<u>EXPLANATORY STATEMENT</u>

Carbon Credits (Carbon Farming Initiative) Act 2011

Carbon Credits (Carbon Farming Initiative—Emissions Abatement through Savanna Fire Management) Methodology Determination 2015

Background

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 sequestering carbon in soil or trees.

In 2014, the Act was amended by the *Carbon Farming Initiative Amendment Act 2014*, to establish the Emissions Reduction Fund (ERF). The ERF has three elements: crediting emissions reductions, purchasing emissions reductions, and safeguarding emissions reductions.

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, by legislative instrument, a Methodology Determination. The purpose of a Methodology Determination is to establish procedures for estimating abatement (emissions reduction and sequestration) from eligible projects and rules for monitoring, record-keeping and reporting. These methodologies will ensure that emissions reductions are genuine—that they are both real and additional to business-as-usual.

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 considers it inconsistent with the offsets integrity standards, which are set out in section 133 of the Act. The Minister will also consider any adverse environmental, economic or social impacts likely to arise as a result of projects to which the Determination applies.

Offsets projects that are undertaken in accordance with the Methodology Determination and approved by the Clean Energy Regulator (CER) can generate Australian Carbon Credit Units (ACCUs), representing emissions reductions from the project.

Project proponents can receive funding from the ERF by submitting their projects into a competitive auction run by the CER. The Government will enter into contracts with successful proponents, which will guarantee the price and payment for the future delivery of emissions reductions.

Further information on the ERF is available on the Department of the Environment website at:

www.environment.gov.au/emissions-reduction-fund.

Background: Emissions Abatement through Savanna Fire Management

Explanatory Statement to F2015L00344

During combustion, fires emit greenhouse gases, including methane and nitrous oxide. Methane has a global warming potential that is 21 to 25 times greater than that of carbon dioxide, and nitrous oxide has a global warming potential that is about 310 times greater than that of carbon dioxide.

Emissions of greenhouse gases are greater for very hot, high intensity fires when compared with cooler, lower intensity fires. In northern Australian savannas, higher intensity fires predominate late in the dry season, and lower intensity fires predominate early in the dry season when vegetation still contains some moisture from the wet season. In the late dry season, vegetation is very dry and unplanned lightening ignitions are common, particularly immediately prior to the wet season. During late dry season fires, there is almost complete combustion of fuels, with the release of large quantities of greenhouse gases. With no or minimal fire management, fires occur predominately in the late dry season. Early dry season fires can reduce the incidence and extent of late dry season fires.

The project activity under this Determination is fire management carried out with the objective of abating greenhouse gas emissions from fire without increasing greenhouse gas emissions from other sources such as livestock or decomposition of organic carbon. The objective is to abate greenhouse gas emissions from fire largely through using fire during the early dry season. The intent is to reduce the proportion of the total area burnt by all fires that occurs in the late dry season.

Under this Determination, abatement is estimated using models parameterised to account for the differences in emissions between vegetation fuel types, fire seasons, fuel loads as a function of time since the last fire, and regions receiving different amounts of average annual rainfall. This Determination covers two rainfall zones shown on the Savanna Fire Management Rainfall Zone spatial data layers:

- the high rainfall zone, is the area of land indicated as the high rainfall zone on the spatial data layer as published on the Department's website; and

- the low rainfall zone, is the area of land indicated as the low rainfall zone on the spatial data layer as published on the Department's website.

The earlier savanna-burning Determinations, the *Carbon Credits (Carbon Farming Initiative) (Reduction in Greenhouse Gas Emissions through Early Dry Season Savanna Burning–1.1) Methodology Determination 2013* and the *Carbon Farming (Reduction of Greenhouse Gas Emissions through Early Dry Season Savanna Burning) Methodology Determination 2012*, only cover projects in the high rainfall zone. Further research has enabled the parameterisation of equivalent models for the low rainfall zone, allowing the extension of this Determination to a wider region. In addition, this Determination improves the models used to estimate abatement in the high rainfall region.

This Determination is based on empirical data that has been stratified by fire season, the years since last burnt, and vegetation fuel types present in the two rainfall zones. Projects require a validated vegetation fuel type map which defines the eligible project area in each rainfall zone. Fire scar maps for each fire season of each year in the baseline and reporting years are derived from satellite data. The vegetation and fire scar maps are overlaid to derive the potential area burnt in each fire season of each year. In addition, 'years since last burnt' maps are derived by overlaying the vegetation fuel type maps with the fire scar maps over the preceding years. The years since last burnt maps determine fine fuel loads in each pixel. The potential emissions of methane and nitrous oxide for each fire season, given the vegetation fuel type and years since last burnt, are determined from fuel loads and parameters defining

the burning efficiency and combustion of fuels. The actual emissions account for the patchiness of burnt fire scars in the fire season, with more complete burns occurring with higher intensity fires in the late dry season. Emissions in the reporting year also arise from use of fossil fuel to establish and maintain the project activity.

Under this Determination, project proponents can either complete geospatial and other calculations manually, or use the appropriate version of the Savanna Burning Abatement Tool (SavBAT 2) which simplifies the reporting and record-keeping requirements.

This Determination provides an incentive for proponents to manage fire in savannas to reduce greenhouse gas emissions. In addition, projects may generate co-benefits, including social, cultural, employment and biodiversity benefits.

Application of the Determination

The Determination sets out the detailed rules for implementing and monitoring offsets projects that result in a net reduction of greenhouse gas emissions from savanna fires through fire management. The rules have been designed to help ensure that emissions reductions are real and additional to business-as-usual.

Project proponents wishing to implement projects under this Determination must make an application to the CER 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; and

- the regulatory additionality requirement; and

- the government program requirement.

Subsection 27(4A) of the Act provides that a Methodology Determination may specify requirements in lieu of the newness requirement or the regulatory additionality requirement. The Determination specifies a requirement in lieu of the newness requirement (see section 10) and in lieu of the regulatory additionality requirement (see section 11), which applies alongside government program requirement.

Public consultation

The exposure draft of the Determination was published on the Department's website for public consultation from 10 December 2014 to 9 January 2015 2014, and nine submissions were received. These have been addressed in the Determination, in addition to responding to comments from a technical assessment and from the Clean Energy Regulator.

The development of this methodology was supported through an Australian Government grant from the Indigenous Carbon Farming Fund Research and Development stream to the North Australia Indigenous Land and Sea Management Alliance. The grant enabled the parameterisation of the carbon abatement estimations for the low rainfall region, and extended existing research for estimating carbon abatement for the high rainfall region.

Determination details

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

Details of the Determination are at <u>Attachment A</u>.

For the purpose of subsections 106(4), (4A) and (4B) of the Act, in making this 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 proposed 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 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 other relevant considerations.

Subitem 393A(2) of Schedule 1 of the *Carbon Farming Initiative Amendment Act 2014* operated in relation to this Determination to deem the request to the Interim ERAC to be the relevant request to the statutory ERAC under subsection 106(10) of the Act. Subitem 393A(3) then allowed the ERAC to consider the consultation on the exposure draft which occurred before 13 December 2014 and not re-open consultation under section 123D of the Act.

A statement of compatibility with human rights is at <u>Attachment B</u>.

Note on this explanatory statement

Numbered sections in this explanatory statement align with the relevant sections of the Determination.

Details of the Methodology Determination

Part 1   Preliminary

1   Name

Section 1 sets out the full name of the Determination, which is the *Carbon Credits (Carbon Farming Initiative—Emissions Abatement through Savanna Fire Management) Methodology Determination 2015*.

2   Commencement

Section 2 provides that the Determination commences on the day after the Determination is registered.

3   Authority

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

4   Duration

Under subparagraph 122(1)(b)(i) of the Act, a Methodology Determination remains in force for the period specified in the Determination.

This section provides that the Determination remains in force from commencement until the day before it would otherwise be repealed under subsection 50(1) of the *Legislative Instruments Act 2003*.

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

If the Determination expires or is revoked during a crediting period for a project to which the Determination applies, the Determination would 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 CER 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).

Under section 27A of the Act the ERAC may also suspend the processing of applications under a Determination if there is reasonable evidence that the Methodology Determination does not comply with one or more of the offsets integrity standards. This does not impact applications for declaration already received by the CER before such a suspension or declared eligible offset projects which apply the Determination.

5   Definitions

Section 5 defines a number of terms used in the Determination.

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

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

6   Meaning of *high rainfall* and *low rainfall zone*

The meaning of the high rainfall zone is land indicated as the high rainfall zone in the Savanna Fire Management Methodology High Rainfall Zone spatial data layer as published on the Department's website at the date of commencement of this Determination.

The meaning of the low rainfall zone is land indicated as the low rainfall zone in the Savanna Fire Management Methodology Low Rainfall Zone spatial data layer as published on the Department's website at the date of commencement of this Determination.

These maps determine whether the land covered by the project is in an eligible area. In addition to this eligibility requirement the project proponent must identify the project areas that contain vegetation fuel types as listed in Schedule 1 commensurate with the scale of the vegetation fuel type map requirements (Division 2) .

7   Meaning of *early dry season* and *late dry season*

Section 7 provides that in every year of the baseline period, and every year of the crediting period, the late dry season starts on 1 August and ends on 31 December. The remainder of the year is defined as the early dry season. It is noted that, for the purposes of this Determination, the definitions of the early and late dry seasons overlap with the wet season, approximately from November to April, during which fire generally does not occur.

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Part 2   Savanna fire management projects

8   Savanna fire management projects

Paragraphs 27(4)(b) of the Act provides that the CER must not declare that an offsets project is an eligible offsets project unless satisfied that it is covered by a Methodology Determination. Paragraph 106(1)(a) of the Act provides for Methodology Determinations to specify the kind of offsets projects to which they apply.

Subsection 8(1) provides that the Determination applies to offsets projects that: (a) aim to reduce the emission of methane and nitrous oxide from fire by using fire management primarily in the early dry season; and (b) are carried out in savannas that includes land in either or both in the high rainfall zone and the low rainfall zone as defined by the Savanna Fire Management Carbon Farming Methodology rainfall zone spatial data layers. For this Determination, fire management means fire management carried out with the objective of abating greenhouse gas emissions from fire without increasing emissions from other sources.

The rainfall zone spatial data layers can be found on the Department's website at www.environment.gov.au.

Subsection 8(2) provides that a project covered by subsection 8(1) is a savanna fire management project.

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Part 3   Project Requirements

Division 1   General

<u>9   General</u>

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 CER must not declare that a project is an eligible offsets project unless the CER is satisfied that the project meets these requirements. Section 9 provides that Part 3 of the Determination sets out requirements for the purpose of paragraph 106(1)(b) of the Act.

Division 2   Additionality

<u>10   Requirements in lieu of newness requirements</u>

Under paragraph 27(4)(d) of the Act, the CER is not able to declare an offsets project an eligible offsets project unless, among other things, the project meets the additionality requirements set out in subsection 27(4A) of the Act. One of those requirements is either the 'newness' requirement specified in subparagraph 27(4A)(a)(i), or else a requirement that is specified, in accordance with subparagraph 27(4A)(a)(ii), in lieu of the newness requirement. Section 10 of the Determination specifies a requirement in lieu of the newness requirement, for the purposes of subparagraph 27(4A)(a)(ii).

The Determination states that there is one provision 'in lieu of newness' (s 10(2)), which is that the project must be a savanna fire management project. . This term is defined in section 8 of the Determination. This provision means that the newness requirement in the Act does not apply.

The policy underlying the newness requirement in subparagraph 27(4A)(a)(i) of the Act is to ensure that emissions reductions are genuinely new, in order to ensure that the Government does not spend funds on projects that are already underway, without support, from the Emissions Reduction Fund. The requirement in lieu of the newness requirement that is imposed by section 10 of the Determination is consistent with, and gives effect to the same policy outcome as, the newness requirement under the Act. For a savanna fire management project under the Determination, the only abatement that is credited is abatement that is additional to what was achieved during the baseline period. That is, if the project proponent had begun early dry season fire management before project commencement, they would only generate credits for abatement over and above the abatement that was achieved in the baseline period. As a result, with this requirement in lieu of the newness requirement, the only abatement credited under the Determination is abatement that is genuinely additional to abatement that had occurred during the baseline period.

For example, proponents can start burning in 2015 in the EDS, and register their project with the CER after the method commences. Under this scenario, their baseline will be in the 10 (high rainfall) or 15 (low rainfall) years that end in 2014 (the calendar year before project commencement), and 'new' abatement will be credited from 2015.

If these proponents had been undertaking the project activity in earlier years, such as under a Government-funded grant, then those years of project activity will be accounted for in the baseline (which will end in 2014), and 'new' abatement (that is over and above the average

during the baseline period) will be credited from 2015. Under this scenario, the average annual baseline will be lower than if they had not been carrying out project activity prior to project commencement.

