Australian Government
Clean Energy Regulator

EMISSIONS REDUCTION FUND

Blue Carbon Accounting Model (BlueCAM) Guidelines

Background

Section 27 of the *Carbon Credits (Carbon Farming Initiative—Tidal Restoration of Blue Carbon Ecosystems) Methodology Determination 2022* (the Determination) requires the use of the Blue Carbon Accounting Model (BlueCAM) to make the calculations under Part 4 of the Determination for tidal restoration projects.

BlueCAM is to be used as in force at the end of a reporting period. Data entered is for each carbon estimation area (CEA) in the project area for the entire reporting period. BlueCAM compares what existed at the project baseline (project declaration date), and end of the previous reporting period (if applicable) to the end of the current reporting period. As per section 29(3) of the Determination, where the net abatement amount ($\mathbf{A}_r$) calculated using BlueCAM for a reporting period is negative, you will need to subtract this number from the net abatement amount for the next reporting period.

BlueCAM includes separate worksheets for each climate region of Australia as specified by the map below (Figure 1). These are referred to as BlueCAM regions. The emissions factors used to calculate abatement and emissions are regionally specific to account for the variability in emissions and sequestration among regions. If a project area covers more than one BlueCAM region, the net abatement amount from each region is summed to obtain the net abatement for the tidal restoration project.

Project areas may be comprised of different land types, ages of vegetation growth and elevation that can be used to delineate carbon estimation areas (CEAs). The requirements for CEAs are set out in section 22 of the Determination and in the Supplement. BlueCAM includes one mangrove option land type drop down menu. Project proponents are required to stratify their CEAs based on the type of vegetation that establishes including the type of mangrove: tall mangroves; tall hinterland mangroves; or scrub mangroves. This will ensure the correct biomass and soil carbon accumulation parameters are applied in BlueCAM. BlueCAM determines which parameters are applied based on the tidal range entered for each mangrove CEA.

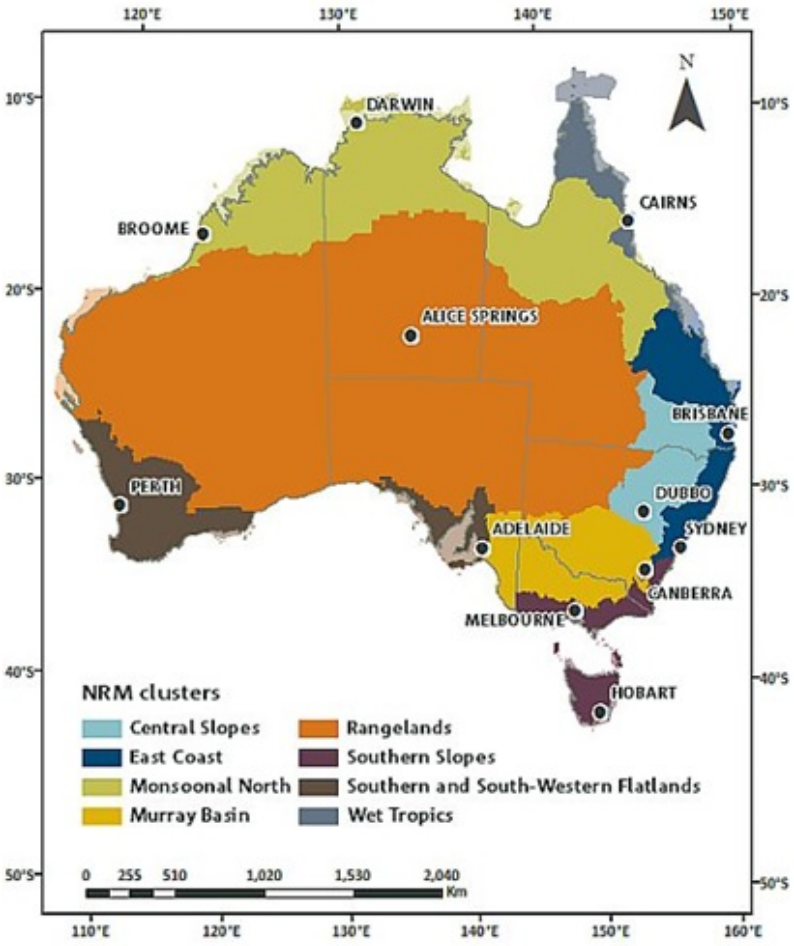

Figure 1: BlueCAM uses Tropical monsoon for "Monsoonal north"; Tropical humid for "Wet Tropics"; Subtropical for "East Coast"; Temperate for "Southern Slopes"; "Southern and South-Western Flatlands" and "Murray Basin" and Arid & Semiarid for "Rangelands". "Central Slopes" are not represented in BlueCAM, as this region does not have tidal boundaries. Figure 1 and shapefiles available from Climate Change in Australia.

