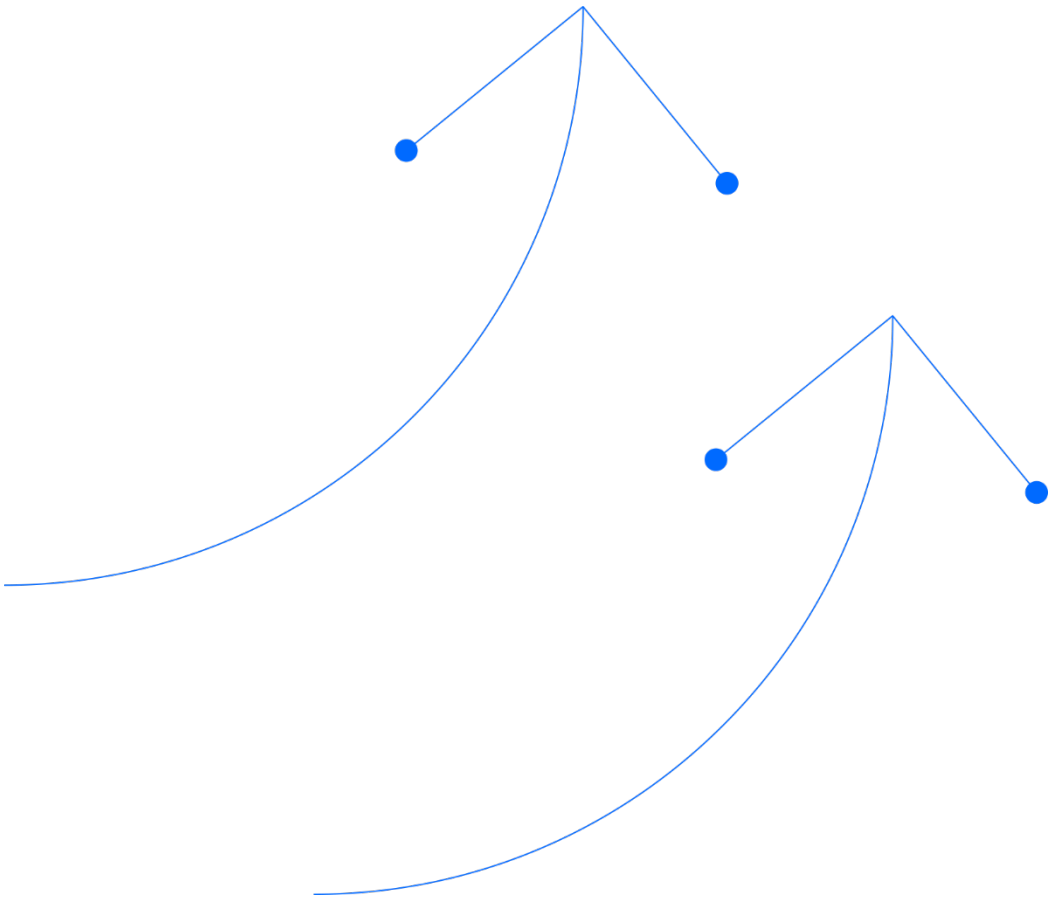
Santos

SANTOS GLNG OFFSET PLAN AND ACQUITTAL SUMMARY

EPBC Act Approval 2012/6615 (Stage 8)

Document Number: 0007-650-PLA-0102

31 October 2025



Date	Rev	Reason For Issue	Reviewed	Endorsed	Approved
9 May 2025	0	For DCCEEW submission	AB	AB	DG
31 October 2025	1	Updated based on DCCEEW review	JK	AB	DG

Declaration of Accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulation 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed [redacted]

Full Name (please print) [redacted]

Organisation (please print) Santos Ltd

Date 31 / 10 / 2025

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Abbreviations

Acronym	Description
ALA	Atlas of Living Australia
CSG	Coal Seam Gas
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DESI	Department of Environment, Science and Innovation (previously Department of Environment and Science [DES])
DoR	Department of Resources, (previously Department of Natural Resources, Mines and Energy)
DotE	Department of the Environment
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
GLNG	Gladstone Liquefied Natural Gas
GFD	Gas Field Development
GTP	Gas Transmission Pipeline
GTDTHQ	Guide to Determining Terrestrial Habitat Quality
MNES	Matters of National Environmental Significance
OAMP	Offset Area Management Plan
RE	Regional Ecosystem
REDD	Regional Ecosystem Description Database
TEC	Threatened Ecological Community
SEVT	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions
VM Act	Vegetation Management Act 1999 (Qld)

1. Introduction

1.1. Background

The Santos Gladstone Liquefied Natural Gas (GLNG) Project involves the development of Coal Seam Gas (CSG) resources in the Surat and Bowen Basins in Queensland, to supply gas via a 430 kilometre (km) gas transmission pipeline (GTP) to the LNG Facility located on Curtis Island.

Throughout the development of the Santos GLNG Project and in accordance with Santos GLNG Project approvals, potentially impacted environmental values are systematically identified and assessed and in order of preference are avoided, minimised or mitigated. For a project the size and scale of the Santos GLNG Project, not all potential impacts to identified values can be avoided and/or mitigated, resulting in significant residual adverse impacts to environmental values. Santos is committed to providing environmental offsets to compensate for significant residual impacts on matters of national environmental significance (MNES).

The Santos GLNG Project requires environmental offsets for significant residual impacts on MNES under five separate approvals under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth; EPBC Act):

- EPBC 2008/4057 which relates to the LNG facility and associated onshore facilities.
- EPBC 2008/4058 which relates to the marine facilities for the LNG facility.
- EPBC 2008/4059 which relates to the CSG fields.
- EPBC 2008/4096 which relates to the GTP.
- EPBC 2012/6615 which relates to the expansion of the CSG fields (the Santos GLNG Gas Field Development [GFD] Project).

1.2. Purpose

This document has been prepared to demonstrate how Santos will acquit MNES offset obligations associated with the Stage 8 development of the GFD Project under EPBC 2012/6615 for impacts across the Arcadia, Fairview and Roma gas fields (herein referred to as Stage 8).

Under EPBC 2012/6615, Santos may carry out the action in project stages and deliver environmental offsets for residual significant impacts to MNES over time. This offset plan has been prepared for Stage 8 of the GFD Project, to address conditions 11-19 under EPBC 2012/6615 (see Section 2).

1.3. Scope

This document includes:

- offset conditions of EPBC 2012/6615 and where each condition is addressed in this document (Section 2)
- details of the methods for assessing significant residual impacts and a summary of the impacts addressed as part of this document for Stage 8 of the GFD Project (Section 3)
- a reconciliation of impacts and offsets for Stages 1-7 of the GFD Project (Section 4)
- summary of how the proposed offset area meets the requirements under the EPBC Act Environmental Offsets Policy (Section 5)
- brief overview of the offset properties selected to acquit the MNES offset requirements of Stage 8 of the GFD Project, namely Bottle Tree (Lot 7 TR39), Kentucky (Lot 1 WT37), Cobbadah (Lot 35 SP140818 and Lot 33 WT347), Mt Tabor (Lot 6 CHS25; Offset area 2) and Springwater (Lot 8 SP261936) (Section 6)
- demonstration of how each MNES offset requirement is acquitted (Section 7)
- offset area management plans (OAMP) for the Bottle Tree offset area (Appendix A), Kentucky offset area (Appendix B), Cobbadah offset area (Appendix C), Mt Tabor offset area (Appendix D) and Springwater offset area (Appendix E).

2. Approval Conditions

Table 1 provides a summary of the conditions related to offsets under EPBC 2012/6615 for Stage 8 of the GFD Project and how they have been addressed within this document.

Table 1 – EPBC Act Approval Conditions and how they are met

Condition number	Condition	How the conditions are met
EPBC Act approval 2012/6615		
11	The approval holder must ensure that environmental offsets comply with the principles of the EPBC Act *Environmental Offsets Policy*.	Offsets to compensate for significant residual impacts associated with Stage 8 of the GFD Project will be delivered in accordance with the principles of the EPBC Act *Environmental Offsets Policy*. Section 5 provides a summary of how the proposed offset area meets the requirements for an offset under the EPBC Act *Environmental Offsets Policy* with additional detail provided in Section 2.9 of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E), and Section 2.8 of the Cobbadah OAMP (Appendix C).
12	The approval holder may carry out the action in project stages. The approval holder must deliver environmental offsets for residual significant impacts to matters of national environmental significance for each project stage.	The action will be carried out in stages. This offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with Stage 8 of the GFD Project, as described in Section 3.
13	The approval holder must submit an Offset Management Plan for the Minister's written approval. The Offset Management Plan may be prepared and submitted to the Minister for written approval in stages. If the approval holder submits the Offset Management Plan in stages, each version of the Offset Management Plan must address the known and predicted impacts of the completed, current, and next proposed project phases.	This offset plan has been submitted for the Minister's written approval. This offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with Stage 8 of the GFD Project, as described in Section 3. A reconciliation of impacts for Stage 1-7 of the GFD Project is included in Section 4.
14	The Offset Management Plan must include: a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities; b. results from pre-disturbance surveys and/or an alternative approved methodology (if used) for the project phase as required under conditions 4 and 5; c. details of the offset areas required to address predicted residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities for the project phase; d. a survey and description of the current condition (prior to any management activities) of each offset area proposed, including existing vegetation (the baseline condition). This must include a shapefile of each offset property boundary; e. information about how the offset areas provide connectivity with other relevant habitats and biodiversity corridors, including a map depicting the offset areas in relation to other habitats and biodiversity corridors; f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary); g. a description of the management measures that will be implemented for the protection of EPBC threatened species, EPBC migratory species and EPBC communities, including a discussion of how measures outlined take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans; h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria; i. a description of potential risks to the successful implementation of the plan, and a description of the contingency measures that would be implemented to mitigate against these risks; j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and	The Bottle Tree offset area, Kentucky offset area, Cobbadah offset area, Mt Tabor offset area and Springwater offset area are proposed to be secured to acquit offset requirements for Stage 8 of the GFD Project. The OAMPs for each of these areas have been developed in accordance with the requirements outlined in condition 14 (see Appendix A, Appendix B, Appendix C, Appendix D and Appendix E). A summary of how each requirement has been addressed is provided below and further detailed in the OAMPs. a. The method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities is discussed in Section 3.2. b. Details of the relevant field assessments are provided in Section 3.2.2 and a summary of the residual significant impacts on MNES for Stage 8 of the GFD Project is provided in Section 3.2.3. c. A description of the proposed Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater offset areas are provided in Section 6 and a summary of the offset areas to be secured to acquit the residual significant impacts for Stage 8 of the GFD Project is provided in Section 7. d. Details of the baseline field surveys and ecological condition are provided in Section 2.5 of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E), and Section 2.4 of the Cobbadah OAMP (Appendix C). Shapefiles of the offset area will be submitted with this offset plan. e. Details on the connectivity and the landscape context are provided in Section 2.2 of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E). f. Performance criteria, trigger levels and remedial actions for management activities are discussed in Section 6 of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E). g. Management measures implemented for the protection of MNES, including how measures outlined take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans are provided in Sections 4 and 6 of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP, as well as Section 6 of the Springwater OAMP (Appendix E). h. The monitoring program to measure the effectiveness of the management measures and progress against the performance and completion criteria is detailed in Section 7 of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D), and Section 8 of the Springwater OAMP (Appendix E).

Condition number	Condition	How the conditions are met
	k. the proposed legal mechanism for securing the offset.	i. Risks to the successful implementation of the OAMP are outlined in Section 5 of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E). j. The timing for implementation of the management and monitoring program is provided in Section 9 of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D), and Section 8.6 of the Springwater OAMP (Appendix E). k. Details on how the offset area for Stage 8 of the GFD Project has been legally secured are provided in Section 2.9 of the Bottle Tree OAMP (Appendix A), Section 2.7 of the Cobbadah OAMP (Appendix C) and Mt Tabor OAMP (Appendix D), and Section 2.8 of the Kentucky OAMP (Appendix B) and Springwater OAMP (Appendix E).
15	The currently approved Offset Management Plan must be implemented by the approval holder.	This offset plan complements previous offsets plans and proposals submitted for approval. Once approved, this offset plan will be implemented.
16	The approval holder must register and legally secure offsets for the first project phase identified in the Offset Management Plan within two years of commencement of the first project phase.	On 6 April 2018, the Springwater offset area was declared an area of high nature conservation value under section 19F of the *Vegetation Management Act 1999* (Qld; VM Act) and legally secured through a Voluntary Declaration. The Santos GLNG GFD Project Stage 1 Offset Plan was approved on 31 October 2016.
17	The approval holder must register and legally secure offsets for a project phase which are sufficient to acquit the residual significant impacts of that project phase.	Santos will apply to have Offset area 2 on Mt Tabor protected via a voluntary declaration under section 19E and 19F of the VM Act. The offset areas on Bottle Tree, Cobbadah and Springwater have been protected via a Voluntary Declaration under section 19E and 19F of the VM Act. See Section 2.9 of the Bottle Tree OAMP (Appendix A), Section 2.7 of the Cobbadah OAMP (Appendix C) and Mt Tabor OAMP (Appendix D), and Section 2.8 of the Kentucky OAMP (Appendix B) and Springwater OAMP (Appendix E) for further detail.
18	If the approval holder submits the Offset Management Plan in stages, the approval holder must prepare and submit an updated Offset Management Plan for each subsequent project phase, for written approval by the Minister. The updated Offset Management Plan must: a. include the information required for the Offset Management Plan at condition 14 for the next project phase; b. include a reconciliation of actual and predicted but yet to be actualised residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities against offsets secured for the commenced project phases. Secured offsets in excess of requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases may be subtracted from the obligations required for subsequent project phases. Any shortfall in secured offsets relative to the requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases must be added to the obligations required for the next project phase; and c. demonstrate how the offset builds on offsets already secured for previous project phases and will contribute to a larger strategic offset for cumulative project impacts.	The Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E) have been prepared to satisfy offset requirements for Stage 8 of the GFD Project. a. The OAMPs have been developed in accordance with the requirements outlined in condition 14. How each requirement has been addressed is further detailed in the OAMP (see Appendix A, Appendix B, Appendix C, Appendix D and Appendix E). b. A reconciliation of impacts for Stage 1-7 of the GFD Project is included in Section 4. c. The Bottle Tree and Kentucky offset area has previously been used to compensate for impacts associated with the GLNG Project under EPBC Act approvals 2008/4059, 2008/4096 and 2012/6615. The Cobbadah offset area has previously been used to compensate for impacts associated with the GLNG Project under EPBC Approval 2012/6615. The Mt Tabor offset area (areas 1 and 2) has previously been used to compensate for impacts associated with the GLNG Project under EPBC Act approval 2012/6615. The Springwater offset area has previously been used to compensate for impacts associated with the GLNG Project under EPBC Act approval 2012/6615. d. Of the five offset areas, Cobbadah and Bottle Tree offset areas will have surplus area remaining after the acquittal of Stage 8 offset requirements, and Santos proposes to draw down on these to acquit future offset requirements.
19	The approval holder must not commence the project phase until the Offset Management Plan, updated for that project phase has been approved by the Minister in writing.	This offset plan and associated OAMPs are submitted for the approval of the Minister. Stage 8 will not commence until the OAMPs for this project stage have been approved.

3. Significant Residual Impacts

3.1. Staging plan

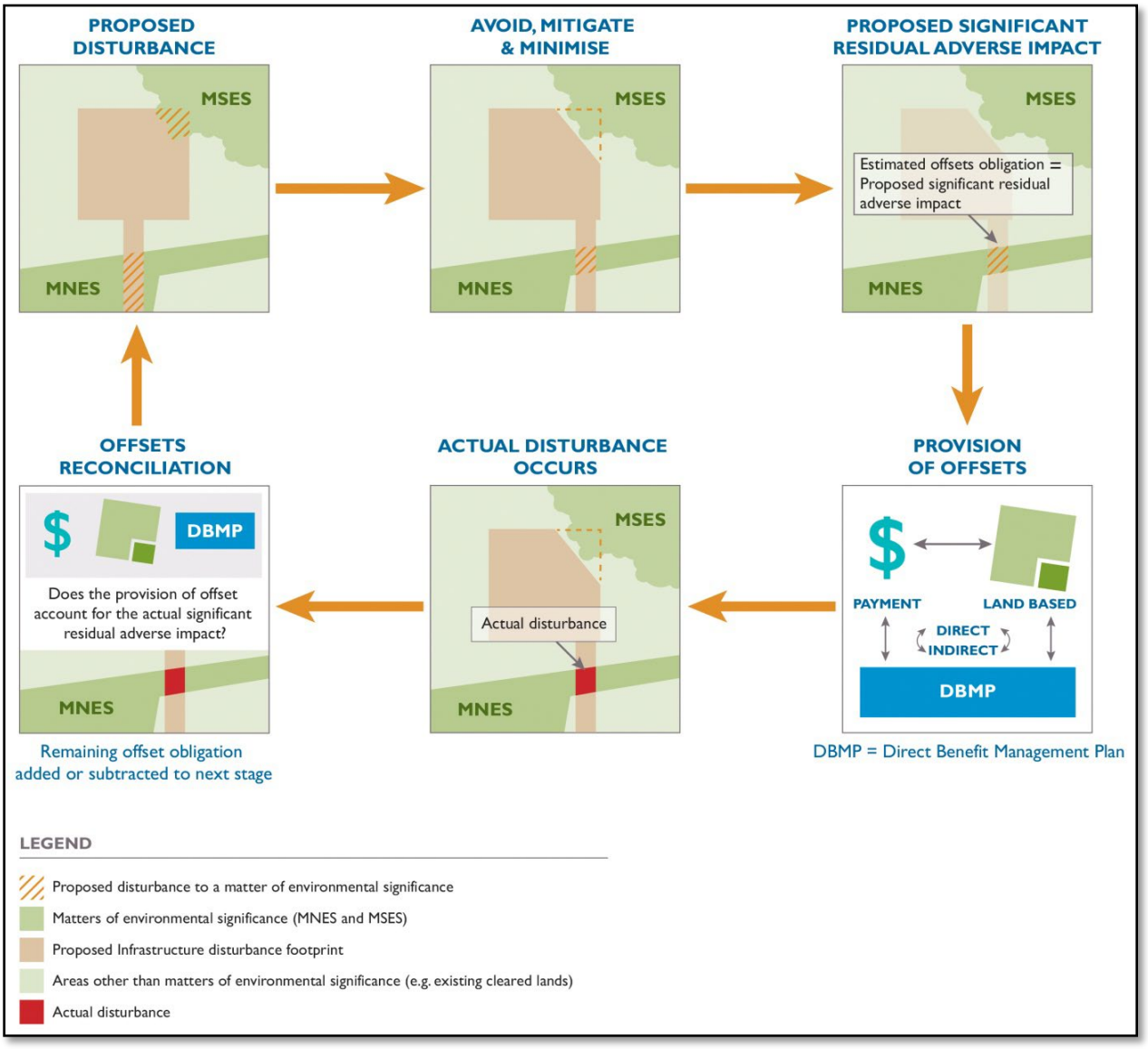
Environmental offsets for the Santos GFD Project will be acquitted in stages. For each offset stage of the GFD Project an environmental offset plan will be developed to:

- Report on the methodology and results of the environmental assessments completed over the proposed disturbance area (e.g. desktop and field ecological assessment results).
- Identify actual significant residual impacts on MNES for each stage.
- Reconcile the offsets obligations, post disturbance, against the advanced offsets provided.

An indicative flow diagram demonstrating the staging process is provided in Figure 1.

This offset plan has been prepared for Stage 8 of the GFD Project in accordance with condition 18 of EPBC 2012/6615.

Figure 1 – The Santos GLNG staging process



3.2. Methods for assessing Stage 8 impacts

3.2.1. Stage 8 development area

The Stage 8 development area occurs across parts of the Arcadia, Fairview and Roma gas fields, from approximately 59 km south-southwest of Rolleston in the north, 38-65 km east-northeast of Injune in the middle, and 40 km east of Roma in the south. The various development areas are located across three regional councils (Banana Shire, Central Highlands and Maranoa) and three subregions (Arcadia, Carnarvon Ranges and Southern Downs) in the Brigalow Belt Bioregion (Boobook 2021a, 2022, 2023, 2024, 2025; Terrestria 2022, 2024, 2025).

The development area consisted of a mix of remnant and regrowth vegetation and has a long history of extensive vegetation clearing for cattle grazing, cropping and logging.

3.2.2. Ecological surveys and assessments

Ecological assessments of the Stage 8 development area were undertaken by suitably qualified ecologists engaged by Santos to provide baseline ecological data and to inform future offset obligations. The assessment included desktop investigations followed by detailed field surveys between November 2020 and November 2024 to confirm the vegetation communities, flora/fauna species and habitat values present within the development area (Boobook 2021a, 2022, 2023, 2024, 2025; Terrestria 2022, 2024, 2025).

Formal survey sites were established in a number of vegetation assessment units, based on identifiable vegetation characteristics across the broader project area (Boobook 2021a, 2022, 2023, 2024, 2025; Terrestria 2022, 2024, 2025). At most sites quaternary vegetation structure and floristics and fauna habitat assessments were conducted. A description of the desktop and field survey assessments are summarised in the following sections.

In-field verification of desktop findings and additional findings of significance were undertaken in general accordancewith the following:

- *Methodology for Conducting Ecological Assessments – GLNG Areas Rev 4.1* (Santos 2014).
- *Functional Thresholds for Assessing Regional Ecosystem Functionality* (Santos 2015).
- *Guide to Determining Terrestrial Habitat Quality* version 1.3 (DES 2020).
- *Methodology for Surveying and Mapping Regional Ecosystems and Vegetation Communities in Queensland*, version 5.1 (Neldner *et al.* 2020).
- *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland,* versions 6.0 and 7.0 (Neldner *et al*. 2022, 2023).

Desktop assessment

A desktop assessment was conducted to inform the field survey. Sources of information utilised during the desktop assessment included the following:

- Queensland government remnant regional ecosystem (RE) and high value regrowth mapping (Department of Resources [DoR] 2024a; Queensland Herbarium 2024).
- EPBC Act Protected Matters Search Tool (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2024).
- Wildlife Online fauna and flora records (Queensland Government 2024c).
- Protected Plants Flora Survey Trigger Map (Queensland Government 2024b).
- Wetlands and waterways mapping (Department of Environment, Tourism, Science and Innovation [DETSI] 2025; DoR 2024b).
- Landscape terrestrial and aquatic values (Queensland Government 2024a; Queensland Herbarium 2024).
- Regulated vegetation and other Matters of State Conservation Significance (Queensland Government 2024a; DoR 2024a, 2024b).
- Atlas of Living Australia (ALA) flora and fauna records within 10 km of the approximate centre of the Site (ALA 2024).

Regional Ecosystem and Threatened Ecological Community assessment

Desktop RE mapping was ground-truthed based on quaternary level of data collected across the disturbance area in accordance with Neldner *et al*. (2022). Vegetation community polygons were verified in accordance with Queensland RE description and biodiversity status as per the Regional Ecosystem Description Database (REDD) (Queensland Herbarium 2024) and classified as remnant RE, vegetation consistent with RE (regrowth) or non-remnant vegetation. For identified regrowth (i.e. vegetation floristically equivalent to a RE but not meeting structural thresholds of remnant RE) an ecosystem functionality assessment was conducted.

For each area of potential threatened ecological community (TEC), an assessment of vegetation survey data was made against the Commonwealth Government's TEC threshold criteria (e.g. Threatened Species Scientific Committee 2013).

BioCondition assessment

BioCondition assessments were used to evaluate ecological functionality of each vegetation community. These assessments were completed within at least 174 sites across the project areas, which were selected to include each mapped RE (remnant and regrowth status). BioCondition assessments were undertaken in accordance with the *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual* (BioCondition Manual) (Eyre *et al*. 2015). Scores for BioCondition sites were calculated in accordance with Eyre *et al*. (2011, 2015), which compares the values obtained at each survey site with values in the benchmark document for that particular RE (Queensland Herbarium and Biodiversity Science 2024).

Threatened species habitat assessment and mapping

Microhabitat assessments were undertaken in conjunction with vegetation community surveys at each survey plot, or as required where significant variation in the type and abundance of habitat features occurred. The results of these assessments, combined with published information and ecologist knowledge of fauna distribution and habitat use, were used to predict habitat suitability for nominated EPBC Act listed threatened flora and fauna confirmed, likely or potentially present within the development area. Identified habitat REs were classified as Essential or General Habitat using the definitions provided in the Santos Fauna Habitat model (Aurecon 2014) as follows:

- Essential Habitat - is an area containing resources that are considered essential for the maintenance of populations ofthe species (e.g. potential habitat for breeding, roosting, foraging, shelter, for either migratory or non-migratory species). 'Essential Habitat' is defined from known records and/or expert advice (including the findings of preclearance surveys).
- General Habitat - consists of areas or locations that are used by transient individuals or where species have been recorded but there is insufficient information to assess the area as 'Essential/core Habitat'. 'General Habitat' may be defined from known records or habitat that is considered to potentially support a species according to expert knowledgeof habitat relationships, despite the absence of specimen backed records. 'General Habitat' may include areas of suboptimal habitat for species.

Incidental records of threatened fauna obtained during vegetation assessments and general property traverses to and between sites (on foot and driving) were fully documented including species name, location (with site co-ordinates or area of extent), habitat and number detected (Boobook 2021a, 2022, 2023, 2024, 2025; Terrestria 2022, 2024).

Microhabitat assessments were conducted at representative sites within each ground-truthed assessment unit present within the development area. Though the presence and abundance of microhabitat features (e.g. hollow logs) likely varies within and between patches (mapping polygons) of a given RE, for the purposes of predictive fauna habitat mapping it is assumed that the results of microhabitat assessment for a RE are applicable throughout the area. That is to say, a conservative approach has been taken with regard to mapping of species habitat where ground-truthing of the entire RE patch is impractical.

Where patches have not been ground-truthed, relevant fauna microhabitat features were assumed to be present, and patches have been mapped as habitat until further assessments can be undertaken. Similarly, where predictive mapping of flora habitat is based on known RE associations it is assumed that suitable habitat exists in all patches of the RE at the Site.

Targeted flora survey

Targeted surveys for threatened flora species were informed by the desktop search results and local experience. Searches for threatened flora species under the EPBC Act and/or *Nature Conservation Act 1992* (Qld) were conducted informally with field botanists targeting likely habitats, including remnant and non-remnant vegetation, as they were encountered during the vegetation community survey. No EPBC Act listed threatened flora were detected during these flora surveys and were deemed unlikely to be present within the impact area (Boobook 2021a, 2022, 2023, 2024, 2025; Terrestria 2022, 2024).

3.2.3. Significant residual impact assessment

The Commonwealth Minister for the Environment requires the approval holder to ensure that environmental offsets comply with the principles of the EPBC Act *Environmental Offsets Policy* and secure environmental offsets to compensate for residual impacts to MNES for each stage of the GFD Project.

The EPBC Act *Environmental Offsets Policy* states that environmental offsets are measures that compensate for the residual adverse impacts of an action on the environment and defines residual adverse impacts as those impacts that remain after avoidance and mitigation measures have been implemented. The EPBC Act *Environmental Offsets Policy* requires residual adverse impacts to be offset if the impact is considered to be 'significant' as defined by the *Matters of National Environmental Significance – Significant Impact Guidelines Version 1.1* (Department of the Environment [DotE] 2013).

Based on the results of the desktop assessment and detailed field surveys described in Section 3.2.2, a likelihood of occurrence assessment for EPBC Act listed threatened species, migratory species and ecological communities was undertaken within the Stage 8 development area to determine the known or potential presence of MNES (Boobook 2021a, 2022, 2023, 2024, 2025; Terrestria 2022, 2024, 2025).

Potential residual impacts were identified for EPBC Act listed threatened species and ecological communities, identified in annex 1 to the EPBC 2012/6615 approval, that were confirmed, likely or potentially present within the Stage 8 development area.

The extent of the residual impact for each MNES was determined by assessing a conservative 'best guess' scenario, e.g. assuming the maximum linear infrastructure corridor widths and larger well layouts on the most likely development layout, within the extent of predictive habitat mapping (defined by potentially suitable RE) within the Stage 8 development area. This generally results in a significant over-estimate of impacts, as it is rare the maximum potential disturbance widths are utilised during all construction. Table 2 summarises the conservative 'best guess' scenario of impacts to EPBC Act listed threatened species and ecological communities based on the predictive habitat mapping for each MNES within the Stage 8 development area.

For EPBC Act listed migratory and marine fauna species a likelihood of occurrence assessment was also undertaken, followed by a significant residual impact assessment in accordance with the *Matters of National Environmental Significance – Significant Impact Guidelines Version 1.1* (DotE 2013) for species identified as confirmed, likely or potentially present within the Stage 8 development area. The results of this assessment are presented in Table 3 and indicate that there would be no significant residual impacts to EPBC Act listed migratory and marine fauna species (Boobook 2025).

Following the results of the significant residual impact assessment described above, Santos proposes to secure environmental offsets to compensate for the impacts to EPBC Act listed threatened species identified in Table 2.