If the proponent starts the project activity in 2015, but does not register the project, say until 2018, then the first year of project activity will be 2018, and the baseline period will end in 2017 – and will include the years of project activity from 2015 – 2017. This will lower their average annual baseline value, and reduce the amount of credits that can be claimed.

<u>11   Requirement in lieu of regulatory additionality requirement</u>

Projects must meet 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.

However, subsection 27(4A) of the Act also provides that a Methodology Determination may specify requirements in lieu of the newness requirement or the regulatory additionality requirement. Requirements in lieu of the government program requirement may be specified in legislative rules made under the Act.

Subsection 11(2) of the Determination specifies a requirement to apply in lieu of the regulatory additionality requirement in the Act, namely that the project must not include land where fire management for the primary purpose of reducing emissions from fire is required to be carried out by or under a law of the Commonwealth, a State or a Territory

The effect of section 11 is that projects will meet the Determination's requirement in lieu of the regulatory additionality requirement even if they have carried out, or are carrying out fire management on land where fire management is required by law, provided that the law's requirement is not for the primary purpose of reducing emissions. For example, projects would meet the regulatory additionality requirement if they were carried out on land where a state law requires fire management for the purpose of reducing bushfire risk.

Division 3   Project area

Under the Act, a project may be carried out over a single project area, or over more than one project area. Subdivision may be mandatory or at the discretion of the project proponent. The project area or project areas are identified in the declaration under section 27 of the Act, in accordance with regulations or legislative rules made for the purposes of paragraph 27(3)(b) of the Act. Once a project has been declared eligible, the project proponent is able to add further project areas to the project, by seeking a variation of the section 27 declaration under regulations or legislative rules made for the purposes of section 29 of the Act. Regulation 3.16 of the Carbon Credits (Carbon Farming Initiative) Regulations 2011 provides that the CER is able to vary a declaration under section 27 as it relates to the project area if satisfied of the requirements mentioned in subsections 27(4) to (11) of the Act as relevant to the project in relation to the amended project area. These requirements include that the project meets such requirements as are set out in the methodology determination that covers the project, in accordance with paragraph 106(1)(b) of the Act (paragraph 27(4)(c)). The

requirements in this Division are among the requirements that are relevant to making a decision in relation to varying the project area of a project.

Generally speaking, a project proponent is able to choose whether to carry out the project over a single project area or over more than one project area. However, there are some restrictions in relation to project areas and variations to project areas, which are provided for in Division 3 of Part 3 of the Determination.

Division of the project may occur due to aggregation, transitioning, partial reporting and / or separating manual calculations for low and high rainfall zones, or for business objectives or other purposes. This means that the project can be thought of as the sum of all project areas that are part of the project. However, projects are not required to be sub-divided, provided they do not meet the conditions in section 14. That is, a project can contain a single project area.

The project areas cannot be divided once they have been reported on in an offsets report. This ensures that project area boundaries are fixed, ensuring consistent accounting of emissions across time. This ensures that areas of land on which emissions were higher in the reporting period than in the baseline period (i.e. where net abatement is less than zero) cannot be 'masked out' by redrawing the boundaries of project areas, and is important in ensuring that the method specified in the Determination estimates abatement in accordance with the offsets integrity standards.

The determination describes the calculations in terms of each project area, so a project with more than one project area will have to undertake calculations separately for each area.

12   Requirement to be in high or low rainfall zone

'Project area' is defined in the Act, in relation to an area-based offsets project, as an area of land on which the project has been, is being, or is to be, carried out. Savanna fire management projects are area-based offsets projects because they are area-based emissions avoidance projects.

Section 12 provides that each part of the project must be on land that is in the high rainfall zone or the low rainfall zone. The note at the bottom of the section confirms that the project may consist of both land in the high rainfall zone and land in the low rainfall zone. The high rainfall zone and the low rainfall zone are defined by the spatial data layers available on the Department's website at www.environment.gov.au. These spatial data layers determine project eligibility, and project proponents are not able to submit alternative records to determine project eligibility.

13   Requirement to have specified vegetation fuel types

Section 13 specifies that all parts of the project area in the high rainfall zone and in the low rainfall zone must contain at least one of the vegetation fuel types listed for that zone in Schedule 1.

'Vegetation fuel type' is defined in the Determination as a functional vegetation community defined by the vegetation's floristic, functional and structural, soil and emissions profile attributes as specified in Schedule 1.

14   When separate project areas in different rainfall zones are needed

Section 14 provides for when separate project areas are needed in different rainfall zones.

Under the Determination, project proponents are able to calculate the carbon dioxide equivalent net abatement either using SavBAT 2 (in accordance with Division 3 of Part 4 of the Determination) or manually (in accordance with both Division 3 and Division 4 of Part 4). However, the calculations set out in Division 4 are premised on the assumption that the project area in relation to which abatement is being calculated lies wholly within either the high rainfall zone or the low rainfall zone; the calculations set out in Division 4 do not deal with project areas that straddle both rainfall zones. For such a project areas, the only way to calculate abatement is through using SavBAT 2.

Because of this limitation, this section sets out, for the purposes of paragraph 106(1)(b) of the Act, a project eligibility requirement. Under this requirement, a project area for which the project proponent intends to calculate net annual project abatement without using SavBAT 2 must be wholly within either the high rainfall zone or the low rainfall zone. A project will not be an eligible offsets project under this determination if firstly, the project area straddles both rainfall zones, and secondly, the project proponent intends to calculate the carbon dioxide equivalent net abatement amount without using SavBAT 2.

To ensure that this eligibility requirement is met, if the project proponent wishes, or might wish, not to use SavBAT 2, and wishes to conduct a savanna fire management project over an area that straddles both rainfall zones, the area over which the project will be conducted will have to be divided into two project areas, each lying wholly within either the high rainfall zone or the low rainfall zone (but not straddling both zones).

On the other hand, if the project proponent wishes to use SavBAT 2, then the entire area over which the project is to be carried out can be within a single project area that straddles both rainfall zones.

15   Variations to project areas

Section 15 gives effect to the policy that, once a project area has been included as part of a project, the project area cannot be divided, enlarged, or reduced in size after the first offsets report has been lodged.

The method for calculating the carbon dioxide equivalent net abatement amount under the Determination (whether calculations are done using SavBAT or not) is premised on the basis that the area over which abatement is calculated is constant over time, that is, that it is the same during each year of the baseline period and each year of the crediting period. The method does not deal with the possibility that the area over which the project is carried out might vary in size over time. Section 15 operates to prevent project areas from being expanded, reduced in size, or split into two or more smaller project areas, to ensure that the method works properly.

Subsection (1) provides that this section only applies to a savanna fire management project if two conditions are satisfied. First, the Regulator must have declared that the project is an eligible offsets project. Secondly, the project proponent must be proposing to vary the declaration after lodging the first offsets report. Because of this subsection, this eligibility requirement plays no material part when an application for a declaration is first made under section 22 of the Act. However, this section is relevant if an application is made, after submission of the first offsets report, under regulations or legislative rules made for the purposes of section 29 of the Act to vary a declaration in relation to the project area or project areas.

When the provision applies, its result is that a project as proposed to be varied is not an eligible offsets project if it would include a project area that overlaps, but is not identical with, a project area that is already identified in the section 27 declaration. This therefore precludes the amendment of section 27 declarations in such a way that would reduce the size of a project area, that would expand a project area, or that would divide an existing project area into two or more smaller project areas. However, it allows the addition of further, non-overlapping project areas to the project.

A note at the foot of the section indicates how the section operates in the case of projects that are transitioning from an earlier savanna-burning determination (this term being defined in section 5 of the Determination). For the Determination to apply to such a project, the section 27 declaration that was made for the project under the earlier savanna-burning determination would have to be varied in accordance with sections 128, 129 and 130 of the Act. When that is done, the project area under the earlier determination will become the project area under the Determination. Should the project proponent wish to add further project areas to the project, they will need to amend the declaration under regulations or legislative rules made for the purposes of section 29. So long as an offsets report has been submitted on the project under the earlier savanna-burning determination, section 15 will apply equally in relation to such a project. That is, the project area under the earlier savanna-burning determination could not be divided into two or more project areas, could not be expanded, and could not be reduced in size. However, additional, non-overlapping project areas could be added to the project, including project areas that are partially or wholly in the low rainfall zone.

Division 4 – Project activity

16   Project activity

Subsection 16(1) provides that the project must be one in which the project proponent carries out fire management in the project area in the early dry season and in which they may, in addition, carry out fire management in the late dry season. 'Fire management' is defined in section 5 as fire management carried out with the objective of abating emissions from fire without increasing greenhouse gas emissions from other sources such as livestock. Fire management typically involves the application of a strategic early dry season fire regime to reduce the risk of occurrence and extent of late dry season fires, through the planning for, and implementation of, burning practices that reduce fuel loads. Planned burnt patches form a mosaic across the landscape, such that they reduce the potential for fire spread in the late dry season.

Fire management may include igniting fires from aircraft, from vehicles along the sides of roads and tracks, from boats on waterways, or by walking across country. The specific location and timing of burning will depend on landscape features within the project area and local weather conditions. A specific approach to fire management is not prescribed in the Determination.

Subsection 16(2) provides that the fire management must be carried out with the intention of ensuring that, in each project area, the early dry season burn for a year in the crediting period is greater than the average early dry season burn during the baseline period. The *early dry season burn* for a particular project area and for a particular calendar year is defined in subsection 16(5) as the ratio of the area burnt within that project area during the early dry season to the total area burnt within that project area during that year. The overall outcome is that fires burning at lower intensities due to a reduction in available fuel for combustion, a

reduction in the area burnt at high intensities, and a reduction in the proportion of fuel which is consumed by fire. Consequently, there is a reduction in emissions of methane and nitrous oxide produced from fires.

Fire management in the late dry season is permitted as this may include the use of fire to control unplanned fire activity, such as the burning of containment lines. The aim of these containment lines is to reduce the spread of unplanned fire, thus reducing the overall area burnt during the late dry season. Consequently, this results in an increase in the proportion of the annual area burnt during the early dry season.

Subsection 16(3) provides that the fire management may be combined with natural or constructed barriers to reduce the potential for fire spread. Barriers refer to an area that has no fuel and thus cannot carry a fire. Ground fuels that carry fires consist of dry grass (and herbs and forbs etc) and the litter from trees and shrubs. Natural fire breaks occur where there is no such vegetation, such as lakes, rivers, creeks and streams, rock pavements, escarpment (cliffs) and areas scoured by wet season rivers. Constructed barriers are roads and tracks that also do not have any such vegetation.

Natural or constructed barriers are most useful when they are linear and thus form predictable breaks in fuels at the landscape scale and slow or prevent the spread of fire. To slow or prevent the spread of a wildfire in the late dry season, barriers that may have been effective in the early dry season may not be effective as they may not be wide enough due to manage the increased radiant heat and/or spotting distances. In general fire management practice these barriers are widened from time to time by the use of prescribed burning and thus the emissions from this activity are quantified by the Determination. It is very rare for fire breaks to be made mechanically (that is using a grader or other machinery to remove vegetation) due to the size of the areas being managed and the distances machinery must travel. Mechanical fire breaks are used only in the late dry season as a means of providing a line to back burn from and only rarely for high value assets. Typically, existing roads and other natural features are used in preference to disturbing vegetation due to time constraints and costs. Thus the emissions from burning from these barriers are quantified by Determination. As clearing of vegetation fire for fire breaks as a project activity is an anomaly it is considered immaterial relative to the emissions abatement and the Determination does not include a method for calculating emissions from vegetation clearing.

Subsection 16(4) provides that the project must not be one in which the project proponent attempts to increase the proportion of the annual area burnt by all fires in the project area in the early dry season by a method other than fire management. For example, the project proponent must not increase cattle grazing, beyond that which would have occurred under business as usual, to minimise the fire incidence in the late dry season.

Part 4   Net abatement amount

Division 1   Preliminary

17   Operation of this Part

Paragraph 106(1)(c) of the Act provides that a Methodology Determination must specify how to calculate the carbon dioxide equivalent net abatement amount for the project in relation to a reporting period. Part 4 sets out these rules.

18   Simplified outline

This section sets out a simplified outline of the method specified in this Part. Each step must be completed in the order specified.

1. The project proponent must develop and validate a vegetation fuel type map for the project—see Division 2. There is an exception to this requirement for projects that are transitioning from an earlier savanna-burning determination, in which case the project proponent is able to rely on existing vegetation maps for those parts of the project that are transitioning.

