sampling does not occur under the model-only approach for carbon stock estimation in Schedule 2. Under Schedule 2, estimation events instead represent a point in time for which carbon stocks in the CEA are estimated using measurement-based, model-only or a combination of the two estimation approaches.

A **first estimation event** is the first estimation event for a CEA that occurred in accordance with paragraph 5(2)(a) of this Schedule.

The definition of **last estimation event** is the last estimation event for the CEA in a reporting period which is covered by the offsets report for that reporting period. It is the estimation event for which the difference between carbon stocks from the first estimation event is calculated for each reporting period.

The definition of **modelled carbon stock estimate** requires at least three geospatially distinct estimates of carbon stocks for each stratum within the CEA for as many layers as nominated under section 10 of Schedule 2, and a specification of the oven dry whole soil mass carbon stock to enable validation of the model and estimation of sampling variance in accordance with Division 4. Carbon stock and soil mass estimates can be provided for a single soil layer (e.g. the carbon stock and the ESM for the 0-30cm layer) or for two layers (the carbon stock and ESM for the 0-30cm layer, and the 30-100cm layer). Carbon stock and soil mass estimates can also be provided for more granular sublayers if modelled carbon stock estimates are expected to be able to meaningfully distinguish between them (and this may assist in aligning the masses of modelled and measured estimates for model-assisted approaches).

The definition of ***validated modelled carbon stock estimate*** is a modelled carbon stock estimate that meets the validation requirements in the Supplement. Validated modelled carbon stock estimates must be accompanied by the following variables in the Supplement for application in model-only carbon stock estimates:

- (a) The extrapolated bias of the model given by the Supplement for the validated modelled carbon stock estimates for the estimation event, in tonnes of soil organic carbon per hectare.
- (b) The fraction of sampling variance given by the Supplement for the validated modelled carbon stock estimates for the estimation event, in tonnes of soil organic carbon per hectare.
- (c) The correlation coefficient given by the Supplement for the validated modelled carbon stock estimates for the estimation event.

3 What is a sample?

The definition of a sample in Schedule 2 is consistent with that of Schedule 1. Permitted approaches to combine samples taken from a number of locations into a single sample (composite samples) are set out in the Supplement.

Model-validation samples are samples used in Subdivision 4 of Division 4 (model-assisted estimates). The sequencing of the allocation and collection of these samples is what distinguishes them from other samples collected in this Schedule. They must be collected after model-based carbon stock estimates are provided to the Regulator to ensure they are independent of the model-based estimate (i.e. that they did not inform the modelled estimate in any way). If samples were not independent of the model-based estimate, the variance and bias of the model may be considerably underestimated, and there is no assurance that the model-based estimates could not have been optimised to perform better in validation sites than outside of these sites. Model-validation samples may also be used to estimate soil organic carbon stocks under a measurement-based approach in combination with any calibration samples collected. They also allow calculation of specific model performance metrics (model bias, fraction of variance and correlation coefficient) which may be utilised by the Supplement to inform model-only carbon stock estimates. The model-validation samples must not be composited, either within strata or across strata, as this would prevent sampling variance being calculated to inform model-only carbon stock estimates.

Calibration samples are samples that can be used in Subdivision 3 of Division 4 (model-only estimations). They are collected before a model-based carbon stock estimate is provided to the Regulator. They cannot be used in Subdivision 4 of Division 4 (model-assisted estimations). There is no requirement to collect calibration samples. Calibration samples may also be used to estimate soil organic carbon stocks under a measurement-based approach in combination with any model-validation samples collected.

Division 2 – Operation of a soil carbon project under this Schedule

4 Operation of a soil carbon project

Section 4 provides that where Schedule 2 is applied to estimate soil organic carbon stocks for a CEA in a given reporting period, soil organic carbon stocks must continue to be estimated using Schedule 2 for the CEA for the remainder of the project's crediting period. Note that Schedule 2 incorporates a measurement-based approach to estimating carbon stocks. The measurement-based approach to estimating carbon stocks does not impact crediting outcomes for the CEA relative to using Schedule 1, and as such a CEA that has used the measurement-based approach under Schedule 2 can continue to use it to estimate soil organic carbon stocks in subsequent reporting periods (there is no need to revert to Schedule 1). However, if a CEA has estimated soil organic carbon stocks using the model-only or model-assisted approach in Schedule 2, the CEA must continue to use Schedule 2 to estimate soil carbon stocks in all subsequent reporting periods.

5 Steps involved in accounting for a soil carbon project

Section 5 sets out the steps involved in accounting for a soil carbon project.

The project area must be mapped into CEAs, emissions accounting areas and exclusion areas with the same purpose as outlined in section 6 of Schedule 1 of this Explanatory Statement.

Subsection 5(2) outlines when the first and subsequent estimations of carbon stocks must occur for a CEA.

The purpose of paragraphs 5(2)(a)(i and ii) is to ensure that the first estimation event involves soil sampling in every CEA, resulting in either a measurement-based or a model-assisted estimate for every CEA. A model-only estimate would not be suitable for the first estimation event because the uncertainty of the first estimation event needs to be minimised through sampling, given that all subsequent estimation events will be compared to the first estimation

event to determine net abatement. Further, sampling every CEA is likely to be necessary to calibrate models to the unique conditions of each individual CEA.