Table 2 – Proposed disturbance to EPBC Act listed threatened fauna within the Stage 8 development area

MNES	Status under EPBC Act[1]	Distribution and known habitat use	Potentially suitable RE	Disturbance area (ha)
Threatened ecological communities				
Brigalow TEC	E	This community extends across most of central and southeast Queensland to northern New South Wales (DCCEEW 2025a). Areas of vegetation that met the definition of "Brigalow (*Acacia harpophylla* dominant and codominant)" were mapped as scattered small patches within the survey area. Some regrowth patches were also assessed as meeting the criteria of the TEC (Terrestria 2022).	11.9.1, 11.9.5	0.51
SEVT TEC	E	The community is an extreme form of dry seasonal subtropical rainforest occurring in the Brigalow Belt and Nandewar regions of Queensland and NSW (DCCEEW 2025k).	11.9.4	0.50
Threatened fauna species				
Collared Delma (*Delma torquata)*	V	This species' estimated distribution ranges from central to southeast Queensland (DCCEEW 2025d). Habitat includes eucalypt woodland with potentially suitable shelter sites (e.g. small rocks, logs, woody debris, leaf litter) and is widespread within the GFD area. All areas of remnant and functional regrowth of the nominated REs are considered potential habitat (Boobook 2020).	11.3.2, 11.5.1, 11.7.2, 11.7.7, 11.9.1, 11.9.7, 11.9.10, 11.10.1, 11.10.3, 11.10.7, 11.10.7a, 11.10.9, 11.10.11	49.49
Yakka Skink (*Egernia rugosa*)	V	Distribution of this species extends from northern to southern Queensland in coastal and inland areas (DCCEEW 2025e). Eucalypt woodland and non-remnant areas with potentially suitable shelter sites (e.g. large logs, log piles) are present within much of the GFD area (Boobook 2020). Mapped Essential Habitat is based on known records within the nominated RE and includes all remnant vegetation and regrowth of the nominated REs. Mapped General Habitat includes all remnant vegetation and regrowth of the nominated RE. This may include sub-optimal habitat (Boobook 2020).	11.3.2, 11.5.1, 11.7.2, 11.9.1, 11.9.5, 11.9.7, 11.9.10, 11.10.1, 11.10.3, 11.10.7, 11.10.7a, 11.10.9, 11.10.11	39.99
Dunmall's Snake (*Furina dunmalli)*	V	This species is distributed from central to southeast Queensland (DCCEEW 2025g).	11.3.2, 11.5.1, 11.7.2, 11.7.7, 11.9.1, 11.9.5, 11.9.7, 11.9.10, 11.10.1,	49.98

MNES	Status under EPBC Act[1]	Distribution and known habitat use	Potentially suitable RE	Disturbance area (ha)
		Potentially suitable foraging and shelter habitat in Eucalypt woodland is present and widespread in remnant and regrowth REs within the GFD area. Mapped General Habitat includes all remnant vegetation and regrowth of the nominated REs (Boobook 2020).	11.10.3, 11.10.7, 11.10.7a, 11.10.9, 11.10.11	
Red Goshawk (*Erythrotriorchis radiatus*)	E	This species is sparsely dispersed across coastal and subcoastal into some central areas of northern Australia (DCCEEW 2025f). Suitable breeding habitat (i.e. permanent water bodies and riparian habitat with tall trees) is only present in parts of the GFD area, but potential foraging habitat (e.g. open areas near water, forests and woodlands) is present throughout. Mapped General Habitat includes all areas of remnant and regrowth of the nominated REs (Boobook 2020).	11.3.2, 11.3.25, 11.10.1, 11.10.3, 11.10.7, 11.10.7a, 11.10.9	25.61
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	V	Distribution of this species occurs from central-northern to southeast Queensland and northern New South Wales (DCCEEW 2025h). Suitable habitat (i.e. grassy woodland) is present within the GFD area. This species usually inhabits areas near a water source, and nests and forages in a wide range of grassy woodland and open forest types. General Habitat includes all areas of remnant and functional regrowth of the nominated REs (Boobook 2020).	11.3.2, 11.3.25, 11.10.1, 11.10.3, 11.10.7, 11.10.7a, 11.10.9	32.11
Northern Quoll (*Dasyurus hallucatus*)	E	This species is known across five regional populations across Queensland, Northern Territory and Western Australia (DCCEEW 2025c). The GFD area is within the species' historical range and areas of potentially suitable den sites (i.e. rock holes/crevices) are present. Mapped Essential Habitat includes all nominated RE within 1 km of shelter habitat (extensive areas of dissected sandstone with deep crevices and caves). Mapped General Habitat includes all remnant and regrowth vegetation of the nominated RE in a buffer 1 to 5 km of potentially suitable shelter habitat (Boobook 2020).	11.3.2, 11.3.25, 11.10.1, 11.10.3, 11.10.7, 11.10.7a, 11.10.9	26.11
Koala (*Phascolarctos cinereus*)	E	Distribution of this species ranges from far north Queensland down to Victoria and into South Australia along the east coast of Australia (DCCEEW 2025j). Suitable habitat (i.e. Eucalyptus-dominated woodlands and open forests) is present and widespread within the GFD area, which is within the known	11.3.2, 11.3.25, 11.5.1, 11.7.7, 11.9.7, 11.9.10, 11.10.1, 11.10.7, 11.10.7a, 11.10.11	36.56

MNES	Status under EPBC Act[1]	Distribution and known habitat use	Potentially suitable RE	Disturbance area (ha)
		range of the species. Essential Habitat includes eucalypt-dominated riparian and floodplain REs. Mapped General Habitat includes all other remnant and regrowth of RE dominated by Myrtaceae species (Boobook 2020).		
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	Distribution of this species includes inland areas of southeast Australia, from central Queensland to southeast South Australia (DCCEEW 2025i). Potentially suitable foraging and roosting habitat is present in remnant woodland within the GFD area, which is within the known range of the species. Mapped General Habitat includes all areas of remnant vegetation and regrowth that may be suitable for foraging or shelter (Boobook 2020).	11.3.2, 11.3.25, 11.5.1, 11.7.2, 11.7.7, 11.9.1, 11.9.5, 11.9.7, 11.9.10, 11.10.1, 11.10.3, 11.10.7, 11.10.7a, 11.10.9, 11.10.11	50.48
Large-eared Pied Bat (*Chalinolobus dwyeri*)	E	This species is estimated to be distributed along coastal areas from central Queensland to Canberra (DCCEEW 2025b). Potentially suitable habitat (i.e. caves and crevices in rocky hills and cliff lines) is present within the GFD area, which is within the known range of the species. Mapped Essential Habitat includes all nominated RE within 5 km of potentially suitable shelter habitat (i.e. extensive areas of dissected sandstone with deep crevices and caves) (Boobook 2020).	11.3.2, 11.3.25, 11.10.1, 11.10.3, 11.10.7, 11.10.7a, 11.10.9	32.61

[1] E = Endangered; V = Vulnerable.

Table 3 – Assessment of potential significant impacts upon EPBC Act listed migratory and/or marine fauna species potentially present within the Stage 8 development area

Class	Species	Significant Impact Criteria (DoE 2013; DES 2023i)							Significant Residual Impact
		Lead to a long-term decrease in the size of a population (including declines due to loss or modification of habitat)	Reduce the Area of Occupancy (AoO), or the Extent of Occurrence (EoO) of the species	Fragment an existing population into two or more populations; or, result in genetically distinct populations forming	Adversely affect habitat critical to the survival of a species (including disruption to breeding, feeding, nesting, migration or resting sites)	Result in invasive species that are harmful to a threatened species becoming established in the threatened species' habitat	Introduce disease that may cause the population to decline	Interfere with the recovery of the species	
Birds	White-throated Needletail (*Hirundapus caudacutus*)	No: this species is an aerial feeding insectivores that forages over a wide range of intact and disturbed landscapes. The species do not breed in Australia and only very rarely roost during their summer presence.	No: proposed disturbance not materially relevant to the species.	No: proposed disturbance not materially relevant to the species.	No: no significant impact on foraging resources is anticipated, no other critical locations are relevant to the species in Australia	None known	No: species is an aerial feeding insectivore that forages over a wide range of intact and disturbed landscapes. It does not breed in Australia and roosts opportunistically during its summer presence.	No: the proposed disturbance is not materially relevant to these species.	No
Birds	Fork-tailed Swift (*Apus pacificus*)								
Birds	Black-eared Cuckoo (*Chalcites osculans*)	No: These bird species are common and widely distributed in eastern Australia and the development is not expected to impact on their distributions.	No: The scale of the development will not significantly reduce AoO or EoO for these species.	No: the scale of the development will not isolate or fragment populations of these mobile species.	No: The scale of the development will not significantly reduce critical habitat for these widespread and mobile species. Three species are non-breeding visitors/passage migrants within the development area.	None known	None known	No: These species are common and widespread mobile fauna, not currently under threat. Species recovery criterion is not relevant to this group of species.	No
Birds	Oriental Cuckoo (*Cuculus optatus*)								No
Birds	Rainbow Bee-eater (*Merops ornatus*)								No
Birds	Rufous Fantail (*Rhipidura rufifrons*)								No
Birds	Satin Flycatcher (*Myiagra cyanoleuca*)								No

4. Impact and Offset Reconciliation for Stage 1-7

In accordance with condition 18 (b) of EPBC 2012/6615, a reconciliation of actual and predicted but yet to be actualised residual significant impacts to MNES against offsets secured for the commenced project stages must be undertaken. Secured offsets in excess of requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases will be subtracted from the obligations required for subsequent project phases. Any shortfall in secured offsets relative to the requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases will be added to the obligations required for the next project phase.

Surplus offset areas remaining after each project phase are used to acquit offset requirements in subsequent phases, and multiple MNES can share the same offset habitat. Accurate calculation of surplus areas requires discounting of the surplus RE areas remaining for a particular MNES that are taken up by MNES from previous stages, regardless of whether the particular MNES required offsetting.

Table 4, Table 5, Table 6 and Table 7 provide a summary of the proposed significant residual impacts on MNES required to be offset for Stages 2 through 7 of the GFD Project across the Springwater, Mt Tabor, Cobbadah, Bottle Tree and Kentucky properties, including the offset area secured on each property to compensate for the proposed disturbance. The offset areas have been approved in accordance with the following under EPBC 2012/6615:

- Santos GLNG Gas Fields Development Project Stage 1 Offset Plan 2016 – 2021 (Document Number: 0007-650-PLA-0008), approved on 31 October 2016 and prepared to support gas field developments in Scotia Gas Field (PL 176).
- Santos GLNG Gas Fields Development Project Stage 2 Offset Plan (Document Number: 0030-650-EMP-0001 [Rev 2]), approved on 29 June 2018 and prepared to support gas field developments in Maisey Gas Field (PL 176).
- Santos GLNG Gas Fields Development Stage 3 Offset Plan Rev 1, 12 April 2021 (Document Number: 0030-650-EMP-0001), approved on 17 May 2021 and prepared to support gas field developments in Scotia Gas Field (PL 176), and Arcadia Gas Field (PL 90, PL 234 and PL 421).
- Santos GLNG Gas Fields Development Stage 4 Offset Plan Rev 0, 21 July 2021 (Document Number: 0007-650-EMP-0019), approved on 3 November 2022 and prepared to support gas field developments in Fairview Gas Field (PL 90, PL 91, PL 92, PL 99, PL 100, PL 232).
- Santos GLNG Gas Fields Development Stage 5 Offset Plan Rev 2, 16 March 2022 (Document Number: 0007-650-EMP-0025), approved on 24 March 2022 and prepared to support gas field developments in Roma East Gas Field (PL 281 and PL 282).
- Santos GLNG Gas Fields Development Stage 6 Offset Plan Rev 1, 19 July 2023 (Document Number: 0007-650-EMP-0039), approved on 5 November 2024 and prepared to support gas field developments in Roma Gas Field (PL 281, PL 313, PL 314, PL 315, PL 317, PL 318, PL 323 and PL 1020).
- Santos GLNG Gas Fields Development Stage 7 Offset Plan Rev 0, 04 October 2024 (Document Number: 0007-650-EMP-0041), approved on 15 January 2025 and prepared to support gas field developments in Arcadia, Fairview and Scotia Gas Fields (PL 91, PL 92, PL 99, PL 100 and PL 232).

Activities comprising Stage 1 of the GFD Project did not incur any significant residual impacts to MNES and therefore have not been included in the table below. Activities comprising Stages 2-7 of the GFD Project are yet to be commenced or completed in full, so an assessment of actual impacts to date is yet to be finalised.

Table 4 – Reconciliation of predicted significant residual impacts associated with Stage 2-4 of the GFD Project and offset area secured on the Springwater property

MNES	Status under EPBC Act[1]	Area of suitable habitat within the Springwater offset area (ha)	Stage 2			Stage 3			Stage 4			Surplus remaining (ha) (after Stages 1 – 4)[2]
			Predicted Stage 2 impacts (ha)	Impacts offset as part of Stage 2 (ha)	Offset area secured (ha)	Residual Stage 2 impacts reconciled and included in Stage 3 (ha)	Predicted Stage 3 impacts including reconciled Stage 2 (ha)	Offset area secured (ha)	Residual Stage 3 impacts reconciled and included in Stage 4 (ha)	Predicted Stage 4 impacts including reconciled Stage 3 (ha)	Offset area secured (ha)	
Threatened ecological communities												
Brigalow TEC	E	368.6	6.8	6.2	53.0	0.6	24.8	209.3	-	3.3	65.6	27.2
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community (SEVT TEC)	E	57.4	-	-	-	-	-	-	-	1.5	26.0	4.1
Threatened fauna species												
Collared Delma (*Delma torquata*)	V	785.9	55.9	49.0	284.0	6.9	48.3	365.2	-	433.4	-	46.1
Yakka Skink (*Egernia rugosa*)	V	785.9	54.8	48.2	279.0	6.6	48.0	365.2	-	435.6	-	46.1
Dunmall's Snake (*Furina dunmalli*)	V	785.9	55.9	49.0	284.0	6.9	48.3	365.2	-	435.2	-	46.1
Red Goshawk (*Erythrotriorchis radiatus*)	E	852.9	-	-	-	-	31.0	370.9	-	438.3	-	50.2
Black-breasted Button-quail (*Turnix melanogaster*)	V	57.4	-	-	-	-	0.6	5.7	-	1.8	26.0	4.1
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	V	445.8	-	-	-	-	10.8	155.9	-	436.0	-	18.9
Northern Quoll (*Dasyurus hallucatus*)	E	852.9	-	-	-	-	-	370.9	-	298.9	-	50.2
Koala (*Phascolarctos cinereus*)	E	445.8	42.1	37.5	217.0	4.6	23.1	155.9	-	287.8	-	18.9
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	852.9	55.9	49.0	340.1	6.9	50.2	370.9	-	438.3	-	50.2
Large-eared Pied Bat (*Chalinolobus dwyeri*)	E	852.9	-	-	-	-	-	370.9	-	374.9	-	50.2

[1] E = Endangered; V = Vulnerable.
[2] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 text and the "Ground-truthed RE" tables in the relevant OAMPs to understand how areas are accounted for in each stage.

Table 5 – Reconciliation of predicted significant residual impacts associated with Stage 4 and Stage 7 of the GFD Project and offset area secured on the Mt Tabor property

MNES	Status under EPBC Act[1]	Area of suitable habitat within the Mt Tabor offset area 1 (ha)	Area of suitable habitat within the Mt Tabor offset area 2 (ha)	Stage 4			Stage 7				Surplus remaining (ha) (after Stage 7)[2]	
				Residual Stage 3 impacts reconciled and included in Stage 4 (ha)	Predicted Stage 4 impacts including reconciled Stage 3 (ha)	Offset area 1 Offset area secured (ha)	Residual Stage 6 impacts reconciled and included in Stage 7 (ha)	Predicted Stage 7 impacts including reconciled Stage 6 (ha)	Offset area 1 Offset area secured (ha)	Offset area 2 Offset area secured (ha)	Offset area 1	Offset area 2
Threatened ecological communities												
Brigalow TEC	E	-	-	-	3.3	-	-	0.6		-	-	-
SEVT TEC	E	-	-	-	1.5	-	-			-	-	-
Threatened fauna species												
Collared Delma (*Delma torquata*)	V	5,124.6	2,343.9	-	433.4	4,172.9	-	313.2	951.5	2,036.5	0	307.4
Yakka Skink (*Egernia rugosa*)	V	4,239.0	1,912.8	-	435.6	4,172.9	-	313.8	66.0	1,907.4	0	5.4
Dunmall's Snake (*Furina dunmalli*)	V	5,124.6	2,343.9	-	435.2	4,172.9	-	308.1	951.5	2,036.5	0	307.4
Red Goshawk (*Erythrotriorchis radiatus*)	E	5,124.6	2,343.9	-	438.3	4,172.9	-	311.8	951.5	2,036.5	0	307.4
Black-breasted Button-quail (*Turnix melanogaster*)	V	-	-	-	1.8	-	-		-	-	-	-
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	V	5,124.6	2,343.9	-	436.0	4,172.9	-	316.8	951.5	2,036.5	0	307.4
Northern Quoll (*Dasyurus hallucatus*)	E	5,124.6	2,343.9	-	298.9	4,172.9	-	317.4	951.5	2,036.5	0	307.4
Koala (*Phascolarctos cinereus*)	E	5,124.6	2,343.9	-	287.8	4,172.9	-	269.6	951.5	2,036.5	0	307.4
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	5,124.6	2,343.9	-	438.3	4,172.9	-	311.8	951.5	2,036.5	0	307.4
Large-eared Pied Bat (*Chalinolobus dwyeri*)	E	5,124.6	2,343.9	-	374.9	4,172.9	-	257.8	951.5	2,036.5	0	307.4

[1] E = Endangered; V = Vulnerable.
[2] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 text and the "Ground-truthed RE" tables in the relevant OAMPs to understand how areas are accounted for in each stage.

Table 6 – Reconciliation of predicted significant residual impacts associated with Stage 5-6 of the GFD Project and offset area secured on the Cobbadah and Kentucky properties

MNES	Status under EPBC Act[1]	Residual Stage 4 impacts reconciled and included in Stage 5 (ha)	Predicted Stage 5 impacts including reconciled Stage 4 (ha)	Stage 5 offsets						Residual Stage 5 impacts reconciled and included in Stage 6 (ha)	Predicted Stage 6 impacts including reconciled Stage 5 (ha)	Impacts offset after reconciliation of Stage 6 (ha)	Stage 6 offsets	
				Cobbadah			Kentucky						Kentucky	
				Area of suitable habitat within the offset area (ha)	Offset area secured (ha)	Surplus area remaining (ha) (after Stage 5)[2]	Area of suitable habitat within the offset area (ha)	Offset area secured (ha)	Surplus area remaining (ha) (after Stage 5)[2]				Offset area secured (ha)	Surplus area remaining (ha) (after Stage 6)[2]
Threatened ecological communities														
Brigalow TEC	E	-	6.5	74.6	72.2	2.4	-	-		-	-	-	-	-
Threatened fauna species														
Collared Delma (*Delma torquata*)	V	-	143.6	774.3	557.9	216.4	1,323.6	806.5	517.2	-	9.6	6.0	92.9	424.3
Yakka Skink (*Egernia rugosa*)	V	-	140.8	565.9	557.9	8.0	1,375.3	806.5	568.8	-	14.6	10.2	92.9	476.0
Dunmall's Snake (*Furina dunmalli*)	V	-	144.0	565.9	557.9	8.0	1,375.3	806.5	568.8	-	14.6	10.2	92.9	476.0
Koala (*Phascolarctos cinereus*)	E	-	116.3	491.3	485.7	5.6	1,323.6	806.5	517.2	-	9.5	5.2	92.9	424.3
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	-	144.0	1,052.2	557.9	494.3	1,375.3	806.5	568.8	-	14.6	9.5	92.9	476.0

[1] E = Endangered; V = Vulnerable.
[2] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 text and the "Ground-truthed RE" tables in the relevant OAMPs to understand how areas are accounted for in each stage.

Table 7 – Reconciliation of predicted significant residual impacts associated with Stage 7 of the GFD Project and offset area secured on the Kentucky, Mt Tabor and Bottle Tree properties

MNES	Status under EPBC Act[1]	Predicted Stage 7 impacts (ha)	Kentucky offset area		Mt Tabor offset area 1		Mt Tabor offset area 2		Bottle Tree offset area	
			Offset area to be secured (ha)	Surplus area remaining (ha) (after Stage 7)[2]	Offset area to be secured (ha)	Surplus area remaining (ha) (after Stage 7)[2]	Offset area to be secured (ha)	Surplus area remaining (ha) (after Stage 7)[2]	Offset area to be secured (ha)	Surplus area remaining (ha) (after Stage 7)[2]
Threatened ecological communities										
Brigalow TEC	E	0.6	-	-	-	-	-	-	19.7	154.9
Threatened fauna species										
Collared Delma (*Delma torquata*)	V	313.2	384.2	40.1	951.5	0.0	2,036.5	307.4	19.7	152.9
Yakka Skink (*Egernia rugosa*)	V	313.8	435.9	40.1	66.0	0.0	1,907.4	5.4	19.7	152.9
Dunmall's Snake (*Furina dunmalli*)	V	308.1	435.9	40.1	951.5	0.0	2,036.5	307.4	19.7	152.9
Red Goshawk (*Erythrotriorchis radiatus*)	E	311.8	435.9	40.1	951.5	0.0	2,036.5	307.4	19.7	153.4
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	V	316.8	384.2	40.1	951.5	0.0	2,036.5	307.4	-	152.9
Northern Quoll (*Dasyurus maculatus*)	E	317.4	435.9	40.1	951.5	0.0	2,036.5	307.4	-	0
Koala (*Phascolarctos cinereus*)	E	269.6	384.2	40.1	951.5	0.0	2,036.5	307.4	-	-
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	311.8	435.9	40.1	951.5	0.0	2,036.5	307.4	19.7	153.4
Large-eared Pied Bat (*Chalinolobus dwyeri*)	E	257.8	435.9	40.1	951.5	0.0	2,036.5	307.4	-	-

[1] E = Endangered; V = Vulnerable.
[2] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 text and the "Ground-truthed RE" tables in the relevant OAMPs to understand how areas are accounted for in each stage.

5. EPBC Act Offset Framework

Offsets for Stage 8 are proposed to be secured on the Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater properties, as detailed in Section 6. Table 8 outlines how the proposed offset areas will be provided to compensate for significant residual impacts to MNES and meet the requirements of the EPBC Act *Environmental Offsets Policy*.

Table 8 – Assessment against Principles of the *Environmental Offsets Policy*

Principle	How the principle is met in this offset proposal
1. deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The Bottle Tree, Kentucky, Mt Tabor and Springwater offset areas acquit MNES offset requirements under EPBC 2012/6615 as outlined in Table 9 of this offset plan. The offset areas will be managed and monitored to improve the quality and viability of habitat for MNES fauna species. The Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E) include specific management objectives with interim performance targets and completion criteria. Management actions are outlined with accompanying adaptive management triggers and corrective actions in the event that monitoring identifies that interim performance targets are not attained or completion criteria are not attained and/or maintained. The offset area will be managed and monitored from original approval of the OAMPs for a minimum of 20 years. It is anticipated that the completion criteria will be achieved within a 20-year period.
2. be built around direct offsets but may include other compensatory measures	MNES offset obligations under EPBC 2012/6615 will be acquitted through the delivery of direct land-based offsets on the Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater offset areas.
3. be in proportion to the level of statutory protection that applies to the protected matter	The threatened status of the impacted protected matters is considered in the *Offsets Assessment Guide* (OAG) in calculating the area of the offset to be provided.
4. be of a size and scale proportionate to the residual impacts on the protected matter	The size of the offset area to be secured for offset obligations has been calculated in accordance with the OAG (Appendix F) and is presented as part of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E)
5. effectively account for and manage the risks of the offset not succeeding	The Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E) have been developed in consideration of known and identified threats to the offset values to manage the risk of failing to achieve the completion criteria and overall environmental outcomes for the offset area. Threats to the offset site are managed by through the implementation of the management measures, including: • fire prevention and management • weed and pest animal monitoring and control • clearing protection • management of grazing

Principle	How the principle is met in this offset proposal
	• restricted access. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans, etc) and identification of potential site-specific risks based on the results of field surveys and discussions with the landholder. The results of the risk assessment, presented in the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E), have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions. If the offset cannot attain and maintain the completion criteria, then additional offsets will be provided to compensate for the impact and the failed offset.
6. be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	The environmental outcomes proposed to be achieved through the implementation of the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E) are based on additional management and monitoring measures conducted as part of business as usual on the properties. For example, under the *Biosecurity Act 2014* (Qld), a person has a general biosecurity obligation to: take all reasonable and practical steps to prevent or minimise each biosecurity risk. The steps proposed in the OAMPs are above reasonable and practical steps required to control feral animals and weeds in central Queensland. With a Voluntary Declaration secured over the Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater offset areas, environmental laws will prevent other land uses inconsistent with the OAMP being approved over these parts of the properties. Santos are in the process of applying to have Offset area 2 on Mt Tabor protected via a voluntary declaration under section 19E and 19F of the VM Act (refer to Appendix B for additional detail).
7. be efficient, effective, timely, transparent, scientifically robust and reasonable	The Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater offset areas have been identified to be suitable using an evidence based and scientifically robust approach, as detailed in the Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E). The environmental outcomes to be achieved through the OAMPs will be delivered progressively over 20 years. The offset areas are or will be legally secured through a Voluntary Declaration under the VM Act, therefore any vegetation clearing contravention of the OAMP is not permissible without specific Queensland government approval. The preparation and implementation of the OAMPs support the efficient, effective, timely, transparent and scientifically robust approach to providing offsets.

Principle	How the principle is met in this offset proposal
8. have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	The Bottle Tree OAMP (Appendix A), Kentucky OAMP (Appendix B), Cobbadah OAMP (Appendix C), Mt Tabor OAMP (Appendix D) and Springwater OAMP (Appendix E) include a detailed monitoring program which will assess the effectiveness of the management actions undertaken and the progress of the offset area in achieving the environmental outcomes. The results of all management and monitoring programs will be included in annual reports to be prepared for each management year. An implementation schedule for monitoring and management is provided in the OAMPs which will be reviewed at least annually to ensure the timely implementation of the OAMPs.

6. Offset Approach

Santos will acquit the offset obligations for Stage 8 of the GFD Project under EPBC 2012/6615 on the Bottle Tree, Kentucky, Cobbadah Mt Tabor and Springwater offset areas. The following sections provide an overview of the properties and Figure 2 spatially presents the location of the proposed offset areas in relation to the GFD Project.

6.1. Bottle Tree

Bottle Tree (Lot 7 TR39) is a 3,853 ha property located in the Brigalow Belt South Bioregion, approximately 75 km north-northeast of Injune in south central Queensland. The Bottle Tree property was acquired by Santos on 12 December 2012 primarily based on the presence of suitable environmental values to provide offsets for the Santos GLNG Project.

Bottle Tree is located entirely within the Brown River Catchment, part of the Fitzroy River Basin, with the major watercourse being Arcadia Creek. Several minor watercourses are present on the eastern side of the property. The topography is varied and is comprised of alluvial plains, undulating plains, low hills and a steep scarp of Precipice Sandstone. Elevation ranges between approximately 300 and 346 metres (m) on the lower lying areas and reaches a maximum of about 630 m at the crest of the Expedition Range. The eastern end of the property adjoins Expedition (Limited Depth) National Park (NP).

Detailed field surveys of the Bottle Tree offset area were initially undertaken by Boobook in 2011, to determine the potential biodiversity offset values and the suitability of the area as an offset for the Santos GLNG Project. In 2020, BioCondition surveys, threatened flora survey and mapping, targeted fauna surveys, canopy cover analysis and RE and vegetation community assessments/ground-truthing and mapping were conducted.

The Bottle Tree offset area supports offsets for approvals associated with the Santos GLNG Project, in accordance with the following approved OAMPs:

- Bottle Tree OAMP for EPBC 2008/4096 and 2008/4059, approved December 2021
- Bottle Tree OAMP for Stage 7 of the GFD Project under EPBC 2012/6615, approved 15 January 2025

A separate OAMP has been prepared to acquit offset requirements for Stage 8 of the GFD Project (EPBC 2012/6615), drawing down on surplus areas of suitable MNES habitat within the approved Bottle Tree offset area (Appendix A). The offset area has been legally secured through a Voluntary Declaration under the VM Act, thereby satisfying the legal security requirements under condition 16 of EPBC 2012/6615.

The Bottle Tree offset area will continue to be managed by Santos to enhance and improve the condition of the environmental values on the property in accordance with the Bottle Tree OAMP in Appendix A.

6.2. Kentucky

Kentucky (Lot 1 WT37) is a 4,368 ha property located approximately 50 km east north-northeast of Injune in south central Queensland. The property is owned by Santos and was acquired primarily for its potential environmental offset values for the Santos GLNG Project. Kentucky is situated within Subregion 20 (Arcadia) of the Brigalow Belt South Bioregion (Sattler and Williams, 1999) within the jurisdiction of the Maranoa Regional Council. Access to the property is via the Beilba Road, east of the Carnarvon Developmental Road between Injune and Rolleston. Current land uses on the property include cattle grazing, activities associated with CSG exploration and production as well as areas dedicated to environmental offsets. The Santos GLNG pipeline also traverses the property in a roughly south-north direction; however, has been excluded from all assessment and offset areas.