2. The project proponent must calculate the carbon dioxide equivalent net abatement amount for the relevant reporting period—see Division 3 and Division 4.

   a. The carbon dioxide equivalent net abatement amount, A, is calculated by adding together the adjusted net annual project abatement, $A_{A,y}$, for each year, y, for which abatement is to be calculated—see Subdivision 1 of Division 3. Where there are two or more project areas, the net abatement amount at the end of the reporting period is also added for all project areas being reported on in the crediting period.

   b. The adjusted net annual project abatement, $A_{A,y}$, is calculated, for each year y, as a function of the net annual abatement for that year, A_y, and the 'uncertainty buffer' for the previous year, R_{y-1}—see Subdivision 2 of Division 3.

   c. The net annual abatement for year y, A_y, can be calculated either using SavBAT 2 or following the steps set out in Division 4—see Subdivision 3 of Division 3.

   d. The net annual abatement for year y, A_y, is a function of several variables. One variable is the annual fossil fuel emissions in calendar year y for fossil fuel type i and greenhouse gas j, $E_{Fo,y,i,j}$, which must be calculated manually, in accordance with Subdivision 4 of Division 3, regardless of whether A_y is calculated using SavBAT 2 or by following the steps set out in Division 4.

The project proponent is only able to calculate the net annual abatement for year y, A_y, by following the steps set out in Division 4, if the project is carried out on an area that is wholly in either the high rainfall zone or the low rainfall zone.

This outline also clarifies that, if the project consists of more than one project area:

   a. the project proponent must carry out the steps set out in Division 3 and, where appropriate, Division 4 separately for each project area; and

b. the carbon dioxide equivalent net abatement amount for the reporting period is the sum of the carbon dioxide equivalent net abatement amounts, *A*, for each project area.

19 Overview of gases accounted for in abatement calculations

Section 19 describes the emission sources that need to be assessed in order to determine the total net change in greenhouse gas emissions resulting from the project activity.

The emission sources which need to be taken into account when calculating abatement are:

- methane and nitrous oxide emissions from the burning of flammable living and dead vegetation (fine, coarse and heavy fuels and shrubs) in the project area during the baseline period and the reporting period; and

- methane, nitrous oxide and carbon dioxide emissions from fuel used to establish and maintain the project, for example from helicopters and other motor-driven equipment or drip torches.

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

Carbon dioxide emissions from burning vegetation are excluded because the carbon dioxide emitted is assumed to be recaptured in vegetation during subsequent growth, and therefore be at equilibrium.

Emissions from a number of sources are excluded, as these are small when compared to fire emissions. These include emissions from decomposition and degradation of living matter in the debris and soil. Emissions from existing livestock and feral animals are excluded, as their numbers are assumed not to significantly increase as a consequence of the project.

Emissions from termites are also excluded. There are few Australian studies investigating the distinction between termite emissions under different fire regimes, different soils, between termite species and between geographically-distinct sites. There is generally a higher density of termites in the low-rainfall zone than in the high-rainfall zone. In addition, the densities of tree and debris biomass (fuels for fire) are lower in the low-rainfall zone than in the high-rainfall zone. As a result, in the low-rainfall zone there is the potential that a greater proportion of methane emissions could be attributed to termites compared with the high rainfall zone. Currently it is not possible to quantify the termite methane emissions in the low-rainfall zone, and termite emissions are most likely immaterial in the high rainfall zone. As fire remains the overall dominant source of methane (likely > 90%) in both rainfall zones, and a change in termite emissions as a result of the project activity is likely to be small relative to the total termite emissions, it is reasonable to assume that the change in termite emissions as a result of the project activity is also immaterial in the low rainfall zone, and it is reasonable to exclude termite emissions from the greenhouse gas assessment boundary.

20 References to factors and parameters from external sources

Section 20 provides that factors and parameters that are required to be sourced from external documents, such as the NGER Regulations or the NGER Measurement Determination, must be taken from the version of the external document that is in force on the last day of the relevant reporting period for the project. This provision does not apply if the Determination stipulates otherwise, or if it is not possible to define or calculate these parameters by reference to the external documents.

Division 2   Vegetation fuel type map

<u>21   Requirement to create vegetation fuel type map</u>

Subsections 21(1) and (2) provide that the project proponent must create a vegetation fuel type map for the project and validate the map in accordance with Sections 22 and 23. A vegetation fuel type map is a map showing the vegetation fuel types listed in Schedule 1 of the Determination that occur in the project. If the map fails the validation, the project proponent must re-interpret and reclassify the map and then repeat the validation process until such time that required accuracy is achieved. Where the project comprises more than one project area the map covering the entire project can then be stratified into the project areas following successful validation. Subsection 21(1)(b) specifies that the requirements of creating and validating apply to each new area added to a project when project declaration is varied under section 27 of the Act.

Subsection 21(3) provides that if the map fails validation then the re-interpretation and re-classification of the map must not use the waypoints that were used to validate the map, nor information from them.

Paragraph 21(4)(a) provides that the map must cover the entire area of the project. The outer boundary of the project area (or areas) may be delineated using cadastral data from state or territory agencies or otherwise as defined by the proponent. However, pixels in the area of the project not vegetated with a vegetation fuel type listed in Schedule 1 are not included in emissions calculations.

Paragraph 21(4)(b) provides that the map must be in raster format. Raster is a common geographic information system (GIS) data format which may be described as a collection of grid cells (pixels) that touch one another either along each side or diagonally in Cartesian space. The image is pixelated (see Figure 1), and each pixel has a single value that in this case represents the vegetation fuel type code or zero. Maps of common vegetation indexes used to create the vegetation fuel type map are commonly derived from satellite data and the resultant product is best left in this native format: satellite derived fire mapping is also in raster format and spatial analysis of multiple datasets across large areas is computationally more powerful in a raster format.
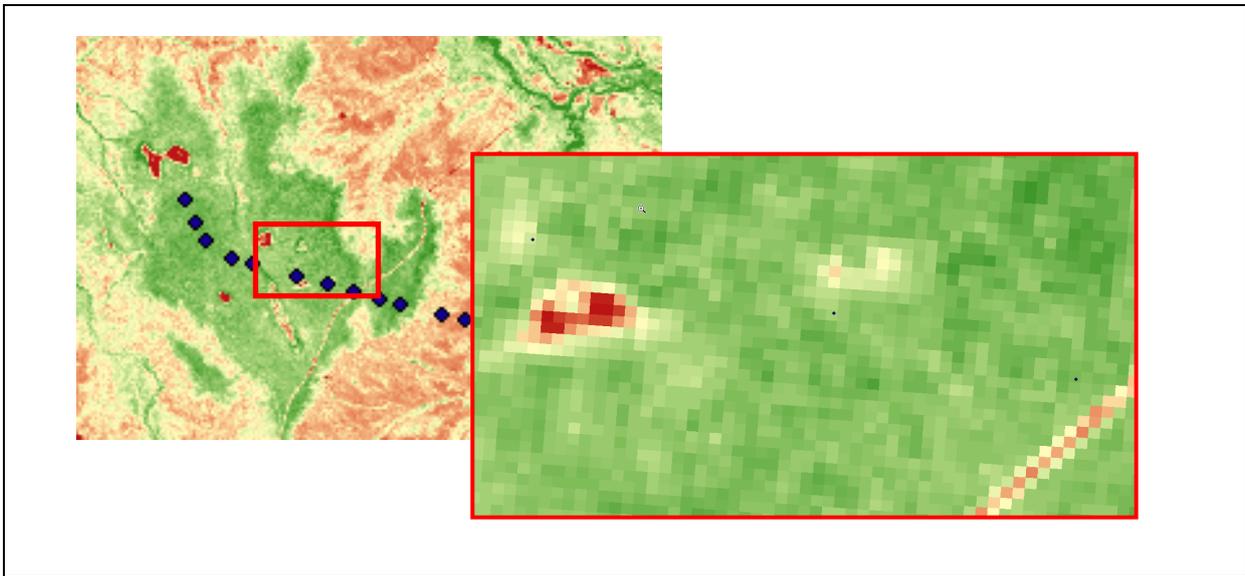

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Figure 1: Landsat satellite image showing typical raster data comprised of pixels in a grid

Paragraph 21(4)(c) provides that the map must have a square pixel size that corresponds to an area of 250 m x 250 m or less, and for maps used in SavBAT 2 that the tool requires square pixels that correspond to exactly 250 m x 250 m.

Fire mapping data sourced from the North Australian Fire Information service (NAFI) commonly used for emissions calculations is derived from red and near-infra red 250 m × 250 m bands of Moderate Resolution Imaging Spectroradiometer (MODIS) satellite imagery. Calculations involving multiple datasets must use similarly scaled data, and so for consistency the map must also have 250 m-sized square pixels to enable these spatial calculations. If the pixels of the map are of a different size, with smaller pixels the only allowable variation, then the map must be "rescaled" in a GIS to 250 m.

Subsection 21(5) provides that the area of the map is all project areas of the project except where the map was prepared because the project area has been varied under a section 27 of the Act and the map of the new area has not been verified in accordance with Subsections 22 and 23. This applies when an application is first made under Section 22 of the Act. In that case, the vegetation fuel type map is required to cover the entire project areas, or the entirety of all project areas. That map must be validated in accordance with Sections 22 and 23 of the Determination, using no less than the minimum number of waypoints specified in that provision. This section also applies if the declaration under section 27 of the Act is varied to add a new project area, or new project areas, to the project. In that case, a vegetation fuel type map must be created in accordance with this section, covering the new project area or areas, and that new map must also be validated in accordance with section 22 of the Determination. That validation for the new project area or areas must also use no less than the minimum number of waypoints specified in that provision.

Paragraph 21(6) specifies that the map indicate a value for each pixel in accordance with Subsections (6) and (7). Subsection (6) provides that the pixels must have a value (or label) that is either a code for a vegetation fuel type listed in Schedule 1 or 'ineligible'. Ineligible pixels include another type of vegetation that is not listed in Schedule 1 or any feature of the landscape that is not vegetation such as water or infrastructure. These ineligible areas include, but are not limited to:

- areas of mangrove and wetlands that are rarely fire affected;

- grasslands which that are not managed using fire management;

- cleared and cultivated land where exotic vegetation dominates;

- cleared land where infrastructure may or may not be present; and/or

- other vegetation that is not in accordance with a vegetation fuel type listed in Schedule 1.

These areas must be referred to on the map as 'INELIGIBLE'.

Identifying a vegetation fuel type

Schedule 1 tables both the mandatory elements and characteristic elements of each eligible vegetation fuel type. The mandatory elements are the structural formation (height and projected foliage cover) of the dominant stratum and the grass type.

Of the mandatory elements column three specifies the dominant stratum for each vegetation fuel type and columns four and five define the canopy height and foliage projected cover for that stratum. The height and projected foliage cover is for the dominant stratum only, not a combination of all strata. Grasses are important in classifying the fuel type but the vegetation fuel type is independent of the percentage grass cover.

For grasses it is the dominance of the grass type and the presence of hummock grass relative to the presence of tussock grass that is defining. The classifying grass type is the dominant type, either tussock or hummock grass or a co-dominate mix relative to each other. In mixed tussock – hummock grasses the dominance is variable. There is no requirement to assess the percentage grass cover to assign vegetation fuel types as the normal range of variability has been captured in the parameters used in the calculation process.

The determination adopts the definition of projected foliage cover used by the National Vegetation Information System. Here foliage projected cover is defined for each stratum as 'the proportion of the ground, which would be shaded if sunshine came from directly overhead'. It includes branches and leaves and is applied to a stratum or plot rather than an individual crown. It is generally not directly measured in the field for the upper stratum, although it can be measured by various line interception methods for ground layer vegetation. Projected foliage cover may be estimated by canopy cover, however the relationships between the two are dependent on season, species, age of vegetation etc. (http://www.environment.gov.au/node/18931)

In addition to the mandatory elements that define each vegetation fuel type, each type is typically characterised by vegetation species and substrates. Presence of these elements is not mandatory as they are variable and for substrates in particular occur in gradients: vegetation fuel types are inclusive of a number of described vegetation communities. The species composition of canopy trees and shrubs is given as a guide to help characterise which vegetation types fall in the fuel types, but a fuel type may not be limited by those species indicated in the characteristic columns of the table. For open forest or woodlands Eucalypts do not have to be the dominant taxa, which is why the name reflects the structure and the characteristic grass type.

Other more specific guidance includes:

- High and low rainfall zones: while open forest or woodland vegetation fuel types are predominated by Eucalypts, eligible woodlands may have Melaleuca present. Shrublands may also have occasional Melaleuca;

- Low rainfall zone:
    - IWMi can include limited areas of open forest with tussock/mixed grass;
    - ISHH can include areas that are described as hummock grassland;
    - ISHH can include areas of low open Melaleuca hummock grassland.

Subsection 21(7) provides for how a value is assigned to a pixel that represents an area of land that is occupied by more than one element. For example, the area of land could be covered by more than one vegetation fuel type listed in Schedule 1, by other ineligible vegetation fuel types, and also possibly by ineligible land. In that case, the value of the pixel is the value that corresponds to the element that occupies a proportion of the land that is greater than the proportion that is occupied by any other of those elements (see Figure 2). This rule is particularly relevant for vector to raster conversion or rescaling.