The first estimation event must occur prior to the end of the reporting period when the project was registered or the project area was included in the project under paragraphs 5(2)(a)(iii and iv). While it can be assumed to be generally disadvantageous for participants to delay baselining for a CEA once project activities have commenced (as any increases in soil organic carbon stocks from the project activity before baselining occurred would not be reflected in net abatement), it is necessary to have a timeframe for when the first estimation must occur to avoid selective timing of the first estimation event (e.g. during drought events).

The purpose of paragraph 5(2)(c) is to ensure carbon stocks are estimated in CEAs at least once every five years to enable net abatement to be determined. Differences in when CEAs are added to a project and when first estimation events occur may mean that some CEAs will contribute to net abatement and others will only have the first estimation event conducted in the first reporting period.

The purpose of paragraph 5(2)(b) is to ensure that sampling occurs at least every 10 years in each CEA to ascertain the uncertainty of any model-only estimates used in that CEA in the interim under paragraph 5(2)(c).

While not all CEAs need to have conducted an estimation event in order to report on a project area in a given reporting period, any CEAs which have undertaken an estimation event (other than the first estimation event) must report those results (under subsection 5(4)). This is to ensure that if CEAs are negatively performing (where carbon stocks decline below baseline or previously credited amounts), they reduce the abatement achieved by the positively performing CEAs. Note that once credits have been issued to a project, not estimating abatement in all CEAs in the project area may make it difficult to receive ACCUs in subsequent reporting periods as previous net abatement for any CEA in the project area is subtracted from the abatement of CEAs reported on in subsequent reporting periods (for example, if expected model-only estimates were unavailable but a fraction of CEAs were still sampled to allow measurement-based estimates). Irrespective of the flexibility provided by subsection 5(4), an estimate of carbon stocks must be provided for each CEA at least every five years under paragraph 5(2)(c).

While subsection 5(2) imposes a number of timeframes for conducting estimation events, individual estimation events may also have a number of dependent processes such as

collection of calibration samples, provision of modelled carbon stock estimate and collection of model-validation samples. The Supplement imposes a number of timeframes for the processes associated with individual estimation events in accordance with subsection 5(3).

6 CEAs, exclusion areas and emissions accounting areas

Section 6 set out the requirements for mapping project areas for the purposes of Subsection 5(1).

Subsection 6(1) requires that CEAs are areas of eligible land where project activities will be carried out until the end of the permanence obligation period for the project. Cessation of eligible management activities (noting that they can be changed) during the permanence obligation period would require removal of the CEA consistent with subsection 9(4) of the Determination. Eligible management activities must be continued beyond the crediting period to avoid the loss of carbon sequestered during the crediting period. To facilitate the removal of individual CEAs in the course of a project, CEAs must have identical responsible landholders. Having different responsible landholders could cause the actions of one landholder to have significant implications for others (such as the cessation of eligible management activities in part of a CEA leading to the removal of the entire CEA). CEAs must be entirely located within a single State or Territory to enable the use of State or Territory specific factors to determine calculate project emissions.

Non-contiguous parts of a CEA are also required to be contained within 10km of each other under subsection 6(2). This is anticipated to be a theoretical maximum as the practical size of CEAs would likely be smaller to reduce the variance associated with soil sampling. The size constraint helps to manage the risk that eligible management activities may cease in a part of a CEA – leading to the removal of the entire CEA.

Subsection 6(3) permits CEAs to be merged or split in accordance with the Supplement. This anticipates that CEAs, particularly those stratified under previous methods, could benefit from being merged to reduce the sampling density required to get precise soil organic carbon stock estimates. Merging and splitting CEAs may also be desirable to achieve as close as possible to the ESM (see Section 13) in the resulting CEAs so that changes in soil organic carbon stocks can be estimated across a constant soil mass.

Subsection 6(4) requires that the project must not remove project areas which would remove part of a CEA rather than the entire CEA. This does not limit the above subsection to split or

merge CEAs prior to removal – but whole CEAs must be removed unless the Supplement provides for the removal of part of a CEA.

Ineligible land included at the start of a project must either be mapped as an exclusion area, as required by subsection 6(5), or an emissions accounting area, as required by subsection 6(5). Where an area of land less than 1% or 50 hectares or whichever is smaller becomes ineligible after the time of stratification, subsection 6(8) allows it to remain as part of an unchanged CEA.

Not all areas for which land management or agricultural activities are to be conducted in the project area will be able to be sampled. Such areas within the project are required to be mapped as emissions accounting areas under subsection 6(6). This accounts for increases in emissions as a result of the project in these areas. Areas which are not subject to land management or agricultural activities may be mapped as exclusion areas under subsection 6(5) – for which neither soil organic carbon stocks nor project emissions are relevant to calculating the net abatement for the project.

Subsection 6(9) requires land in CEA that is ineligible land to be removed from the project area, unless subsections 6(8) or 6(10) apply. The removal of the ineligible land from the project area will trigger relinquishment obligations for the ACCUs issued in relation to that land. Note that under the Act and Rules, ineligible land for which ACCUs have been issued can be removed from the project area by transferring it to another sequestration offsets ERF project which in turn must be revoked in its entirety to trigger the relinquishment obligations.

Subsection 6(8) allows dwellings or structures to be constructed on CEAs without requiring the removal of the area from the project if the dwellings or structures are the smaller of 1% or 5 hectares of the area of the CEA.