The property lies within rugged terrain and contains large vegetation remnants that are contiguous with Expedition (Limited Depth) National Park to the east and Lonesome Holding (proposed National Park) to the north. The property is located entirely within the Dawson River Catchment, part of the Fitzroy River Basin, with the major watercourses being the Dawson River and Baffle Creek. The topography is varied and is comprised mainly of hills, ridges, plateaux and steep scarps, with sandstone of the Precipice and Evergreen Formations forming the underlying geology. Small alluvial flats occur beside the Dawson River. Baffle Creek and its associated tributaries have associated deep gorges.

Detailed field surveys of the Kentucky offset area were initially undertaken by Boobook in 2010, to determine the potential biodiversity offset values and the suitability of the area as an offset for the Santos GLNG Project. Specifically, BioCondition surveys, threatened flora survey and mapping, targeted fauna surveys, canopy cover analysis and RE and vegetation community assessments/ground-truthing and mapping were conducted.

The Kentucky offset area supports offsets for approvals associated with the Santos GLNG Project, in accordance with the following approved OAMPs:

- Kentucky OAMP for EPBC 2008/4096 and 2008/4059, approved December 2021
- Kentucky OAMP for Stage 5 of the GFD Project (EPBC 2012/6615), approved March 2022
- Kentucky OAMP for Stage 7 of the GFD Project (EPBC 2012/6615), approved 15 January 2025

A separate OAMP has been prepared to acquit offset requirements for Stage 8 of the GFD Project (EPBC 2012/6615), utilising the remaining surplus offset areas within the approved Kentucky offset area (Appendix B). The offset area has been legally secured through a Voluntary Declaration under the VM Act, thereby satisfying the legal security requirements under condition 16 of EPBC 2012/6615.

The Kentucky offset area will continue to be managed by Santos to enhance and improve the condition of environmental values on the property in accordance with the Kentucky OAMP in Appendix B.

6.3. Cobbadah

Cobbadah is a 3,853 hectare (ha) property located approximately 120 km north-west of the project and 30 km west of Injune. The property is located adjacent to the Great Dividing Range in the Brigalow Belt Bioregion (Southern Downs Subregion), approximately 40 km southeast of Oakvale State Forest and 25 km southwest of Doonkuna State Forest. The current primary land use on the property is cattle grazing.

The property is located entirely within the Dawson River Catchment, part of the Fitzroy River Basin, with all drainage channels on the property flowing into Hutton Creek which dissects the property, flowing from west to east. The topography is varied across the property, comprising early Tertiary Olivine basalt in upland areas capping Late Jurassic sandstone (Westbourne Formation and Springbok Sandstone) with lowland areas characterised by depositional alluvium. Elevation ranges between 460 metres (m) above sea level in the low-lying valleys, up to approximately 940 m in the south of the property. The high elevation in the south of the property is associated with Mount Hutton, which is located in the very southeast corner of Cobbadah.

Detailed field surveys of the offset area were undertaken by CO2 Australia ecologists between January 2017 and August 2020, to determine the potential biodiversity offset values and the suitability of the area as an offset for the Santos GLNG Project. Specifically, RE and TEC assessments/ground-truthing and mapping, BioCondition surveys, threatened fauna habitat assessment and mapping and incidental threatened flora surveys were conducted.

An OAMP for the Cobbadah offset area was approved by the Commonwealth Government in 24 March 2022 for Stage 5 of the GFD Project under EPBC 2012/6615. The Cobbadah OAMP has been updated to include additional offset areas throughout the property, secured with the landholder and affording opportunities to partially acquit offset requirements for Stage 8 of the GFD Project under EPBC 2012/6615 as well as future impacts. The Cobbadah offset area has been legally secured through a Voluntary Declaration under the VM Act, thereby satisfying the legal security requirements under condition 16 of EPBC 2012/6615. The Cobbadah offset area will continue to be managed by Santos to enhance and improve the condition of the environmental values on the property in accordance with the OAMP in Appendix C, including future offset areas that Santos will draw down on in future.

6.4. Mt Tabor

Mt Tabor, also known as ‘Goorathuntha’, is a 71,200 ha property located approximately 120 km northeast of Augathella, south Central Queensland (Lot 6 CHS25). The property is owned by Goorathuntha Traditional Owners Ltd and is currently used for cattle grazing.

Mt Tabor is situated within Subregion 24 (Carnarvon Ranges) of the Brigalow Belt Bioregion (Sattler and Williams, 1999) and straddles the boundary between Murweh Shire Council and Maranoa Regional Council. The property is located in the north-eastern portion of the Warrego catchment of the Murray-Darling Basin (Boobook 2021b). Numerous streamlines, a branched upper tributary catchment of Tickerabang Creek and several peripheral gullies are present on the Site, allowing temporary pools to occur in streams throughout the Site (Boobook, 2021b). Several farm dams are also present, although no permanent streams, springs or wetlands are known to occur (Boobook 2021b).

Detailed field surveys of the offset area were undertaken by Boobook in Lot 6 CHS25 between December 2020 and January 2021 with additional field surveys within adjacent areas completed by CO2 Australia in April 2024, to determine the potential biodiversity offset values and the suitability of the area as an offset for the Santos GLNG Project. Specifically, RE and TEC assessments/ground-truthing and mapping, BioCondition surveys, threatened fauna habitat assessment and mapping, targeted fauna surveys and incidental threatened flora surveys were conducted.

The Mt Tabor offset area supports offsets for various stages of the GFD Project (EPBC 2015/6615) in accordance with the following approved OAMPs:

- Mt Tabor OAMP for Stage 4 of the GFD Project (EPBC 2012/6615), approved 3 November 2022
- Mt Tabor OAMP for Stage 7 of the GFD Project (EPBC 2012/6615), approved 15 January 2025

An OAMP has been prepared to include proposed acquittal of offset requirements for Stage 8 of the GFD Project (EPBC 2012/6615), which draws down on surplus areas of suitable MNES habitat within offset area 2, within the Mt Tabor property (Appendix D). The Mt Tabor Offset area 1 has been legally secured through a Voluntary Declaration under the VM Act, thereby satisfying the legal security requirements under condition 16 of EPBC 2012/6615. Following approval of the updated Mt Tabor OAMP, Santos will apply to have Offset area 2 protected via a Voluntary Declaration under section 19E and 19F of the VM Act.

The Mt Tabor offset area will continue to be managed by Santos to enhance and improve the condition of the environmental values on the property in accordance with the Mt Tabor OAMP in Appendix D.

6.5. Springwater

Springwater is a 12,636 ha grazing property (Lot 8 SP261936) and is located within Maranoa Regional Council, approximately 46 km east-northeast of Injune, Queensland. The offset management area is located in the northeast sections of the Springwater property and is bounded by the Hutton Creek in the west and the property boundary of Fairview Station in the north and the east.

Springwater is located within subregion 24 (Carnarvon Ranges) of the Brigalow Belt South Bioregion (Sattler and Williams, 1999). Current land uses include cattle grazing, irrigated cropping, tree plantations and petroleum activities. The property is contiguous with large areas of remnant vegetation in the north on Beilba State Forest, ‘Fairview’ Holding and Expedition (Limited Depth) NP, to the northeast on Expedition Resource Reserve, and to the south on Hallett State Forest. The Site is owned and managed by Santos.

Detailed field surveys of the Springwater offset area were initially undertaken by Boobook in 2015, to determine the potential biodiversity offset values and the suitability of the area as an offset for the Santos GLNG Project. Specifically, BioCondition surveys, threatened flora survey and mapping, targeted fauna surveys, canopy cover analysis and RE/vegetation community assessments/ground-truthing and mapping were conducted.

The Springwater offset area supports offsets for various stages of the GFD Project (EPBC 2015/6615) in accordance with the following approved OAMPs:

- Springwater OAMP for Stage 1 of the GFD Project (EPBC 2012/6615), approved 31 October 2016
- Springwater OAMP for Stage 2 of the GFD Project (EPBC 2012/6615), approved 29 June 2018, revised to incorporate additional development and reapproved 24 October 2019
- Springwater OAMP for Stage 3 of the GFD Project (EPBC 2012/6615), approved 17 May 2021
- Springwater OAMP for Stage 4 of the GFD Project (EPBC 2012/6615), approved 23 September 2021, revised to incorporate additional development and reapproved 03 November 2022

An OAMP has been prepared to acquit offset requirements for Stage 8 of the GFD Project drawing down on surplus areas of suitable MNES habitat within the approved Springwater offset area (Appendix E).

147°30'0"E 148°0'0"E 148°30'0"E 149°0'0"E

24°30'0"S 25°0'0"S 25°30'0"S 26°0'0"S 26°30'0"S

Cairdbeign State Forest
Yarrai Nature Refuge
Nandowrie State Forest
Squire State Forest
Albinia National Park
Albinia Resources Reserve
Albinia Conservation Park
Rolleston
Mount Hope State Forest
Mount Pleasant State Forest
Dawson Highway
Rainbow Nature Refuge
Phiara Downs Nature Refuge
Cometside Nature Refuge
Humboldt National Park
Humboldt State Forest
Expedition State Forest
Mount Nicholson State Forest
Expedition Resources Reserve
Carnarvon Station Nature Refuge
Serocold State Forest
Carnarvon Highway
Nuga Nuga National Park
Expedition National Park
Palmgrove National Park (scientific)
Pluto Timber Reserve
Carnarvon National Park
Bandana State Forest
McLeay State Forest
Bottle Tree
Mt Tabor
Forfar State Forest
Eden State Forest
Boxvale State Forest
Expedition (Limited Depth) National Park
Attica State Forest
Howe State Forest
Forrest State Forest
Kentucky
Belington Hut State Forest
Koolbellup State Forest
Hillside State Forest
Oakvale State Forest
Doonkuna State Forest
Beilba State Forest
Stephenton State Forest
Springwater
Sunnyside State Forest
Cobbadah
Hallett State Forest
Moorabinda Nature Refuge
Injune
Mount Armour Nature Refuge
Orkadilla State Forest
Chesterton Range National Park
Waroonga State Forest
Walhallow State Forest
Taboonbay State Forest
Gubberamunda State Forest 1
Gubberamunda State Forest 2
Gubberamunda-Forest 3
Woodduck State Forest
Barabanbel State Forest 3
Barabanbel State Forest 1
Barabanbel State Forest 2
Tokatakiya Nature Refuge
Mitchell
Eversfield Station Nature Refuge

PL 1083 PL 1082 PL 1062 PL 1059 PL 1017 PL 1019 PL 1021 PL 1020 PL 1123 PL 1012
PL 451 PL 450 PL 440 PL 420 PL 421 PL 457 PL 90 PL 91 PL 92 PL 99 PL 100
PL 236 PL 235 PL 234 PL 233 PL 232
PL 322 PL 314 PL 315 PL 323 PL 313 PL 316 PL 317 PL 318 PL 319 PL 320 PL 321
PPL 166

Santos

Location diagram

Figure 2
Project Context
Roma Stage 8 offset acquittal

- Santos Petroleum Lease
- Petroleum pipeline license
- Resources Reserve
- Timber Reserve
- Nature Refuge
- ***Statewide Corridor***
- Regional
- State
- Offset property

Protected area
- National Park
- National Park (scientific)
- State Forest
- Conservation Park

N

0 10 20 40
Kilometres

Date: 29/04/2025 Datum: GDA2020 Scale: 1:800,000@A3

AUTHOR: S.Worrall
DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
- State Corridors
- Protected Areas

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Stage 8 Acquittal\Mapping\Stage8 Acquittal mapping.aprx

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7. Offset Acquittal

Table 9 presents a summary of the offset areas to be secured to acquit offset requirements for Stage 8 of the GFD Project under EPBC 2012/6615 on Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater, as well the area of surplus offset values remaining within the offset areas. For MNES where a surplus is noted, Santos proposes to draw down on these to acquit future offset requirements. Additional information and areas of surplus offset is provided in the relevant OAMPs.

The results of the detailed field assessments including the ground-truthed RE mapping and fauna habitat associations were used to inform the suitability and location of the offset areas on Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater, and are discussed in detail as part of the OAMPs (see Appendix A, Appendix B, Appendix C, Appendix D and Appendix E).

The minimum offset area required to be secured for each MNES was determined in accordance with the EPBC Act OAG. The OAG inputs and supporting justifications for each of the OAMPs are provided in Appendix F. A habitat quality score for each MNES for both the impact and offset area has been calculated to inform the OAG.

The habitat quality of the impact area for each MNES required to be offset (Table 2) was calculated as part of the ecological surveys and assessments undertaken across the Stage 8 development area (Section 3.2.2). The habitat quality scores for each MNES were determined generally in accordance with Queensland Herbarium's BioCondition Manual and the *Guide to Determining Terrestrial Habitat Quality* (version 1.3; GTDTHQ; DES 2020). The final habitat quality scores calculated as part of the ecological surveys and assessments were taken from each of the relevant reports and area weighted, based on the proposed Stage 8 MNES impacts, to calculate an overall habitat quality score for input into the OAGs for each MNES. A detailed summary of the impact area habitat quality score calculations is provided in Appendix F.

In the absence of detailed habitat quality assessments within particular development areas for Stage 8 or for some MNES offset requirements, a conservative approach has been adopted and the habitat quality of the impact area to be offset has been assumed to be 7. This approach is based on the rapid assessment process allowed under the GTDTHQ for the impact site only. A score of 7 represents an average score of generic remnant REs in Queensland based on Queensland Herbarium expert analysis.

A baseline habitat quality score for each MNES offset value, determined based on the results of the detailed field assessments in the offset areas, was used to inform the OAGs and will be used as a metric to assess the success of the OAMPs through the interim performance targets and completion criteria. A detailed summary of the field assessments, baseline habitat quality scores for each MNES and interim performance targets and completion criteria are provided in the OAMPs (see Appendix A, Appendix B, Appendix C, Appendix D and Appendix E).

Table 9 – Offset acquittal for Stage 8 of the GFD Project under EPBC 2012/6615

MNES	Status under EPBC Act[1]	Impact area (ha)	Bottle Tree offset area			Kentucky offset area			Cobbadah offset area			Mt Tabor offset area 2			Springwater offset area			Total % acquittal
			Offset area to be secured (ha)	% acquittal	Surplus area available (ha)[2]	Offset area to be secured (ha)	% acquittal	Surplus area available (ha)[2]	Offset area to be secured (ha)	% acquittal	Surplus area available (ha)[2]	Offset area to be secured (ha)	% acquittal	Surplus area available (ha)[2]	Offset area to be secured (ha)	% acquittal	Surplus area available (ha)[2]	
Threatened ecological communities																		
Brigalow TEC	E	0.51	122.20	4,314.32	32.71	-	-	-	-	-	-	-	-	-	27.15	539.18	0	**4,853.50%**
SEVT TEC	E	0.50	-	-	-	-	-	-	1.00	18.01	486.10	-	-	-	4.12	83.25	0	**101.26%**
Threatened fauna species																		
Collared Delma (*Delma torquata*)	V	49.49	122.20	75.92	30.71	40.11	12.46	0	-	-	-	307.42	95.50	0	46.17	16.10	0	**199.99%**
Yakka Skink (*Egernia rugosa*)	V	39.99	122.20	78.30	30.71	40.11	12.85	0	-	-	-	5.38	1.72	0	46.17	16.60	0	**109.48%**
Dunmall's Snake (*Furina dunmalli*)	V	49.98	122.20	75.18	30.71	40.11	12.34	0	-	-	-	307.42	94.57	0	46.17	15.94	0	**198.02%**
Red Goshawk (*Erythrotriorchis radiatus*)	E	25.61	122.20	100.25	31.20	-	-	-	-	-	-	307.42	126.10	0	50.29	23.15	0	**249.50%**
Black-breasted button-quail (*Turnix melanogaster*)	V	0.50	-	-	-	-	-	-	-	-	-	-	-	-	4.12	101.55	0	**101.55%**
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	V	32.11	-	-	-	-	-	-	-	-	-	307.42	122.67	0	18.97	8.49	0	**131.16%**
Northern Quoll (*Dasyurus maculatus*)	E	26.11	-	-	-	-	-	-	-	-	-	307.42	148.42	0	50.29	27.25	0	**175.67%**
Koala (*Phascolarctos cinereus*)	E	36.56	-	-	-	40.11	11.52	0	-	-	-	307.42	88.32	0	18.97	6.11	0	**105.95%**
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	50.48	122.20	62.03	31.22	40.11	10.18	0	-	-	-	307.42	78.02	0	50.29	14.33	0	**164.56%**
Large-eared Pied Bat (*Chalinolobus dwyeri*)	E	32.61	-	-	-	-	-	-	-	-	-	307.42	99.03	0	50.29	18.18	0	**117.21%**

[1] E = Endangered; V = Vulnerable.
[2] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 text and the "Ground-truthed RE" tables in the relevant OAMPs to understand how areas are accounted for in each stage.

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Appendix A

Bottle Tree Offset Area Management Plan

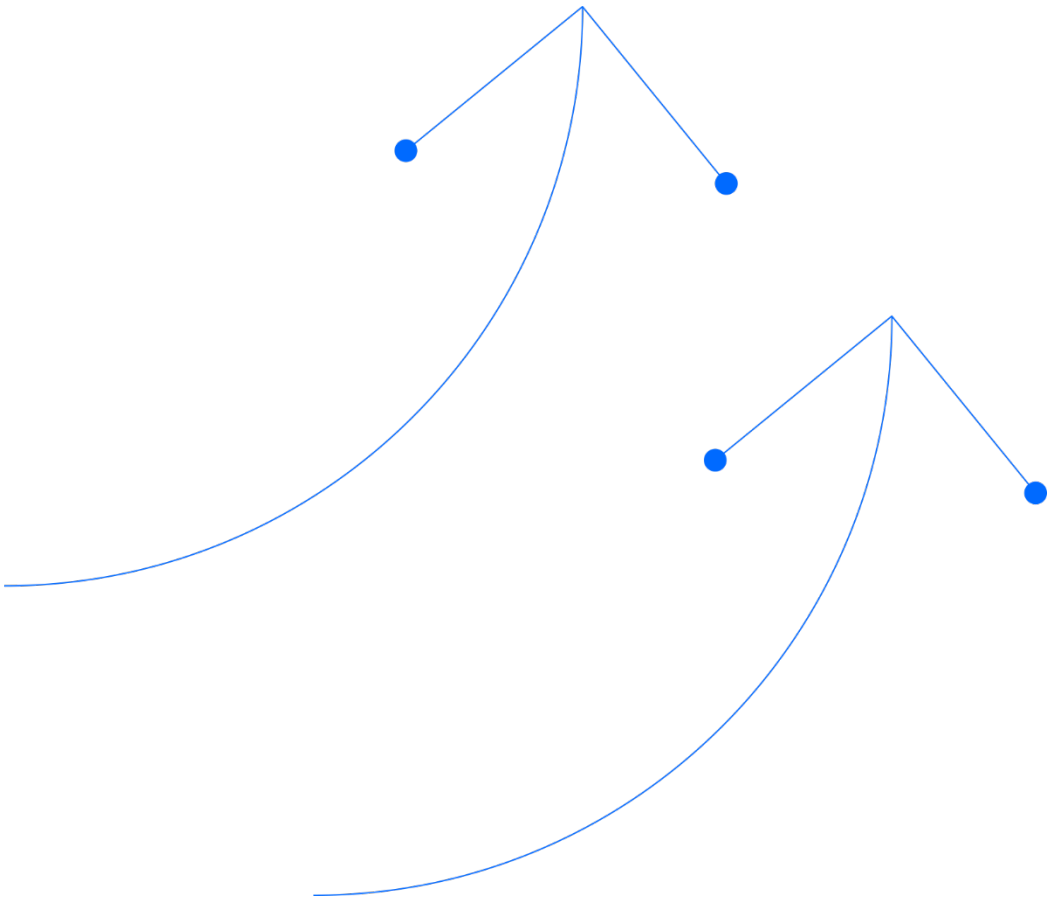
Santos

SANTOS GLNG BOTTLE TREE OFFSET AREA MANAGEMENT PLAN

EPBC Act Approval 2012/6615 (Stage 8)

Document Number: 0007-650-EMP-0045

31 October 2025



Date	Rev	Reason For Issue	Reviewed	Endorsed	Approved
9 May 2025	0	For DCCEEW submission	AB	AB	DG
31 October 2025	1	Updated based on DCCEEW review	JK	AB	DG

Declaration of Accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or document to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulation 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed [redacted]

Full Name (please print) [redacted]

Organisation (please print) Santos Ltd

Date 31 / 10 / 2025

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Abbreviations

Acronym	Description
BPA	Biodiversity Planning Assessment
°C	Degrees Celsius
DAF	Department of Agriculture and Forestry (Qld)
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEHP	Department of Environment and Heritage Protection (DEHP); now Department of Environment, Tourism, Science and Innovation (DETSI)
EMP	Environmental Management Plan (Guidelines)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
GIS	Geographical Information System
GLNG	Gladstone Liquefied Natural Gas
GTDTHQ	Guide to Determining Terrestrial Habitat Quality
GTP	Gas Transmission Pipeline
ha	Hectare
kg	Kilogram
km	Kilometre
MNES	Matters of National Environmental Significance
m	Metre
mm	Millimetre
NP	National Park
OAG	*Offsets Assessment Guide*
OAMP	Offset Area Management Plan
PMAV	Property Map of Assessable Vegetation
RE	Regional Ecosystem
REDD	Reginal Ecosystem Description Database
SEVT	Semi-evergreen vine thickets (of the Brigalow Belt (North and South) and Nandewar Bioregions)
SSMP	Significant Species Management Plan
spp	species
TEC	Threatened Ecological Community
VM Act	*Vegetation Management Act 1999* (Qld)

Executive summary

This offset area management plan (OAMP) has been prepared to address the offset requirements for matters of national environmental significance (MNES) associated with Stage 8 of the Gas Fields Development (GFD) Project in accordance with the Santos Gladstone Liquefied Natural Gas (GLNG) Project *Environment Protection and Biodiversity Conservation Act 1999* (Cth; EPBC Act) approval EPBC 2012/6615.

Santos will draw down on a 122.2 hectare (ha) area of the existing 2,768.5 ha of offset area secured on the Bottle Tree property (Lot 7 TR39), to partially acquit MNES offset requirements for Stage 8 of the GFD Project under EPBC 2012/6615 (Table ES 1). The remaining 2,660.9 ha of offset area on Bottle Tree is currently being used to acquit offset obligations for the Gas Transmission Pipeline Project (EPBC 2008/4096), GLNG Project (EPBC 2008/4059), Stage 7 of the GFD Project (EPBC 2012/6615) and includes 31.22 ha of surplus areas of suitable MNES habitat for Santos to drawdown on for future project offset acquittals. This OAMP relates to the 122.2 ha offset area required to partially acquit Stage 8 under EPBC 2012/6615, as calculated in accordance with the EPBC Act *Offsets Assessment Guide* (OAG) to support the overall conservation gain of the offset area.

The Bottle Tree property is located within the Santos GLNG Project tenements approximately 75 kilometres north-east of Injune and adjacent to the Expedition (Limited Depth) National Park. The property is mapped within a state conservation corridor. Desktop and field surveys of the Bottle Tree property have been completed to confirm the presence of offset values and suitability to satisfy the Project's offset obligations as follows:

- 2011
  - Preliminary desktop assessment of biodiversity offset values.
  - Detailed field assessment to ground truth vegetation and confirm presence of environmental values.
- 2015
  - Further refine ground-truthed and potential Regional Ecosystem (RE) types and their extent as well as confirming location of potential areas to support biodiversity offsets.
- 2020
  - Update fine-scale RE mapping and BioCondition assessments.
  - Targeted flora and fauna surveys and habitat assessments.
- 2021
  - BioCondition assessments.
  - Targeted flora and fauna surveys and habitat assessments.

The outcome of this OAMP is to partially acquit the offset obligations for Stage 8 under EPBC 2012/6615. The Bottle Tree offset area will be managed and monitored, based on an adaptive management framework, to achieve the interim performance targets and completion criteria presented in Table ES 2.

The key management actions to be implemented include:

- restricting access to the offset area,
- management and restoration of regrowth Threatened Ecological Community (TEC),
- maintenance and upgrades of existing access tracks, fencing and firebreaks,
- fire management through strategic grazing and fuel hazard reduction burns,
- weed management, and
- pest animal management.

Ongoing monitoring events will be undertaken to assess the effectiveness of the management actions and progress of the offset area in achieving the interim performance targets and completion criteria, including:

- biannual offset area inspections,
- biomass monitoring,
- fuel load monitoring,

- weed monitoring,
- pest animal monitoring,
- rapid monitoring events,
- habitat quality assessments,
- Brigalow stem counts, and
- photo monitoring.

Annual reports will be prepared to detail progress of the offset area in achieving the interim performance targets and completion criteria for each management year including the results of management and monitoring activities completed.

The offset area is protected via a Voluntary Declaration under Sections 19E and 19F of the *Vegetation Management Act 1999* (Qld) (including surplus areas identified in Table ES 1). The Voluntary Declaration will remain in place for the life of EPBC 2012/6615.

Table ES 1 – Summary of the Bottle Tree offset area and Stage 8 acquittal for EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Habitat within the Bottle Tree offset area (ha)	Offset area (ha)				% acquittal of Stage 8[2]	Surplus area (ha)[3]
				Approved for Phases 1 and 2 under EPBC 2008/4059	Approved under EPBC 2008/4096	Approved for Stage 7 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615		
Threatened ecological communities									
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC)	E	0.51	1,720.8	355.10	1,019.47	19.70	122.20	4,314.32	32.71
Threatened fauna species									
Collared Delma (*Delma torquata*)	V	49.49	2,183.8	579.80	1,140.89	19.70	122.20	75.92	30.71
Yakka Skink (*Egernia rugosa*)	V	39.99	2,075.7	480.10	1,140.89	19.70	122.20	78.30	30.71
Dunmall's Snake (*Furina dunmalli*)	V	49.98	2,075.7	480.10	1,140.89	19.70	122.20	75.18	30.71
Red Goshawk (*Erythrotriorchis radiatus*)	E	25.61	2,254.7	647.50	1,143.63	19.70	122.20	100.25	31.20
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	50.48	2,254.7	647.50	1,143.63	19.70	122.20	62.03	31.20

[1] E = Endangered; V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties
[3] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 5 of this OAMP to understand how areas are accounted for in each stage.

Table ES 2 – Interim performance targets and completion criteria for the Bottle Tree offset area for Stage 8 acquittal under EPBC 2012/6615

MNES	Baseline habitat quality score	Interim performance targets			Completion criteria
		Year 5	Year 10	Year 15	Year 20
Threatened ecological communities					
Brigalow TEC (Moderate quality)	4	Increase in the habitat quality score from baseline score of 4. The anticipated improvement is expected to range between 4.5 and 5. Bioclimatic variables and their relevant influences in achieving this improvement will be discussed in the annual compliance report. Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports.	Increase in the habitat quality score from year 5. The anticipated improvement is expected to range between 5 and 5.5. Bioclimatic variables and their relevant influences in achieving this improvement will be discussed in the annual compliance report. Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports.	Increase in the habitat quality score from year 10. The anticipated improvement is expected to range between 5.5 and >6. Bioclimatic variables and their relevant influences in achieving this improvement will be discussed in the annual compliance report. Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports.	Improve the quality of habitat to achieve a score of at least 6 Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports. Areas of regrowth Brigalow TEC meet the requirement for remnant vegetation under the relevant Queensland legislation. Under the VM Act the following criteria would need to be met: • covering more than 50% of the undisturbed predominant canopy; and • averaging more than 70% of the vegetation's undisturbed height; and • composed of species characteristic of the vegetation's undisturbed predominant canopy.
Threatened fauna species					
Collared Delma	3	Increase in the habitat quality score from baseline score of 3	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 5
Yakka Skink	3	Increase in the habitat quality score from baseline score of 3	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 5
Dunmall's Snake	4	Increase in the habitat quality score from baseline score of 4	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 6
Red Goshawk	4	Increase in the habitat quality score from baseline score of 4	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 6
South-eastern Long-eared Bat	4	Increase in the habitat quality score from baseline score of 4	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 6

1. Introduction

The Santos Gladstone Liquefied Natural Gas (GLNG) Project involves the development of Coal Seam Gas resources in the Surat and Bowen Basins in Queensland, to supply gas via a 430 kilometre (km) gas transmission pipeline (GTP) to the liquified natural gas facility located on Curtis Island. Throughout the development of the Santos GLNG Project and in accordance with Santos GLNG Project approvals, potentially impacted environmental values are systematically identified and assessed and in order of preference are avoided, minimised or mitigated.

The Santos GLNG Project is required to provide environmental offsets for significant residual impacts on matters of national environmental significance (MNES) in accordance with approvals granted under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Bottle Tree offset area was originally approved by the Department of Agriculture, Water and the Environment in March 2021 to acquit MNES offset requirements under EPBC 2008/4059, and later updated to acquit offset requirements under 2008/4059, 2008/4096 and 2012/6615, including surplus areas of suitable MNES habitat for Santos to drawdown on for future project offset acquittal.

This offset area management plan (OAMP) has been prepared to address the partial acquittal of the MNES offset obligations associated with Stage 8 of the Gas Fields Development (GFD) Project under the GLNG Project approval EPBC 2012/6615, outlined in Table 1, and will draw down on the approved surplus areas within the Bottle Tree offset area (Figure 1; Figure 2; Section 2.6).