Ineligible features such as roads and waterways of a width approximately less than half the width of a pixel (i.e. 125 m in width) will typically not dominate a pixel that is otherwise occupied by a single vegetation fuel type. Such features should be identified in the vector data used to create the vegetation fuel type map: this information is readily available at a fine scale. However the vector to raster conversion is likely not to identify the presence of such features when they narrow relative to the 250 m pixel size. This outcome is to be expected and does not introduce bias as there is equal probability that a pixel will contain eligible vegetation that is not identified as dominating the pixel and hence this abatement will not be credited
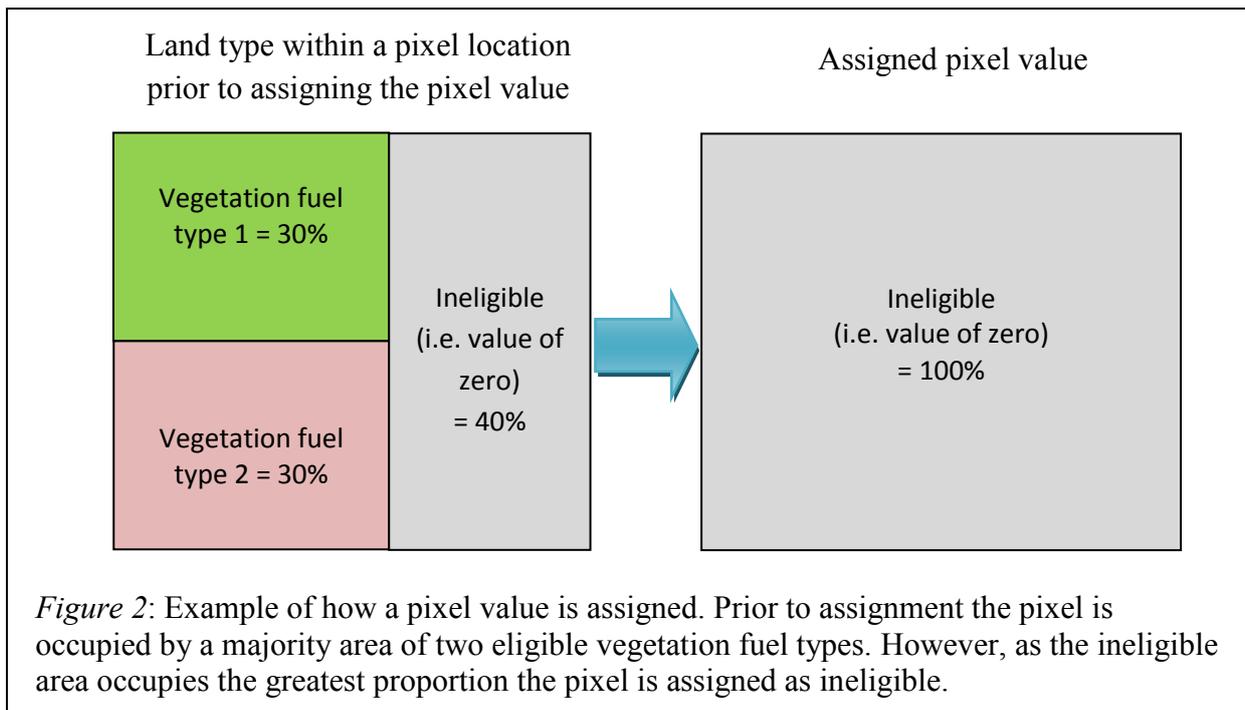
Figure 2: Example of how a pixel value is assigned. Prior to assignment the pixel is occupied by a majority area of two eligible vegetation fuel types. However, as the ineligible area occupies the greatest proportion the pixel is assigned as ineligible.

Subsection 21(8) allows transitioning projects to use the vegetation class map that was approved for use under an earlier savanna-burning determination. For these projects Table B shows how the vegetation classes of the earlier savanna-burning determination correspond with the vegetation fuel types in this Determination.

Note that for transitioning projects that used SavBAT 1, the vegetation class map complies with the requirements specified in the SavBAT 2 user manual (http://savbat2.net.au) and will upload successfully into SavBAT 2. SavBAT 2 will identify and display the corresponding vegetation fuel type.

Creating a vegetation fuel type map

The Determination does not specify how a vegetation type map must be created as the method will depend on the data that is available and the experience of the person who creates the map for the project (the mapper). This part is included in the explanatory statement to provide background as to how a vegetation fuel type map may be created.

The vegetation fuel type map may be derived from an existing vegetation mapping product at an appropriate scale or based on recent aerial or remote-sensing data and ancillary information. Remote sensing data may include vegetation indexes, fractional cover, elevation and slope. Ancillary information may be geomorphology or land systems. Options for the creation of the map are presented below including:

- reclassification of existing vegetation mapping

- aerial photo interpretation, or

- object-based image analysis techniques

Regardless of the approach taken, survey data from the project area(s) will need to be collected to assist in the interpretation and classification of the raw data and information. This survey data is commonly referred to as calibration data. This calibration data must not be the same data used in the assessment set to validate the map in accordance with Subsection 23, i.e. it must be independent. Methods that ensure that calibration and validation data are independent are addressed later in this Explanatory Statement. How the calibration data is collected and used is at the discretion of the mapper. Calibration waypoints are usually global positioning system (GPS) located either on the ground or from the air. Data at each waypoint is collected that describes the vegetation fuel type from field observations. Supplementary photos are typically taken. If vegetation mapping at an appropriate scale exists then this may be re-classified to represent the vegetation fuel types. Any vegetation map used must be at a spatial scale equal to or finer than that required for the vegetation fuel type map. As a guide, the classification scale of any existing vegetation map used to derive the vegetation fuel type map must be functionally equivalent to National Vegetation Information System (NVIS) Information Hierarchical level IV or higher (i.e. Sub-Formation, Association or Sub-Association) (http://www.environment.gov.au/node/18930).

An example of suitable mapping is the Regional Ecosystem mapping in Queensland. The mapping scale is 1:100,000 (i.e. minimum feature of 100 m width or four ha) and each Regional Ecosystem has a detailed description of the vegetation and the associated land type. The use of this dataset may be limited by the date of mapping in a particular area and that map units can often be more heterogeneous than what actually occurs on the ground at the required resolution. Each map unit may be categorised with up to five different Regional Ecosystem classes with a percentage presence. In addition, there are Regional Ecosystem classes that include a structural description of 'woodland to open forest'.

A vegetation fuel type map product is available in SavBAT 2 which gives approximates of vegetation fuels in six zones over northern Australia savannas. This map is not certified as meeting the requirements of the methodology and cannot be submitted in an offsets report to the Clean Energy Regulator. The two zones in Queensland are a re-classification of Regional Ecosystem classes, however the accuracy of this data for use as a 'ready to validate' vegetation fuel type map in these two zones is unknown. The map is also not considered 'ready for validation' in the other four zones. The base map functionality is provided in SavBAT 2 to assist proponents with hypothetical abatement forecasts.

Hence existing datasets need careful interpretation to determine the correct translation of classification units into a vegetation fuel type prior to considering any validation. Recent survey data from the project area and detailed ancillary information is required to calibrate existing mapping products as woody thickening, clearing or other changes that may have occurred from the time of the mapping.

If the vegetation fuel type map is not derived from an existing vegetation mapping it may be created manually using aerial photo interpretation methods, or automatically using object-based image analysis techniques via image segmentation software. Aerial photo interpretation is resource-intensive. The map is created by using expert knowledge to visually delineate patterns that represent homogenous areas determined from contextual differences (shape, colour, texture etc.) Object-based image analysis techniques can be used to segment imagery and create objects that are homogenous; pixels are grouped based on the imagery digital

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signature and/or contextual information and ancillary data. This is an iterative process dependent on the parameters set by the mapper to define the objects using calibration data. The final iteration selected for classification will create objects that best represent the land cover patterns being mapped, i.e. vegetation fuel types.

For object-based image analysis techniques suitable scale satellite imagery including MODIS (250 m) or Landsat (30 m) is readily available. It is recommended that in deriving the vegetation fuel type map from satellite imagery that data layers describing vegetation structure are used. The visible red and infra- red bands and colour composites are used to discern vegetation from satellite imagery or specific vegetation indices such as Normalised Difference Vegetation Index. Other data products available are 'Persistent Green' a foliage projective cover layer derived from a ten-year median Landsat data set, (www.auscover.org.au/xwiki/bin/view/Product+pages/Persistent+Green-Vegetation+Fraction) or 'Dynamic Land Cover' (www.ga.gov.au/scientific-topics/earth-obs/landcover) derived from MODIS using Enhanced Vegetation Index. These products provide a suitable base layer for the vegetation fuel type map but require the integration of ancillary information and calibration data to provide an accurate classification of vegetation fuel types.

Ancillary information is used to assist in the stratification and differentiation of land and vegetation types, and may be integrated at the segmentation step of mapping. Ancillary data may include digital elevation models, soil, geomorphological and hydrological data. This information highlights probable areas for different fuel types through known associations between vegetation fuel types and land types. Classification methods are used to classify the generated objects that represent patterns on the ground based on recent known ground data such as the calibration waypoints.

22   Validation survey

Subsection 22(1) requires that to validate a vegetation fuel type map, the project proponent must conduct a survey with a set of waypoints that satisfies this section. Vegetation fuel type map validation is required once for each vegetation fuel type map, and not at periodic intervals throughout the project life.

Subsection 22(2) specifies that vegetation fuel type map validation must occur no earlier than three years before project commencement; or if the map was created after the project commenced then no later than when the first offsets report is submitted that relies on that map. Validation requires the use of recent data to ensure that the mapping accuracy is for the current state of the vegetation.

Subparagraph 22(3)(a)(i) requires that these validation waypoints must be collected from the project area(s). Thus a map with an accuracy of 80 per cent or greater (subsection 23(5)) can only be used if the minimum number of waypoints specified in Subsection 23(4) is collected wholly from the project area(s), not outside of or partly in the project area.

Subparagraph 22(3)(a)(ii) requires that the validation survey data must not be the same as any data used to calibrate the map, i.e. the validation data must be independent. Options that ensure that calibration and validation data are independent may include having a single observer using different transects for the two purposes.

Subparagraph 22(3)(a)(iii) requires each waypoint must identified by a unique label. This allows for each waypoint to be readily identified.

Subparagraph 22(3)(a)(iv) requires that the location of the waypoints must attempt to intersect as much as reasonably practical, all vegetation fuel types and project areas in the project. The ability of the mapper to intersect all such areas will be dependent on a number of issues including the method of collection: ground based observations will typically be within a distance of a road that is less than half a day's walk and; Aerial observations are typically taken from a helicopter which, while covering ground more quickly than ground based observations, have their own set of limitations.

Aerial sampling is recommended over ground sampling as it allows for a larger geographical range of sample points over the project area. Aerial sampling also has the benefit of covering long distances and accessing areas that would otherwise be inaccessible in a reasonable time frame. Wherever possible, flight paths should cover the range of vegetation fuel types and traverse the extent of the project area(s). For aerial surveys, prior to undertaking the survey the mapper needs to determine where helicopter fuel is available and the range of the helicopter that will be used. Knowing these factors the mapper will seek to fly over areas that are uncertain and, wherever possible, also over all vegetation fuel types. With a general plan in mind they then identify a series of waypoint that maximises the linearity of the transects and keeps the helicopter on as level a flight as possible (i.e. no sharp banking). The exact flight path during the survey will be responsive to safety considerations and the needs of the aircraft and the mapper.

The usual legal meaning of the expression '*having regard to*' applies to this subparagraph: the decision-maker is required to give the matters listed 'proper, genuine and realistic consideration', but is not necessarily required to act in accordance with those matters. Wording of this nature does not ordinarily prevent the decision-maker from having regard to other relevant matters. For the purposes of audit, the project proponent is advised to retain evidence that he or she did in fact have regard to these matters, particularly in cases in which the project proponent did not eventually act in accordance with them (for example, if the transects are wholly located in a single project area, or if they only intersect a single vegetation fuel type). This expression precludes the use of existing survey data where it cannot be shown that regard was given to the vegetation fuel types as described in this Determination and the spatial extent of the project area or areas.

Paragraph 22(3)(b) gives the mapper the flexibility to undertake a survey approach that is fit for purpose. This is stated to avoid doubt that the waypoints need not be randomly selected.

Paragraph 22(4) requires each waypoint to have the following attributes: a unique label; date and time of collection, and; the latitude and longitude of the waypoint.

Paragraph 22(5)(a) provides that, around each waypoint, an area of approximately one hectare must be surveyed. This allows for the waypoint to represent a homogenous area over the ground and not a point, ensuing that the assessment of the vegetation fuel type at each waypoint is on a scale similar to the resolution of the map. One hectare, while less than the size of a vegetation fuel type map pixel (i.e. 6.25 ha), is a practical size for a person to visually assess and reach a conclusion as to the eligibility of the vegetation.