Subsection 6(10) allows ineligible land to remain in a CEA, where the Regulator determines that the continued mapping as a CEA is unlikely to result in the crediting of non-genuine carbon abatement – having regard to all the circumstances.

Subsections 6(11) and 6(12) require that land in a CEA with forest cover or forest potential that becomes part of a project area of a project registered under another methodology determination that is not a soil carbon method is removed from the project area. This avoids CEAs of soil carbon projects overlapping with CEAs of projects registered under vegetation methods under the ERF, such as the *Carbon Credits (Carbon Farming Initiative)*

(Human-Induced Regeneration of a Permanent Even-Aged Native Forest—1.1) Methodology Determination 2013.

Subsection 6(13) requires that CEAs, exclusion areas and emissions avoidance areas are mapped in accordance with the Supplement, which provides detail such as the required geospatial attributes of the mapping.

7 Sampling design

This section sets out the requirements for the sampling design. Subsection (7)(1) specifies that each CEA is required to be divided into three or more strata for each estimation event (*strata* meaning subdivisions of a CEA). At least three samples must be taken in each stratum where a sampling round occurs under subsection 5(2) of this Schedule. This requires at least nine samples to be collected from each CEA if sampling is used for an estimation event. This may not equate to nine measurements of soil organic carbon in the CEA if across strata compositing is used (a sample analysis approach that may be permitted by the Supplement).

The total number of samples the project proponent should take to minimise sampling variability for an estimation event in a CEA will depend on how variable the soil and management activities are across the CEA and the project proponent's willingness to pay for additional samples.

Subsection (7)(2) requires that any sampling design meets the requirements included in the Supplement.

Subsection (7)(3) specifies that for each sampling round, the project proponent must submit to the Regulator, prior to undertaking any sampling, a sampling plan meeting any requirements included in the Supplement. This must be submitted at a time specified in the Supplement, which may be prior to undertaking the sampling.

8 Sampling

Subsection 8(1) provides that the sampling round for the first estimation event in each CEA must attempt to sample to at least 30 cms. The results of this sampling will set the ESM under section 13. The depth must be consistent across the CEA.

Subsection 8(2) provides that the sampling round for subsequent estimation events must attempt to attain the ESM. A failure to attain the equivalent soil mass may result in lower carbon stock estimates in subsequent sampling rounds. There is no need to mandate the nominated soil depth for subsequent sampling rounds as compaction of soil may mean that shallower sampling depths are capable of attaining the ESM.

Paragraph 8(2)(b) requires that when the sampling depth (xcm) is greater than 30cm, analysis must be undertaken separately for the 0-30cm and the 30-xcm depth layers. This ensures abatement generated using the Determination can feed into the current National Greenhouse Gas Inventory approach which is calculated for the 0-30cm layer of soil.

Paragraph 8(2)(c) requires that an independent person undertake the sampling and sets out who can qualify as an independent person for the purposes of sampling. One of these requirements is that the independent person cannot be the same person who prepares or reviews the land management strategy. The independent person requirements for this section are different to the requirements to be considered a qualified person for preparing a land management strategy under section 13 of the Determination.

9 Sample analysis

Detail regarding sample analysis is located in the Supplement. This includes information on the measurement of soil organic carbon stocks using different approaches. The requirements and recommendations in the Supplement will differ from project to project depending on the approach used, which will determine which parts of the Supplement are applicable.

Subsection 9(2) avoids any ambiguity around who can prepare soil samples, clarifying that a person (who may be the sampler) with the listed competencies must prepare the soil samples.

Division 3 – Working out the change in soil organic carbon stock for a CEA

10 Working out the change in soil organic carbon stock for a CEA

Subsection (1) requires that if Schedule 2 is to be applied to determine the change in soil organic carbon stock for a CEA in a reporting period, then that change must be worked out using Equation 116.

Subsection (2) requires that, where sampling occurs to a depth greater than 30cm, the change in soil organic carbon stock for a CEA may need to be determined twice:

1. once for the 0-xcm layer, which is used to calculate net abatement of the project (under paragraph 10(2)(c)); and
2. once for the 0-30cm layer, which must be calculated separately to allow for project results to inform Australia's National Inventory Reports (which report soil organic carbon stock change to a depth of 30cm).

Paragraph 10(2)(b) provides that it is not necessary to determine change in soil organic carbon stock for a CEA beyond the 30cm layer. This approach recognises that sampling to a depth greater than 30cm, to 100cm for example, can introduce significant variance into the calculations of soil organic carbon stocks for a CEA which reduces net abatement if soil organic carbon increases have concentrated in the upper (0-30cm) layer. Particularly early in the crediting period, carbon stock changes are expected to occur in the upper layer of soil with changes in the deeper layer (e.g. 30-100cm layer) relatively delayed or non-existent. The option to exclude the 30-xcm layer from accounting, but continue to sample and analyse this layer, allows the deeper layer to be monitored without reducing the abatement observed in the upper layer. Significantly positive changes (using the specified probability of exceedance approach) in the deeper layer can then be reported when observed (assuming baseline sampling round also occurred to this depth), thus incentivising management activities that are also able to achieve soil organic carbon stock increases in the deeper layer.