Table 1 – Summary of the disturbance in which offsets will be provided for Stage 8 of the GFD Project under EPBC 2012/6615

MNES	Status under EPBC Act	Disturbance area (ha)
Threatened ecological communities		
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC)	Endangered	0.51
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community (SEVT TEC)[1]	Endangered	0.50
Threatened fauna species		
Collared Delma (*Delma torquata*)	Vulnerable	49.49
Yakka Skink (*Egernia rugosa*)	Vulnerable	39.99
Dunmall's Snake (*Furina dunmalli*)	Vulnerable	49.98
Red Goshawk (*Erythrotriorchis radiatus*)	Endangered	25.61
Black-breasted Button-quail (*Turnix melanogaster*)[1]	Vulnerable	0.50
Squatter Pigeon (southern) (*Geophaps scripta scripta*)[1]	Vulnerable	32.11
Northern Quoll (*Dasyurus hallucatus*)[1]	Endangered	26.11
Koala (*Phascolarctos cinereus*)[1]	Endangered	36.56
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	Vulnerable	50.48
Large-eared Pied Bat (*Chalinolobus dwyeri*)[1]	Endangered	32.61

[1] Offset requirements for these MNES are acquitted on other properties for Stage 8.

1.1. Purpose

This OAMP is written consistent with the *Environmental Management Plan* (EMP) *Guidelines* (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2024), and provides a detailed management and monitoring framework for the Bottle Tree offset area in accordance with the requirements for Stage 8 of EPBC 2012/6615 as presented in Table 2 below. Table 3 details how this OAMP satisfies the requirements of a comprehensive EMP, and how the following information in this plan aligns with the Environmental Management Plan Guidelines set by DCCEEW (2024).

Table 2 – Approval conditions satisfied through this OAMP

Condition number	Condition	How the conditions are met
EPBC Act Approval 2012/6615		
11	The approval holder must ensure that environmental offsets comply with the principles of the EPBC Act *Environmental Offsets Policy*.	Offsets to compensate for significant residual impacts associated with Stage 8 of the GFD Project will be delivered in accordance with the principles of the EPBC Act *Environmental Offsets Policy*. An offset area will be secured on Bottle Tree to partially acquit offset obligations for the MNES matters outlined in Table 1. The Bottle Tree offset area has been identified to comply with the requirements for an offset under the EPBC Act *Environmental Offsets Policy* as detailed in Section 2.9 of this OAMP.
12	The approval holder may carry out the action in project stages. The approval holder must deliver environmental offsets for residual significant impacts to matters of national environmental significance for each project stage.	The action will be carried out in stages. An offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with Stage 8 of the GFD Project.
13	The approval holder must submit an Offset Management Plan for the Minister's written approval. The Offset Management Plan may be prepared and submitted to the Minister for written approval in stages. If the approval holder submits the Offset Management Plan in stages, each version of the Offset Management Plan must address the known and predicted impacts of the completed, current, and next proposed project phases.	An offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with Stage 8 of the GFD Project. This OAMP for the Bottle Tree offset area is submitted as part of the offset plan to address Stage 8 of the GFD Project. A reconciliation of impacts for Stage 1-7 of the GFD Project is included in the offset plan.
14	The Offset Management Plan must include: a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities; b. results from pre-disturbance surveys and/or an alternative approved methodology (if used) for the project phase as required under conditions 4 and 5; c. details of the offset areas required to address predicted residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities for the project phase; d. a survey and description of the current condition (prior to any management activities) of each offset area proposed, including existing vegetation (the baseline condition). This must include a shapefile of each offset property boundary; e. information about how the offset areas provide connectivity with other relevant habitats and biodiversity corridors, including a map depicting the offset areas in relation to other habitats and biodiversity corridors; f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary); g. a description of the management measures that will be implemented for the protection of EPBC threatened species, EPBC migratory species and EPBC communities, including a discussion of how measures outlined take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans; h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria; i. a description of potential risks to the successful implementation of the plan, and a description of the contingency measures that would be implemented to mitigate against these risks; j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and k. the proposed legal mechanism for securing the offset.	The Bottle Tree offset area is proposed to be secured to partially acquit offset requirements for Stage 8 of the GFD Project. An OAMP for the Bottle Tree offset area has been developed in accordance with the requirements outlined in condition 14. A summary of how each requirement has been addressed is provided below. a. The method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities is discussed in the offset plan, submitted in conjunction with this OAMP. b. Details of the relevant field assessments within the GFD Project Stage 8 development area are provided in the offset plan, submitted in conjunction with this OAMP. c. A summary of the significant residual impacts associated with Stage 8 of the GFD Project is provided in Table 1 of this OAMP and the offset plan. A summary of the offset area required to acquit the Stage 8 offset requirements is provided in the offset plan, with a summary of the proposed offset area on Bottle Tree and how it partially acquits the Stage 8 offset requirements provided in Section 2.6 of this OAMP. In accordance with the EPBC Act *Environmental Offsets Policy* the proposed offset areas required to be secured for each MNES were determined using the *Offsets Assessment Guide* (OAG) as described in Section 2.7. d. A summary of the ecological field surveys undertaken on the Bottle Tree offset area is described in Section 2.5. Details of the baseline ecological condition are provided in Section 2.6 and Appendix A of this OAMP. e. Details on the connectivity and the landscape context are provided in Section 2.2. f. Individual completion criteria have been developed for each MNES as part of the environmental outcomes to be achieved for the Bottle Tree offset area (Section 4). In addition, specific management objectives and performance criteria have been developed which will provide the basis for achieving the MNES completion criteria. The complete adaptive management process for this OAMP is encapsulated in Table 12 and includes management actions, monitoring events, adaptive management triggers and corrective actions that have been assigned to each management objective and performance criteria. g. Management measures to be implemented as part of this OAMP have been developed to address key threats known or with the potential to occur within the Bottle Tree offset area identified as part of detailed field surveys and take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans. A summary of the known and potential threats and proposed management measures are detailed in Section 6. h. The monitoring program to measure the effectiveness of the management measures and progress against the performance and completion criteria is detailed in Section 7. i. Risks to the successful implementation of this plan are included in the risk assessment presented in Appendix C. j. The timing for implementation of the management and monitoring program are provided in Section 9. k. Details on how the Bottle Tree offset area for Stage 8 of the GFD Project will be legally secured are provided in Section 2.9 of this OAMP.
15	The currently approved Offset Management Plan must be implemented by the approval holder.	Once approved, this OAMP will be implemented.

Condition number	Condition	How the conditions are met
16	The approval holder must register and legally secure offsets for the first project phase identified in the Offset Management Plan within two years of commencement of the first project phase.	Details on how the Bottle Tree offset area for Stage 8 of the GFD Project has been legally secured are provided in Section 2.9
17	The approval holder must register and legally secure offsets for a project phase which are sufficient to acquit the residual significant impacts of that project phase.	Details on how the Bottle Tree offset area for Stage 8 of the GFD Project has been legally secured are provided in Section 2.9.
18	If the approval holder submits the Offset Management Plan in stages, the approval holder must prepare and submit an updated Offset Management Plan for each subsequent project phase, for written approval by the Minister. The updated Offset Management Plan must: a. include the information required for the Offset Management Plan at condition 14 for the next project phase; b. include a reconciliation of actual and predicted but yet to be actualised residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities against offsets secured for the commenced project phases. Secured offsets in excess of requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases may be subtracted from the obligations required for subsequent project phases. Any shortfall in secured offsets relative to the requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases must be added to the obligations required for the next project phase; and c. demonstrate how the offset builds on offsets already secured for previous project phases and will contribute to a larger strategic offset for cumulative project impacts.	An updated version of this OAMP will be submitted for any subsequent stages of the GFD project.
19	The approval holder must not commence the project phase until the Offset Management Plan, updated for that project phase has been approved by the Minister in writing.	This OAMP is submitted for the approval of the Minister. Stage 8 will not commence until this OAMP for the project stage has been approved.

Table 3 – Alignment of OAMP with EMP Guidelines

Key content	Reference within OAMP	Reference to EMP guideline
Conditions of approval	Section 1.1, Table 2 details the approval conditions satisfied through this OAMP.	Section 3, page 8
Property information and baseline data	Section 2 describes the Bottle Tree property, Sub-section 2.5 lists the history of ecological surveys undertaken at the Bottle Tree property, including baseline surveys, and Sub-section 2.6 describes the ground-truthed environmental values of the property.	Section 3
Offset values	Section 3 describes and details the offset values of this OAMP, and Section 4 lists the associated environmental outcomes.	Section 3
Adaptive management framework and program	Section 5 describes the adaptive management framework to be applied through this OAMP, and Section 4, Table 9 details the interim performance targets. Section 6, Table 12 describes the management program.	Section 3, page 11-12
Management program entailing objectives, triggers, and actions	Section 6.1, Table 10 details the management objectives, performance targets, method of management actions, and measurable milestones of progression in terms of monitoring actions, monitoring timing and frequency, management triggers and corrective actions.	Section 3, page 11-12
A detailed monitoring program	Section 7 breaks down the monitoring program into six Sub-sections, and details the program timing, frequency, methods.	Section 3, page 11-12
A detailed monitoring and implementation schedule	Section 9, Table 19 summaries the overall schedule of the monitoring program inclusive of timing, activity, location of activity, method and reliability of method.	Section 3, page 11-12
Risk assessment and management actions to avoid, mitigate and manage risks	Section 6, Table 12 identifies risks which have been identified as potentially impeding to the outcomes of environmental management objectives.	Section 4, pages 13-14
Risk matrix	Table C3 in Appendix C applies a risk matrix including residual risk rating following mitigation measures, management triggers and corrective actions.	Section 4, pages 13-14
Maintenance of monitoring records	Section 8 details the reporting obligations of this OAMP and how information will be stored for the lifetime of the approval.	Section 3, page 9

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Willows Gemfields
Gregory Highway
Fernlees
Avocet Nature Refuge
Goonderoo Nature Refuge
Amaroo State Forest
Kenmare Nature Refuge
Arthurs Bluff State Forest
Ghungalu Conservation Park
Blackdown Tableland National Park
Duaringa State Forest
Boolburra
Capricorn Highway
Dawson Range State Forest
Shotover State Forest
Snake Range National Park
Minerva Hills National Park
Springsure
Vandyke Creek Conservation Park
Cairdbeign State Forest
PL 1083
PL 1082
Humboldt State Forest
Humboldt National Park
Woorabinda
Baralaba
Mimosa Park Nature Refuge
Redcliffe State Forest
Yarrai Nature Refuge
Nandowrie State Forest
Squire State Forest
Expedition State Forest
Albinia National Park
Albinia Resources Reserve
Albinia Conservation Park
Rolleston
Mount Hope State Forest
Mount Pleasant State Forest
Rainbow Nature Refuge
Phiara Downs Nature Refuge
Cometside Nature Refuge
Bauhinia
PPL 166
Zamia Creek Conservation Park
Dawson Highway
Roundstone State Forest
Roundstone Conservation Park
Mount Nicholson State Forest
Expedition Resources Reserve
Carnarvon Station Nature Refuge
Serocold State Forest
Carnarvon Highway
Nuga Nuga National Park
Expedition National Park
Palmgrove National Park (scientific)
Theodore State Forest
PL 451
PL 236
PL 440
PL 450
PL 235
7TR39
Presho State Forest
Carnarvon National Park
Bandana State Forest
McLeay State Forest
PL 1062
Mebir State Forest
Attica State Forest
Forfar State Forest
Eden State Forest
Boxvale State Forest
PL 420
Expedition (Limited Depth) National Park
PL 1059
PL 1017
Tualka State Forest
Waterton State Forest 1
PL 421
Gwambagwine State Forest
PL 234
PL 233
Lake Murphy Conservation Park
Leichhardt Highway
Howe State Forest
Forrest State Forest
Belington Hut State Forest
Hillside State Forest
Oakvale State Forest
PL 90
Doonkuna State Forest
PL 457
PL 91
Beilba State Forest
PL 232
Taroom
Sunnyside State Forest
PL 92
Stephenton State Forest
PL 1012
Hallett State Forest
PL 100
PL 99
Carraba Conservation Park
Injune
Moorabinda Nature Refuge
Mount Armour Nature Refuge
Waroonga State Forest
Taboonbay State Forest
Walhallow State Forest
Gubberamunda State Forest 3
Gubberamunda State Forest 2
Gubberamunda State Forest 1
Woodduck State Forest
Dinoun State Forest
Mount Organ State Forest
Hinchley State Forest
Juandah State Forest
Emu State Forest
Combabula State Forest
PL 1019
PL 322
PL 314
PL 1021
Barabanbel State Forest 3
Barabanbel State Forest 1
Barabanbel State Forest 2
Tokatakiya Nature Refuge
Mungallala
Womalilla
Mitchell
PL 315
PL 1020
PL 323
Hodgson
Roma
PL 313
Blythdale
Wallumbilla
PL 1123
Amby
Muckadilla
Warrego Highway
Inglebogie State Forest
Yuleba
Dulacca
Jackson
PL 316
PL 317
PL 318
Yuleba State Forest
Eversfield Station Nature Refuge
PL 319
PL 320
PL 321

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Location diagram

Figure 1
Project Context

- Bottle Tree
- Santos Petroleum Licence
- Santos Petroleum Pipeline Licence

Statewide Corridor
- Regional
- State

Protected areas
- National Park
- National Park (scientific)
- State Forest
- Conservation Park
- Forest Reserve
- Resources Reserve
- Timber Reserve
- Nature Refuge

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Date: 3/05/2025 Coordinate System: GDA2020 Scale: 1:950,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Statewide Corridors v1.6
- Protected areas
- Resource licenses
AUTHOR: S.Worrall

Path: P:\GIS\Data\Projects\Santos\20250416_Roma_Stage8_OAMP\s\Bottle Tree\Bottle Tree_OAMP_mapping_20250502.aprx

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2. Bottle Tree Property

2.1. Property overview

Bottle Tree (Lot 7 TR39) is a 3,853 ha property located approximately 75 km north-northeast of Injune in south central Queensland (Figure 1). The property is owned by Santos and was acquired primarily for its potential environmental offset values for the Santos GLNG Project. Bottle Tree is situated within Subregion 20 (Arcadia) of the Brigalow Belt South Bioregion (Sattler and Williams 1999) within the jurisdiction of the Central Highlands Regional Council. Access to the property is via the Arcadia Valley Road, east of the Carnarvon Developmental Road between Injune and Rolleston. Current land uses on the property include cattle grazing, activities associated with coal seam gas exploration and production as well as areas dedicated to environmental offsets.

The property is located entirely within the Brown River catchment, part of the Fitzroy River basin, with the major watercourse being Arcadia Creek. Several other minor watercourses are present on the property. The topography is varied and is comprised of alluvial plains, undulating plains, low hills and a steep scarp of Precipice Sandstone in the east. Elevation ranges between approximately 300 and 346 metres (m) on the lower lying areas of the property and reaches a maximum of about 630 m at the crest of the Expedition Range in the east.

Table 4 summarises Bottle Tree landholder and property details.

Table 4 – Bottle Tree landholder and property details

Landholder and Property Details	
Registered Owner/s on Title:	Santos GLNG Pty Ltd (JV representative) Total GNG Australia PAPL (Downstream) Pty Ltd KGLNG Liquefaction Pty Ltd
ABN/ACN:	ABN 12 131 271 648 (Santos GLNG Pty Ltd.)
Postal Address:	PO Box 329, Roma Queensland 4455
Lot on plan(s):	Lot 7 TR39
Address:	5744 Arcadia Valley Road, Arcadia Valley Queensland
Tenure:	Freehold
Area:	3,853 ha
Primary Local Government Area:	Central Highlands Regional Council
Permits	
Coal Exploration Permit:	EPC 1772 Tri-Star Coal Company, expires 21 Feb 2029
Petroleum and gas exploration permit	ATP1191 SANTOS QNT Pty Ltd, expired 30 Sep 2023.
Petroleum and gas production permit	PL1062 SANTOS QNT Pty. Ltd (application) PL420 Santos Toga Pty Ltd, expires 12 Oct 2044 PL421 Santos Toga Pty Ltd, expires 15 Sep 2044
Infrastructure permit	PPL166 Santos GLNG Pty Ltd, expires 17 Nov 2051

2.2. Connectivity

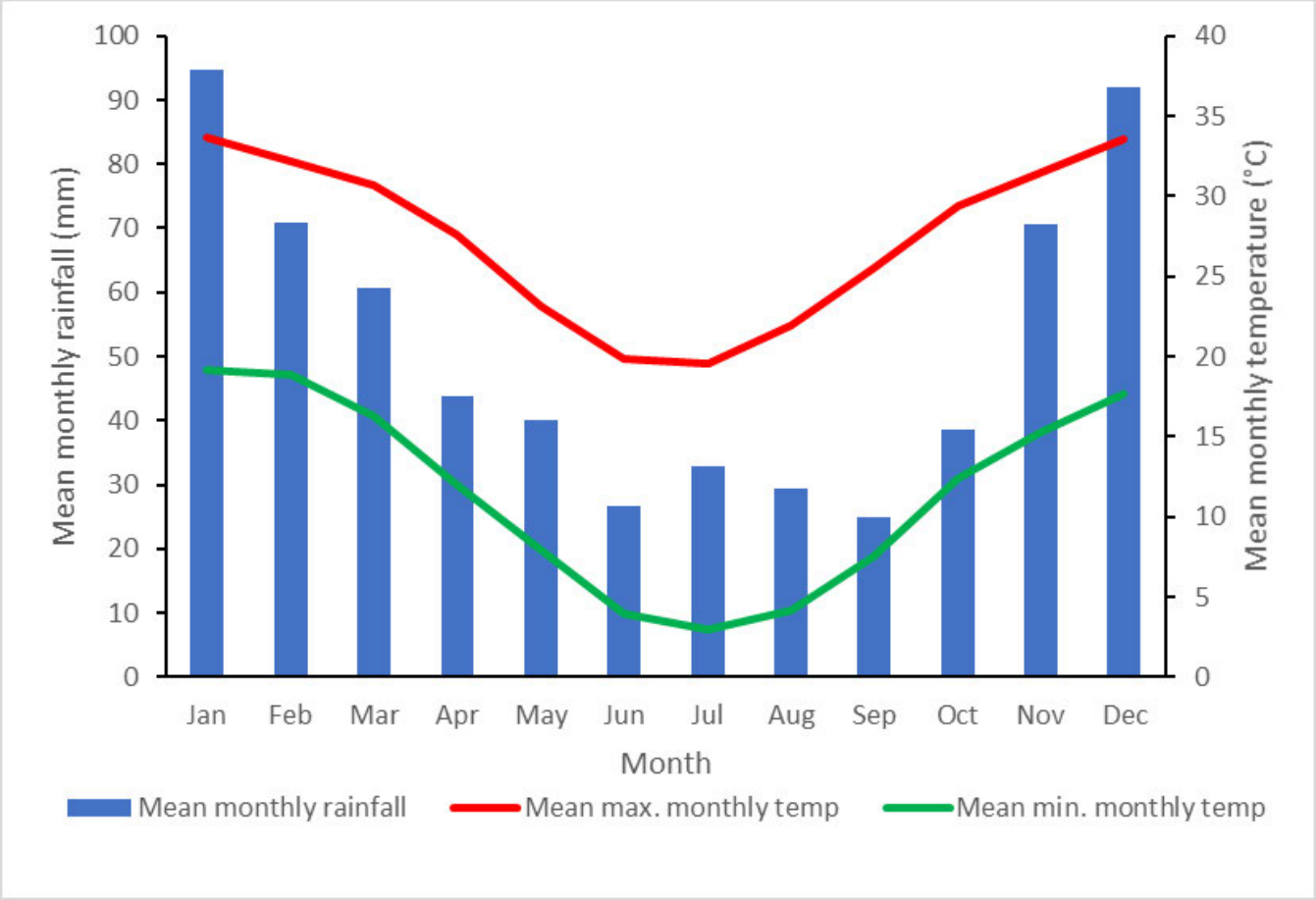
The Bottle Tree property is mapped within a state conservation corridor (Figure 1). Conservation corridors have been mapped as part of the Queensland Government's Biodiversity Planning Assessments (BPA) which assess the biodiversity significance of land in a bioregion. The mapping of corridors within the Brigalow Belt Bioregion, in which the Bottle Tree property is located, has focussed on those corridors that link adjacent bioregions or connect wildlife refugia. Corridors identified as of state significance are considered of the greatest importance at the bioregional scale. As illustrated in Figure 1 the state conservation corridor runs along the eastern portion of the property as part of the contiguous tract of remnant vegetation including Expedition (Limited Depth) National Park (NP).

More detail on BPAs can be found at https://www.qld.gov.au/environment/plants-animals/biodiversity/ planning.

2.3. Climate

The Bottle Tree property is characterised by a hotter wet season (typically November to March) and a cooler dry season (typically April to October) (see Figure 3). Weather records from the Injune weather station (#43015), approximately 75 km south-west of Bottle Tree, show the mean monthly rainfall for the period 1961-1990 ranges from 24.9 millimetres (mm) (September) to 94.6 mm (January) (Bureau of Meteorology [BoM] 2024). Mean monthly maximum temperatures range from 19.6 degrees Celsius (°C) (July) to 33.7°C (January) and mean monthly minimum temperatures range from 3°C (July) to 19.2°C (January) (BoM 2024).

Figure 2 – Mean monthly temperature and rainfall records



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148°52'0"E
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25°10'0"S
25°12'0"S
25°14'0"S
Blackfellow Creek
Ironbark Creek
Arcadia Creek
Station Creek

SANTOS

Figure 2
Property Overview

Bottle tree
Offset area boundary
Major road
Property access track

Watercourse
Major watercourse
Minor drainage line
Drainage contour

EPBC 2008/4059 offset area
Phase 1
Phase 2
Future habitat area

EPBC 2012/6615 offset area
Stage 7
Stage 8

EPBC 2008/4096 offset area
Conditions 15-22 and GTP SSMP
Ooline (Cadelia pentasylis)
Xerothamnella herbacea
Surplus areas

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Kilometres

Date: 3/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:42,000@A3

Location diagram

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Statewide Corridors v1.6
- Protected areas
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMP\s\Bottle Tree\BottleTree_OAMP_mapping_20250502.aprx

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2.4. On-ground property assessments

Santos has dedicated 2,768.5 ha for environmental offsets within the Bottle Tree property (herein referred to as the offset area) (Figure 2).

A combination of desktop and detailed on-ground assessments of the offset area have been undertaken to confirm the suitability of the area to satisfy the Project's offset obligations. The key desktop and field surveys of the offset area completed to date are summarised below:

- 2011
  - Preliminary desktop assessment of biodiversity offset values (Ecofund 2011).
  - Detailed field assessment undertaken by Boobook to ground truth vegetation and confirm presence of environmental values (Boobook 2011).
- 2015
  - Further refine ground-truthed and potential Regional Ecosystem (RE) types and their extent as well as confirming location of potential areas to support biodiversity offsets based on examination of high-resolution aerial photography provided for the property by Santos (Boobook 2015).
- 2020
  - Update large-scale RE mapping across the offset area (Terrestria 2020).
  - BioCondition assessments within the Bottle Tree offset area in accordance with the BioCondition methodology (Eyre *et al*. 2015). The number of assessments sites per unit was guided by the *Guide to Determining Terrestrial Habitat Quality* (version 1.2; GTDTHQ; Department of Environment and Heritage Protection [DEHP] 2017). The condition of each site was compared to the benchmark data provided for each RE. Benchmarks were obtained from either Santos' internal BioCondition results (Boobook 2015) or from the DEHP website at http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/#benchmarks. Photo monitoring sites were established at all BioCondition assessment sites.
  - Targeted flora surveys and habitat assessments, including unbounded meander flora surveys were conducted in line with the timed meander survey methodology contained within the DEHP Flora Survey Guidelines (DEHP 2016).
  - Targeted fauna surveys using the following methods to assess fauna species richness for the endangered and vulnerable species listed below within the Bottle Tree offset area:
    - Northern quoll
    - Large-eared pied bat
    - Black-breasted button-quail
    - Red goshawk
    - Australian painted snipe
    - Collared delma
    - Ornamental snake
    - Squatter pigeon (southern)
    - Yakka skink
    - Dunmall's snake
    - South-eastern long-eared bat
    - Australasian bittern
    - Koala
    - Southern greater glider
    - Powerful owl
  - Survey methods:
    - Camera traps focused on bait stations
    - Elliott B trapping
    - Funnel trapping
    - Ultrasonic bat call detection
    - Active daytime habitat searching
    - Spotlighting habitat searches
    - Active koala searches and scat analysis.

  - Unbounded fauna surveys were conducted to assess the presence and abundance of native and pest fauna and threatening processes. General assessments were carried out across the entirety of the offset area including passive recording techniques such as sightings, recognition of characteristic vocalisations, and/or identification of animal signs.
  - Fauna surveys were conducted from 06 – 11 January 2020. Weather conditions were very hot and very dry, with only 71 mm of rainfall in the 6 months preceding. The average maximum daily temperature for the preceding 3 months was 35°C. Subsequent active searches and camera trapping was employed between 24th March and 3rd April 2020. A total of 254 mm of rainfall had fallen between the 11 January and 10 March 2020 and conditions for reptiles had improved markedly. However insufficient time had passed in order for population numbers to have recovered. Never-the-less the chances of finding threatened reptiles had increased for those individuals that had survived the drought. It is expected that reptile activity and diversity on the site will increase during improved seasonal conditions and as the offset habitats mature.
- 2021
  - BioCondition assessments within the Bottle Tree offset area in accordance with the BioCondition methodology (Eyre *et al*. 2015).
  - Targeted flora surveys and habitat assessments, including unbounded meander flora surveys were conducted in line with the timed meander survey methodology contained within the DEHP Flora Survey Guidelines (2016).
  - Targeted fauna surveys for the endangered and vulnerable species listed above to assess ongoing fauna species richness within the Bottle Tree offset area.

2.5. Ground-truthed vegetation and habitat mapping

Based on the results of detailed ecological field assessments ground-truthed vegetation (Figure 4) within the offset area has been classified into four categories remnant, advanced regrowth, young regrowth and future offset commitment (Boobook 2015; Terrestria 2020).

- Remnant: woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy (Neldner *et al*. 2012).
- Advanced regrowth: areas previously cleared or disturbed (e.g. by wildfire) and containing well advanced woody vegetation floristically and structurally consistent with the RE but typically <70% of the height and <50% density of the RE. Such regrowth with appropriate management will likely achieve remnant status (potentially <30 years).
- Young regrowth: areas previously cleared or disturbed (e.g. by wildfire) and containing varying densities of woody vegetation floristically consistent with the RE type. Such regrowth lacks structural elements typical of the RE but with appropriate management may eventually achieve remnant status (likely >30 years).
- Future Offset Commitment (future habitat): areas previously cleared or otherwise significantly disturbed which have little woody vegetation present and are currently unsuitable as biodiversity offsets. It is envisioned that as natural regeneration occurs within these areas native shrub and canopy layers will develop to the point where they can be designated as viable habitat offset areas.

The results of detailed field assessments were subsequently used to confirm the suitability of the mapped ground-truthed RE on the offset area to support habitat for the Project's MNES offset requirements also taking into account the habitat mapping rules for the Santos GLNG Project area outlined in *Predictive Habitat Mapping Rules for Selected MNES Fauna Species within the Roma, Fairview and Arcadia Gas Fields* (Boobook 2020).

Known habitat requirements for each conservation significant species were assessed against on-ground microhabitat observations within each vegetation type of the offset area. The assessments were used to map the extent of habitat for MNES within the offset area defined as habitat containing potentially suitable vegetation and microhabitat features and/or that may currently be occupied by or utilised by the species on a seasonal/opportunistic basis.

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148°52'0"E
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25°10'0"S
25°12'0"S
25°14'0"S
Blackfellow Creek
ARCADIA VALLEY ROAD
Ironbark Creek
Arcadia Creek
Station Creek

Ground-truthed RE
- 11.9.4, Regrowth (young)
- 11.9.4, Regrowth (advanced)
- 11.9.4, Remnant
- 11.9.5, Regrowth (young)
- 11.9.5, Regrowth (advanced)
- 11.9.5, Remnant
- 11.9.5a, Regrowth (young)
- 11.9.5a, Regrowth (advanced)
- 11.9.5a, Remnant
- 11.10.3, Remnant
- 11.10.4, Remnant
- 11.10.7, Remnant
- 11.3.17, Regrowth (young)
- 11.3.17, Regrowth (advanced)
- 11.3.2, Regrowth (advanced)
- 11.3.2, Remnant
- 11.3.25, Regrowth (young)
- 11.3.25, Regrowth (advanced)
- 11.3.25, Remnant
- 11.3.27, Regrowth (young)
- 11.3.27, Remnant

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Location diagram

Figure 4
Ground-truthed vegetation

- Bottle Tree
- Offset area boundary
- Major road
- Property access track

Watercourse
- Major watercourse
- Minor drainage line
- Drainage contour
- EPBC 2008/4059 Future habitat area

Offset area EPBC 2008/4096
- Xerothamnella herbacea offset area
- Ooline (Cadelia pentasylis) offset area

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

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Date: 3/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:42,000@A3

Queensland
Brisbane

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2.5.1. Vegetation description

Table 5 provides a summary of the ground-truthed RE mapped on the Bottle Tree offset area.