The information from the waypoints must be derived from a GPS, i.e. the latitude and longitude information and possibly the time and date of collection and a unique label. The survey method must be either ground or aerial. This means that remotely sensed imagery from satellites is not able to be used for validation as it is not a visual assessment.

A valid survey of a waypoint includes a visual assessment of the vegetation structure, the dominant canopy trees (that is *Eucalyptus* or *Melaleuca* or other), and the dominant understorey graminoid life form. The data collector must specify a value for each waypoint as

either a vegetation fuel type or ineligible. Where more than one vegetation fuel type or ineligible land occupies the area, then the rule for assigning a value is analogous to that for assigning values to pixels as stated in subsection 21(7). For guidance on what to assess in the survey see the list of vegetation fuel types in Schedule 1 of the Determination and the description of how to create a vegetation fuel type map from Section 22 of this Explanatory Statement. Surveys may be undertaken from the air on the ground. For aerial surveys, waypoint collection via helicopter is recommended over fixed wing aircraft due to better ground view and manoeuvrability. It is recommended to fly at an altitude and speed that enables a steady pace of data collection. The choice of altitude and speed will allow for visualisation of the ground strata and dominant vegetation and for any supplementary photos taken, while at all times ensuring the safety of the aircraft and occupants. The data collector must have sufficient knowledge and experience to recognise the different vegetation fuel types.

23   Validation

This section sets out how to validate a vegetation fuel type map for the purposes of section 21.

Paragraph 23(2)(a) provides that, while the project proponent must validate the raster vegetation fuel type map, that a copy of the raster map is first converted to vector format to be consistent with the format of the validation waypoint data. This map is known as the *vectorised vegetation fuel type map*. Converting raster maps to vectors is a standard function of GIS software, however there are different ways in which this can be done. This subsection specifies that the conversion must not simplify or smooth the polygon boundaries. Most software used for this conversion will apply smoothing as a default, so care needs to be taken to ensure adherence to this requirement. If conversion is correctly implemented, the vector boundaries will follow the same grid patters as the raster map (i.e. vector boundaries at 250 m and 90 degree increments, see Figure 3).

Paragraph 23(2)(b) provides that each polygon in the *vectorised vegetation fuel type map* must be assigned a code representing the code of the pixel or pixels that comprise the polygon. For any polygon all pixels that are encompassed by that polygon must have the same code.

Paragraph 23(2)(c) provides that if the project proponent decides to set aside some of the validation waypoint data and only use a subset for the assessment they may do this. This subset is the *assessment set*. The assessment set may also include all the validation waypoints collected. If a subset is selected then the selection of the subset, like the validation waypoint must have regard to all vegetation fuel types and project areas in the project. The usual legal meaning of the expression '*having regard to*' applies to this paragraph.

Paragraph 23(3)(b) gives the mapper the flexibility to select the assessment set from the waypoint observations randomly or systematically. This is stated to avoid doubt that the waypoints comprising the assessment set need not be randomly selected from the validation waypoints.

Section 5 (Definitions) specifies that each waypoint have a buffer which is circular area with a radius of 100 metres which surrounds a waypoint. This buffer is applied in recognition that the survey is of a general area and not a point and that, particularly for aerial observations, that the location data recorded is approximately over the observation location. This buffer is independent of the size of the survey area (1 ha) as they fulfil different objectives. Paragraph 23(3)(a) requires that these waypoint buffers cannot overlap. Where waypoint buffers overlap

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it is necessary for the mapper to omit these observations from the validation data (see Figure 3). Which waypoints are omitted is at the discretion of the mapper. Waypoints that are omitted should be selected having regard to optional spatial distribution of the remaining waypoints. It is not the intent of this Division that a mapper would delete a waypoint that is not a verified waypoint to improve the accuracy assessment.
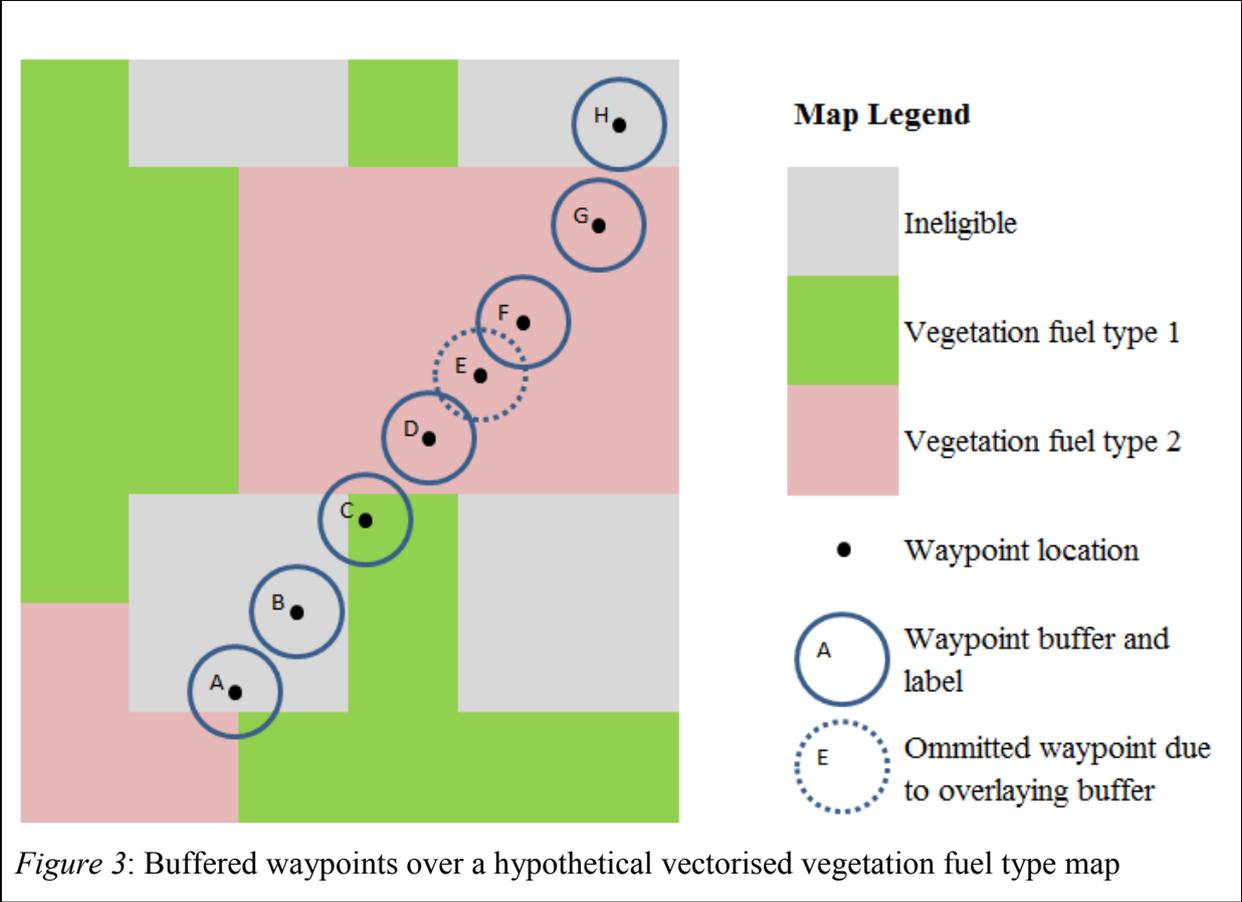
Figure 3: Buffered waypoints over a hypothetical vectorised vegetation fuel type map

Subsection 23(4) provides that the number of waypoints required to validate the map is determined in accordance with Table C. The number of waypoints set out in Table C ensures that a minimum set of points is collected to ensure that accuracy can be assessed to an acceptable level of confidence. Where the project is comprised of more than one project area, the number of waypoints required is determined by the hectares in the project, not the hectares of each project area individually. However, under paragraph 21(1)(b), where a project has varied their declaration under section 27 of the Act then the number of waypoints required applies to the added areas of land.

Example A

A new project has two project areas, each 4,000 km^2. The sum of these areas is 8,000 km^2 so at least 250 waypoints are required to represent both areas, not a minimum of 250 waypoints in each project area (i.e. a total minimum of 500 points).

Example B

As existing project has one project area at 4,000 km^2. This project area was surveyed with 300 waypoints. The project decides to vary their declaration and add a second project area, also at 4,000 km^2. If both project areas had been in the original declaration then the map, at 8,000 km^2 could have been validated with the same number of waypoints (300) as long as the

location of the waypoints attempted to intersect as much as reasonably practical, all vegetation fuel types and project areas. However as this is a variation under section 27 of the Act then the number of waypoints required applies to the added areas of land: The project vegetation fuel type map will have the 300 validation waypoints from the original area and at least 250 waypoints are required to be collected from the new area of land

Subsection 23(5) specifies that the accuracy of the map must be 80 per cent or greater.

Subsection 23(6) specifies the rules for the revalidation of maps that have failed the validation and that have been re-interpreted and re-classified to improve the accuracy. The accuracy requirements remain unchanged but the project proponent can re-use the waypoints that were used for the first failed validation process. This validation data must however still meet the requirement described later in subparagraph 22(3)(a)(ii) and remain independent of the calibration data used to re-interpret the map. In addition to any previously used validation data the mapper can, at their discretion, supplement this data with additional waypoints.

Subsection 23(7) specifies how the accuracy is calculated, noting that any waypoints that have intersecting 100m buffers must be omitted from the data (see Figure 3). This is to ensure that each validation observation is independent of other validation observations. A waypoint is a verified waypoint if any part of the buffer area overlaps with an area of the vectorised vegetation fuel type map that has the same value as the waypoint.

Examples

The following example use Figure 3 to identify how the rules apply.

Example A

Waypoint A has a value of vegetation fuel type 2. The waypoint latitude and longitude was recorded in an eligible area of the project area, however part of the waypoint buffer overlays an area of the vectorised vegetation fuel type map of the same value. The waypoint buffer does not overlap another waypoint buffer so this waypoint is both an assessed and verified waypoint.

Example B

Waypoint E buffer overlaps with the waypoint buffers of D and F. The mapper could delete waypoints D and F, leaving E, but chooses to delete only E to distribute the waypoints more evenly and maximise the number of observations. E becomes an omitted waypoint and does not contribute to either the number of assessed or verified waypoints. The waypoint buffers for waypoints D and F do not overlap with any other waypoint buffer so they are both included in the number of assessed waypoints. D and F have a value of vegetation type 1 but no part of their buffers overlap with an area of the vectorised vegetation fuel type map of the same value. Waypoints D and F are an assessed waypoint but not a verified waypoint.

Division 4   Calculation of carbon dioxide equivalent net abatement amount - general

Subdivision 1 Carbon dioxide equivalent net abatement amount

24   Carbon dioxide equivalent net abatement amount

Section 24 provides that all project proponents, including those using SavBAT 2, must complete Equation 1 for all years of all project areas being reported on in the crediting period. Equation 1 calculates the carbon dioxide equivalent net abatement amount for the project. This equation sums the adjusted net annual project abatement—from Subdivision 2—across all years reported on in the crediting period.

Subsection 24(1) applies if the project has not been sub-divided into project areas. The value calculated from Equation 1 is the carbon dioxide equivalent net project abatement.

Subsection 24(2) applies if the project has been divided into project areas. If there are two or more project areas being reported on, then the net adjusted abatement must also be summed across all of these project areas to determine the net project abatement.

Adjusted net annual project area abatement is summed across all years reported on in the crediting period.

Subdivision 2   Calculation of adjusted net annual project abatement

<u>25   Outline</u>

This section outlines the calculation of the adjusted net annual project abatement, $A_{A,y}$.

If SavBAT 2 includes the functionality to calculate adjusted net annual project abatement, the project proponent may either use SavBAT 2 to perform the calculation, or may perform it manually. If SavBAT 2 does not include that functionality, the project proponent must perform the calculation manually, in accordance with this Subdivision.

Where proponents have elected to sub-divide their project in accordance with section 14, all calculations from this step onwards apply to each project area being reported on. For projects that have elected not to sub-divide their project, then calculations apply to the single project area.

<u>26   Calculation of adjusted net annual project abatement</u>

For each calendar year in the crediting period, the adjusted net annual project abatement is calculated in accordance with this section.

Adjusted net annual abatement is calculated in accordance with Subdivision 2 for each calendar year reported on in the crediting period. Net annual abatement is adjusted to manage inter-annual variability in emissions abatement and the risk of the project containing some year(s) with emissions that are higher than the baseline average annual emissions. Adjusting the net annual abatement in each project area reduces the risk of over-crediting of projects.

An uncertainty buffer (R_y) is calculated for each project area at the end of each calendar year. At the beginning of the project, including transitioning projects, the value of the uncertainty buffer is zero.