However, paragraph 10(2)(b) provides that it is necessary to determine the change in soil organic carbon stock for a CEA beyond the 30cm layer, where:

1. soil management activities disturb the soil deeper than 20cm (as sampling must occur 10cm deeper than the disturbance). In these circumstances, it is a requirement to account for the soil to the depth of disturbance plus a 10cm buffer to reflect the possibility that the disturbance has had an influence beyond the depth of disturbance.

This ensures that where management activities may have shifted concentrations of soil organic carbon within the soil profile, these impacts are accounted for.

2. The change in soil organic carbon stocks for the 30-xcm layer is negative (using the specified probability of exceedance approach). This is intended to avoid carbon stock reversals in the deeper layer being omitted from net abatement calculations.

Subsection 10(4) clarifies that the change in soil organic carbon stock with the probability of exceedance specified in the Supplement for a reporting period for a CEA which has not undergone an estimation event (or has only undertaken the first estimation event) in the reporting period is zero.

Division 4 - Working out the soil organic carbon stock and sampling variance for a CEA

Division 4 of Schedule 2 works out the soil organic carbon stock and sampling variance for a CEA for an estimation event.

Subdivision 1—Area, soil mass and estimation approaches for the calculation of soil organic carbon stock and sampling variance for a CEA

Subdivision 1 works out the soil organic carbon stock, variance and ESM for a CEA.

11 Working out the soil organic carbon stock for a CEA

Section 11 multiplies the mean soil organic carbon stock for the CEA by the area of the CEA to give the total soil organic carbon stock for the CEA in tonnes.

12 Working out the sampling variance of soil organic carbon stock for a CEA

Section 12 multiplies the sampling variance of the mean soil organic carbon stock for the CEA by the square of the area of the CEA to give the sampling variance of soil organic carbon stock for the CEA in tonnes of soil organic carbon squared.

13 Determining ESM from the sampled soil masses derived during the baseline sampling round

When comparing soil organic carbon stocks across estimation events, it is necessary to adjust for changes in soil carbon mass to prevent crediting for changes in the soil mass that is sampled rather than changes in soil organic carbon concentration in that soil. Soils cannot be reliably sampled to the same mass for a number of reasons:

1. Soil bulk density varies within CEAs due to factors such as parent material, topography, soil moisture, management, tillage and soil organic carbon content resulting in different soil masses being collected to the same depth of sampling.
2. The area within a CEA may contain obstructions such as bedrock which prevent sampling to a constant depth. Variations in soil moisture conditions within a CEA can also affect the depth to which soil can be sampled using agronomic coring equipment (particularly in dry, high clay soils).

The ESM is the mass to which all soil organic carbon stock estimates across all estimation events are adjusted in the CEA. It is set to a specified percentile of the masses of the samples collected for the baseline sampling round in the CEA. This percentile is set out in the Supplement. In response to new data being collected, the percentile may be revised over time (either up or down) to ensure it results in both an accurate and conservative estimation of change between sample rounds over time.

To determine the ESM for a CEA:

- the mass of each sample in the CEA is determined in accordance with the Supplement, which may include provisions to adjust the mass of each sample by removing sub-layers;
- the ESM must be determined for each layer (0-30cm, 0-xcm) in accordance with subsection 10(2);
- the samples for the CEA for the baseline sampling round must be collected at a consistent nominated depth.

The ESM for a CEA may change if CEA boundaries change or if the ESM percentile in the Supplement is changed.

14 Approaches for estimating mean soil organic carbon stock and its sampling variance and degrees of freedom in a CEA

The mean soil organic carbon stock, its sampling variance and corresponding degrees of freedom must be calculated for the CEA for the estimation event in accordance with the provisions of section 14. These outputs inform the calculation in Division 5 of the change in soil organic carbon stock in the CEA with the specified probability of exceedance.

There are three estimation approaches in this schedule for calculating these outputs, each corresponding to a unique subdivision of Division 4:

1. A measurement-based approach to soil organic carbon stock estimation (subsection 14(3)) in Subdivision 2 of this Schedule uses the mean and sampling variances associated with the samples collected in each stratum to define a stratum level mean and its associated sampling variance. The degrees of freedom for each stratum is calculated using the stratum sampling variance and the number of samples collected in the CEA. The stratum values are then aggregated to CEA values. Estimates using the measurement-based approach are consistent with the measurement-only approach in Schedule 1.
2. A model-only approach to soil organic carbon stock estimation (subsection 14(4)) in Subdivision 3 uses modelled carbon stock estimates calculated according to requirements set out in the Supplement. This results in estimates of the mean soil organic carbon stock in each stratum of the CEA using estimates of the bias, fraction of sampling variance, the correlation coefficient and degrees of freedom for the model. These variables are calculated based on other CEAs to which the model-assisted approach is applied (Subdivision 4 of Division 4) and are adjusted for application in the specific CEA to which the model-only approach is applied (in a process set out in the Supplement).
3. A model-assisted approach to soil organic carbon stock estimation (subsection 14(5)) in Subdivision 4 requires the provision of modelled carbon estimates and collection of samples for the CEA. The approach has the potential to reduce the variance of the carbon stock estimate relative to sampling alone and increase crediting or reduce the sampling density required. A regression is performed between the modelled carbon and measured carbon stock estimates which provides the mean and the sampling variance of the regression estimate of carbon stocks in the CEA. The degrees of freedom is determined by both the number of validation samples collected as well as the variance of the regression estimate of carbon stocks in the CEA.