The offset area is bookended by well-connected, good quality remnant vegetation, to the west by riparian woodlands associated with Brown's Creek and to the east by woodland and open forest of Brigalow (*Acacia harpophylla*), Gum-top ironbark (*Eucalyptus decorticans*) and semi-evergreen vine thickets (SEVT) associated with the base of the Expedition Range escarpment. These communities are in relatively good condition and little impacted by ecosystem altering weeds. The contrasting substrates of the alluvial creek system and the rocky rudosols of the Expedition Range provide a broad range of habitat types that can potentially support a wide range of threatened flora and fauna species.

The middle of the offset area is dominated by relatively flat clay plains derived from fine-grained sandstones that support regenerating woodlands and open forest dominated by Brigalow. These communities are regenerating on lands previously cleared for cattle grazing and consequently much of this land supports relatively young low canopies with low species diversity, lacking fallen woody material and supporting exotic pasture grasses within the ground layer. These communities are developing and will, over time, develop taller canopies with mature shrub layers that will shade out exotic pasture grasses and produce litter layers.

Non-remnant grassland across the offset area have been identified as future commitment offset areas. These areas are often dominated by introduced pasture grasses, including buffel grass. In the lower areas this habitat appears to be subject to regeneration with immature woodland shrubs and trees occurring in varying densities. With limited structural and floristic diversity, non-remnant grassland habitats support limited fauna diversity in comparison to the other habitats present. These areas were very dry at the time of survey providing very little feeding resources for granivores or herbivores. The potential for these areas to support threatened fauna species will increase over time as these areas will be managed to increase native flora diversity and reduce the prevalence of exotic pasture grasses.

2.5.2. Habitat description

Following the results of detailed field assessments known habitat requirements for each fauna species surveyed for were assessed against on-ground microhabitat observations within each habitat type to categorise the quality of habitat present into good quality habitat, lesser quality habitat and future habitat (Terrestria 2020). This assessment also considered the habitat mapping rules for the Santos GLNG Project area outlined in the *Predictive Habitat Mapping Rules for Selected MNES Fauna Species within the Roma, Fairview and Arcadia Gas Fields* report (Boobook 2020).

- High quality habitat is defined as habitat containing sufficient suitable microhabitat features to be occupied or utilised by a threatened species. These habitat types are generally found within remnant vegetation and advanced regrowth.
- Moderate quality habitat is defined as habitat containing some areas of suitable microhabitat features that provide patches that threatened species could periodically occupy on a seasonal or opportunistic basis and is progressing toward good quality habitat. These areas are generally found within young regrowth.
- Future habitat includes those areas known to previously support habitat for threatened species and may potentially support threatened species in the future following appropriate management.

Table 6 provides a summary of the extent of suitable habitat available on the Bottle Tree offset area for MNES offset requirements based on the results of detailed field assessments and subsequent analysis based on habitat associations (Terrestria 2020). An additional description of the offset area for each MNES is provided in Section 3.

Table 5 – Ground-truthed RE mapped within the Bottle Tree offset area

RE	Description	Type	Bottle Tree offset area (ha)					
			EPBC 2008/4059 Phase 1 and Phase 2 offset area	EPBC 2008/4096 offset area	EPBC 2012/6615 Stage 7 offset area	EPBC 2012/6615 Stage 8 offset area	Surplus offset	Total area
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Remnant	6.77	-	-	-	-	6.77
		Regrowth (advanced)	2.49	-	-	-	-	2.49
		Regrowth (young)	-	-	-	-	-	-
11.3.17	*Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains	Regrowth (advanced)	17.89	-	-	-	-	17.89
		Regrowth (young)	-	121.43	-	-	-	121.43
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Remnant	54.36	-	-	-	-	54.36
		Regrowth (advanced)	0.90	-	-	-	-	0.90
		Regrowth (young)	-	2.74	-	-	-	2.74
11.3.27	Freshwater wetlands	Remnant	12.40	-	-	-	-	12.40
		Regrowth (young)	-	-	-	-	0.49	0.49
11.9.4	Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks	Remnant	61.72	-	-	-	-	61.72
		Regrowth (advanced)	37.98	-	-	-	-	37.98
		Regrowth (young)	8.40	-	-	-	-	8.40

RE	Description	Type	Bottle Tree offset area (ha)					
			EPBC 2008/4059 Phase 1 and Phase 2 offset area	EPBC 2008/4096 offset area	EPBC 2012/6615 Stage 7 offset area	EPBC 2012/6615 Stage 8 offset area	Surplus offset	Total area
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	Remnant	2.60	-	-	-	-	2.60
		Regrowth (advanced)	154.32	-	-	-	-	154.33
		Regrowth (young)	282.15	1,017.14	19.70	122.20	30.71	1,471.91
11.9.5a		Remnant	79.89	-	-	-	-	79.89
		Regrowth (advanced)	7.82	-	-	-	-	7.82
		Regrowth (young)	-	2.33	-	-	-	2.33
11.10.3	*Acacia catenulata* or *A. shirleyi* open forest on coarse-grained sedimentary rocks. Crests and scarps	Remnant	0.22	-	-	-	-	0.22
11.10.4	*Eucalyptus decorticans, Lysicarpus angustifolius* +/- *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp. woodland on coarse-grained sedimentary rocks	Remnant	205.10	-	-	-	-	205.10
11.10.7	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	Remnant	3.01	-	-	-	-	3.01
-	Future habitat areas	Non-remnant	494.9	-	-	-	-	494.90
-	Non-remnant vegetation or existing infrastructure with no offset value	Non-remnant	-	-	-	-	-	18.80
Total			**1,432.93**	**1,143.64**	**19.70**	**122.20**	**30.71**	**2,768.49**

Table 6 – Extent of suitable habitat available on the Bottle Tree offset area for MNES

MNES	Potentially suitable REs	Habitat mapping rules	High quality habitat (ha)	Moderate quality habitat (ha)*
Threatened ecological communities				
Brigalow TEC	11.9.5	*High Quality Habitat* includes all areas of remnant and mature regrowth. *Moderate Quality Habitat* includes all immature regrowth.	156.9	1,471.9
Threatened fauna species				
Collared Delma (*Delma torquata*)	11.3.2, 11.3.17, 11.9.4, 11.9.5, 11.9.5a, 11.10.3, 11.10.4, 11.10.7	*High Quality Habitat* includes all areas of remnant and mature regrowth of all REs except wetlands and watercourses (RE 11.3.27 and RE 11.3.25). *Moderate Quality Habitat* includes all immature regrowth of suitable REs.	579.8	1,604.1
Yakka Skink (*Egernia rugosa*)	11.3.2, 11.3.17, 11.9.5, 11.9.5a, 11.10.3, 11.10.4, 11.10.7	*High Quality Habitat* includes all remnant vegetation and mature regrowth except wetlands, watercourses and SEVT (RE 11.3.27, RE 11.3.25 and RE 11.9.4). *Moderate Quality Habitat* includes all immature regrowth of suitable REs.	480.1	1,595.7
Dunmall's Snake (*Furina dunmalli*)	11.3.2, 11.3.17, 11.9.5, 11.9.5a, 11.10.3, 11.10.4, 11.10.7	*High Quality Habitat* includes all areas of remnant vegetation and mature regrowth that may be suitable for foraging or shelter except wetlands, watercourses and SEVT (RE 11.3.27, RE 11.3.25 and RE 11.9.4). *Moderate Quality Habitat* includes all immature regrowth of suitable REs.	480.1	1,595.7
Red Goshawk (*Erythrotriorchis radiatus*)	11.3.2, 11.3.17, 11.3.25, 11.3.27, 11.9.4, 11.9.5, 11.9.5a, 11.10.3, 11.10.4, 11.10.7	*High Quality Habitat* includes all woody vegetation (remnant, mature regrowth) This species may also forage within non-remnant vegetation. *Moderate Quality Habitat* includes all immature regrowth of suitable REs.	647.5	1,607.3
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	11.3.2, 11.3.17, 11.3.25, 11.3.27, 11.9.4, 11.9.5, 11.9.5a, 11.10.3, 11.10.4, 11.10.7	*High Quality Habitat* includes all areas of remnant vegetation and mature regrowth that may be suitable for foraging or shelter of all Res. *Moderate Quality Habitat* includes all immature regrowth of suitable REs.	647.5	1,607.3

* Note, only moderate quality habitat available to acquit offset requirements under EPBC 2012/6615 following acquittal of offsets requirements for Phase 1 and 2 of EPBC 2008/4059 and EPBC 2008/4096.

2.6. Offset area

The offset area is 2,768.5 ha and located across most of the Bottle Tree property, as illustrated in Figure 4. The offset area includes:

- 1,143.6 ha to acquit offset requirements under EPBC 2008/4096 (conditions 15-22) and the GTP Significant Species Management Plan (GTP SSMP; 3380-GLNG-4-1.3-0104 Rev W).
- 1,432.9 ha to acquit offset requirements under Phases 1 and 2 of EPBC 2008/4059 including 494.9 ha of future habitat area that will support threatened species in the future following appropriate management (approved by DCCEEW 25 October 2021; however, was provided in addition to acquitting MNES offset obligations under EPBC 2008/4059 to support the overall conservation gain of the offset area).
- 19.7 ha to acquit offset requirements under Stage 7 of EPBC 2012/6615.
- 122.2 ha to acquit offset requirements under Stage 8 of EPBC 2012/6615.
- 32.71 ha of remaining surplus offset value comprising moderate quality habitat for MNES, to be used by Santos to acquit future project offset requirements.
- 18.8 ha of non-remnant vegetation or existing infrastructure with no offset value. This area was included to maintain useful land management practices such as existing fence lines.

Table 7 provides a summary of the Bottle Tree offset area including the offset area allocated to acquit the MNES offset requirements under EPBC 2012/6615, EPBC 2008/4096, EPBC 2008/4059 and the remaining area of surplus offset values available within the Bottle Tree offset area. For MNES where a surplus is noted, Santos proposes to draw down on these to acquit future offset requirements under related approvals.

The results of the detailed field assessments including the ground-truthed RE mapping and fauna habitat associations discussed in Section 2.6, were used to inform the suitability and location of the offset area on the Bottle Tree property.

The quantum of offset area required to be secured for each MNES for Stage 8 under EPBC 2012/6615 was determined in accordance with the EPBC Act OAG.

A baseline habitat quality score for each MNES offset value was determined generally in accordance with the GTDTHQ (version 1.2; DEHP 2017) based on the results of the detailed field assessments (Section 2.5). The baseline habitat quality score will be used as a measure to assess the success of the OAMP through the interim performance targets and completion criteria outlined in Section 4. A detailed summary of the baseline habitat quality scores for each MNES is provided in Appendix A.

2.7. Development and land use

Santos has comitted to excluding any development for the Project from the Bottle Tree offset area.

The areas on the Bottle Tree property outside of the offset area may be utilised for petroleum and/or farming infrastructure and facilities; however, no infrastructure will be located within the offset area or impact the offset area's ability to achieve the completion criteria outlined in this OAMP.

Prior to being acquired by Santos, the Bottle Tree property was formerly utilised for grazing purposes. The following ancillary infrastructure is still present on the property and will be maintained ongoing without impact to the offset area:

- Cattle Yards
- Bottle Tree house and workshop.

Table 7 – Summary of the Bottle Tree offset area and acquittal for Stage 8 of EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Habitat within the Bottle Tree offset area (ha)	Offset area (ha)				% acquittal of Stage 8[2]	Surplus area (ha)[3]
				Approved for Phases 1 and 2 under EPBC 2008/4059	Approved under EPBC 2008/4096	Approved for Stage 7 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615		
Threatened ecological communities									
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC)	E	0.51	1,720.8	355.10	1,019.47	19.70	122.20	4,314.32	32.71
Threatened fauna species									
Collared Delma (*Delma torquata*)	V	49.49	2,183.8	579.80	1,140.89	19.70	122.20	75.92	30.71
Yakka Skink (*Egernia rugosa*)	V	39.99	2,075.7	480.10	1,140.89	19.70	122.20	78.30	30.71
Dunmall's Snake (*Furina dunmalli*)	V	49.98	2,075.7	480.10	1,140.89	19.70	122.20	75.18	30.71
Red Goshawk (*Erythrotriorchis radiatus*)	E	25.61	2,254.7	647.50	1,143.63	19.70	122.20	100.25	31.20
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	50.48	2,254.7	647.50	1,143.63	19.70	122.20	62.03	31.20

[1] E = Endangered; V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties
[3] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 5 of this OAMP to understand how areas are accounted for in each stage.

2.8. Offset protection

The 2,768.5 ha Bottle Tree offset area (including surplus areas identified in (Table 7) is protected via a Voluntary Declaration under section 19E and 19F of the VM Act and declared as an area of high nature conservation value. The Voluntary Declaration is registered on the property title and will be binding on current and future landowners.

A Voluntary Declaration under the VM Act is an authorised legally binding mechanism and is considered appropriate to legally secure MNES values and protect the area from vegetation clearing. The offset area will be mapped as a Category A area on the Property Map of Assessable Vegetation (PMAV). A Category A area on a PMAV is described as an “Area subject to compliance notices, offsets and voluntary declarations”.

The Voluntary Declaration will remain in place for the life of EPBC 2012/6615. The Voluntary Declaration may only be removed in accordance with the provisions of the VM Act or if the chief executive of the Queensland Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development considers it necessary.

The Voluntary Declaration and offset area coordinates for the declared area are provided in Appendix B.

In addition, once areas of regrowth vegetation on the Bottle Tree property have reached the requirements to achieve remnant status Santos will apply to these areas reclassified as remnant vegetation in accordance with the relevant Queensland legislation. Santos will notify the Commonwealth Government within 30 business days of the reclassification occurring.

2.9. EPBC Act Environmental Offset Policy

Table 8 outlines how the Stage 8 GFD Project offset obligations partially acquitted on the Bottle Tree offset area meet the requirements of the EPBC Act *Environmental Offsets Policy*.

Table 8 – Assessment against Principles of the Offset Policy

Principle	How the principle is met in this offset proposal
1. deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The Bottle Tree offset area partially acquits MNES offset requirements under EPBC 2012/6615 as outlined in Table 7. The remaining will be acquitted elsewhere. The Bottle Tree offset area will be managed and monitored to improve the quality of Brigalow TEC and viability of habitat for threatened fauna species. This will include the management of regrowth vegetation to become self-sustaining functional remnant vegetation communities. This OAMP sets out specific management objectives with interim performance targets and completion criteria. Management actions are outlined with accompanying adaptive management triggers and corrective actions in the event that monitoring identifies that interim performance targets are not attained or completion criteria are not attained and/or maintained. The offset area will be managed and monitored from approval of the OAMP for a minimum of 20 years. It is anticipated that the completion criteria will be achieved within a 20-year period.
2. be built around direct offsets but may include other compensatory measures	MNES offset obligations under EPBC 2012/6615 will be acquitted through the delivery of direct land-based offsets on the Bottle Tree offset area and additional land based offset areas to be secured by Santos.
3. be in proportion to the level of statutory protection that applies to the protected matter	The threatened status of the impacted protected matter is considered in the OAG in calculating the area of the offset to be provided.
4. be of a size and scale proportionate to the residual impacts on the protected matter	The size of the offset area to be secured for offset obligations has been calculated in accordance with the OAG (Santos 2025).

Principle	How the principle is met in this offset proposal
5. effectively account for and manage the risks of the offset not succeeding	This OAMP has been developed in consideration of known and identified threats to the offset values to manage the risk of failing to the achieve the completion criteria and overall environmental outcomes for the offset area. Threats to the offset site are managed by through the implementation of the management measures discussed in Section 6, including: • Fire prevention and management • Weed monitoring and control • Clearing protection • Management of grazing • Restricted access. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans etc) and identification of potential site-specific risks based on the results of field surveys and discussions with the landholder. The results of the risk assessment, presented in Appendix C, have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions. If the offset cannot attain and maintain the completion criteria then additional offsets will be provided to compensate for the impact and the failed offset (see Section 5.2.4).
6. be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	The environmental outcomes proposed to be achieved through the implementation of this OAMP are based on additional management and monitoring measures conducted as part of business as usual on the Bottle Tree property. For example under the *Biosecurity Act 2014* (Qld) a person has a general biosecurity obligation to: take all reasonable and practical steps to prevent or minimise each biosecurity risk. The steps proposed in this OAMP are above reasonable and practical steps required to control feral animals and weeds in central Queensland. Now that the Voluntary Declaration has been secured over the offset area, environmental laws prevent other land uses inconsistent with this OAMP being approved over this part of the property.
7. be efficient, effective, timely, transparent, scientifically robust and reasonable	The Bottle Tree offset area has been identified to be suitable using an evidence based and scientifically robust approach. The environmental outcomes to be achieved through this OAMP will be delivered progressively over 20 years. The offset area has been legally secured through a Voluntary Declaration under the VM Act, therefore any vegetation clearing contravention of this OAMP is not permissible without specific Queensland government approval. The preparation and implementation of this OAMP supports the efficient, effective, timely, transparent and scientifically robust approach to providing offsets.
8. have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	This OAMP includes a detailed monitoring program which will assess the effectiveness of the management actions undertaken and the progress of the offset area in achieving the environmental outcomes. The results of all management and monitoring programs will be included in annual reports (Section 8). An implementation schedule for monitoring and management is provided in Section 9 which will be reviewed at least annually to ensure the timely implementation of this OAMP.

3. Offset Values

The following sections provide a description of the offset area that will be managed as part of this OAMP for each MNES offset value. Figure 5 and Figure 6 presents the MNES offset areas on Bottle Tree.

3.1. Brigalow TEC

Brigalow TEC within the offset area comprises areas of remnant and mature regrowth RE 11.9.5 and 11.9.5a.

Extensive tracts of Brigalow-dominated open forest occur across most of the centre of the offset area. Significant patches of mature Brigalow occur within the central north of the offset area with some significant patches of Brigalow with bottle trees and SEVT. Areas of remnant and mature regrowth are in relatively good condition and meet the requirements for Brigalow TEC (as listed under the EPBC Act). Canopy cover is relatively closed, weed cover is negligible and abundant fallen timber is generally present. There are scattered shrubs, often of SEVT species. This habitat provides suitable foraging values for a variety of forest bird species that prefer a closed canopy. There is abundant shelter for ground fauna (particularly reptiles) in the form of fallen logs and low shrubs. Peeling bark is common in this habitat providing refuge for arboreal reptiles. The balance of Brigalow communities across much of the centre of the offset area are characterised by immature Brigalow regrowth. These communities have low disjunct canopies ranging from dense to very sparse, little to no shrub layer development and ground layers devoid of fallen woody material and litter being dominated by exotic grasses and bare earth. These areas currently provide little in the way of habitat for threatened species, with the possible exception of the ornamental snake in areas of cracking clays and gilgais and yakka skink where concentrated patches of fallen woody material may provide sufficient habitat for a colony to persist. The mature regrowth patches offer increased habitat values in comparison to the immature regrowth areas (Terrestria 2020).

3.2. Collared Delma

Habitat for collared delma within the offset area comprises areas of RE 11.3.2, 11.3.17, 11.9.4, 11.9.5, 11.9.5a, 11.10.3,11.10.4, and 11.10.7.

Collared delma is known to occur in REs on land zones 3, 9 and 10 including 11.3.2, 11.9.10, 11.10.1 and 11.10.4 all of which identified in the offset area (DCCEEW 2025b). The species appears to require rocks, timber, bark or other surface debris for shelter (DCCEEW 2025b). Riparian vegetation communities flanking Brown's creek were confirmed to be in good condition including the presence of fallen woody material and leaf litter providing suitable foraging and shelter habitat for the species. The patches of Brigalow and SEVT understorey along the escarpments also provides significant value in the form of potential shelter sites including areas comparing abundant fallen timber and thick leaf litter layer in addition to presence of large rocks and extensive rock crevice habitat.

3.3. Yakka Skink

Habitat for yakka skink within the Bottle Tree offset area consists of REs 11.3.2, 11.3.17, 11.9.5, 11.9.5a, 11.10.3, 11.10.4, 11.10.7 and extends across the majority of the property where Brigalow and Belah woodland and scrub vegetation is present.

The species is commonly found under partly buried rocks and logs or in abandoned animal burrows. The large well-connected expanses of remnant and mature regrowth vegetation along Brown's Creek and at the base of the Expedition Range provide good habitat. Older growth communities contain good structure in the form of developed shrub and ground layers and fallen timber and deep leaf litter. Fallen timber is abundant along Brown's Creek and fallen timber and rock crevices are abundant along the base of the expedition range, providing potential shelter (Terrestria 2020).

Discrete patches of Gum-top ironbark (*Eucalyptus decorticans*) woodland occur on the lower slopes of the Expedition range escarpment in the west of the offset area. These communities are in relatively good condition with large individual canopy trees with small hollows and some exfoliating bark (Terrestria 2020). Fallen woody material is common in this community and large boulders providing potential shelter opportunities.

3.4. Dunmall's Snake

Habitat for Dunmall's snake within the offset area comprises RE 11.3.2, 11.3.17, 11.9.5, 11.9.5a, 11.10.3, 11.10.4, and 11.10.7.

The species occurs in a variety of habitats including forests to woodlands (including *Eucalyptus*, *Acacia Callitris* spp.) on sandy soils, cracking clay soils with Brigalow scrub, and dry vine scrub (Terrestria 2020). Areas of remnant and mature regrowth REs on land zones 3, 9 and 10 are considered suitable foraging and shelter. Areas comprising abundant fallen timber, large rocks and extensive rock crevice habitat are located along the riparian vegetation communities flanking Brown's creek, and patches of Brigalow understorey along the Expedition range escarpment. These areas are all considered to provide significant foraging and shelter habitat for Dunmall's snake.

3.5. Red Goshawk

Habitat for red goshawk within the offset area comprise RE 11.3.2, 11.3.17, 11.3.25, 11.3.27, 11.9.4, 11.9.5, 11.9.5a ,11.10.4, 11.10.3 and 11.10.7.

Suitable habitat for red goshawk includes vegetation along and adjacent to the steep cliffs of the Expedition range combined with tall open forests of Brown's Creek and tall ironbark woodlands at the base of the escarpment. Red goshawk is a highly mobile species with a large home range. Breeding habitat is in intact tall forest associated with major drainage lines; however, the species may often forage much further away from these areas (DCCEEW 2025d).

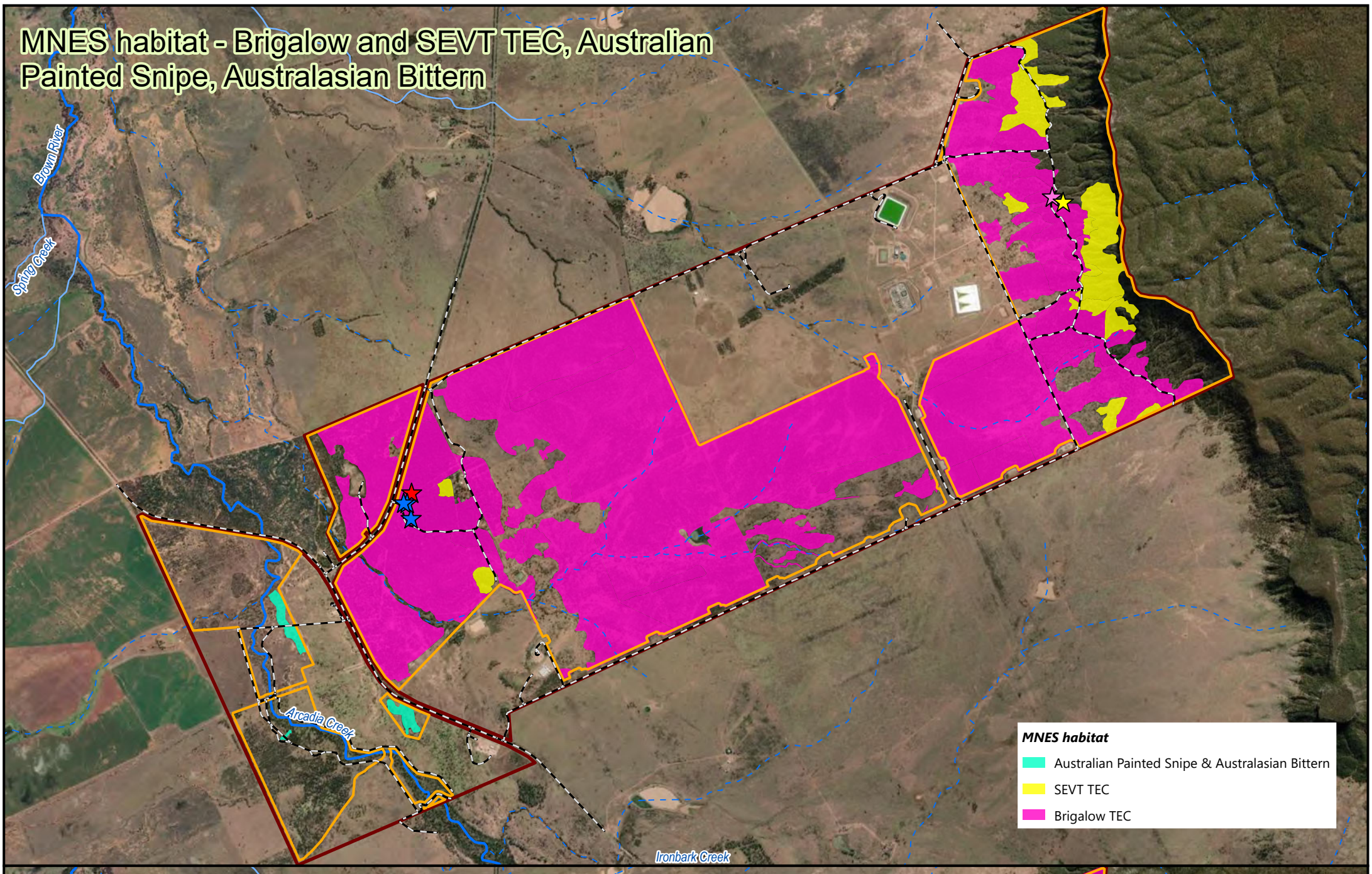
3.6. South-eastern Long-eared Bat

Habitat on the Bottle Tree offset area for south-eastern long-eared bat includes RE 11.3.2, 11.3.17, 11.3.25, 11.3.27, 11.9.4, 11.9.5, 11.9.5a, 11.10.3, 11.10.4, 11.10.7.

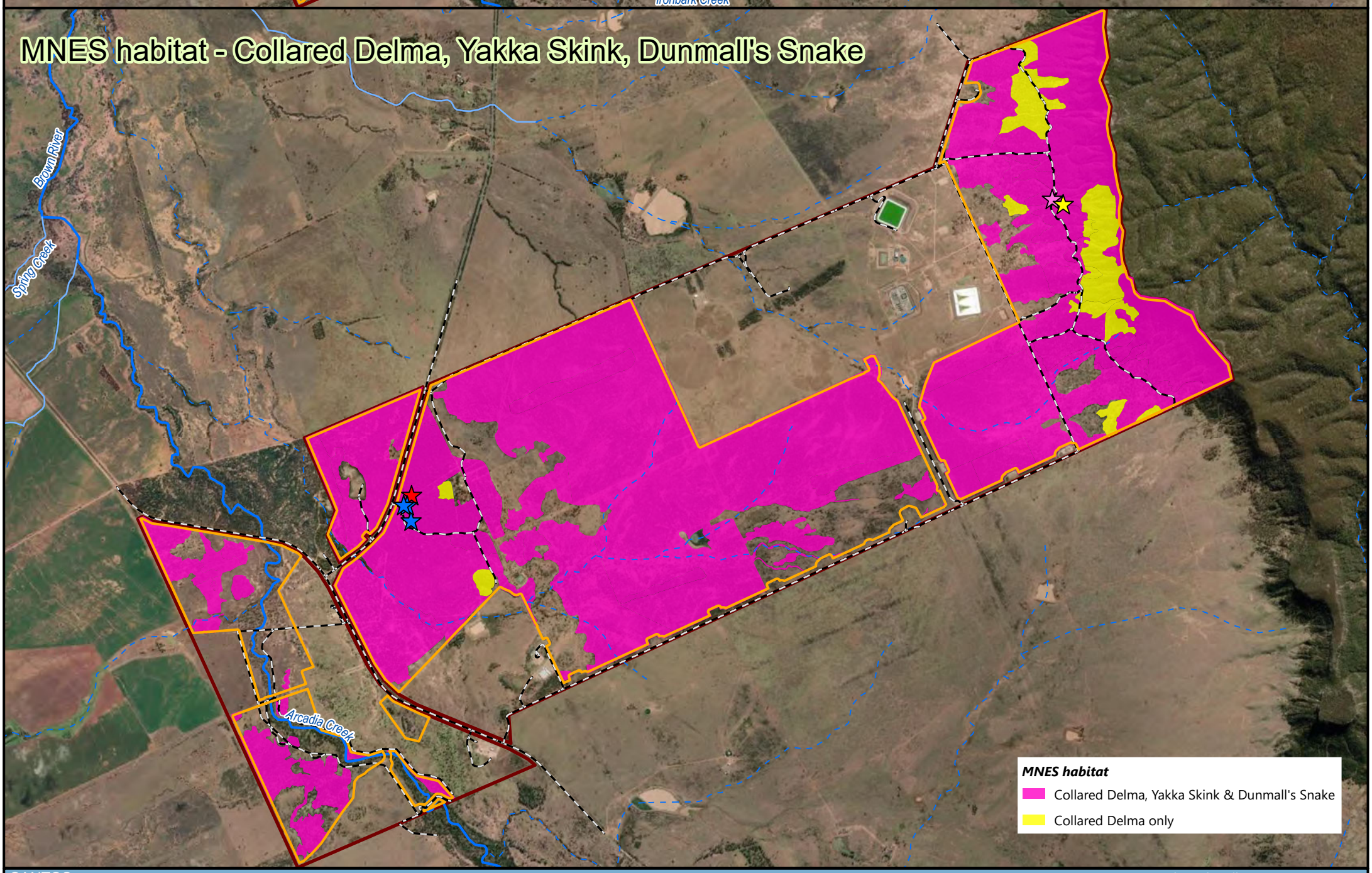
The species is known to occur in a variety of dry forest habitats including River Red Gum, open woodland, mallee, Brigalow and other arid and semi-arid habitats. The preferred habitat is mallee and *Callitris* woodlands (Pennay *et al.* 2011), and habitats that have a distinct canopy with a dense, cluttered understorey (Turbill and Ellis 2006). It roosts in tree hollows or under bark (New South Wales National Parks and Wildlife Service 2003). Surveys suggest the species requires large tracts of forest to occur (Turbill *et al*. 2008).