The uncertainty buffer is capped at a threshold defined as 5% of the average annual baseline emissions, so that projects which continuously perform well are not penalised. The uncertainty buffer is added to in years where net annual project area abatement is greater than zero and the value in the uncertainty buffer in the previous calendar year is less than the capped value. The uncertainty buffer is subtracted from in years where net annual abatement is less than zero. The uncertainty buffer is not returned to project proponents at the end of the project crediting period.

The adjustment applied to net annual project abatement depends on: (1) whether the value in the uncertainty buffer at the end of the previous calendar year (R_{y-1}) was more or less than zero; (2) whether the capped uncertainty buffer value has been achieved; and (3) whether net annual project abatement is greater or less than zero.

In a common scenario, where the value of the uncertainty buffer at the end of the previous calendar year was greater than, or equal to, zero but less than the capped value, and net annual abatement is greater than zero, net annual abatement is adjusted by 10% and a value equivalent to this 10% is added to the uncertainty buffer. This scenario and the other possible scenarios are summarised in the examples below, and adhere to the rules stipulated in the tables in section 26.

If the carbon dioxide equivalent net abatement amount for the final reporting period in the crediting period is a negative amount the carbon dioxide equivalent net abatement amount for the reporting period is taken to be zero. This net negative abatement is accounted for partially, or fully, by the amount in the uncertainty buffer.

Analysis of emissions data for existing projects indicates that, during the contract period, all projects should receive approximately 98% of the credits they would have received in the absence of adjustment, with an acceptably small number of projects being over-credited.

The calculations in the Determination are made over whole calendar years. It is not possible to calculate abatement over a period shorter than one calendar year or over a twelve-month period not beginning on 1 January.

Examples

Example A

The value in the uncertainty buffer at the end of the previous calendar year is equal to the capped value (calculated as 5% of the average annual baseline emissions). Net annual project abatement is 6,000 t CO_2-e. The adjusted abatement is 6,000 t CO_2-e, as no further credits need to be added to the uncertainty buffer.

The remaining examples assume that the value in the uncertainty buffer at the end of the previous calendar year is less than the capped uncertainty buffer value.

Example B

The value of the uncertainty buffer at the end of the previous calendar year was 4,000 t CO_2-e and net annual abatement is -300 t CO_2-e. Adjusted net annual abatement is zero and the value of the uncertainty buffer at the end of the calendar year is 3,700 t CO_2-e.

Example C

The value of the uncertainty buffer at the end of the previous calendar year was 4,000 t CO_2-e and net annual abatement is 6,000 t CO_2-e. Adjusted net annual abatement is 5,400 t CO_2-e and the value of the uncertainty buffer at the end of the calendar year is 4,600 t CO_2-e.

Example D

The value of the uncertainty buffer at the end of the previous calendar year was -400 t CO_2-e and net annual abatement is -200 t CO_2-e. Adjusted net annual abatement is zero and the value of the uncertainty buffer at the end of the calendar year is -600 t CO_2-e.

Example E

The value of the uncertainty buffer at the end of the previous calendar year was -400 t CO_2-e and net annual abatement is 200 t CO_2-e. Adjusted net annual abatement is 0 t CO_2-e and the value of the uncertainty buffer at the end of the calendar year is -200 t CO_2-e.

Example F

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The value of the uncertainty buffer at the end of the previous calendar year was -400 t CO_2-e and net annual abatement is 5,000 t CO_2-e. Adjusted net annual abatement is 4,140 t CO_2-e and the value of the uncertainty buffer at the end of the calendar year is 460 t CO_2-e.

Subdivision 3   Calculation of net annual project abatement

27   Net annual project abatement

The Determination allows project proponents to choose between completing geospatial and other calculations manually, and using a new version of the Savanna Burning Abatement Tool (SavBAT 2) which simplifies the reporting and record-keeping requirements.

The offset functionality in SavBAT 2 will calculate net annual abatement for each project area.

Net annual project emissions include fossil fuel emissions and fire emissions.

Subdivision 4   Annual fossil fuel emissions by fuel type and greenhouse gas

28   Annual fossil fuel emissions—by fuel type and greenhouse gas

If the project proponent uses SavBAT 2 to calculate net annual abatement, the proponent must still calculate fossil fuel emissions in accordance with section 28 and enter the fuel usage details into SavBAT 2. This is because net annual abatement is a product of fire and fuel emissions in the reporting year.

All project proponents must complete Equation 2, to determine fossil fuel emissions used for calculating net project abatement. Equation 2 sums fossil fuel emissions by fuel type (e.g. diesel) and greenhouse gas type.

Section 28 provides that fossil fuel emissions are calculated using Equation 2 for the project or each project area in each calendar year reported on in the crediting period. Fossil fuel emissions in the baseline period are not accounted for in the Determination.

Sources of fossil fuel emissions include fuel used in transportation to manage fire and collect data, and fuel used in drip torches to light fires.

Division 4   Calculation of net annual abatement without using SavBAT 2

Subdivision 1 Preliminary

29   Application of Division

This Subdivision applies only if a project proponent calculates net annual project abatement, A_y, without using SavBAT 2.

30   Simplified outline

This section sets out a simplified outline of how the net annual project abatement for year y of the crediting period being reported on, A_y.

Figure 4 provides a flow diagram of the order of calculations for determining net project abatement, as described in the Determination.

```
┌─────────────────────────────────────────────────────────────────────┐
│          Carbon dioxide equivalent net abatement amount             │
│                          (Section 24)                               │
└─────────────────────────────────────────────────────────────────────┘
                                   ▲
┌─────────────────────────────────────────────────────────────────────┐
│              Adjusted net annual project abatement                  │
│                          (Section 26)                               │
│                 (SavBAT2* and Manual Calculations)                  │
└─────────────────────────────────────────────────────────────────────┘
          ▲                                          ▲
┌──────────────────────────────┐   ┌──────────────────────────────────┐
│  Net annual project abatement│   │        Uncertainty Buffer        │
│       (Section 31 and 27)    │ → │        (Section 25 and 26)       │
│ (Manual Calculations /       │   │   (SavBAT2* and Manual           │
│   SavBAT2 output)            │   │    Calculations)                 │
└──────────────────────────────┘   └──────────────────────────────────┘
          ▲                                          ▲
┌──────────────────────────────┐   ┌──────────────────────────────────┐
│ Average annual baseline      │   │   Total annual project emissions │
│ emissions                    │   │         (Section 35)             │
│ (Section 34)                 │   │ (Manual Calculations /           │
│ (Manual Calculations /       │   │   SavBAT2 output)                │
│   SavBAT2 output)            │   └──────────────────────────────────┘
└──────────────────────────────┘              ▲        ▲
┌──────────────────────────────┐   ┌──────────────────────────────────┐
│   Annual fossil fuel         │   │        Fire emissions            │
│   emissions                  │   │        (Section 36)              │
│   (Section 28)               │   │    (Manual Calculations)         │
│ (SavBAT2 and manual users)   │   └──────────────────────────────────┘
│          and                 │              ▲
│   (Section 55)               │   ┌──────────────────────────────────┐
│  (Manual Calculations)       │   │  Fire emissions—by fire season   │
└──────────────────────────────┘   │        (Section 37)              │
                                   │    (Manual Calculations)         │
                                   └──────────────────────────────────┘
          ▲                                  ▲        ▲
┌──────────────────────────────┐   ┌──────────────────────────────────┐
│   Potential fire emissions   │   │         Area burnt               │
│       (Section 46)           │   │        (Section 38)              │
│   (Manual Calculations)      │   │    (Manual Calculations)         │
└──────────────────────────────┘   └──────────────────────────────────┘
          ▲                          ▲                    ▲
┌──────────────────────────────┐   ┌──────────────────┐ ┌─────────────┐
│ Potential emissions—by       │   │ Calculating fire │ │ Patchiness  │
│ greenhouse gas               │   │ scar area        │ │(Schedule 2, │
│ (Section 47 - 50)            │   │ (Section 45)     │ │  Table J)   │
│ (Manual Calculations)        │   │ (Manual          │ │(Manual      │
└──────────────────────────────┘   │  Calculations)   │ │Calculations)│
          ▲                         └──────────────────┘ └─────────────┘
┌──────────────────────────────┐   ┌──────────────────┐
│   Fine fuel load values      │   │ Seasonal fire    │
│       (Section 55)           │   │ maps             │
│   (Manual Calculations)      │   │ (Section 41 - 44)│
└──────────────────────────────┘   │ (Manual          │
          ▲                         │  Calculations)   │
┌──────────────────────────────┐   └──────────────────┘
│    Calculating YSLB          │        ▲        ▲
│      (Section 52)            │                 ┌──────────────────────┐
│   (Manual Calculations)      │                 │   Monthly fire maps  │
└──────────────────────────────┘                 │     (Section 40)     │
          ▲                                       │ (Manual Calculations)│
┌──────────────────────────────┐                 └──────────────────────┘
│ Calculating area burnt for   │
│ each YSLB value              │
│ (Section 53 - 54)            │
│ (Manual Calculations)        │
└──────────────────────────────┘
```
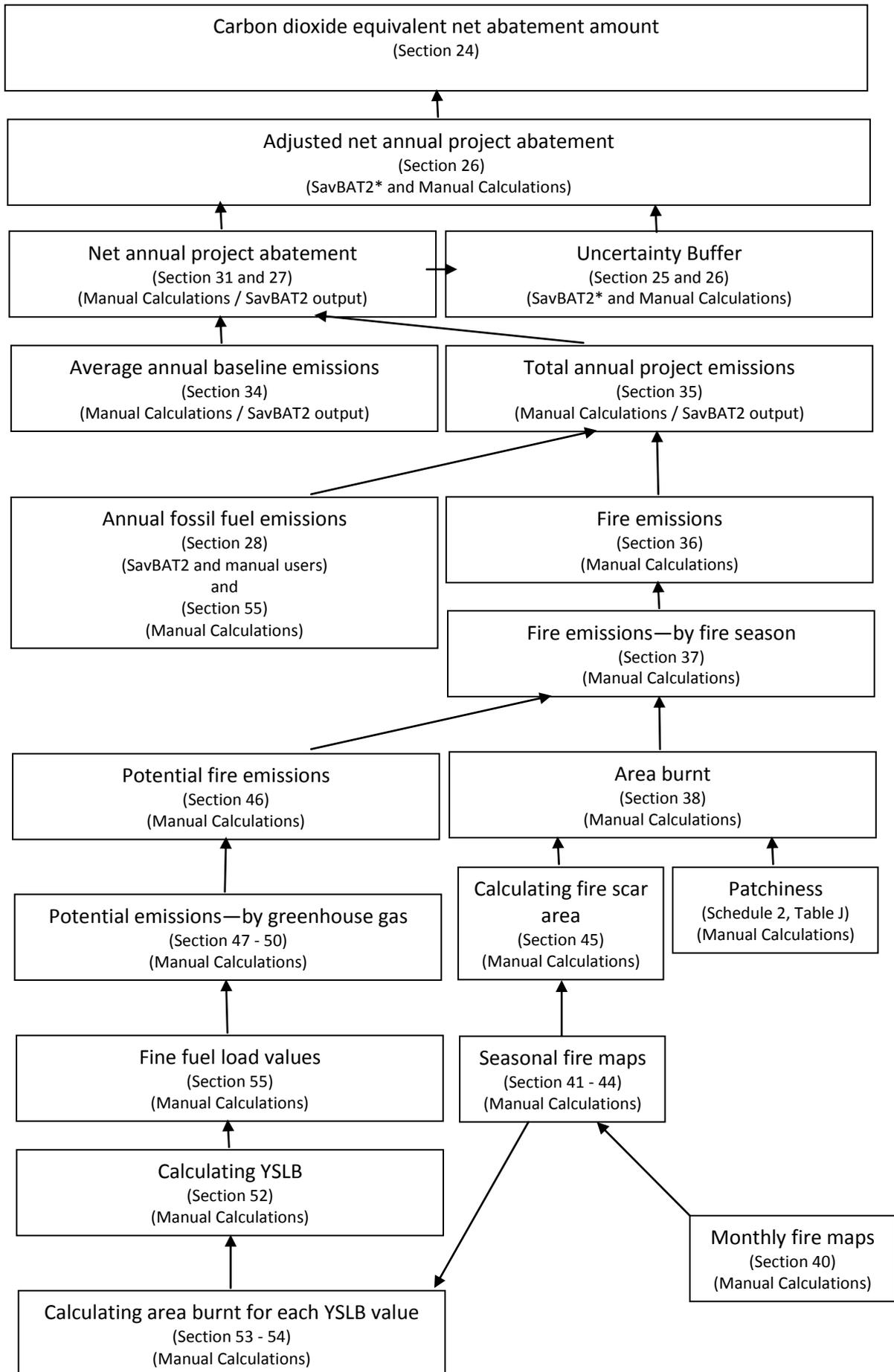
29

Figure 4 – Flow diagram of calculations for determining net project abatement. For projects that have been sub-divided into project areas, calculations are for each project area. At the end of each reporting period the carbon dioxide equivalent net abatement is summed across all project areas reported on. Equations are presented in order from higher level (primary) equations, to lower level (sub-ordinate, or input equations).