If more than one approach could be used to calculate these outputs for a CEA, for example a model-assisted or measurement-based approach, subsection 14(2) provides that the provision in section 14 that results in the lowest variance must be used.

Subdivision 2—Measurement-based soil organic carbon stock estimation and its sampling variance for the CEA for each estimation event

Subdivision 2 applies a measurement-based approach to estimate soil organic carbon stock and its sampling variance for the CEA for an estimation event. It must be applied to any samples collected for the estimation event, including calibration samples collected to inform modelled carbon stock estimates (for the purposes of Subdivision 3 or 4 of this Division) and model-validation samples collected for the purposes of Subdivision 4 of this Division. They are all considered samples for the purposes of this subdivision. If both calibration and validation samples have been collected from the CEA, the application of this subdivision could result in a lower variance than the application of Subdivision 4 (model-assisted approach) for the purposes of subsection 14(2). In that circumstance, this subdivision will be used for the calculation of carbon stocks in the CEA, as it would be the most precise estimate of carbon stock for the CEA.

15 Working out the soil organic carbon stock of each sample in each layer

This section adjusts the carbon stock of each layer of a sample to the ESM when converted to the tonnes of oven dry whole soil per hectare in accordance with the Supplement.

If a soil sample's layer mass exceeds the ESM, the approach aligns the carbon stock to the ESM by reducing the carbon stock in proportion to the amount by which the mass exceeds the ESM (which is achieved more precisely if sublayers have been analysed). If a soil sample has been divided into sublayers for analysis of carbon stock, the carbon stock of each sublayer is summed, progressing incrementally down from the soil surface to the depth required to produce a mass that is equal to or exceeds the ESM. In the sublayer where ESM is met or exceeded, the contribution to the carbon stock of the estimate is proportional to the fraction of the soil mass of the sublayer required to achieve the ESM of the soil layer.

If a soil layer's mass is less than the ESM, only the carbon stock in the soil layer's mass can contribute to the estimate. It would not be appropriate to apply the soil organic carbon concentration of the soil layer to the higher mass of the ESM – as soil carbon concentration is assumed to decline with depth and the possibility that there is no soil beneath the depth reached.

16 Mean soil organic carbon stock in a stratum

This section calculates the mean soil organic carbon stock for each stratum in the CEA based on the samples from that stratum using the standard equation for the mean.

17 Area-weighted mean soil organic carbon stock in a CEA

This section calculates the mean carbon soil organic stock in a CEA based on an area-weighted average of the mean soil organic stock of each stratum in that CEA.

18 Sampling variance of the mean soil organic carbon stock within a stratum

This section calculates the sampling variance of the mean soil organic carbon stock for each stratum in the CEA using the standard equation for sampling variance (not population variance).

19 Sampling variance of the mean soil organic carbon stock within a CEA

This section calculates sampling variance of the mean soil organic carbon stock for the CEA based on an area weighted (using the square of the area because sampling variance is a squared variable) summation of the sampling variances of the mean soil organic carbon stock for each stratum within the CEA.

20 Degrees of freedom for the sampling variance of the mean soil organic carbon stock within a CEA

This section calculates the degrees of freedom for the sampling variance of the mean soil organic carbon stock within the CEA based on:

1. Where individual or within-strata composite samples were used for the estimation event, the area-weighted sampling variance and sample numbers in each stratum.
2. Where across strata composite samples were collected across equal area strata, the number of composite samples in the CEA.

This section is used to calculate the degrees of freedom for the sampling variance of the mean soil organic carbon stocks within the CEA between estimation events in Equation 115 (if applied under subsection 14(2)).

Subdivision 3—Model-only soil organic carbon stock estimation and its sampling variance for the CEA for each estimation event

Subdivision 3 applies a model-only approach to estimate soil organic carbon stock and its variance for the CEA for an estimation event.

21 Working out the modelled soil organic carbon stock in each layer of each stratum

This section adjusts the modelled carbon stock estimates to the ESM. As per the definition of modelled carbon stock estimates, these must be provided with a corresponding oven dry whole soil mass for each geospatially distinct unit in each stratum of the CEA.

If the modelled soil mass exceeds the ESM, the approach aligns the carbon stocks to the ESM by reducing the soil organic carbon stock in proportion to the amount by which the modelled soil mass exceeds the ESM (which can be achieved more precisely if modelled carbon stock estimates have been provided for individual sublayers). If modelled carbon stock estimates have been provided for individual sublayers, the soil organic carbon stock of each layer is summed, progressing incrementally down from the soil surface to the depth required to produce a value for sample mass that is equal to or exceeds the ESM. In the sublayer where ESM is met or exceeded, the contribution of the carbon stock of the estimate is proportional to the fraction of the soil mass of the sublayer required to achieve the ESM of the soil layer.

If the total mass of a modelled carbon stock estimate is less than the ESM, only the carbon stock to the model's soil mass can contribute to the estimate. It would not be appropriate to assume that the higher mass of soil to the ESM has the same soil organic carbon concentration as the model for the lower soil mass – based on the second assumption listed above as well as the possibility that there is no soil beneath the mass estimated by the model.