The majority of the offset area is considered to provide suitable foraging habitat comprising habitat with a patchy lower storey including *Callitris*. In eastern portion of the offset area comprises large well connect expanses of remnant and mature regrowth vegetation along Brown's creek and at the base of Expedition Range. Older growth communities contain good structure in the form of developed shrub and ground layers and fallen timber and deep leaf litter. Rock crevices and caves along the base and edge of the escarpment also provide roosting habitat for south-eastern long-eared bat. The Bottle Tree offset area is located adjacent to extended tracts of woodlands associated with the Expedition Range (Terrestria 2020).

MNES habitat - Brigalow and SEVT TEC, Australian Painted Snipe, Australasian Bittern



MNES habitat - Collared Delma, Yakka Skink, Dunmall's Snake



SANTOS

Location diagram

Figure 5
MNES habitat

- Bottle Tree
- Offset area boundary
- Property access tracks

Watercourse

- Major watercourse
- Minor drainage line
- Drainage contour

Threatened fauna record

- Large-eared pied bat
- Dunmall's snake
- Arcadia velvet gecko
- Golden-tailed gecko

N

0 1 2
Kilometres

Date: 3/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:52,500,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Bottle Tree\BottleTree_OAMP_mapping_20250502.aprx

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MNES habitat - South-eastern Long-eared Bat, Red Goshawk, Squatter Pigeon

Brown River
Spring Creek
Washpool Reserve
Arcadia Valley Road
Arcadia Creek
Ironbark Creek

MNES habitat
- South-eastern Long-eared Bat, Red Goshawk, Squatter Pigeon
- South-eastern Long-eared Bat, Red Goshawk only

MNES habitat - Ornamental Snake, Black-breasted Button-quail, Large-eared Pied Bat, Northern Quoll

Brown River
Spring Creek
Washpool Reserve
Arcadia Valley Road
Arcadia Creek

MNES habitat
- Ornamental Snake & Black-breasted Button-quail
- Ornamental Snake
- Black-breasted Button-quail
- Large-eared Pied Bat & Northern Quoll

SANTOS

Figure 6
MNES habitat

- Bottle Tree
- Offset area boundary
- Property access tracks

Watercourse
- Major watercourse
- Minor drainage line
- Drainage contour

Threatened fauna record
- Large-eared pied bat
- Dunmall's snake
- Arcadia velvet gecko
- Golden-tailed gecko

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 3/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:52,500,000@A3

Location diagram

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMP\s\Bottle Tree\Bottle Tree_OAMP_mapping_20250502.aprx

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4. Environmental Outcomes to be Achieved

The outcome of this OAMP will partially acquit the Stage 8 offset obligations for the GFD Project under EPBC 2012/6615 in accordance with the EPBC Act *Environmental Offsets Policy*.

The specific environmental outcomes to be achieved for the offset on Bottle Tree are defined as interim performance targets and completion criteria, detailed in Table 9, based on the proposed habitat quality score to be achieved for each MNES in the OAGs for Stage 8 under EPBC 2012/6615 (Santos 2025).

A summary of all the interim performance targets and completion criteria for the Bottle Tree offset area related to each of the MNES offset areas secured under EPBC 2008/4096, 2008/4059 and 2012/6615 is provided in Appendix D.

Table 9 – Interim performance targets and completion criteria for the Bottle Tree offset area for Stage 8 acquittal under EPBC 2012/6615

MNES	Baseline habitat quality score[1]	Interim performance targets			Completion criteria
		Year 5	Year 10	Year 15	Year 20
Threatened ecological communities					
Brigalow TEC (Moderate quality)	4	Increase in the habitat quality score from baseline score of 4. The anticipated improvement is expected to range between 4.5 and 5. Bioclimatic variables and their relevant influences in achieving this improvement will be discussed in the annual compliance report. Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports.	Increase in the habitat quality score from year 5. The anticipated improvement is expected to range between 5 and 5.5. Bioclimatic variables and their relevant influences in achieving this improvement will be discussed in the annual compliance report. Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports.	Increase in the habitat quality score from year 10. The anticipated improvement is expected to range between 5.5 and >6. Bioclimatic variables and their relevant influences in achieving this improvement will be discussed in the annual compliance report. Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports.	Improve the quality of habitat to achieve a score of at least 6 Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports. Areas of regrowth Brigalow TEC meet the requirement for remnant vegetation under the relevant Queensland legislation. Under the VM Act the following criteria would need to be met: • covering more than 50% of the undisturbed predominant canopy; and • averaging more than 70% of the vegetation's undisturbed height; and • composed of species characteristic of the vegetation's undisturbed predominant canopy.
Threatened fauna species					
Collared Delma	3	Increase in the habitat quality score from baseline score of 3	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 5
Yakka Skink	3	Increase in the habitat quality score from baseline score of 3	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 5
Dunmall's Snake	4	Increase in the habitat quality score from baseline score of 4	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 6
Red Goshawk	4	Increase in the habitat quality score from baseline score of 4	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 6
South-eastern Long-eared Bat	4	Increase in the habitat quality score from baseline score of 4	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 6

[1]Brigalow TEC offset area for 2008/4096 and 2012/6615 corresponds to moderate quality habitat.

5. Approach to Management

This OAMP is based on an adaptive management approach which involves 'flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood' (National Research Council 2004).

5.1. Adaptive management

Adaptive management includes two key phases:

- Establishment of the key components of a management framework including engaging stakeholders, developing clear and measurable objectives and performance criteria, identification and selection of potential management actions and the development of monitoring protocols which enable the evaluation of progress towards achieving objectives, and which will effectively contribute to the adaptive management decision making process.
- An iterative learning phase which involves utilisation of the management framework to learn about the natural resource system and iteratively adapt management strategies and approaches based on what is learned (Williams 2011).

The management of natural systems involves uncertainty which can affect the success of the management measures in achieving the objectives and performance criteria. Williams (2011) and Williams and Brown (2016) identify four kinds of uncertainty, outlined as follows, with how they have been addressed through the development of this OAMP:

- environmental variation:
  - caused by external factors that act upon natural systems, but which are not influenced by the resource conditions and dynamics, for example variation in rainfall or temperature,
  - largely outside of the control of the manager (Williams 2011), and
  - influence is considered in the analysis of the effectiveness of the adaptive management approach, the analysis of the ability to achieve and maintain performance criteria and when considering the need for corrective actions.
- partial observability:
  - includes potential uncertainty arising from variation in the collection of data during monitoring events, and from being unable to completely observe the natural system in its entirety (Williams and Brown 2016), and
  - addressed in this OAMP through the development of a monitoring program based on scientifically tested and repeatable methods.
- partial controllability:
  - relates to the difference between the intended effect of the management measures to be implemented through this OAMP and the actual effect of their implementation on the ground (Williams and Brown 2016), and
  - address through adherence to an adaptive management approach including regular monitoring of conformance with performance criteria, assessment of adaptive management triggers, the implementation of corrective actions, review and amendments to the OAMP, and reporting to ensure that management measures are being effectively implemented on the ground.
- structural and process uncertainty:
  - concerns a lack of knowledge or understanding regarding biological and ecological processes and relationships, and differing views regarding how natural systems respond to management (Williams and Brown 2016), and
  - addressed through the adaptive management approach. Following the results of ongoing management, monitoring and reporting, the OAMP will be reviewed and updated as required to incorporate learnings, updated conservation advice and best practice management techniques.

5.2. OAMP adaptive management framework

5.2.1. Risk assessment

The adaptive management process for this OAMP is supported by a risk assessment through which the known and potential risks for each offset value have been evaluated. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans etc) and identification of potential site-specific risks. As presented in Appendix C, the risk assessment included an assessment of the likelihood and consequence for each identified risk, both with and without the implementation of control strategies. The results of the risk assessment have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions.

Implementation of the adaptive management process aims to reduce the risk of the identified threats occurring to ensure that the overall outcome sought by this OAMP are achieved.

5.2.2. Adaptive management process

The adaptive management process for this OAMP includes the following key components:

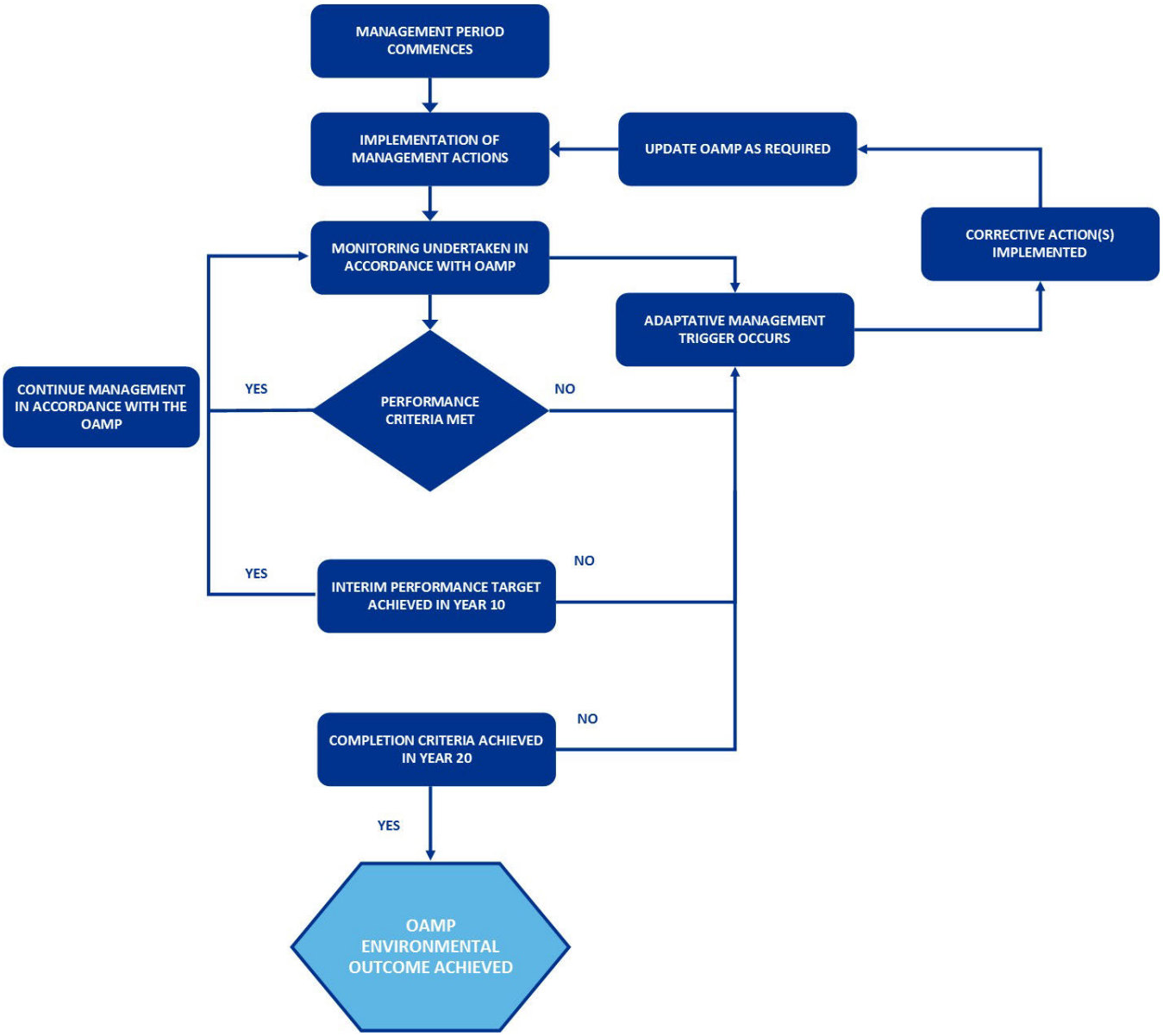
- **identified threats to offset values** – known and potential threats to the offset values have been identified as part of the risk assessment process
- **relevant offset values** – MNES or other offset matter for which the identified threat is relevant have been indicated
- **management objectives** – management objectives have been developed to address each identified threat to the offset values, and to ensure that the interim performance targets and completion criteria are attained
- **performance criteria** – assessable criteria have been defined to measure adherence to the management objectives
- **management actio**n – specific management actions have been identified to ensure that the performance criteria and management objectives are satisfied, and which will ultimately result in attainment of the interim performance targets and completion criteria
- **monitoring** – a combination of qualitative and quantitative methodologies has been included to assess whether management actions are meeting the performance criteria and management objectives, and ultimately, whether the OAMP is supporting the delivery of the interim performance targets and completion criteria
- **adaptive management trigger** – measurable events or parameters have been identified which, when triggered, indicate that a performance criterion has not been satisfied, instigating the implementation of contingency plans and corrective actions
- **corrective actions** – a two-step process has been established to identify the likely cause of the non-compliance with the performance criteria and allow for identification of suitable corrective actions. Corrective actions include the implementation of a feasible, appropriate and effective action to address the identified issue and ensure the performance criteria is satisfied.

Figure 7 illustrates the ongoing adaptive management cycle of implementation, learning and review, with the aim of achieving the interim performance targets and completion criteria. Through the implementation of this adaptive management process, it is anticipated that the interim performance targets and completion criteria will be attained and maintained for the life of the approval.

5.2.3. Timing for implementation of the OAMP

The offset area will be managed and monitored until the interim performance targets and completion criteria are achieved. It is anticipated that through the adaptive management approach, interim performance targets and completion criteria will be achieved within the proposed 20-year management period. However, if the interim performance targets and/or completion criteria for offset values have not been achieved within the anticipated timeframes, management and monitoring will continue beyond the 20-year management period in accordance with this OAMP until the completion criteria have been achieved. Once attained, completion criteria will be maintained for at least the life of the EPBC Act approval relevant to this OAMP.

Figure 7 – Process for implementation of the OAMP



5.2.4. Risk of offset failure

Based on the adaptive approach to management and the proposed management and monitoring program, it is considered that the management objectives, interim performance targets and completion criteria will be successfully achieved.

In the unlikely event that the interim performance targets are not achieved for one or more offset values by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions.

It should be noted that unavoidable temporary perturbations such as severe drought, or insect/fungal pest invasion that may cause a temporary decrease in metrics such as canopy or shrub cover from which the community still may recover within the next 5-year period should not preclude assessment of a satisfactory increase in ecological condition by the completion date.

If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements. The revised OAMP will be submitted to the Commonwealth Government.

6. Management Program

6.1. Management objectives

A summary of the management objectives and performance criteria for the offset area is presented in Table 10, and the complete adaptive management process for this OAMP is encapsulated in Table 12. The management measures provided in Table 11 take into account the information the relevant conservation advices, recovery plans and threat abatement plans for each MNES. Management actions, monitoring events, adaptive management triggers and corrective actions have been assigned to each management objective and performance criteria.

Table 10 – Summary of the management objectives and performance criteria

Management objectives	Performance criteria
Achieve the completion criteria including habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events so as to achieve the scores in the completion criteria. Achieve structural and floristic components for a vegetation community to be reclassified as remnant.
Maintain the extent of offset value habitat within the offset area	No unapproved and/or intentional clearing of habitat within the offset area, with the exception of clearing that is required for fencing, access, firebreaks and public safety as outlined in Table 13.
Ensure that the livestock grazing restrictions outlined in Section 6.2.5 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events.
	Biomass levels of 2,500 kilograms (kg)/ha are retained at each of the monitoring sites at the end of the dry season.
	Livestock are only observed to be grazing in the offset area during strategic grazing event/s.
Minimise predation risk by wild dogs to threatened fauna species.	Reduction in Catling* Index for wild dogs from year 1 and subsequent monitoring events.
Minimise predation risk by feral cats to threatened fauna species.	Reduction in Catling* Index for feral cats from year 1 and subsequent monitoring events.
Minimise predation risk by foxes to threatened fauna species.	Reduction in Catling* Index for foxes from year 1 and subsequent monitoring events.
Minimise degradation of offset value habitat by feral horses.	Reduction in the observed presence of feral horse on the property.
Minimise degradation of offset value habitat by feral pigs.	Reduction in mean feral pig abundance score from year 1 and subsequent monitoring events.
Manage invasive weed species to reduce degradation of offset value habitat.	A decrease in species richness and relative abundance of weed species at 80% of monitoring sites from year 1 and subsequent monitoring events. No new weed species are identified at any monitoring site (based on year 1 and subsequent monitoring data).

Management objectives	Performance criteria
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	No unplanned fire within the offset area Increase in habitat quality scores as a result of implementation of any fire management measures.
Regrowth Brigalow vegetation managed to meet the criteria for remnant status within the OAMP timeframe.	Regrowth Brigalow vegetation meets the criteria for remnant vegetation.
Achieve the interim performance targets and completion criteria for each offset value within 5, 10 and 20 years, respectively.	The interim performance targets are achieved for all offset values by year 5, 10 or 15. The completion criteria are achieved for all offset values by year 20.

* Catling index provides a measure of relative abundance of wild dogs, foxes and feral cats within the offset area. The Catling index will be measured as the percentage of camera nights in which the pest species was observed as part of fauna camera monitoring for the species, as outlined in Section 6.2.7.

Table 11 – Recovery actions for each MNES and their associated threats

MNES	Threats	Recovery/management actions
Threatened ecological communities		
Brigalow TEC	Threats to the TEC have been determined based on conservation advice and the Threat Abatement Plan (DCCEEW 2025a): • Clearing of regrowth vegetation. • Inappropriate fire regimes and management. • Pest plant infestation. • Potential knowledge gaps. • Increased grazing by livestock.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025a): • Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.5). • Exclusion of cattle from the offset area (see Section 6.2.4). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4).
Threatened fauna species		
Collared Delma (*Delma torquata*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025b): • Alteration of ground cover as a consequence of unsuitable fire regime. • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Predation by feral predators (e.g., cats, foxes, wild dogs). • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025b): • Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.5). • Biomass monitoring (see Section 7.2). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Exclusion of cattle from the offset area (see Section 6.2.4). • Weed management and monitoring (see Sections 6.2.6 and 7.3).

MNES	Threats	Recovery/management actions
Yakka Skink (*Egernia rugosa*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025c): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Destruction of potential shelter habitat associated with rabbit warren ripping. • Predation by feral predators (e.g., cats, foxes, pigs). • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Destruction of potential shelter habitat associated with rabbit warren ripping. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025c): • Exclusion of cattle from the offset area (see Section 6.2.4). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Weed management and monitoring (see Sections 6.2.6 and 7.3). • Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2). • Biomass monitoring (see Section 7.2).
Dunmall's snake (*Furina dunmalli*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025e): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Predation by feral predators (e.g., cats, foxes, pigs). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025e): • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Exclusion of cattle from the offset area (see Section 6.2.4). • Weed management and monitoring (see Sections 6.2.6 and 7.3). • Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2).

MNES	Threats	Recovery/management actions
Red Goshawk (*Erythrotriorchis radiatus*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025d): • Loss of suitable foraging habitat through land clearing and effects associated with fragmentation of large contiguous patches of forest and woodland, particularly large trees in alluvial valleys. • Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity. • Potential of reduced prey (e.g., medium sized birds) as a consequence of unsuitable fire regime.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025d): • Exclusion of cattle from the offset area (see Section 6.2.4). • Fuel hazard management and monitoring (see Section 6.2.5 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.5). • Biomass monitoring (see Section 7.2).
South-eastern long-eared bat (*Nyctophilus corbeni*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025f): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Alteration of the structure of suitable habitat (e.g. mix of shrubby and open structure habitat) including loss of hollow-bearing trees as a consequence of unsuitable fire regime. • Impacts on understorey habitat as a consequence of livestock grazing, impacting habitat for understorey invertebrate prey. • Competition for hollows from native fauna species (e.g., parrots and cockatoos) and non-native fauna species (e.g., European honeybees, common myna), especially where hollows are limited.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025f): • Exclusion of cattle from the offset area (see Section 6.2.4). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Weed management and monitoring (see Sections 6.2.6 and 7.3). • Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2). • Biomass monitoring (see Section 7.2).

Table 12 – Management objectives, performance criteria, adaptive management triggers and corrective actions

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
Achieve the completion criteria including habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events so as to achieve the scores in the completion criteria. Achieve structural and floristic components for a vegetation community to be reclassified as remnant.	Implementation of the management actions and adaptive management framework as outlined in this OAMP.	Repeatable, measurable BioCondition monitoring at fixed monitoring locations to calculate comparable Habitat Quality scores in accordance with GTDTHQ (version 1.2; DEHP 2017) over the lifetime of the OAMP.	Fixed transects were established and assessed as part of the baseline (see Figure 9). Transect locations were randomly stratified and are representative of offset values across vegetation communities and condition.	BioCondition assessments will be undertaken at each of the transects in year 1 and then every two years for the first six years, and then every three years thereafter.	Monitoring of offset value habitat quality scores and condition of habitat will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Rapid monitoring events (Section 7.5.1). • Habitat quality assessments to determine habitat quality scores (Section 7.5.2). • Targeted fauna surveys (Section 7.5.4). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime to better support enhancement of offset values. • For offset values that have not achieved interim performance targets by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions. • If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the offsets assessment guide. The revised OAMP will be submitted to the Commonwealth Government.
Maintain the extent of offset value habitat within the offset area.	No unapproved and/or intentional clearing of habitat within the offset area, with the exception of clearing that is required for fencing, access, firebreaks and public safety as outlined in Table 13.	Protection of the offset area via a Voluntary Declaration under section 19E and 19F of the VMA, as described in Section 2.9.	The offset area will be legally protected from unapproved vegetation clearing activities through compliance with the Voluntary Declaration under Section 19E and 19F of the VM Act, and declared an area of high nature conservation value. See Section 2.9.	The entirety of the offset area is subject to the conditions of the Voluntary Declaration under the VM Act.	Restrictions outlined in Table 13 will be implemented for the lifetime of the project and OAMP.	Reporting to the Commonwealth Government consistent with EPBC approval. Offset area inspections will be undertaken twice per year for the duration of the management period and will report on any major or noticeable changes to the extent of offset value habitat.	Any activities in contravention of the Voluntary Declaration and this OAMP.	**Step 1: Investigate cause of trigger** • Investigate reasons why unapproved clearing occurred e.g. unauthorised access. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Addition fencing, signage and/or security for the offset area. • Restoration of the impacted area.
		Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in	Compliance with restrictions for vegetation clearing associated with maintenance and establishment of				Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with	**Step 1: Investigate cause of trigger** • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately.

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
		accordance with Sections 6.2.2, 6.2.4 and 6.2.5. In the event that vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be planned, recorded and monitored.	access tracks, fencing and firebreaks will also be assessed as part of offset area inspections (Section 7.1).				the restrictions outlined in Section 6.2.	• Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.
Ensure that the livestock grazing restrictions outlined in Section 6.2.5 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events.	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses and promote the establishment of native perennial grass species in accordance with Section 6.2.5.	Best practice management for strategic livestock grazing within the offset area will be undertaken as follows: • livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover, and • within the offset area a minimum of 2,500 kg/ha of biomass will be retained at the end of the dry season. See Section 6.2.5. for more detail.	The precise location of strategic livestock grazing will occur at the discretion of the landholder and/or property manager of whom is responsible for cattle management.	Strategic livestock grazing effort (i.e. the number of cattle and their exposed time to an area) will be managed at the discretion of the landholder and/or property manager of whom is responsible for cattle management.	Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.5.1 and 7.5.2. These will include assessment of % cover of native perennial grasses.	Decrease in the richness and average % cover of native perennial grasses at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: – Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. – Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime. – Installing additional watering points for livestock to manage livestock in accordance with the grazing regime.
	Biomass levels of 2,500 kg/ha are retained at each of the monitoring sites at the end of the dry season.	Implementation of a strategic grazing regime to protect and maintain environmental values in accordance with Section 6.2.5.				Biomass monitoring will be undertaken in accordance with Section 7.2.	Biomass monitoring results indicate less than 2,500 kg/ha of biomass is present at any of the monitoring sites at the end of the dry season.	**Step 1: Investigate cause of trigger** • Investigate the reason for biomass being less than 2,500 kg/ha. • Re-evaluate the strategic grazing regime to assess the suitability of grazing to ensure no less than an average of 2,500 kg/ha of biomass is retained at the end of the dry season. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Removal of stock or spelling grazing from the area of the offset in which less than 2,500 kg/ha of biomass was identified. • Review adherence to livestock grazing restrictions in Section 6.2.5. • Where relevant, amending livestock management practices in the OAMP, including amending stocking rates, and/or duration and/or frequency of strategic grazing events.

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
Minimise predation risk by wild dogs to threatened fauna species.	Reduction in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	Implement control actions for wild dogs in accordance with Section 6.2.7.	• Ground baiting • Foot hold traps • Shooting	The requirement for and location of pest animal management will be strategically and safely designed, informed by pest animal monitoring results.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results.	Undertake monitoring for wild dogs in accordance with Section 7.4.	An increase in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in the: – Catling* index for wild dogs, feral cats and/or foxes – relative abundance of feral pigs and horses. • Review adherence to pest management control measures as outlined in Section 6.2.7. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency and intensity of pest animal control. • Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the OAMP and targeted pest animal control programs.
Minimise predation risk by feral cats to threatened fauna species.	Reduction in Catling* Index for feral cats from year 1 and subsequent monitoring events.	Implement control actions for feral cats in accordance with Section 6.2.7.	• Ground baiting • Trapping • Shooting			Undertake monitoring for feral cats in accordance with Section 7.4.	An increase in Catling* Index for feral cats from year 1 and subsequent monitoring events.	
Minimise predation risk by foxes to threatened fauna species.	Reduction in Catling* Index for foxes from year 1 and subsequent monitoring events.	Implement control actions for foxes in accordance with Section 6.2.7.	• Night shooting • Poisoning • Trapping			Undertake monitoring for foxes in accordance with Section 7.4.	An increase in Catling* Index for foxes from year 1 and subsequent monitoring events.	
Minimise degradation of offset value habitat by feral horses.	Reduction in the observed presence of feral horse on the property.	Implement control actions for feral horses in accordance with Section 6.2.7.	Relocation through mustering or trapping.			Undertake monitoring for feral horses in accordance with Section 7.4.	An increase in the observed presence of feral horses across monitoring events.	
Minimise degradation of offset value habitat by feral pigs.	Reduction in mean feral pig abundance score from year 1 and subsequent monitoring events.	Implement control actions for feral pigs in accordance with Section 6.2.7.	• Trapping • Shooting • Poisoning			Undertake monitoring for feral pigs in accordance with Section 7.4.	An increase in mean feral pig abundance score from year 1 and subsequent monitoring events.	
Manage invasive weed species to reduce degradation of offset value habitat.	A decrease in species richness and relative abundance of weed species at 80% of monitoring sites from year 1 and subsequent monitoring events. No new weed species are identified at any monitoring site (based on year 1 and subsequent monitoring data).	Implement weed control actions in accordance with Section 6.2.6. Adhere to weed hygiene restrictions in accordance with Section 6.2.1.	Weed treatment methods will be suitable to the target weed species and may include biological, chemical, or mechanical control. See Section 6.2.6 for more detail.	The results of weed monitoring activities will inform the location for weed treatment and control.	Weed treatment and control will be undertaken at optimal timing according to the lifecycle of the target species, i.e. before seeding.	Undertake weed monitoring in accordance with Section 7.3.	An increase in species richness and relative abundance of weed species at more than 20% of monitoring sites from year 1 and subsequent monitoring events. A new weed species is identified at one or more monitoring sites.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds. • Investigate potential sources or reasons for the occurrence of the new weed species. • Review adherence to weed management control measures as outlined in Section 6.2.6. • Review adherence to weed hygiene restrictions as outlined in Section 6.2.1. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Amending weed hygiene restrictions. • Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to. • Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld). • Increasing the frequency and intensity of weed control. • Updating weed control methods in the OAMP and targeted weed control programs.