* - only do manual calculations if functionality for these steps is not available in SavBAT 2.

Subdivision 2 Calculation of net annual project abatement

31   Net annual project abatement

Section 31 provides that net annual abatement is calculated using Equation 3 for the project or each project area in each calendar year reported on in the crediting period.

Net annual abatement is calculated by subtracting the project emissions—from Equation 5—from the average annual baseline emissions—from Equation 4A if the project area is in the low rainfall zone, or from Equation 4B if the project area is in the high rainfall zone.

Subdivision 3 Baseline period and average annual baseline emissions

32   Requirement to determine baseline periods and calculate average annual baselines

The project proponent must determine a baseline period, and the average annual baseline emissions for the project in accordance with this Subdivision.

33   Baseline period

Subsection 33(1) provides that the length of the baseline period is 15 years if the area is in the low-rainfall zone, or the length of the baseline period is 10 years if the area is in the high-rainfall zone.

For land in the high-rainfall zone, a 10-year baseline period will cover approximately three fire cycles. For land in the low-rainfall zone, a 15-year baseline period will cover approximately one to two fire cycles. These lengths for baselines account for inter-annual variability, and provide a reliable estimate of emissions in the absence of the project.

Subsection 33(2) defines requirements for determining baseline periods for transitioning projects.

Under section 29 of the Act and the applicable regulations or legislative rules, the project area may be varied.

Subsection 33(2) applies to projects that have transitioned and were eligible offsets projects under an earlier savanna-burning determination – that is either:

- the *Carbon Credits (Carbon Farming Initiative)(Reduction of Greenhouse Gas Emissions through Early Dry Season Savanna Burning—1.1) Methodology Determination 2013;* or

- the *Carbon Farming (Reduction of Greenhouse Gas Emissions through Early Dry Season Savanna Burning) Methodology Determination 2012*;

This section provides that transitioning projects and transitioning project areas must maintain their 10-year baseline periods as defined and reported on under earlier savanna-burning determinations.

Project commencement is defined in section 5 as the first day of the project's first reporting period under this Determination.

34   Average annual baseline emission

Subsection 34(a) provides that average annual baseline emissions are calculated using Equation 4A if an area is in the low-rainfall zone. Equation 4A calculates average annual fire emissions over the 15 years in the baseline period for the low rainfall zone.

Subsection 34(b) provides that average annual baseline emissions are calculated using Equation 4B if an area is in the high-rainfall zone. Equation 4B calculates average annual fire emissions over the 10 years in the baseline period for the high rainfall zone.

Average annual baseline emissions are calculated for the project where it has not been sub-divided, or otherwise for each project area.

Subdivision 4 Total annual project emissions

35   Total annual project emissions

Section 35 provides that annual project emissions are calculated using Equation 5 in each calendar year reported on in the crediting period. Annual project emissions consist of fire emissions—calculated in accordance with Division 4, Subdivision 5—and fossil fuel emissions—from Division 4, Subdivision 9.

Subdivision 5 Baseline and project fire emissions

36   Fire emissions

Section 36 provides that fire emissions are calculated using Equation 6 in each calendar year in the baseline period and each calendar year reported on in the crediting period. Equation 6 sums the emissions from the two fire seasons.

37   Fire emissions—by fire season

Section 37 provides that fire emissions in each fire season are calculated using Equation 7 in each calendar year in the baseline period and each year reported on in the crediting period.

Equation 7 sums across each vegetation type the product of the area burnt in each project area (in hectares) by the potential fire emissions from that area (in tonnes CO_2-e per hectare). The area burnt is calculated using Equation 8, and the potential fire emissions are calculated using Equation 9.

38   Area burnt

Section 38 provides that the area burnt is calculated using Equation 8 in each fire season in each calendar year of the baseline period and each calendar year reported on in the crediting period.

Equation 8 multiplies the areas of fire scars—from Division 4, Subdivision 6—by a patchiness factor for the relevant fire season. The patchiness factors are set out in Table J of Schedule 2 of the Determination.

Patchiness is the fraction of a fire scar area that is actually burnt in a fire and is different for the two fire seasons. Fire combustion is more complete in the late dry season, so there are fewer patches present within the fire scars.

Subdivision 6—Calculating fire scar area

39   Method for calculating fire scar area

This section provides how to calculate the fire scar area. Project proponents must create their own monthly fire maps if they do not source them from the NAFI. Where monthly fire maps are sourced from the NAFI, the maps must cover the project area.

For each year of the baseline and reporting periods the area burnt is compiled into monthly maps and these are used to create the seasonal fire maps. To calculate the fire scar area in calendar year y vegetation fuel type v in fire season the vegetation fuel type map is overlaid with each seasonal fire map using GIS software. For seasonal maps that are developed from monthly maps not sourced from the NAFI the project proponent is required to validate the map in accordance with Sections 42, 43 and 44.

40   Monthly fire maps

Subsection 40(1) provides how to create monthly fire maps not sourced from the NAFI. These maps must:

1. cover the project area; and

2. show the presence or absence of all fire scars within each pixel over a calendar month; and

3. be geospatial maps in raster format; and

4. have a pixel size of 250 metres by 250 metres or less.

Subsection 40(3) provides that in determining the presence or absence of fire in the month then if more than half of the area of the pixel burnt in that calendar month, then the pixel is assigned as 'burnt'; otherwise it is assigned as 'unburnt'.

Subsection 40(2) provides that if the maps used to designate fire scars are not available at a scale of 250 metres by 250 metres or less, then they can be created from maps at a scale of one kilometre by 1 kilometre or less. However the application of this allowance is restricted in subsection 40(4): if twelve monthly fire maps are used to calculate emissions for a calendar year, the maps must be derived from a single satellite imagery product. This requirement prevents bias that may or may not exist between satellite products.

41 – Seasonal fire maps

Each seasonal fire map must assign to each pixel a value of 'burnt' or 'unburnt' in accordance with subsection 41(2). Seasonal fire maps must:

1. be a geospatial map in raster format; and

2. show the presence or absence of all fire scars within each pixel in the relevant fire season and calendar year; and

3. be developed from monthly fire maps that fall within the relevant fire season and that comply with section 40; and

4. have the finest possible resolution allowed for by the monthly fire maps.

Project proponents must assign a value of either 'burnt' or ;unburnt' to all pixels in the original seasonal fire maps.

42   Validation of seasonal fire maps if monthly fire maps not sourced from the NAFI

Project proponents must validate each seasonal fire map that was developed from monthly maps not sourced from the NAFI.

The processes for validation are largely the same as those for validation of vegetation fuel type maps (see Part 4, Division 2). The processes differ in that the seasonal fire map validation process requires that observations are assigned a value of burnt, unburnt and unknown, with all 'unknowns' omitted from the accuracy assessment. These omissions are in addition to a requirement to omit waypoints that have overlapping buffers.

43   Validation survey for seasonal fire maps

A validation survey for seasonal fire maps is largely the same as those for validation of vegetation fuel type maps (see Part 4, Division 2). Here the survey is restricted to a time period for each seasonal fire map and the data observer is assigning the waypoint with different values.

Subparagraph 43(2)(a)(iii) specifies that waypoints for validation must be collected for both the early dry season and the late dry season map and specifies the timing of that collection. For a seasonal fire map that relates to the early dry season—between April and July (inclusive) of that season (subparagraph 44(2)(a)(iii)(A)); and for a seasonal fire map that relates to the late dry season—between September and December (inclusive) of that season (subparagraph 44(2)(a)(iii)(B)).

In these landscapes, for a fire of typical intensity, evidence of the fire activity may not be apparent from aerial survey in as little as six to 10 weeks following the fire. Specifying the timing of the validation survey ensures that the timing appropriately records fires from the season of interest only, and does not record a meaningless result. For example a survey undertaken in late February would be of vegetation that has responded to wet season rains at a time when fires have not been possible for several weeks. In this case the survey would identify that 100% of the project area is unburnt in the new early dry season, as would the fire map. So, while this validation process shows an accuracy of 100%, the results are spurious.

In undertaking the survey the data observer assigns to each waypoint assign to the waypoint a code as follows:

(i)   if more than half of the area surveyed is burnt—'burnt';

(ii)   if less than half of the area surveyed is burnt—'unburnt';

(iii)   if not readily apparent—'unknown'.

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<u>44   Validation of seasonal fire maps</u>

The processes for validation are largely the same as those for validation of vegetation fuel type maps (see Part 4, Division 2).

<u>45   Calculating fire scar area</u>

For Subdivision 45, the fire scar area in calendar year y vegetation fuel type v in fire season s, $S_{y,v,s}$, is the total of the pixels identified as burnt for that calendar year and that vegetation fuel type in that fire season, as calculated accordance with this Subdivision.

An area is included in fire scar area in calendar year y vegetation fuel type v in a given fire season if the burnt patches within the pixel occupy more than half the pixel area. In the methodology, the patchiness for both the early and late dry seasons is greater than 50%. Therefore most pixels are classified as burnt if fire has occurred within the spatial extent of the pixel.

GIS software must be used to calculate the area of each fire scar. The process involves:

1. overlay the vegetation fuel type map with each seasonal fire map; and

2. using that map, calculate the area of each fire scar, $S_{y,v,s}$, in hectares, for:

    a. each vegetation fuel type; and

    b. each fire season; and

    c. each calendar year in the baseline period; and

    d. each calendar year in the crediting period.

Subdivision 7—Calculation of potential fire emissions

<u>46   Potential fire emissions</u>

Section 46 provides that potential fire emissions are calculated using Equation 9 in each fire season in each calendar year in the baseline period and each year reported on in the crediting period.

For each calendar year in the baseline period and each calendar year reported on in the crediting period, Equation 9 sums:

- potential methane emissions from fine fuels—from Equation 10;

- potential methane emissions from non-fine fuels—from Equation 11;

- potential nitrous oxide emissions from fine fuels—from Equation 12; and

- potential nitrous oxide emissions from non-fine fuels—from Equation 13.

Potential emissions are the quantity of methane and nitrous oxide emissions that would be released as a result of a fire on one hectare of a project area, should the whole hectare be burnt. Potential fire emissions do not account for patchiness of burning, which is related to completeness of fuel combustion. Model parameters for the emissions calculations reflect differences in fire behaviour between vegetation fuel types, seasons of burning, and fuel loads.

Potential emissions must be calculated for methane and nitrous oxide according to each vegetation fuel type and fire season, as these variables have an effect on fire behaviour, and

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hence emissions from fire. For example, there are differences in the types and quantities of emissions from a fire that burns one hectare of eucalypt open woodland in the early dry season, when compared to emissions from a fire burning one hectare of sandstone heath in the late dry season.

Additionally, potential emissions must be calculated separately for fine fuels and non-fine fuels (coarse, heavy and shrub fuels), as there is seasonal variability in fine fuel loads not observed in coarser fuels.

'Fine fuel' is defined in section 5 as vegetation fuel comprising grass, leaf litter, bark and dead small twigs of less than six millimetres in diameter. Non-fine fuel is comprised of coarse, heavy and shrub fuels, each of which is defined in section 5. Project proponents are not required to measure the quantities of fine and non-fine fuels present in each project area. Average values, based on the year since last burnt (for fine fuels) and vegetation fuel type are used in calculations.

47   Potential methane emissions – fine fuel size class

Section 47 provides that potential methane emissions from fine fuel are calculated using Equation 10 in each fire season in each calendar year in the baseline period and each year reported on in the crediting period.

For each vegetation fuel type, Equation 10 multiplies the fine fuel load—from Equation 15—by:

- the burning efficiency for the relevant fire season (BE_s);

- the methane emission factor for the vegetation fuel type ($EF_{CH4,v}$);

- the carbon content for the vegetation fuel type (CC_v);

- the ratio of molecular to elemental mass for methane (1.3333); and

- the global warming potential of methane (GWP_{CH4}).

The burning efficiency is the proportion of combusted fuel that is volatilised in a fire. The burning efficiency varies with fire severity, fuel size class and fire season. The values for the burning efficiency for the fine fuel size class in each fire season, taking fire severity into account, are set out in Table I of Schedule 2 of the Determination.

The methane emission factors for the fine fuel size class for each vegetation fuel type are set out in Table L of Schedule 2 of the Determination.

The carbon contents of the fine fuel size class for each vegetation fuel type are set out in Table M of Schedule 2 of the Determination.

The global warming potential of methane must be taken from the NGER Regulations in force at the end of the reporting period (see section 20).

48   Potential methane emissions –coarse, heavy and shrub fuel size classes

Section 48 provides that potential methane emissions from the non-fine fuels (sum of coarse, heavy and shrub fuel size classes) are calculated using Equation 11 in each fire season in each calendar year in the baseline period and each year reported on in the crediting period.