If there is confidence that a CEA's ESM is to be unchanged for the duration of the project's crediting period (i.e. the CEA's boundaries won't change), providing the modelled carbon stock estimates to the ESM may suffice. However, there are circumstances where providing modelled carbon stock to masses above and below the ESM will reduce the chances of misaligned masses across estimation events (resulting in a conservative estimate of carbon stocks in subsequent estimation events according to the operation of this section). This could occur if:

1. layers are to be adjusted in accordance with paragraph 10(2)(b) of this Schedule.
2. any provisions included in the Supplement are used to align masses between estimation events by removing sublayers.

3. strata are to be moved between CEAs in accordance with subsection 6(3) of this Schedule.
4. model-assisted estimates are provided for the first estimation event (see subdivision 4) for which the ESM is not yet known.
5. soils are predicted to be shallower than the ESM in some parts of the CEA.

Note that it is not possible to revise the soil mass for modelled carbon stock estimates once they have been provided to the Regulator. The soil masses of modelled carbon stock estimates have a direct impact on the carbon stock for the CEA and to revise these after sampling has occurred would reduce confidence in the independence of any validation that may have occurred under subdivision 4 of this division (the model-assisted approach).

The more individual sublayers for which modelled carbon stock estimates have been provided, the less the impact of conservative adjustments required to align soil masses across estimation events.

Some process-based soil organic carbon models estimate volumetric carbon stocks. The volumetric carbon stocks would need to be converted to an oven dry whole soil mass based on the depth of sampling and the ESM. Where both the model estimates are provided and sampling occurs to a similar depth (30cm – such as used in Australia’s National Inventory’s Full Carbon Accounting Model), this is a relatively easy conversion. Project proponents sampling to a deeper depth than the depth to which their process-based models provide estimates may choose to provide carbon stock estimates using the process-based model for the 0-30cm layer and distinct empirical relationships around subsoil dynamics for the 30-xcm layer.

22 Mean modelled soil organic carbon stock in a CEA

This section calculates the mean modelled carbon soil organic stock in a CEA based on an area-weighted average of the mean soil organic stock of each stratum in that CEA.

23 Extrapolated bias-adjustment of the modelled soil organic carbon stock within a CEA

This section adjusts the mean modelled carbon soil organic stock in a CEA based on the bias of the model that is extrapolated from the application of the model in other CEAs where model-validation sampling occurred for the estimation event. In the CEAs where model-validation sampling occurred for the estimation event, the bias of the model is

calculated according to section 46 in this Schedule. The bias of the model for the CEA to which this division is applied is calculated in accordance with the Supplement.

The Supplement may provide which CEAs, where model-validation occurred for the estimation event, may contribute to the calculation of the bias for the CEA to which this division is applied, and how the bias is aggregated into a single estimate.

24 Extrapolated estimate of the sampling variance of mean carbon stocks in the CEA

The extrapolated estimate of the sampling variance of the mean carbon stocks in the CEA (used in equation 72) is calculated from the application of the model in other CEAs where model-validation sampling occurred for the estimation event. In the CEAs where model-validation sampling occurred for the estimation event, the correlation can be calculated according to section 47 and the fraction of variance according to section 48 in Schedule 2. The correlation and fraction of sampling variance for the CEA to which this subdivision is applied is calculated in accordance with the Supplement.

A discount is applied to increase the sampling variance of the modelled soil organic carbon stock for the CEAs where model-validation sampling occurred for the estimation event when it is extrapolated to the CEAs to which this subdivision is applied. This discount is required to ensure conservatism, as the true variance for the CEAs to which this subdivision is applied is unknown. The discount factor is specified in the Supplement. This discount operates such that, where a model correlation of 0 is observed in the CEAs where model-validation sampling occurred for the estimation event, this results in the sampling variance of the model in the CEAs to which this subdivision is applied being multiplied by the discount factor plus one. As the model correlation in the CEAs where model-validation sampling occurred for the estimation event approaches 1, the effect of the discount factor approaches 0 and the sampling variance of the modelled soil organic carbon stock for the CEAs to which this subdivision is applied is assumed to equal the sampling variance for the CEAs where model-validation sampling occurred for the estimation event. The discount factor may be adjusted over time as project data becomes available to assess the certainty of modelled estimates.

Equation 87 also multiplies the fraction of sampling variance for the CEA to which this division is applied by the mean bias-adjusted modelled soil organic carbon stock for the CEA (determined in equation 86). This ensures that sampling variance scales with the mean soil organic carbon stock of the CEA (higher carbon stocks are expected to result in higher model variances).

25 Degrees of freedom for the sampling variance of the mean soil organic carbon stock within a CEA

The degrees of freedom of the sampling variance of the mean soil organic carbon stock within a CEA (used in equation 115) is given by the Supplement and based on the number of samples collected from the other CEAs where model-validation sampling occurred for the estimation event (not the CEA to which this subdivision is applied).

Subdivision 4—Model-assisted soil organic carbon stock estimation and its sampling variance in the CEA for each estimation event

26 Application of this subdivision

Subdivision 4 applies a model-assisted approach to estimate soil organic carbon stock and its variance in the CEA for an estimation event.

27 Working out the modelled soil organic carbon stock in each layer of each stratum

This section has the same purpose as section 21 of Schedule 2 and therefore that section of the Explanatory Statement provides an overview of the operation of this section. It differs from section 21 in that it does not rely on validated modelled carbon stock estimates being available but can also utilise modelled carbon stock estimates which have not been validated in accordance with the Supplement. The model is required to be applied to each geospatially distinct unit in each stratum of the CEA.