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	No unplanned fire within the offset area Increase in habitat quality scores as a result of implementation of any fire management measures.	All fire management measures to be implemented in accordance with the program outlined in Section 6.2.5.	Monitor and control fuel loads, where required. Fuel loads will be managed through implementation of the following: • maintained fire breaks, • controlled grazing regimes; and, • fuel hazard reduction burns. All management methods will be undertaken in compliance with Section 6.2.5.	Fuel load management will be carried out where safe and practicable. Precise location will be determined in collaboration with the landholder and a suitability qualified ecologist.	If deemed necessary, fuel load management will be carried out when required during suitable climatic conditions.	Habitat quality assessments to determine habitat quality scores will be undertaken in accordance with Section 7.5.2. Rapid monitoring events will be undertaken to assess the general condition of vegetation in accordance with Section 7.5.1.	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores. • Review adherence to the fire management measures as outlined in Section 6.2.5. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass monitoring. • Increasing the frequency of weed control measures. • Amending the strategic grazing regime. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks. • Review timing and intensity of fuel hazard reduction burns in accordance with the Regional Ecosystem Description Database (REDD) fire management guidelines and conservation advice for the particular offset value.
Regrowth Brigalow vegetation managed to meet the criteria for remnant status within the OAMP timeframe.	Regrowth Brigalow vegetation meets the criteria for remnant vegetation.	Selective regrowth thinning of Brigalow TEC where regrowth of Brigalow vegetation (RE 11.9.5) occurs at >10,000 stems per hectare in accordance with Section 6.2.3.	It is recommended that Brigalow be selectively thinned when stem densities are very high (e.g. >10,000 stems per hectare). To be effective, thinning has to utilise methods that cause slow stem death (e.g. ringbarking, selective herbicide application) and reduce secondary suckering (these are time and labour-intensive (Peeters and Butler 2014; Dwyer and Mason 2017). See Section 6.2.3.	Within areas of regrowth Brigalow TEC.	If deemed necessary based on the results of ongoing monitoring events.	Habitat quality assessments (Section 7.5.2). Brigalow regrowth assessment (Section 7.5.5).	Brigalow regrowth exceeds 10,000 stems per hectare based on previous monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reasons why stem density is >10,000 stems/ha and whether management intervention is required. • Mechanical thinning is effective and appropriate. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency thinning activities. • Revise the type of thinning method used.

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
Achieve the interim performance targets and completion criteria for each offset value within 5, 10, 15 and 20 years, respectively.	The interim performance targets are achieved for all offset values by year 5, 10 or 15. The completion criteria are achieved for all offset values by year 20.	All management actions outlined in Section 6 will be implemented to ensure that the interim performance targets and completion criteria are achieved.	All management control actions detailed in Section 6 will be implemented where necessary and practicable.	Management methods and actions will take place where required within the Offset area.	Management methods and actions will occur during seasonally suitable timing, in collaboration with the landholder and contractor undertaking the scope of work.	Monitoring of the offset area will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Offset value assessments (Section 7.5). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values.

6.2. Management actions

6.2.1. General restrictions

Table 13 details the restrictions to be implemented for the offset area to ensure the completion criteria and management objectives are met.

Table 13 – Offset area restrictions

Restrictions	Details
Weed hygiene	• Weed hygiene measures will be implemented to prevent the movement of weed material into the offset area. • All persons entering the offset area will be required to ensure vehicles and equipment are weed free. • All contractors entering the offset area must hold a current weed hygiene certificate or equivalent for all vehicles and equipment. • Evidence is to be provided on request to the landowner and Santos environmental advisors that vehicles, slashers or any machinery implementing management actions are clean prior to entry to minimise potential weed spread.
Vehicles	• Vehicle movement will be limited to designated access tracks in the offset area and access will be restricted to authorised personnel only. • Vehicles will travel to track conditions to minimise the risk of vehicle strike to fauna.
Vegetation clearing	• Clearing will be excluded from the offset area through demarcation and protection by means of Voluntary Declaration under the VM Act. Clearing for timber gathering and development will also be excluded. • Clearing of native vegetation will not be permitted within the offset area as part of any management and monitoring activities associated with this OAMP, except for clearing that is required for: – maintenance of access tracks and/or fire breaks, – fence construction and maintenance, and – ensuring public safety or as directed by emergency management response personnel in the event of unplanned fire or other emergency or associated procedure. • If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be appropriately planned, recorded and monitored. • Machinery will not be allowed on site after heavy or prolonged rainfall events until after the site has dried to allow for safe movement of traffic.
Unauthorised access or use	• Access into the offset area will be restricted to authorised personnel only. • The offset area will be demarcated as an exclusion zone in the Santos GIS. • Signs will be installed in prominent locations (i.e. at access points into the offset area) which recognise that the areas are protected for conservation purposes. The signs will advise that access into the offset area is restricted to authorised personnel only. • The property will be suitably fenced to restrict access by unauthorised persons. • At no time can persons access the site without first approaching the Land Advisor of the Bottle Tree property and informing them of their intent. • When entering and leaving the property, the Land Advisor must be advised. • Contractors will only be permitted to access the property following the direct engagement by Santos.

6.2.2. Access tracks

Existing access tracks will be utilised to facilitate necessary management, maintenance and monitoring activities as part of this OAMP. If existing access tracks become impassable (through erosion or vegetation regrowth), maintenance activities of these tracks (e.g. grading) will be prioritised over alternative track alignments. Gully crossings are likely to be subject to periodic, ongoing maintenance because of erosion following rain events.

Existing and new access tracks will be no wider than 5 m and vegetation disturbance will be minimised.

6.2.3. Brigalow regrowth restoration

The dominant vegetation community on Bottle Tree consists of regrowth Brigalow with exotic pasture (predominately Buffel grass) understory.

Through the implementation of this OAMP these areas will be restored to establish self-sustaining functional remnant vegetation communities analogous to Brigalow TEC. Regrowth Brigalow within the offset area has been mapped as mature regrowth and immature regrowth, as previously described in Section 3.1. To achieve remnant status the areas of regrowth Brigalow need to demonstrate that the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

Thinning randomly selected stems of the dominant species in a Brigalow regrowth community has been found to accelerate:

- growth of retained stems
- recovery of forest structure
- recruitment of some native shrub species (Dwyer and Mason 2017).

Selective regrowth thinning will occur where regrowth of Brigalow vegetation (RE 11.9.5) occurs at >10,000 stems per hectare and the density of stems is considered to be affecting the sites capacity to return to remnant status.

It is recommended that Brigalow be selectively thinned when stem densities are very high (e.g. >10,000 stems per hectare). To be effective, thinning has to utilise methods that cause slow stem death (e.g. ringbarking, selective herbicide application) and reduce secondary suckering (these are time and labour-intensive (Peeters and Butler 2014; Dwyer and Mason 2017).

Where thinning does occur, the vegetation must not be thinned less than the density of a benchmark site for equivalent community. Benchmark sites will be obtained from the Queensland Government database or from nearby remnant vegetation of the same community.

The requirement for management by mechanical thinning will be informed by monitoring events (see Section 7.5.5).

6.2.4. Fencing

To assist with management of livestock control for weed and fuel load management and exclusion of livestock from specific areas of the offset, fencing will be installed as presented in Figure 8. Fencing will be installed to manage livestock access to the wetland and riparian area on the western side of the Bottle Tree offset area. Existing fencing is located around the boundary of the Ooline and *Xerothamnella herbacea* offset areas to exclude stock at all times.

Fencing will comprise of a 4-wire fence consisting of 3 strand 1.57HT barb with a plain high tensile wire at the top, wood and/or steel posts at 7 m spacing, a strainer post every 100 m and 1 gate located every 1 km. This type of fencing is also considered appropriate to facilitate the fauna movement across the property. Importantly, the movement of the species being offset will not be impeded by the proposed fencing design.

Any vegetation disturbance associated with new fence construction will be minimised in accordance with Table 13.

Regular inspections of all fencing will be undertaken in accordance with Section 7.1, and repairs to the fences will be made as required.

148°46'0"E
148°48'0"E
148°50'0"E
148°52'0"E
25°8'0"S
25°10'0"S
25°12'0"S
25°14'0"S
Blackfellow Creek
ARCADIA VALLEY ROAD
Ironbark Creek
Arcadia Creek
Station Creek

SANTOS

Figure 8
Property Infrastructure

Bottle Tree
Offset area
Major road
Property access tracks
Fence

Watercourse
Major watercourse
Minor drainage line
Drainage contour

Dam

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 3/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:42,000@A3

Location diagram

Queensland
Brisbane

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GIS\Data\Projects\Santos\20250416_Roma_Stage8_OAMPs\Bottle Tree\BottleTree_OAMP_mapping_20250502.aprx

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6.2.5. Fire management

A planned and co-ordinated fire management strategy will be implemented to:

- minimise the risk and impacts of unplanned fire especially to fire sensitive Brigalow and SEVT TECs, and
- improve habitat quality through:
  - controlling weeds, biomass levels and fuel loads
  - supporting development of structural components of habitat for offset values (e.g. recruitment of native plants, establishment of fire sensitive native herbs and groundcover, important microhabitat including fallen logs and leaf litter, and increased understorey)
  - promoting germination and recruitment of Eucalypt species and other species characteristic of the specific RE.

Unplanned fire risk will be managed through:

- establishment and regular maintenance of firebreaks (Figure 8)
- monitoring and managing fuel loads primarily through the implementation of a controlled grazing regime (Section 6.2.5)
- fuel hazard reduction burns (if required; Section 6.2.5).

Firebreaks will be established and maintained around the boundary of the offset area, with green firebreaks established where the offset area joins native vegetation, see Figure 8. Firebreaks will be maintained at least annually in mid / late autumn and, or early spring to remove overhanging trees or fallen debris and dense vegetation. Firebreak maintenance will be undertaken to a width of up to 10 m.

Strategic grazing

The Bottle Tree property has in the past been managed as an open grazing enterprise where the focus has been on production and sustaining a viable income from domestic stock.

Strategic grazing within the offset area will be used to manage fuel loads and control exotic weeds and pasture grasses such as *Cenchrus ciliaris*. As increasing grazing intensity is correlated with an increase in weedy cover (Franks 2002), and a decrease in native grass species richness, grazing will be permitted in the offset area on a managed and limited basis to control weeds and reduce fuel loads.

Best practice management for strategic livestock grazing within the Bottle Tree offset area will be undertaken as follows:

- Livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover.
- Within the offset area a minimum of 2,500 kg/ha of biomass will be retained at the end of the dry season.
- Additional fencing will be installed to manage livestock access to the riparian and wetland areas (RE 11.3.27) on the western side of the offset area (Figure 8).
- Livestock will be excluded at all times from the Ooline and *Xerothamnella herbacea* offset areas (Figure 2 and Figure 8).

To minimise erosion and subsequent impacts on water quality, strategic grazing will be excluded where rainfall causes inundated or waterlogged soils. The location and extent of grazing exclusion areas will be reviewed annually based on the results of management and monitoring events.

The suitability of conditions for undertaking a grazing event will be informed by biomass monitoring events as described in Section 7.2.

Fuel hazard reduction burns

The aim of fuel hazard reduction burns is to manage excess fuel loads, to initiate regeneration of Eucalypt communities and to create habitat with a mosaic of different fire frequencies and times since fire.

Fire management, through fuel hazard reductions burns will be guided by conservation advice documentation (e.g. for MNES) and the REDD (Queensland Herbarium 2024), which provides recommendations for fire management for each of the component RE (Table 14), guidelines published in the *Fire & Biodiversity Monitoring Manual* published by Southeast Queensland Fire and Biodiversity Consortium (2002), local regional fire plans, regional fire authorities and local knowledge of fire behaviour.

Based on this advice, fire is to be excluded from areas of Brigalow TEC and SEVT TEC in the offset area. To reduce the risk of fire occurring within Brigalow TEC and SEVT TEC in the offset area, very cool fuel hazard reduction burns (trickle burns) in a rotational mosaic pattern may be conducted in adjacent areas.

Hazard reduction burns will be considered if fuel hazard ratings within the offset area are unable to be maintained below extreme in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines *et al.* 2010; Appendix E) through the implementation of strategic grazing and weed control. However, the location and timing for fuel hazard reduction burns will be informed by the results of biomass monitoring (Section 7.2) and fuel load monitoring (Section 7.2.2) in conjunction with the results of habitat quality assessments and considering the REDD fire management guidelines for the vegetation community and MNES conservation advices.

In general, fire management will be undertaken in a mosaic pattern at the appropriate time of year when there is:

- high soil and fuel moisture levels, ideally following minimum of 40 mm of rainfall
- low ambient temperature and wind speed
- high atmospheric humidity
- low risk of long-term impacts/high intensity fire, and/or when plants approach a more active growing phase.

Table 14 – Fire management guidelines for each component RE

RE	Associated TEC	Fire Exclusion?	Fire Management
11.10.3	-	Yes	• Protection from fire is necessary. • Maintain fire management of surrounding country with numerous small fires throughout the year so that fires will be very limited in extent. • There is typically not enough ground vegetation within this RE to carry a fire.
11.10.4	-	No	• Maintain fire management of surrounding country. • Burn surrounding country only under conditions of good soil moisture and when plants are actively growing. • This RE is likely to be difficult to burn owing to a lack of ground fuel that normally occurs in this RE.
11.10.7	-	No	• Conduct a moderate to high burn every 6-10 years. • Timing for burning should be during late wet to early dry season when there is good soil moisture, early storm season or after good spring rains. • Burn less than 10-30% of the area in any year. • Burn surrounding vegetation under conditions of good soil moisture and when plants are actively growing throughout the year so that fires will be very limited in extent. • Best protection from fire is through the creation of a multi-aged mosaic in surrounding vegetation and perimeter burning.
11.3.2	Poplar Box TEC	No	• Conduct a low to moderate burn every 6-10 years. • Timing for burning should be late wet to early dry season when there is good soil moisture, early storm season or after good spring rains. • Burn less than 30% of the area in any year. • Burn under conditions of good soil moisture and when plants are actively growing. Sometimes a small amount of wind may move the fire front quickly so that burn intensity is not too severe to destroy habitat trees. • Management of this vegetation type will be based on maintaining vegetation composition, structural diversity, fauna habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfire by: – maintaining a fire mosaic, – control invasive shrubs, – low to moderate intensity burns with good soil moisture to minimise loss of hollow trees, and – avoiding riparian communities where appropriate.
11.3.17	-	No	• Conduct a burn every 6-10 years, avoiding hottest and driest time of the year. • Burn less than 10% of the area in any year.

RE	Associated TEC	Fire Exclusion?	Fire Management
			• Burn in association with fire management of surrounding vegetation. • Protection of this RE also relies on broad-scale management of surrounding country with numerous small fires throughout the year so that fires will be very limited in extent. • Low intensity fires with good soil moisture will be useful in reducing fuel loads and fire spread in later fires. Moderate fires may assist in regeneration of hard-seeded spp. • Best protection from wildfires is probably the creation of a multi-aged mosaic and perimeter burning.
11.3.25	-	No	• Conduct a low intensity burn every 3-5 years primarily during the early dry season. • Protection of this RE also relies on fire management of adjacent vegetation communities with numerous small fires throughout the year so that wildfires will be limited in extent. • In some situations it may be best not to burn as this RE is often critical habitat for fauna and flora species. • If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants. • If riparian areas need to be burnt to reduce fuel loads then burning should occur when there is good soil moisture and active growth.
11.3.27	-	No	• Depending on position in the landscape, protection of this RE relies on broad-scale fire management of surrounding country, with numerous small fires throughout the year so that wildfires will be very limited in extent. • In some situations it may be best not to burn as this RE is often critical habitat for fauna and flora species. • If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants. • If riparian areas need to be burnt to reduce fuel loads then burning should occur when there is good soil moisture and active growth.
11.9.4	SEVT TEC	Yes	• Protection from fire is necessary. • Maintain fire management of surrounding country with numerous small fires throughout the year so that fires will be very limited in extent. • Maintenance of fire breaks may be appropriate on flat country, but natural features will be useful as breaks in 'wild' country. • Fuel reduction in the surrounding vegetation under low fire danger conditions and/or revegetation of cleared areas reduce the risk of damaging wildfires. • Maintain or re-establish native vegetation communities adjacent to this ecosystem. Grazing may be useful in managing fuel loads created by introduced grasses such as buffel.

RE	Associated TEC	Fire Exclusion?	Fire Management
11.9.5 and 11.9.5a	Brigalow TEC	Yes	• Protection from fire is necessary. • High intensity fires will cause damage to overstorey. • Maintain fire management of surrounding country so that any fires will be very limited in extent. Frequent fire at the edge of this community keeps fuel loads low. • The invasion of exotic grasses such as buffel grass increases the risk from fire. Grazing may be an option for reducing fuel loads in Brigalow TEC.

6.2.6. Weed management

Weed management in the offset area will aim to minimise the introduction, establishment and spread of restricted and prohibited pest plants under the *Biosecurity Act 2014* (Qld) and other invasive species, that present a threat to vegetation communities and species habitat in the offset area. Weed management will focus on reducing the extent of the existing weeds as well as minimising the risk of introduction of additional weed species to the offset areas:

Detailed ecological assessments of the Bottle Tree property (Section 2.5) identified a small number of *Opuntia spp*. (*Opuntia stricta* [Prickly pear], *Opuntia tomentosa* [Tree Pear], *Opuntia aurantiaca* [Tiger Pear]); however, the species/populations were deemed to cause no measurable threat to the site or management objectives. In addition, it was noted that the existing biological control measures for the Opuntia spp. were quite effective and that little, if any, further management of these species would be required (Boobook 2015).

Parthenium (*Parthenium hysterophorus*) presents a high potential for introduction to the property, due to its presence in the surrounding region (known to occur in the southern arcadia valley) and ability to disperse.

Reductions in the extent of buffel grass and parthenium are most effectively achieved by maximising the competitive advantage of native ground cover species. This requires native species richness and abundance to be maximised. In historically grazed environments the most effective way to ensure high species richness is through conservatively managed cattle grazing (Fensham 1998). Conservative cattle grazing requires maintenance of enough biomass to maximise grass growth and appropriate spelling to allow for native species to set seed.

Accordingly, a strategic grazing regime will be implemented to reduce the presence and biomass of exotic pasture grasses in the offset areas (refer to Section 6.2.5). To supplement this, weeds will be managed using biological, chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets, for the relevant weed species.

Biological control measures will continue to be used to manage Opuntia spp.; however, the species will not be completely eradicated from the Bottle Tree property. For the biological control measures currently in place to remain effective, a small number of plants are required to remain on site.

6.2.7. Pest animal management

Pest animals present or have the potential to occur on or within the immediate vicinity of the Bottle tree property and pose the following threats:

- Predation of fauna by foxes, cats and wild dogs.
- Erosion and degradation of habitat and competition by pigs and feral horses.

Pest animal control activities will be undertaken to minimise the introduction of pest animals and control existing pest animal populations in accordance with the *Biosecurity Act*. Table 15 provides examples of approved species-specific pest animal control measures recommended by the Queensland and Commonwealth governments. Results of pest animal assessments will be reviewed following each reporting event to inform the need for, location and timing of species-specific control measures in subsequent years.

Table 15 – Examples of species-specific control methods for pest animal species

Species	Status under *Biosecurity Act 2014*	Example control method	Reference
Wild dog (*Canis familiaris*)	Category 3,4,6	• Ground baiting • Foot hold traps • Shooting	(DAF 2024a)
Fox (*Vulpes vulpes*)	Category 3,4,5,6	• Ground baiting • Trapping • Shooting	(DAF 2024b)
Feral cat (*Felis catus*)	Category 3,4,6	• Night shooting • Poisoning • Trapping	(DAF 2023a)

Species	Status under *Biosecurity Act 2014*	Example control method	Reference
Pig (*Sus scrofa*)	Category 3,4,6	• Trapping • Shooting • Poisoning	(DAF 2023b)
Feral horse (*Equus caballus*)	-	Relocation through mustering or trapping	(DAF 2022)

7. Monitoring

The results of the monitoring program outlined in the following sections will be used to inform operational management decisions, including adaptive implementation of this OAMP to ensure the performance criteria and management objectives, and ultimately interim performance targets and completion criteria are met.

The monitoring results will also be used to assess adherence to performance criteria, and to determine when corrective actions are required to be implemented. The results will also be compared to those from previous monitoring events to assess change over time and to inform the ongoing implementation of the OAMP.

7.1. Offset area inspections

The aim of offset area inspections is to enable a general assessment of the offset area to identify any potential issues that may require remedial action to be undertaken. Inspections will be undertaken twice per year for the duration of the management period to assess the following:

- condition of fencing, gates and signs and existing gas field infrastructure
- condition of access tracks
- condition of firebreaks
- compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks
- incidence of erosion within offset area, particularly around permanent and semi-permanent water bodies or areas subject to inundation or waterlogging
- damage/degradation resulting from pest animal activity within the offset area
- signs of land degradation and over-grazing
- presence of weed/invasive species
- exclusion of livestock
- incidental fauna observations and any additional risks to offset values (i.e. evidence of vehicle strike)
- within Brigalow regrowth, observations for excessive regrowth Brigalow that may require thinning.

7.2. Biomass monitoring

Biomass monitoring for fire management will be undertaken twice a year, at the end of the wet season and end of the dry season, to:

- determine the risk of fire to the offset site
- inform fire management strategies to control fuel loads.

Biomass is at its greatest at the end of the wet season (April) with fire risk greatest towards the end of the dry season (October). Biomass will be monitored within the offset areas using appropriate photo standards which will be used to determine dry matter yields and subsequently fuel loads. Biomass monitoring will be undertaken at the same permanent weed monitoring sites established as part of the year 1 monitoring.

Fuel loads will be managed through strategic grazing events (see Section 6.2.5) if the biomass assessment at the end of the wet season shows that biomass is greater than 2,500 kg/ha within the offset area.

The stocking rate of these strategic grazing events will be determined through a feed budgeting assessment (see Section 7.2.1) undertaken prior to a grazing event in the offset area. A feed budgeting assessment is a recognised method of determining the stocking rate based on the amount of feed available and the amount of feed desired at the end of the grazing event (i.e. >2,500 kg/ha).

7.2.1. Feed budgeting assessment

The process for undertaking a feed budget assessment will include the following sequence of activities:

- Determine the current amount of feed present (kg/ha) using appropriate photo standards available on the Future Beef website[1].
- Determine the amount of feed desired (kg/ha) at the end of the grazing event.
- Calculate the total useable feed (kg/ha) by subtracting the feed desired from the feed present.
- Determine utilisation (i.e. the proportion of useable feed that livestock can use).
- Determine the feed available for the grazing animal (kg/ha) by multiplying the total useable feed by the utilisation rate.
- Calculate the safe stocking rate by:
  - determining the feed consumption per day (kg/day),
  - determining the number of days feed is required (days),
  - calculating the feed requirement per head (kg/hd) by multiplying the feed consumption per day by the number of days,
  - calculating the stocking rate (ha/hd) by dividing the feed requirement per head by feed available, and
  - calculate the number of stock (head) by dividing the area of the paddock by the stocking rate.

The amount of feed available prior to the grazing event will be estimated using the appropriate photo standards available on the Future Beef website. The “Dry Season Feed Budget” worksheet will then be used to calculate the required stocking rate for the grazing event.

At the completion of the grazing event, photo standards will be used to assess ground cover and ecosystem biomass. Should the grazing event be required to be extended (e.g. as a result of additional rainfall and resultant grass growth and potential weed flowering), the feed budget assessment will be recalculated using the “Dry Season Feed Budget” worksheet.

7.2.2. Fuel load monitoring

Fuel load monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix E). Fuel load assessment monitoring will include a baseline survey in year 1 (post-wet season; April), with ongoing fuel load assessment monitoring conducted every year at the same time and location as biomass monitoring post wet season. Monitoring will focus on assessing the key structural layers of the fine fuels that burn in bushfires, specifically bark, elevated fuels, near-surface fuels and surface fuels. This will allow for a rapid assessment of each fuel layer, which in in turn is given a hazard rating and are then combined to provide an overall fuel hazard rating of low, moderate, high, very high or extreme.

The fuel hazard rating will be monitored to compare any changes from previous assessments. In conjunction with results of habitat quality assessments, the results of the fuel load assessments will be used to determine if fuel hazard reduction burns are required within the offset area. Weed management and strategic grazing within the offset area will also be undertaken to maintain fuel hazard rating below extreme.

7.3. Weed monitoring

Weed monitoring sites will be randomly stratified, fixed monitoring sites representative of offset values and incorporating natural variability such as aspect (e.g. a mix of north-, east-, south- and west-facing monitoring sites), community type – (e.g. woodland, riparian). There will also be fixed monitoring sites at strategic trafficable areas (e.g. entry gates, creek crossings, stock watering points) to monitor potential introduction and/or irruptions of prohibited and restricted weed species.

The offset area will be monitored for weeds every two years (post wet season) to determine the species richness and abundance, for the duration of the management period. The results of this monitoring will inform the methods for weed treatment and control (see Section 6.2.6).

[1] See https://futurebeef.com.au/knowledge-centre/pastures-forage-crops/pasture-photo-standards/.

Non-native plant cover is also assessed as part of the habitat quality assessments detailed in Section 7.5.2, and the presence of weed species will also be recorded as part of the general offset area inspections (see Section 7.1), where noted.

7.4. Pest animal monitoring

The offset area will be monitored for evidence of pest animals every two years (post-wet season), including a baseline survey in year 1 of the distribution and abundance of pest animals.

Based on the results of year 1 surveys, pest animal monitoring sites will be established in year 1. Monitoring of pest animals will target areas of known impacts/movements (e.g. along topographic features, including creeks, pads, paths, ridge-tops and roads) to not only maximise the success of encountering pest animals, but target monitoring in environments that are more regularly impacted (e.g. drainage lines, moist gullies and around swamps and lagoons favoured by feral pigs; Hone 1995). The location of pest animal monitoring sites will be assessed prior to each monitoring event.

Pest animal monitoring will also be undertaken in association with and immediately prior to the pest animal control activities (Section 6.2.7). Initial monitoring results will determine the degree of effort required to control the pest population and post control monitoring will determine the degree of success of control operations.

Monitoring of pest animals will involve the deployment of motion sensing infra-red cameras as well as other techniques such as sand plots as appropriate to determine pest animal species present in the offset area and indicative population numbers.

Methods for determining the presence and relative abundance for foxes, feral cats, rabbits and feral pigs are presented in Table 16. Evidence of pest animals, including feral horses, will be documented during the offset area inspections (see Section 7.1)

Table 16 – Pest animal monitoring methodology

Pest animal	Methodology to be implemented
Fox Wild dog Feral cat	To assess the relative abundance of foxes and feral cats within the offset area, camera monitoring will be undertaken as follows to provide a measure of the Catling index for each species. The Catling index will be measured as the percentage of camera nights in which the pest species was observed. An increase or decrease in the Catling index value between subsequent monitoring events will represent an increase or a decrease in the relative abundance of pest species and a measure of the success of pest animal control. • fauna monitoring cameras will be placed in the offset area • cameras will be placed along tracks and left in place for a minimum of three consecutive nights • an analysis of the camera footage will be undertaken to determine the percentage of camera nights with animal captures for each species observed. This percentage represents the Catling index (Mitchell and Balogh 2007b, c).
Feral pig	An assessment of the presence or absence of feral pig signs[a] as a measure of the relative abundance of feral pigs within the offset area in accordance with Mitchell and Balogh (2007a) and Hone (1988), will be undertaken as follows: • nominate randomly stratified sites across the offset area in environments that are more regularly impacted (e.g. drainage lines, moist gullies, around swamps etc) • calculate an abundance score for each transect as the percentage of 'present' feral pig signs • calculate the mean abundance score (and variance) across all transects in the offset area. The average frequency of occurrence across the offset area will be used as an index of abundance and compared between subsequent monitoring events to assess the effectiveness of feral pig control. Furthermore, changes to scores for individual sites/transects can point to areas to target control activities. [a] Feral pig signs can include rooting, wallows, dung, footprints, travel pads, plant damage and tree rubs, as well as the physical presence of feral pigs.

7.5. Offset value assessments

7.5.1. Rapid monitoring event

Rapid monitoring events will be carried out each year monitoring events are not completed for habitat quality assessments (Section 7.5.2) and targeted fauna survey (Section 7.5.4).

These will be aligned with the offset area inspections (see Section 7.1) and carried out by suitably qualified ecologists during spring and early summer (October to January) to coincide with the optimal time of year for fauna in the Brigalow Belt Bioregion (Eyre *et al*. 2018).

During each rapid monitoring field assessment, the following will be conducted:

- Incidental fauna surveys including early morning and late evening bird surveys and other MNES species will be conducted throughout the day by the ecologists.
- Photos will be taken at designated and fixed photo monitoring points as outlined in Section 7.5.3. The locations of the fixed photo monitoring points are shown in Figure 9.

7.5.2. Habitat quality assessment

A detailed baseline assessment of habitat quality was completed in April 2020, including establishment of BioCondition sites in all major vegetation communities.

Vegetation condition and habitat quality for each MNES will be assessed in accordance with the GTDTHQ version 1.2, developed by the Queensland Government to measure the habitat quality of a land-based offset. The species habitat index component of the habitat quality score will be calculated based on the results of the targeted fauna surveys detailed in Section 7.5.4.

Fixed transects were established and assessed as part of the baseline in 2020 (see Figure 9). BioCondition assessments will be undertaken at each of the transects in year 1 and then every two years for the first six years, and then every three years thereafter. As part of year 1 monitoring activities, monitoring points will be marked with a capped stake and a GPS location will be recorded.

The results of habitat quality assessments for subsequent years will include summary data from previous reporting years, presented to allow trend analysis of each of the measured attributes and assess progress towards achieving the interim performance targets and completion criteria.