Entering your data into BlueCAM

Select the worksheet that applies to the BlueCAM region for each project area of your tidal restoration project. Enter data in cells highlighted blue from A3 to E3 which apply to the project area:

- **A3:** Enter the reporting period start date in the format of DD/MM/YYYY.
- **B3:** Enter the reporting period end date in the format of DD/MM/YYYY.
- **C3:** Select your project permanence period in the dropdown menu (either 25 years or 100 years) in accordance with your project declaration. This determines the sequestration buffer applied (B_{seq}).
- **D3:** In the dropdown menu, select 'Yes' if a project area discount applies to your project and 'No' if a project area discount does not apply to your project. This determines the sequestration buffer (B_{seq}). A project area discount applies to your project if your project is a 100-year permanence period project and all its project areas include less than 80% by area of land identified as impacted land in each current permanence period tidal inundation map made in accordance with section 15 of the Determination.

- **E3:** Enter the tidal range in meters to one decimal place for your project area in accordance with the Supplement. The tidal range is the difference in height between the maximum high tide (highest astronomical tide) and the minimum low tide (lowest astronomical tide) in the project area.
  - » ***highest astronomical tide*** means the highest tide level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions.
  - » ***lowest astronomical tide*** means the lowest tide level which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions.

Enter data in cells highlighted blue in column H relating to fuel consumed (Q_f) to undertake project activities for each project area. Enter the fuel use for the reporting period in the relevant worksheet if the project area covers more than one BlueCAM region. BlueCAM uses the emissions factor values from Schedule 1 Part 4 of the *National Greenhouse and Energy Reporting (Measurement Determination) 2008.* There are separate emissions factors for vehicle models prior to 2004 (Division 4.1) and post-2004 (Division 4.2). Note that the units are in kilolitres (1,000 litres) to one decimal place.

- **H3-H6**: Enter the amount of fuel consumed to undertake project activities for the project area for the reporting period into the appropriate cell based on the fuel type (gasoline, diesel) and vehicle model (pre or post-2004).

Enter data in cells highlighted blue from column K to column T which apply to each CEA in the project area. For each CEA enter the following data:

- **Column K:** Enter the CEA area (**ACEA**) in hectares to one decimal place as calculated in accordance with the Blue Carbon Supplement.
- **Column L:** Enter the average elevation of the CEA in meters to one decimal place with respect to the Australian Height Datum (AHD) as identified in accordance with the Blue Carbon Supplement.
- **Column M:** Has the CEA been affected by tidal flows from the eligible project activities? Some CEAs may not immediately be affected by the eligible project activities and may experience tidal flows in later years of the project. Select 'Yes' if the CEA experienced flows due to the eligible project activity in the reporting period, or 'No' if the CEA did not experience tidal flows due to the eligible project activities in the reporting period.
- **Column N:** For the first reporting period for the CEA, select 'Yes'. Otherwise, select 'No'.
- **Column O:** Select the land type for the CEA at the date of declaration of the project as an eligible offsets project (date of project registration), this is the baseline land type. Use the arrows or scroll bar in the drop down menu to select the appropriate type for your project. Refer to the land type definitions below.
- **Column P:** If in a subsequent reporting period for the CEA, select the land type for the CEA at the end of the previous reporting period. Otherwise, select 'NA'.
- **Column Q:** Select the dominant land type for the CEA at the end of the current reporting period. Refer to the guidance provided below on how to define a coastal ecosystem type for a CEA where multiple coastal ecosystem types co-exist. BlueCAM compares the land type for the current reporting period with the land type for the previous reporting period and baseline period and includes estimates of emissions

and abatement if a transition has occurred. A transition occurs when a coastal wetland ecosystem first establishes in the CEA. If a coastal wetland ecosystem has not established in the CEA, enter the land use type for the end of the previous reporting period.