28 Mean modelled soil organic carbon stock in a CEA

This section has the same purpose as section 22 of Schedule 2 and therefore that section of the Explanatory Statement provides an overview of the operation of this section. It differs in that it does not rely on validated modelled carbon stock estimates being available but can also utilise modelled carbon stock estimates which have not been validated in accordance with the Supplement. The mean modelled soil organic carbon stock produced represents the mean across all geographically distinct units in the CEA.

29 Working out the modelled soil organic carbon stock for each model-validation site

This section has the same purpose as section 21 of Schedule 2 and therefore that section of the Explanatory Statement provides an overview of the operation of this section.

It differs from section 21 as it is specific to the estimate for each model-validation site within the CEA rather than to all geographically distinct units. This allows subsequent statistics to be calculated on the basis of ESMss between the model and samples. It also differs in that it does not rely on validated modelled carbon stock estimates being available but can also utilise modelled carbon stock estimates which have not been validated in accordance with the Supplement.

30 Mean modelled soil organic carbon stock for each model-validation site in a stratum

This section has the same purpose as section 28 of Schedule 2 and therefore that section of the Explanatory Statement provides an overview of the operation of this section. It differs from section 28 as the mean of the sites in a stratum can be different from the mean of the model across all geographically distinct units within the stratum.

31 Working out the soil organic carbon stock of each model-validation site in each layer

This section has the same purpose as section 15 of Schedule 2 and therefore that section of the Explanatory Statement provides an overview of the operation of this section. It differs from section 15 as it is applied only to model-validation samples, not all samples collected for the estimation event.

32 Mean soil organic carbon stock in a stratum from model-validation samples

This section has the same purpose of section 16 of Schedule 2 and therefore that section of the Explanatory Statement provides an overview of the operation of this section. It differs from section 16 as it is applied only to model-validation samples, not all samples collected for the estimation event.

33 Area-weighted mean soil organic carbon stock in a CEA from model-validation samples

This section replicates section 17 of Schedule 2 and therefore that section of the Explanatory Statement provides an overview of the operation of this section. It differs from section 17 as it is applied only to model-validation samples, not all samples collected for the estimation event.

34 Variance of the mean soil organic carbon stock within a stratum from model-validation samples

This section replicates section 18 of Schedule 2 and therefore that section of the Explanatory Statement provides an overview of the operation of this section. It differs from section 18 as it is applied only to model-validation samples, not all samples collected for the estimation event.

35 Variance of the mean soil organic carbon stock within a CEA from model-validation samples

This section replicates section 19 of Schedule 2 and therefore that section of the Explanatory Statement provides an overview of the operation of this section. It differs from section 19 as it is applied only to model-validation samples, not all samples collected for the estimation event.

36 Sampling fraction in each stratum

This section works out the sampling fraction for each stratum and reflects the proportion of the stratum from which samples were collected. For example, if a stratum had 100 equal-area polygons with unique modelled carbon stock estimates, and 12 samples were collected from 10 polygons (2 polygons have 2 samples collected from them), the sampling fraction of the stratum would be 0.1. The sampling fraction is not 0.12 as an estimation area (e.g. pixel or polygon) is only counted once even if multiple sample locations happen to co-locate on the same estimation area.

This sampling fraction is used to weight subsequent statistics in the subdivision, where strata with a higher sampling fraction have a greater influence on the statistics than strata with a lower sampling fraction.

37 Sampling density weighting in each stratum

This section works out the sampling density weighting for each stratum based on the sampling fraction from section 36, and the number of samples collected from the stratum, as well as the area of the stratum. The sampling density weighting is used to weight subsequent statistics in the subdivision, where strata with a higher sampling density weighting have a greater influence on the statistics than strata with a lower sampling density weighting.

38 Area-weighted mean of the modelled carbon stocks at sample sites

This section calculates the mean modelled soil organic carbon stocks for the CEA based on an area-weighted average of the mean modelled soil organic stock of the model-validation sites in that CEA worked out in section 30 of Schedule 2. This is used in section 40 of Schedule 2.

39 Regression coefficient for the modelled and sampled carbon stocks in the CEA

This section calculates the regression coefficient for the modelled and measured carbon stocks in the CEA. It uses the sampling density weighting (section 37 of Schedule 2) as well as the modelled and measured soil organic carbon stocks for the model-validation sites. It informs the regression estimate of carbon stocks (section 40 of that Schedule) as well as the variance of that estimate (section 44 of that Schedule).

40 Regression estimate of carbon stocks in the CEA

This section calculates the regression carbon stock estimate for the CEA. It corresponds to the mean of the measured carbon stocks for the CEA plus an adjustment depending on the relationship between the mean of the modelled carbon stocks for the CEA and the modelled carbon stocks for the validation sites for the CEA.

For example, if the model predicted that the model-validation sites had a lower mean than it predicted for the CEA, the difference between the two would be multiplied by the regression coefficient of the model. The regression coefficient can be positive or negative but if the model predictions were positively correlated with the model-validation sites, the difference would be multiplied by a factor between 0 and 1.