For each vegetation fuel type and non-fine fuel size class, Equation 11 multiplies the fuel load—from Table K in Schedule 2—by:

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- the burning efficiency for the relevant fire season ($BE_{s,k}$);
- the methane emission factor for the vegetation fuel type ($EF_{CH4,v,k}$);
- the carbon content for the vegetation fuel type ($CC_{v,k}$);
- the ratio of molecular to elemental mass for methane (1.3333); and
- the global warming potential of methane (GWP_{CH4}).

The burning efficiency is the proportion of combusted fuel that is volatilised in a fire. The burning efficiency varies with fire severity, fuel size class and fire season. The values for the burning efficiency for the fine fuel size class in each fire season, taking fire severity into account, are set out in Table I of Schedule 2 of the Determination.

The methane emission factors for the fine fuel size class for each vegetation fuel type are set out in Table L of Schedule 2 of the Determination.

The carbon contents of the fine fuel size class for each vegetation fuel type are set out in Table M of Schedule 2 of the Determination.

The global warming potential of methane must be taken from the NGER Regulations in force at the end of the reporting period (see section 20).

49   Potential nitrous oxide emissions – fine fuel size class

Section 49 provides that potential nitrous oxide emissions from the fine fuel size class are calculated using Equation 12 in each fire season in each calendar year in the baseline period and each year reported on in the crediting period.

For each vegetation fuel type, Equation 12 multiplies the fine fuel load—from Equation 15— by:
- the burning efficiency for the relevant fire season (BE_s);
- the nitrous oxide emission factor for the vegetation fuel type ($EF_{N2O,v}$);
- the carbon content for the vegetation fuel type (CC_v);
- the nitrogen to carbon ratio of the vegetation fuel type (NC_v);
- the ratio of molecular to elemental mass for nitrous oxide (1.5714); and
- the global warming potential of nitrous oxide (GWP_{N2O}).

The burning efficiency is the proportion of combusted fuel that is volatilised in a fire. The burning efficiency varies with fire severity, fuel size class and fire season. The values for the burning efficiency for fine fuel in each fire season, taking fire severity into account, are set out in Table I of Schedule 2 of the Determination.

The nitrous oxide emission factors for fine fuel for each vegetation fuel type are set out in Table N of Schedule 2 of the Determination.

The carbon contents of fine fuel for each vegetation fuel type are set out in Table M of Schedule 2 of the Determination.

The global warming potential of methane must be taken from the NGER Regulations in force at the end of the reporting period (see section 20).

The nitrogen to carbon ratios for fine fuel for each vegetation fuel type is set out in Table O of Schedule 2 to the Determination.

50   Potential nitrous oxide emissions – coarse, heavy and shrub fuel size classes

Section 50 provides that potential nitrous oxide emissions from the non-fine fuels (sum of coarse, heavy and shrub fuel size classes) are calculated using Equation 13 in each fire season in each calendar year in the baseline period and each calendar year reported on in the crediting period.

For each vegetation fuel type and non-fine fuel size class, Equation 13 multiplies the fuel load—from Table K in Schedule 1—by:

- the burning efficiency for the relevant fire season ($BE_{s,k}$);
- the nitrous oxide emission factor for the vegetation fuel type ($EF_{N20,v,k}$);
- the carbon content for the vegetation fuel type ($CC_{v,k}$);
- the nitrogen to carbon ratio of the vegetation fuel type ($NC_{v,k}$);
- the ratio of molecular to elemental mass for nitrous oxide (1.5714); and
- the global warming potential of nitrous oxide (GWP_{N2O}).

The burning efficiency is the proportion of combusted fuel that is volatilised in a fire. The burning efficiency varies with fire severity, fuel size class and fire season. The values for the burning efficiency for these fuel size class in each fire season, taking fire severity into account, are set out in Table I of Schedule 2 of the Determination.

The nitrous oxide emission factors for these fuel size class for each vegetation fuel type are set out in Table N of Schedule 2 of the Determination.

The carbon contents of these fuel size class for each vegetation fuel type are set out in Table M of Schedule 2 of the Determination.

The global warming potential of methane must be taken from the NGER Regulations in force at the end of the reporting period (see section 20).

The nitrogen to carbon ratios for these fuel size class for each vegetation fuel type is set out in Table O of Schedule 2 to the Determination.

Subdivision 8—Fine fuel loads

51   Method for calculating fine fuel load

Section 52 provides an outline for calculating fine fuel loads based on the time since the last fire burnt each pixel.

52   Producing years since last burnt (YSLB) maps

Section 52 provides that the project proponent must produce a YSLB map in each calendar year in the baseline period and each year reported on in the crediting period. A YSLB map shows how many years have elapsed since each burnt pixel was last burnt.

Project proponents will need data from the five years prior to the first year in the baseline period to determine the year since last burnt for all pixels in the baseline.

Each YSLB map must be produced using GIS software.

Subsection 52(2) provides that the project proponent must produce each YSLB map by aggregating either monthly NAFI fire maps or validated seasonal fire maps derived from monthly fire maps not sourced from NAFI into yearly fire maps for the year for which the YSLB map is produced and each of the previous five years. Using these maps, the project proponent must determine the year in which each burnt pixel was most recently burnt, and assign a YSLB value to each burnt pixel according to subsection 52(3 and 4).

- If the pixel burnt in the five previous years, the pixel is assigned a value of between 1 and 5 to denote the number of years since it was most recently burnt. For example, if five years have elapsed since the pixel last burnt, the pixel is assigned a value of 5; if three years have elapsed, then the pixel is assigned a value of 3.

- If the pixel has not burnt in the previous five years, then the pixel is assigned a value of 6.

- If the pixel is not burnt in the year for which the YSLB value is produced, the pixel is assigned a value of zero. These pixels are not used in calculations of fine fuel loads.

53   Calculating area burnt for each YSLB value

For paragraph 51(b), the area $S_{YSLB,y,v}$ is determined by overlaying the YSLB map with the vegetation fuel type map (see Division 3).

54   Fine fuel load values

Section 54 provides that the fine fuel load, in tonnes per hectare, is calculated using Equation 14 for each vegetation fuel type in each season in each calendar year of the baseline period and each year reported on in the crediting period.

Fuel loads for fine fuels accumulate with the time elapsed since vegetation was last burnt. For example, if vegetation was burnt one year ago, the fine fuel load amount will be lower than for vegetation burnt five years ago.

Subdivision 9—Calculating fossil fuel emissions

55   Fossil fuel emissions

Section 55 provides that fossil fuel emissions must be calculated using Equation 15 for methane and nitrous oxide from each fossil fuel type used in each project area in each calendar year reported on in the crediting period.

The energy content of each fossil fuel type and the emission factor of each greenhouse gas must be taken from the NGER Measurement Determination in force at the end of the reporting period (see section 20).

Part 5—Reporting, record-keeping and monitoring requirements

Division 1 Offsets report requirements

56   Operation of this Division

Subsection 106(3) of the Act provides that a Methodology Determination may require the project proponent of an eligible offsets project to comply with specified reporting, record-keeping and monitoring requirements.

Under Parts 17 and 21 of the Act, a failure to comply with these requirements may constitute a breach of a civil penalty provision, and a financial penalty may be payable.

The reporting and monitoring requirements specified in Part 5 of the Determination are in addition to any requirements specified in the Act and legislative rules.

No record-keeping requirements are specified in the Determination. However, project proponents will have to comply with the record-keeping requirements set out in legislative rules.

Paragraph 106(3)(a) of the Act provides that a Methodology Determination may require project proponents to include specified information relating to the project in each offsets report about the project. Other reporting requirements are set out in the legislative rules.

57   Information that must be included in an offset report

Subsection 57(1) lists items that must be provided to the CER with each offsets report, or for each project area to which the report relates.

Subsection 57(1)(a) provides that the vegetation fuel type map must be accompanied by an ERF audit report, relating to the validation of the map, prepared in accordance with the legislative rules. The project proponent should retain evidence that they had regard, when collecting waypoints, to use transects that intersected all vegetation fuel types in the project area; and if the project has been divided into project areas—each project area. If the vegetation fuel type map is validated before the project is divided into project areas, then this latter clause is not applicable.

Subsection 57(1)(b) provides that a description of the project activities undertaken in the project or each project area, including location and timing of early dry season burning activities is provided with each report. This provision does not require a project to produce records for each ignition point of each prescribed fire or indeed all ignition point during the early dry season of a project year. The intent is that the project keeps a record of when prescribed early dry season fires were lit by the project proponent and the outcome of a fire in terms of a map of the area burnt for each fire. Records may be supplemented by aircraft logs if aerial incendiaries were used.

Subsection 57(1)(c) provides that a declaration to the effect that densities of livestock in lands owned or managed by the project proponent have not increased as a consequence of the project is provided with each report.

Subsection 57(1)(d) provides that if the project proponent used SavBAT 2 to calculate net annual abatement—a copy of each report produced by SavBAT 2 for each calendar year in the reporting period. For example, if in the reporting period ending with the 2019 calendar year a project area is reported on that was not reported in 2018, the 2018 and 2019 SavBAT 2 reports must be provided for that project area.

Subsection 57(1)(e) provides that, for each project area where SavBAT 2 has not been used, copies of each seasonal fire map mentioned in section 41; and for each monthly fire map not sourced from the NAFI—an ERF audit report relating to the validation of the seasonal fire map for which that monthly fire map was used, prepared in accordance with the rules made under the Act. The project proponent should retain evidence that they had regard, when collecting waypoints, to use transects that intersected both burnt and unburnt areas in the project area; and if the project has been divided into project areas—each project area. If the seasonal fire maps are validated before the project is divided into project areas, then this latter clause is not applicable.

Subsection 57(2) provides that, for seasonal fire maps not produced by SavBAT 2 a single map may show the area burnt in both fire seasons in a calendar year if each fire season is uniquely identified.

Subsection 57(3) sets out that the offsets reporting requirements for information on which version of the NGER (Measurement) Determination has been used by a project proponent to meet the calculation requirements of Divisions 3 and/or 4. The proponent is required to detail in their offsets report the version of the NGER (Measurement) Determination that was used when undertaking calculations, the dates that the version was used and why it was not possible for the proponent to use the version that was in force at the end of the reporting period.

Division 2   Monitoring

<u>58   Operation of this Division</u>

Paragraph 106(3)(d) of the Act provides that a Methodology Determination may include specified requirements to monitor the project.

<u>59   Fossil fuel use</u>

Fossil fuel used in implementing the project activity must be estimated. Fossil fuel use may include but is not limited to fuel used in transportation to manage fire, collect data in the field, and in drip torches.

Subsection 59(1) provides that, for each fuel type, the project proponent must monitor the amount of fuel combusted when undertaking project activities in each calendar year reported on in the crediting period.

Subsection 59(2) provides a non-exhaustive list of items from which fuel use may be monitored.

Subsection 59(3) provides that, if fossil fuel use for project activities cannot be monitored separately from fossil fuel use for non-project activities, estimates of fossil fuel use for project activities may be based on the time spent undertaking project activities and the known average fuel consumption of vehicles or machinery.

Division 3   Partial reporting

<u>60   Partial reporting</u>

The effect of subsection 77A(1) of the Act is that project proponents may divide a project (the overall project) into two or more parts and report on those parts as if they were projects in

their own right. Each of these parts can be reported on separately. For example, a savanna fire management project may choose to divide the project due to aggregation, transitioning, partial reporting and / or separating manual calculations for low and high rainfall zones, or for business or other reasons.

Subsection 77A(2) of the Act provides that the division of the overall project must comply with such requirements (if any) as are set out in the applicable Methodology Determination for the overall project. For savanna fire management projects those requirements are set out in section 60 of the Determination.

Section 60 of the Determination provides that an overall project may only be divided into parts that consist of one or more whole project areas.

The effect of section 77A of the Act is that, if an overall project is divided in this manner, the project proponent is to give to the CER, among other things, offsets reports for the period for which the project is divided, as if each part into which the project has been divided were an eligible offsets project in its own right. An offsets report is not required for the entire, undivided project. Section 77A of the Act does not otherwise impact on when offsets reports are required.

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—Emissions Abatement through Savanna Fire Management) Methodology Determination 2015

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—Emissions Abatement through Savanna Fire Management) Methodology Determination 2015* (the Determination) sets out the detailed rules for implementing and monitoring offsets projects that would reduce emissions of greenhouse gases associated with fire management taking place on savannas in the high and low rainfall zones in northern Australia.

Project proponents wishing to implement the Determination must make an application to the Clean Energy Regulator (the Regulator) and meet the eligibility requirements set out under the Determination. Offsets projects that are approved by the Regulator can generate Australian Carbon Credit Units, representing emissions reductions from the project. Project proponents can receive funding from the Emissions Reduction Fund by submitting their projects into a competitive auction run by the Regulator. The Government will enter into contracts with successful proponents, which will guarantee the price and payment for the future delivery of emissions reductions.

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.

Greg Hunt, Minister for the Environment