- **Column R:** Has a coastal wetland ecosystem previously established in the CEA? Enter the age of the coastal wetland vegetation at the end of the previous reporting period. If coastal wetland vegetation has not established, enter 0 or leave the cell blank.
- **Column S:** Has a coastal wetland ecosystem established in the CEA in the current reporting period? Enter the age of the coastal wetland vegetation in the ecosystem since it first established in the project area. For example, the number of years since mangrove propagules, supratidal tree species, seagrass or very small saltmarsh plants were established and first observed in the project area. Enter the age in whole years rounded down to the nearest whole year.
    - » Note that for section 22(1)(c) of the Determination, the Supplement requires that for a CEA comprising supratidal forest or mangroves, vegetation within a CEA must be of similar age such that 90 per cent of the plants comprising the land type have first established over a period of time no greater than 5 years.
- **Column T:** Have excavation activities occurred in the CEA during the reporting period? If excavation activities have occurred, enter the area of the CEA that that has been excavated in hectares to one decimal place. If excavation activities have not occurred in the CEA during the reporting period, enter 0.
- For reporting periods other than the first reporting period, enter data into the carry over net abatement ($\mathbf{A_{r-1}}$) which applies to the project area:
- **Column AO**: Only enter a value for this cell if for the previous reporting period there was negative net abatement. That is, a negative output number in BlueCAM in cell AT3 ($\mathbf{A_r}$) for the previous reporting period. In this case, enter that number into cell AO3 for this reporting period to the nearest whole number.

Interpreting the results

The outputs of BlueCAM are separated into the emissions source and carbon pool components of the Blue Carbon project for each CEA in tonnes CO_2-e in **Columns V-AT**. These parameters align with the equations in the Determination and are used in the summary calculations in BlueCAM to determine the net abatement amount for the reporting period. A description of the parameters is included below.

Greenhouse gas emissions source

- **Column V**: Avoided emissions of CO_2 ($\mathbf{E_{B,CO2}}$) determined based on the baseline land type (equation 9).
- **Column W**: Avoided emissions of CH_4 ($\mathbf{E_{B,CH4}}$) determined based on the baseline land type (equation 7).
- **Column X**: Avoided emissions of N_2O ($\mathbf{E_{B,N2O}}$) determined based on the baseline land type (equation 8).
- **Column Y:** Emissions of CO_2 ($\mathbf{E_{B,CO2}}$) for the reporting period determined based on the land type at the end of the reporting period (equation 9).

- **Column Z:** Emissions of CH_4 ($\mathbf{E_{r,CW,CH4}}$) for the reporting period determined based on the land type at the end of the reporting period (equation 10).
- **Column AA:** Emissions of N_2O ($\mathbf{E_{r,CW,N2O}}$) for the reporting period determined based on the land type at the end of the reporting period (equation 11).
- **Column AB**: Ecosystem transition emissions ($E_{r,TR,CO2}$) calculated where there is a change in the vegetation type between the baseline or subsequent reporting periods (equation 12). This includes emissions from natural disturbance events. Emissions from a disturbance event are calculated when there has been a decrease in the age of the coastal wetland vegetation, or a change in the land type to indicate that the vegetation has died off.
- **Column AC:** The total emissions for each CEA in tonnes CO_2-e (equation 6). The emissions in tonnes CO_2-e for the CEA during the reporting period is compared with the emissions of the CEA at the project registration date (baseline emissions). This value includes emissions caused by land type transitions with vegetation die-off and replacement by another ecosystem type. The value for each CEA may be positive (emissions avoided compared with baseline emissions) or negative (emissions increased compared with baseline emissions).

Vegetation

- **Column AE:** The amount of carbon sequestered in above ground live biomass for the CEA determined based on the land type.
- **Column AF:** The amount of carbon sequestered in below ground live biomass for the CEA determined based on the land type.
- **Column AG:** The total carbon sequestered in above- and below-ground live biomass ($\mathbf{C_{v,i,r}}$) in tonnes CO_2-e for the CEA during the reporting period (see equation 4).