The operation of the regression is such that, if there is confidence that models can predict which areas of a stratum have high carbon stocks, and which have low carbon stocks, a small number of model-validation samples can more confidently estimate the true mean of the CEA's stratum. This facilitates fewer samples being collected, and larger strata being used

under a model-assisted approach than would otherwise be optimal under a measurement based approach.

41 Variance of the modelled soil organic carbon stock within a stratum

This section calculates the variance of the mean modelled soil organic carbon stock for the model-validation sample sites in the CEA. This is used in section 43 of Schedule 2.

42 Covariance of the sampled and modelled soil organic carbon stocks in each stratum

This section calculates the covariance of the measured and modelled soil organic carbon stocks for each stratum. This is used in section 43 of Schedule 2.

43 Regression estimate of sampling variance of mean carbon stocks within a stratum

This section calculates the regression estimate of sampling variance of mean carbon stocks for each stratum in a CEA. The sampling variance is determined by the variance of the measured soil organic carbon stocks, the variance of the mean modelled soil organic carbon stocks, and the covariance of the measured and modelled soil organic carbon stocks for the stratum. This is used in sections 44 and 45 of Schedule 2.

44 Regression estimate of sampling variance of mean carbon stocks in the CEA

This section calculates the regression estimate of sampling variance of mean carbon stocks in the CEA. To determine the sampling variance in the CEA, the variance for each stratum is weighted by the area of each stratum. This is used in Equation 72 (if applied under subsection 14(2) of Schedule 2).

45 Degrees of freedom for the regression estimate of sampling variance of mean carbon stocks in the CEA

This section is used to calculate the degrees of freedom for the variance of the mean soil organic carbon stocks within the CEA between estimation events in Equation 115 (if applied under subsection 14(2) of Schedule 2).

46 Bias of the carbon stock estimation in the CEA

This section calculates the bias of the modelled carbon stocks in a CEA where validation sampling occurred – that is, how the modelled estimates of carbon stocks differ to the measured estimates of carbon stocks. The modelled carbon stocks in the CEA where a model-only approach is applied can then be adjusted by the bias of the model.

47 Correlation of the sampled and modelled soil organic carbon stocks for the CEA

This section calculates the correlation of the modelled and measured carbon stocks in each stratum of a CEA. The modelled carbon stocks in the CEA where a model-only approach is applied can then be adjusted by the correlation of the modelled and measured carbon stocks.

48 Fraction of sampling variance in the CEA

This section calculates the fraction of variance for a CEA by dividing the regression estimate of sampling variance of mean carbon stocks for the CEA by the regression carbon stock estimate for the CEA. The modelled carbon stocks in the CEA where a model-only approach is applied can then be adjusted by the variance of the model (which is the fraction of variance multiplied by the mean modelled carbon stock).

Division 5—Working out the creditable change in soil organic carbon stock for a CEA

49 Working out the creditable change in soil organic carbon stock in a CEA for a reporting period

This division calculates the creditable change in soil organic carbon in the CEA associated with the specified probability of exceedance for a reporting period between the first estimation event in the CEA and the last estimation event in the reporting period.

50 Change in carbon stock between estimation events

This section calculates the difference between carbon stocks in the CEA between the first estimation event in the CEA and the last estimation event in the reporting period.

51 Standard error for change in soil organic carbon stock

This section calculates the standard error of the mean difference between total soil organic carbon stocks for the CEA between the first estimation event in the CEA and the last estimation event in the reporting period, based on the variance of the carbon stock estimate for the first and last estimation event.

52 Degrees of freedom for a CEA between estimation events

This section calculates the degrees of freedom (df) to use in section 53 of Schedule 2 for the CEA. This approach uses Satterthwaite Approximation, as the variances of the carbon stock estimate for the first and last estimation event are not assumed to be equal.

53 Change in soil organic carbon stock in the CEA with the specified probability of exceedance for a reporting period

This section calculates the change in soil organic carbon stock for a CEA for a reporting period between the first estimation event and the last estimation event for the reporting period associated with the probability of exceedance specified in the Supplement. The specified probability of exceedance needs to be conservative, without precluding reasonable rates of soil organic carbon stock change being recognised.

A one-tailed student's t-test is used as it is generally used in the scientific literature for comparing the difference in soil organic carbon across two time periods.

This equation applies a temporary discount of 0.25 to the creditable amount of change in soil organic carbon stock where only two estimation events have occurred. This reduces the potential for credits to be issued for increases in carbon stocks that may not be maintained over time. This is because effect of climatic influences relative to management-induced changes is assumed to be more influential in the early stages of the project. After 3 or more estimation events, credits withheld due to the discount will be returned if carbon increases are maintained.

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—Estimation of Soil Organic Carbon Sequestration using Measurement and Models) Methodology Determination 2021

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—Estimation of Soil Organic Carbon Sequestration using Measurement and Models) Methodology Determination 2021* (the Determination) sets out the detailed rules for implementing and monitoring offsets projects that sequester organic carbon in agricultural soils.

Project proponents wishing to implement the Determination must apply to the Clean Energy Regulator (the Regulator) and meet the eligibility requirements set out under the *Carbon Credits (Carbon Farming Initiative) Act 2011*. Offsets projects undertaken in accordance with the Determination, and approved by the Regulator, can generate Australian Carbon Credit Units representing emissions reductions from the project.

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.

The Hon Chris Bowen MP

Minister for Climate Change, Energy, Environment and Water