Soils

- **Column AI**: Baseline soil carbon accumulation ($\boldsymbol{C_{a,i,r}}$) determined based on the baseline land type. The total soil carbon accumulation is adjusted by the baseline accumulation to ensure only additional abatement due to the project activity is credited.
- **Column AJ**: Avoided soil carbon losses ($\boldsymbol{C_{l,i,r}}$) determined based on the baseline land type.
- **Column AK:** The amount of carbon sequestered in soil ($\boldsymbol{C_{s,i,r}}$) in tonnes CO_2-e for the CEA during the reporting period.
- **Column AL:** The emissions from loss of soil carbon due to excavation activities that occurred in the CEA during the reporting period (equation 5). If no excavation activities have occurred in the CEA this will be 0.
- **Column AM:** The total amount of carbon sequestered in soil in tonnes CO_2-e for the CEA during the reporting period (see equation 4).

Net abatement amount

- **Cell AQ3:** The total amount of emissions avoided (below baseline emissions) or emitted (above baseline emissions) in tonnes CO_2-e for the project area during the reporting period ($E_{r,}$). This is the sum of Column AC and is the value for equation 6 in the Determination. This value may be positive (emissions avoided compared with baseline emissions) or negative (emissions increased compared with baseline emissions).
- **Cell AR3:** The total amount of carbon sequestered in above and below ground live biomass and soil (the carbon stock change) in tonnes CO_2-e for the project area during the reporting period compared with the baseline carbon (ΔC_r). This is the sum of Column AG and Column AM and is the value for equation 3 in the Determination.
- **Cell AS3:** The total amount of emissions from the fuel consumed ($E_{fk,r}$) in tonnes CO_2-e for the project area during the reporting period. This is the sum of cells H3 to H6 and is the value for equation 13 in the Determination.
- **Cell AT3:** The net abatement amount for the project area for the reporting period (A_r). This is the summed total of emissions avoided (AQ3), the total carbon stock change (AR3) multiplied by the sequestration buffer, less any emissions from fuel (AS3). This is used to determine the amount of ACCUs the project is eligible to receive for the project for the reporting period (see equation 2). The value can be positive or negative. If AT3 is negative, this value is entered in cell AO3 in the subsequent reporting period.

Land type definitions

There are 15 land types defined in the Determination, including 9 land types that characterise baseline land types, 5 coastal wetland ecosystems that may establish as a result of the project activity.

Baseline land type

Cropping land means land used to grow crops.

Drainage channels means brackish or freshwater drains or ditches created for the drainage of land for agricultural purposes, such as growing sugarcane.

Flooded agricultural land, managed wet meadow or pasture means land that is:

(a) flooded for all or part of a year; and

(b) used for agricultural or pastoral purposes.

Forest land means land with forest cover that is not a supratidal forest or mangrove.

Grazing land means land that is used for grazing of production livestock.

Other use land means land that is used at the end of the baseline period in some way for human activities that is not covered by the other land types. It may also include rocky outcrops.

Ponds and other constructed water bodies means freshwater or brackish ponds, dams, or reservoirs that have been created by people.

Saline water bodies means saline or hypersaline ponds or waterbodies that have been created by people, including for aquaculture activities.

Sugarcane land means land used to grow sugarcane.

Tidally restricted fresh and brackish wetlands means a type of coastal wetland ecosystem that is not affected by tidal flows because its hydrology has been modified by people.

Examples included construction of dams, weirs and bunds (for examples see the National Environmental Science Program report and the Queensland Government Department of Agriculture and Fisheries website).

Coastal wetland ecosystem land types

Mangroves means an ecosystem comprised of trees and shrubs which:

(a) occupy the intertidal zone of floodplains, including marine and estuarine areas; and

(b) grow in saline or brackish water.

The species composition and biomass vary regionally and with local environmental factors. As of 3 December 2021, descriptions of different types of mangroves in different states can be found at the following links:

- Queensland
- South Australia
- New South Wales
- Victoria
- Western Australia
- Northern Territory

Other coastal wetland ecosystem means an ecosystem on impacted land that is not any of the other land types. It may include rocky outcrops or mudflats where there is no wetland vegetation.

Saltmarsh means an ecosystem that:

(a) is comprised of salt tolerant plants that are herbaceous as well as some woody shrubs; and

(b) occurs on floodplains and in estuaries and can be flushed with water from a combination of water sources including rainfall, rivers, groundwater and seawater.

Saltmarsh species composition varies regionally and with local environmental factors. As of 3 December 2021, descriptions of different types of saltmarshes in different states can be found at:

- Northern Territory
- New South Wales
- Queensland – refer to information for saline swamps and grass and sedge swamps; additional detail is available in mapping surveys available online.
- South Australia

- Tasmania – refer to Prahalad, V. and Kirkpatrick, J.B., 2019. Saltmarsh conservation through inventory, biogeographic analysis and predictions of change: Case of Tasmania, south-eastern Australia. Aquatic Conservation: Marine and Freshwater Ecosystems, 29(5), pp.717-731, available online.
- Victoria and
- Western Australia – refer also to the National Environmental Science Program Marine report : and McComb. A.J., Kobryn, H. T., and Latchford, J., 1995. Samphire Marshes of the Peel-Harvey Estuarine System, Western Australia, available online.

Seagrass means an ecosystem comprised of grass-like plants that grows in shallow (including the intertidal zone) to deep coastal waters.

Seagrass are classified as marine and estuarine wetlands Seagrass species composition varies regionally and with local environmental factors. As of 3 December 2021, descriptions of seagrass can be found at:

- Wetland Info website
- OzCoasts website

Sparsely vegetated saltmarsh (saltflats) means a sparsely vegetated saline or hypersaline (more saline than seawater) ecosystem.

Saltflats are often found high in the intertidal zone in drier evaporative environments, where tidal inundation is infrequent. These ecosystems may support cyanobacterial mats but have little vegetation and animal life compared with saltmarsh, due to the higher salt content They are often described as a component of other marine and estuarine ecosystems. As of 3 December 2021, descriptions of ecosystems can be found at:

- OzCoasts website
- Queensland
- Northern Territory
- South Australia

Supratidal forest means an ecosystem comprised of woody vegetation that occupies land adjacent to the intertidal zone and comprised of plants in the genera *Casuarina*, *Melaleuca* and other associated species.

As of 3 December 2021, descriptions of supratidal tree swamps for different states can be found at:

- New South Wales, Victoria and South Australia – refer to the New South Wales Department of Environment guide and information for threatened species
- Northern Territory and Queensland – refer to *Wetland Info* website
- Western Australia

Defining a coastal ecosystem type for a CEA where multiple coastal ecosystem types co-exist

Where possible, CEAs should be defined by a single coastal ecosystem type. However, the composition of vegetation communities that develop when tidal flows are introduced to an area can be complex. Although BlueCAM requires each CEA to be classified as a single dominant coastal ecosystem type, it will often be the

case that multiple coastal ecosystem types co-exist within the same area. For example, a combination of casuarina species and mangrove species may co-exist in the same area of land.

The dominant vegetation layer taken to define the coastal wetland ecosystem type in a CEA is that which contributes the greatest vegetation cover to the vegetation community present in the CEA[1]. Table 1 provides guidance for classifying the dominant coastal wetland ecosystem type based on the composition of the vegetation community in the CEA.

Paragraph 33(1)(e) of the Determination also requires project proponents to include digital time and date stamped, geolocated images for land in each CEA to evidence the coastal wetland ecosystem type that is selected for use in BlueCAM as part of each offsets report prepared for a tidal restoration project.

Table 1: Classifying the dominant coastal ecosystem type within a CEA

Coastal wetland ecosystem type	Composition of vegetation community in CEA
Mangroves	>50% of the vegetation cover in the CEA is comprised of mangrove species; or >50% of the vegetation cover in the CEA is comprised of mangrove species and supratidal forest species, and the vegetation cover of the mangroves exceeds that of the supratidal forest species.
Saltmarsh	The CEA contains >10% saltmarsh cover and is not dominated by species of another coastal wetland ecosystem type.
Seagrass	The CEA contains >10% seagrass cover and is not dominated by species of another coastal wetland ecosystem type.
Sparsely vegetated saltmarsh (salt flats)	≤10% of the CEA is covered by vegetation.
Supratidal forest	>50% of the vegetation cover in the CEA is comprised of supratidal forest species; or >50% of the vegetation cover in the CEA is comprised of mangrove species and supratidal forest species, and the vegetation cover of the supratidal forest species exceeds that of the mangrove species.

[1] This approach to classification is aligned with the approach taken in the Queensland Government Environmental Protection Agency's *Coastal Wetlands of South East Queensland Mapping and Survey Guide* which is available at https://wetlandinfo.des.qld.gov.au/resources/static/pdf/ecology/mangroves/volume-1-mapping-survey.pdf