7.5.3. Photo monitoring

Photo monitoring is a qualitative analysis technique that provides the opportunity for visual time series analysis of changes in vegetation composition, structure and integrity. In areas where active management is being undertaken, photo monitoring offers a simple and effective visual means by which to capture the response of the vegetation to management actions. Photo monitoring will be conducted at all habitat quality assessment sites presented in Figure 9, based on best practice photo monitoring techniques, see Appendix 4 of *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2*. (Eyre *et al.* 2015).

Photo monitoring will be undertaken as part of habitat quality assessments (Section 7.5.2) and rapid monitoring events (Section 7.5.1).

148°46'0"E 148°48'0"E 148°50'0"E 148°52'0"E

25°8'0"S 25°10'0"S 25°12'0"S 25°14'0"S

Blackfellow Creek

ARCADIA VALLEY ROAD

BT22 BT33 BT282 BT43 BT292 BT53 BT1000 BT13 BT272 BT382 BT262 BT372 BT362 BT242 BT252 BT322 BT302 BT352 BT342 BT442 BT412 BT63 BT72 BT422 BT432 BT122 BT132 BT332 BT192 BT402 BT392 BT312 BT92 BT232 BT82 BT212 BT152 BT222 BT102 BT142 BT162 BT112 BT202

Ironbark Creek

Arcadia Creek

Station Creek

Ground-truthed RE

- 11.9.4, Regrowth (young)
- 11.9.4, Regrowth (advanced)
- 11.9.4, Remnant
- 11.9.5, Regrowth (young)
- 11.9.5, Regrowth (advanced)
- 11.9.5, Remnant
- 11.9.5a, Regrowth (young)
- 11.9.5a, Regrowth (advanced)
- 11.9.5a, Remnant
- 11.10.3, Remnant
- 11.10.4, Remnant
- 11.10.7, Remnant
- 11.3.17, Regrowth (young)
- 11.3.17, Regrowth (advanced)
- 11.3.2, Regrowth (advanced)
- 11.3.2, Remnant
- 11.3.25, Regrowth (young)
- 11.3.25, Regrowth (advanced)
- 11.3.25, Remnant
- 11.3.27, Regrowth (young)
- 11.3.27, Remnant

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Location diagram

Figure 9
Monitoring sites

- Bottle Tree
- Offset area boundary
- Property access tracks
- Major road

Watercourse

- Major watercourse
- Minor drainage line
- Drainage contour

- Habitat quality monitoring point

CO2 AUSTRALIA

N

0 1 2

Kilometres

Date: 3/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:42,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMP\s\Bottle Tree\BottleTree_OAMP_mapping_20250502.aprx

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7.5.4. Targeted fauna surveys

Targeted fauna surveys will be conducted to assess the distribution and richness of the fauna offset values within the offset area. The targeted fauna survey methods focus on the MNES species that are unlikely to be detected effectively during the rapid assessment surveys due to cryptic behaviour or localised habitat requirements. Targeted surveys will be undertaken generally in accordance with recommended surveys guidelines from the Queensland and Commonwealth governments and/or other reputable published guidelines. Table 17 provides a summary of the proposed methodology, search effort and timing for targeted surveys. It is important to note that the proposed survey methodology will be reviewed prior to each survey event and if considered necessary will be modified to ensure they are based on the ecology, habitat requirements and behavioural aspects of the species of interest.

Targeted fauna surveys will be carried out in conjunction with habitat quality assessments in year 1 and then every two years for the first six years, and then every three years thereafter.

Table 17 – Fauna species survey methods

Technique	Regime	Target and method
Funnel Trap	Six at each of five trap sites over four consecutive nights, checked early morning and afternoon.	Placed in pairs either side along a 30 m drift-fence. Targeting Dunmall's Snake and Collared Delma.
Harp Trap	Two per night for four consecutive nights, locations chosen based on presence of suitable flyways	Targeting South-Eastern Long-eared Bat, which is not identifiable by ultrasonic calls.
Spotlighting	Meander along watercourses.	Targeting Dunmall's Snake.
Spotlighting	Rocky areas.	Targeting Collared Delma.
Spotlighting	By vehicle along tracks.	Targeting Dunmall's Snake.
Bird Survey	Meander along watercourses during the day.	Targeting Yakka Skink and nest sites for Red Goshawk.
Diurnal Herpetofauna Search	Late morning/early afternoon.	Conducted by two searchers, duration is determined by site-specific habitat quality and presence of suitable micro-habitat. Targeting Collared Delma, Dunmall's Snake and Yakka Skink.

7.5.5. Brigalow stem counts

Brigalow regrowth within the offset area will be monitored to assess the stem density of dominant species to inform any requirement for selective thinning within the vegetation community.

As described in Section 6.2.3 selective thinning of Brigalow regrowth will be considered where the density of a dominant tree species within the vegetation community is >10,000 stems/ha and the density of stems is considered to be effecting the sites capacity to return to remnant status.

The number of stems per dominant tree species will be counted in 25 m x 25 m plots within Brigalow regrowth offset areas. The location of each 25 m x 25 m plot will be nested in the habitat quality monitoring locations presented in Figure 9 and will be established as part of the first monitoring event following approval of this OAMP. Stem density assessments will be undertaken in year 1, and then every two years for the first six years, and then every three years thereafter.

8. Reporting

8.1. Reporting

A report detailing the progress of the offset area in achieving the interim performance targets and completion criteria will be prepared for each management year by the suitably qualified ecologist responsible for conducting the monitoring.

The report will contain, at a minimum:

- a description of the monitoring conducted, when it was conducted, and by whom,
- a discussion of the weather in the lead up to and during the monitoring,
- results of monitoring events conducted,
- an overview of the management actions implemented since the last report,
- a description of the performance criteria not met, any triggers that have been exceeded and the corrective actions that were implemented,
- an indication of any risks or potential threats that have become apparent to the management area since the development of this management plan, and activities to be undertaken to manage these threats and/or risks, and
- progress towards achieving the interim performance targets and completion criteria.

8.2. Update of OAMP

The OAMP will be reviewed, audited and updated every five years. In addition, the OAMP will be updated in accordance with the principles of adaptive management, if required, to incorporate any changes identified through management activities, site visits and monitoring activities. This may include the revision of current management actions, identification of additional activities (including monitoring activities) and responses to adaptive management triggers, other environmental threats to the offset area, information obtained through research programs.

9. Implementation Schedule

Table 18 and Table 19 summarise the implementation schedule for the management, monitoring and reporting activities presented in this OAMP. Santos will be wholly responsible for the implementation of this OAMP and reporting on the performance of the offset area in meeting the offset obligations under EPBC Approval 2012/6615 and Section 4 of this OAMP.

Table 18 – Implementation of management actions

Activity		Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Related monitoring
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
General restrictions (Section 6.2.1)	Access, vehicles, vegetation clearing, weed hygiene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	At all times	General offset inspections (Section 7.1)
Access tracks (Section 6.2.2)	Maintenance/new tracks	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
Fencing (Section 6.2.4)	Construction of additional fencing to support livestock exclusion and strategic grazing	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
	Maintenance	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪		
Fire management (Section 6.2.5)	Fuel hazard reduction burns	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	Biomass monitoring (Section 7.2)
Grazing (Section 6.2.5)	Strategic grazing	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required based on the results of biomass monitoring, and informed by weed monitoring	Biomass monitoring (Section 7.2) Weed monitoring (Section 7.3)
Weed management (Section 6.2.6)	Buffel grass and other weeds	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities in addition to strategic grazing to be undertaken as required	Weed monitoring (Section 7.3)
Pest animal management (Section 6.2.7)	Wild dog, feral cat; fox, pig and feral horse	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities to be undertaken as required	Pest animal monitoring (Section 7.4)
Brigalow regrowth restoration (Section 6.2.3)	Brigalow regrowth thinning	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Thinning to be undertaken as required should stem density become >10,000 stems/ha and the density of stems is considered to be affecting the sites capacity to return to remnant status	Brigalow stem counts (Section 7.5.5)
Reporting (Section 8)	Annual reporting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annual reports to be prepared each year. The OAMP will be reviewed, audited and updated every 5 years.	Reporting (Section 8)
	Update OAMP					▪					▪					▪					▪		

Table 19 – Implementation of monitoring events

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required																			Timing	Survey/monitoring guidelines	Reliability
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Offset area inspections (Section 7.1)	Twice yearly inspections of to enable a general assessment of the offset area and identify any potential issues that may require remedial action. See Section 7.1 for the criteria to be assessed as part of each inspection.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Inspections will be undertaken at least twice a year. Usually at the end of the wet season and the end of the dry season, with one of the inspections occurring prior to the submission of the annual report.	See Section 7.1 for a list of potential issues to be inspected.	General assessment of the offset management areas to identify any potential issues that may require remedial action to be undertaken.
Biomass monitoring (Section 7.2)	Biomass monitoring for fire management and to inform strategic grazing regime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Twice every year at the end of the wet season (April) and towards the end of the dry season (October)	Assessment against Future Beef photo standards (Section 7.2).	Methodology developed by the Queensland Government.
Fuel load monitoring (Section 7.2.2)	Assessment of the fuel hazard rating within the offset area to inform fire management strategies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually at the end of the wet season (April)	*Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix E).	Method developed by the Victorian Government.
Weed monitoring (Section 7.3)	Ongoing weed surveys to assess the effectiveness of weed control	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		Every two years post wet season	NSW Guidelines for Monitoring weed Control and recovery of native vegetation (Auld 2009) Photo monitoring of selected sites to assess visual changes in weed species and infestations over time. The use of precision unmanned aerial vehicles (drone) technology, aerial imagery and/or remote sensing.	Assessment will be undertaken generally in accordance with published, reputable guidelines.
Pest animal monitoring (Section 7.4)	Ongoing pest animal surveys to assess the effectiveness of pest animal control	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		Every two years post wet season	Monitoring method outlined in Section 7.4.	Assessment undertaken generally in accordance with published monitoring techniques developed by the NSW Government.

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required																			Timing	Survey/monitoring guidelines	Reliability
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Offset value assessments (Section 7.5)	Rapid monitoring events		✓		✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		Each year monitoring events are not completed for habitat quality assessments (Section 7.5.2), targeted fauna survey (Section 7.5.4)	See Section 7.5.1.	
	Assessment of vegetation condition and habitat quality	✓		✓		✓			✓			✓			✓			✓			✓	Year one, and then every two years for the first six years, and then every three years thereafter.	GTDTHQ (version 1.2; DEHP 2017).	Assessment undertaken in accordance with method developed by the Queensland Government and aligns with the EPBC Act *Environmental Offsets Policy* measure of 'habitat quality' and is intended to provide a consistent framework for environmental offsets in Queensland.
	Photo monitoring	✓		✓		✓			✓			✓			✓			✓			✓		Photos at each photo monitoring point will be taken in a north, east, south and westerly direction. A record of the photographs will be maintained, including GPS co-ordinates, date and time of each photograph and the direction in which the photograph was taken.	Based on best practice photo monitoring techniques, see Appendix 4 of *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2.* (Eyre *et al.* 2015).
	Targeted fauna surveys	✓		✓		✓			✓			✓			✓			✓			✓		See methods outlined in Section 7.5.4.	Techniques for fauna surveys are based on recommended survey guidelines published by the Queensland and Commonwealth governments.
	Brigalow stem counts	✓		✓		✓			✓			✓			✓			✓			✓		See methods outlined in Section 7.5.5.	Guidance for thinning of Brigalow regrowth and monitoring based on published research (Peeters and Butler 2014; Dwyer and Mason 2017).

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Appendix A

Baseline habitat quality score for Bottle Tree offset area

Table A1 - Baseline habitat quality score for Bottle Tree offset area (sites BT13 – BT242)

Site	BT13	BT22	BT33	BT43	BT53	BT63	BT72	BT82	BT92	BT102	BT112	BT122	BT132	BT142	BT152	BT162	BT192	BT202	BT212	BT222	BT232	BT242
RE	11.9.5	11.10.4	11.10.4	11.10.4	11.10.4	11.10.7	11.9.5a	11.3.17	11.3.17	11.3.17	11.3.17	11.3.17	11.3.17	11.3.2	11.3.2	11.3.2	11.3.25	11.3.25	11.3.25	11.3.27	11.3.27	11.9.4
Site type*	Adv	Rem	Rem	Rem	Rem	Rem	Rem	Adv	Yng	Yng	Yng	Yng	Yng	Rem	Adv	Rem	Adv	Rem	Rem	Rem	Rem	Yng
Site condition (/10)	4.9	6.3	5.5	6.2	6.6	4.4	5.8	4.3	5.4	2.8	2.9	2.1	3.1	3.9	5	4.9	7.1	5.8	6.1	6.9	6.3	1.6
Site context (/10)	7.0	8.0	9.0	9.0	9.0	5.5	7.0	5.0	6.0	3.5	3.5	3.5	3.5	6.5	5.5	5.5	6.0	5.5	5.5	2.0	4.5	6.0
Habitat quality score – threatened ecological communities /10 (site condition 60%, site context 40%)																						
Brigalow TEC	5.7	-	-	-	-	-	6.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Species habitat index /10																						
Collared Delma	5.6	6.6	6.6	6.6	6.6	5.4	5.0	5.0	2.2	2.2	2.2	2.2	2.2	4.2	4.2	4.2	-	-	-	-	-	2.8
Dunmall's Snake	7.2	8.2	8.2	8.2	6.6	6.0	6.0	5.0	3.4	3.4	3.4	3.4	3.4	6.0	6.0	6.0	-	-	-	-	-	-
Red Goshawk	7.2	7.2	7.2	7.2	7.2	5.6	5.6	4.8	4.0	4.0	4.0	4.0	4.0	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	4.0
Yakka Skink	5.6	7.6	7.6	7.6	7.6	7.0	5.0	3.4	2.2	2.2	2.2	2.2	2.2	7.6	7.6	7.6	-	-	-	-	-	-
South-eastern Long-eared Bat	4.8	7.2	7.2	7.2	7.2	5.6	5.6	4.8	4.0	4.0	4.0	4.0	4.0	9.2	9.2	9.2	8.2	9.2	9.2	5.6	5.6	4.0
Habitat quality score – fauna species /10 (site condition 30%, site context 30%, species habitat index 40%)																						
Collared Delma	5.8	6.9	7.0	7.2	7.3	5.1	5.8	4.8	4.3	2.8	2.8	2.6	2.9	4.8	4.8	4.8	-	-	-	-	-	3.4
Dunmall's Snake	6.4	7.6	7.6	7.8	7.3	5.4	6.2	4.8	4.8	3.2	3.3	3.1	3.3	5.5	5.6	5.5	-	-	-	-	-	-
Red Goshawk	6.4	7.2	7.2	7.4	7.6	5.2	6.1	4.7	5.0	3.5	3.5	3.3	3.6	6.8	6.8	6.8	7.6	7.1	7.2	6.3	6.9	3.9
Yakka Skink	5.8	7.3	7.4	7.6	7.7	5.8	5.8	4.2	4.3	2.8	2.8	2.6	2.9	6.2	6.2	6.2	-	-	-	-	-	-
South-eastern Long-eared Bat	5.5	7.2	7.2	7.4	7.6	5.2	6.1	4.7	5.0	3.5	3.5	3.3	3.6	6.8	6.8	6.8	7.2	7.1	7.2	4.9	5.5	3.9

Note: Data is only provided for REs that the threatened community or species is associated with.
* Site type: Rem – remnant; Adv – regrowth (advanced); Yng – regrowth (young).

Table A2 - Baseline habitat quality score for Bottle Tree offset area (sites BT252 – BT1000)

Site	BT252	BT262	BT272	BT282	BT292	BT302	BT312	BT322	BT332	BT342	BT352	BT362	BT372	BT382	BT392	BT402	BT412	BT422	BT432	BT442	BT1000
RE	11.9.4	11.9.4	11.9.4	11.9.4	11.9.5	11.9.5	11.9.5	11.9.5	11.9.5	11.9.5	11.9.5	11.9.5	11.9.5	11.9.5	11.9.5	11.9.5	11.9.5a	11.9.5a	11.9.5a	11.9.5a	11.9.4
Site type*	Yng	Rem	Rem	Adv	Yng	Yng	Yng	Yng	Yng	Yng	Adv	Adv	Adv	Adv	Rem	Adv	Rem	Rem	Adv	Rem	Rem
Site condition (/10)	2.3	6.1	5.8	6.1	3.1	2.6	2.6	1.1	3.6	2.4	3.4	3.1	4.2	2.9	6.3	5.6	7.2	7.3	6.1	6.9	5.3
Site context (/10)	6.0	9.0	9.0	9.0	6.0	6.0	5.0	5.0	7.0	5.0	5.0	7.0	8.0	8.0	6.0	6.0	6.0	7.0	8.0	7.0	9.0
Habitat quality score /10 (site condition 60%, site context 40%)																					
Brigalow TEC	-	-	-	-	4.0	3.6	2.6	4.9	3.4	4.0	4.7	5.7	5.0	6.2	5.8	6.7	7.2	6.9	7.0	4.0	-
Species habitat index /10																					
Collared Delma	2.8	6.6	6.6	6.6	2.8	2.2	2.2	2.2	3.0	2.2	5.0	5.6	5.6	5.6	5.0	5.0	5.0	5.0	5.0	5.0	6.6
Dunmall's Snake	-	-	-	-	5.6	3.4	3.4	3.4	4.2	3.4	5.0	6.4	7.2	7.2	5.6	5.0	5.6	5.6	5.0	5.6	-
Red Goshawk	4.0	5.6	5.6	5.6	4.0	4.0	4.0	4.0	4.0	4.0	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
Yakka Skink	-	-	-	-	2.8	2.2	2.2	2.2	2.2	2.2	3.8	4.8	5.6	5.6	5.0	5.0	4.2	4.2	3.4	3.4	-
South-eastern Long-eared Bat	4.0	5.6	5.6	5.6	4.0	4.0	4.0	4.0	4.0	4.0	4.8	4.8	4.8	4.8	5.6	4.8	5.6	5.6	5.6	5.6	5.6
Habitat quality score fauna species /10 (site condition 30%, site context 30%, species habitat index 40%)																					
Collared Delma	3.6	7.2	7.1	7.2	3.9	3.5	3.2	2.7	4.4	3.1	4.5	5.3	5.9	5.5	5.7	5.5	6.0	6.3	6.2	6.2	6.9
Dunmall's Snake	-	-	-	-	5.0	4.0	3.7	3.2	4.9	3.6	4.5	5.6	6.5	6.2	5.9	5.5	6.2	6.5	6.2	6.4	-
Red Goshawk	4.1	6.8	6.7	6.8	4.3	4.2	3.9	3.4	4.8	3.8	4.8	5.3	5.9	5.5	5.9	5.7	6.2	6.5	6.5	6.4	6.5
Yakka Skink	-	-	-	-	3.9	3.5	3.2	2.7	4.1	3.1	4.0	5.0	5.9	5.5	5.7	5.5	5.6	6.0	5.6	5.5	-
South-eastern Long-eared Bat	4.1	6.8	6.7	6.8	4.3	4.2	3.9	3.4	4.8	3.8	4.4	5.0	5.6	5.2	5.9	5.4	6.2	6.5	6.5	6.4	6.5

Note: Data is only provided for REs that the threatened community or species is associated with.
* Site type: Rem – remnant; Adv – regrowth (advanced); Yng – regrowth (young).

Appendix B

Bottle Tree Voluntary Declaration and offset area boundary co-ordinates

Notice of Declaration (2022/001929)

Sections 19E to 19L of the Vegetation Management Act 1999

Queensland Government

Department of **Resources**

1. Details of request

1.1. Proponent's name: Santos GLNG Pty Ltd – ACN 131 271 648,

PAPL (Downstream) Pty Ltd – ACN 147 649 205,

Total GLNG Australia – ARBN 146 680 524,

KGLNG Liquefaction Pty Ltd – ACN 146 143 311.

1.2. Date request received: 28 June 2022

1.3. Request: declare stated land as an area of high nature conservation value

1.4. Property description: part of lot 7 on plan TR39 - Central Highlands RC

1.5. Land tenure: Freehold

1.6. Decision reference: 2022/001929

2. Declaration information

2.1. Declaration made:

The chief executive of the Department of Resources declares the area identified on Declared Area Map DAM 2022/001929 as an area of high nature conservation value in accordance with section 19F of the *Vegetation Management Act 1999*.

The chief executive considers the declared area to meet the following criteria under section 19G of the *Vegetation Management Act 1999*—

The declared area is an area of high nature conservation value under section 19G(1)(b), as the area is: *an area containing a vegetation clump or corridor that contributes to the maintenance of biodiversity;* and *another area that contributes to the conservation of the environment.*

The documents outlined in 2.2 form part of this declaration.

2.2. Declaration documents:

The following documents are part of this declaration, and must be read in conjunction with this notice:

- Declared area map (DAM 2022/001929) and attachment
- Santos GLNG Bottle Tree Offset Area Voluntary Declaration Management Plan, Rev 2, dated 02 March 2022

2.3. Property Map of Assessable Vegetation

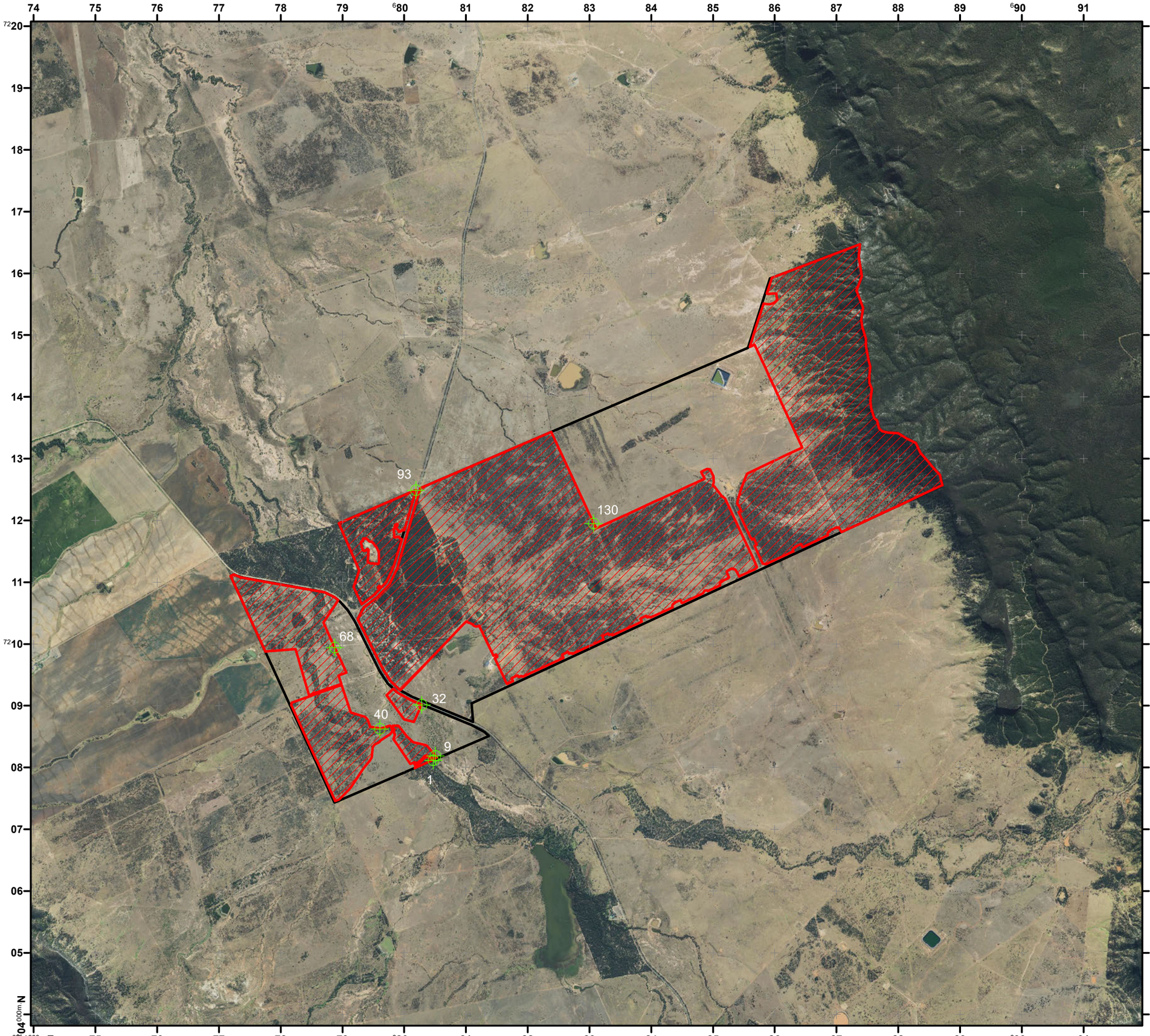
In accordance with s20B of the *Vegetation Management Act 1999*, Property Map of Assessable Vegetation PMAV 2022/002224 has been prepared for the declared area.

Date of declaration: 12 September 2022

3. Delegated officer's signature

Sandra Witheyman

Senior Natural Resource Management Officer



Declared Area Map

Sheet 1 of 1

DAM 2022/001929

LOT on PLAN
7TR39

Queensland Government

0 1.2 2.4 3.6 4.8
km

Scale: 1:60000
(original size A3)

N

LEGEND

- Subject Lot(s)
- Declared Area
- Derived reference start points

This plan must be read in conjunction with Declaration Notice 2022/001929

Notes:
Property boundary provided by Department of Resources.
The property boundaries shown on this plan are approximate only. They are not an accurate representation of the legal boundaries.

While every care is taken to ensure the accuracy of this product, the Department of Resources, makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might incur as a result of the product being inaccurate or incomplete in any way and for any reason. Data must not be used for direct marketing or be used in breach of the privacy laws.

Map Information:
Horizontal Datum: GDA 2020
Projection: Universal Transverse Mercator - Zone 56
Imagery: Earth-i © , distribution 21AT, all rights reserved 2022

© The State of Queensland (Department of Resources) 2022

Map Prepared by: RH
Department of Resources
PO Box 15216
CITY EAST QLD 4002

Map Preparation Date: 08/09/2022

This colour plan must be reproduced in colour.

Appendix C

Risk assessment

Risk assessment summary

The following risk assessment assess the potential risk of failing to achieve the management objectives, interim performance targets and completion criteria for the offset area as outlined in this OAMP.

For each risk identified, the potential consequence of the risk (rated from 1 (no impact) to 6 (irreversible impact; Table C1) was assessed against the likelihood of that risk occurring (Table C2) to determine a risk rating. The risk rating was evaluated by using the matrix in Table C2.

The consequence and likelihood of each risk was first considered without the management measures in place to provide an initial risk rating. The consequence and likelihood of each risk occurring was then reassessed following the implementation of the management measures to provide a residual risk rating.

Table C3 provides the risk register which was used to document the findings of the risk assessment process.

Table C1 – Consequence rating relative to offset value

	Consequence
I	No impact to MNES Value
II	Small-scale impact to MNES
III	Moderate-scale impact to MNES
IV	Large-scale impact to MNES
V	Extensive population or community scale impact to MNES
VI	Irreversible impact to MNES.

Table C2 – Likelihood classification and risk matrix

Santos Risk Matrix

Santos

Consequence							
	Safety	**Negligible Harm** + No bodily damage or minimal harm or impairment (hours to days)	**Minor Harm** + Short term impairment (days to weeks)	**Moderate Harm** + Temporary disablement or medium term impairment (weeks to months)	**Severe Harm** + Long term/life altering disablement or impairment	**Single Fatality OR Critical Life Threatening Injuries**	**Multiple Fatalities**
	Environment	+ No impact to Environmental Value (EV).	+ Small-scale impact to EV(s) of conservation significance + Potential surface or groundwater impact.	+ Moderate-scale impact to EV(s) of conservation significance + Localised surface or groundwater impact.	+ Large-scale impact to EV(s) of conservation significance + Moderate-scale surface water impact; + Localised impact to groundwater with potential or known beneficial use.	+ Extensive population or community scale impact to EV(s) of conservation significance + Extensive impact to other EV(s).	+ Irreversible impact to EV(s).
	Community & Reputation	+ No actual or potential community criticism + Details remain within Santos sites and/or offices	+ Minor level local community criticism (< week) + No reputation impact	+ Local community criticism (> week) or one-day community protest + Local company reputation impacted	+ State-level community criticism or protest over multiple days/locations + State-based company reputation impacted + Very short-term share price impact (< week)	+ National community criticism or large scale protest + Company reputation and approvals impacted + Shareholder intervention or short-term share price impact (< month)	+ Sustained national community criticism or widespread protest + Industry reputation and approvals impacted + Changes at executive/board level or long-term share price impact (> month)
	Financial (A$)	< $30k	$30k to $300k	$300k to $3m	$3m to $30m	$30m to $300m	> $300m
	Workforce	+ Will require some staff attention over several days. + No actual or potential impact to culture	+ Will require several days local management time. + Minor impact to employee engagement and limited staff turnover	+ Will require head office staff and take several weeks of site management time. + Moderate impact to employee engagement and staff turnover above industry average with some key roles	+ Will require several weeks of senior management time + Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession	+ Will require several months of senior management time + Impact to employee engagement (< 18 months), high staff turnover and attraction issues	+ Will require more than a year of senior management involvement and operations severely disrupted + Impact to employee engagement (> 18 months), significant key role turnover and attraction issues
	Compliance	+ Non-conformance with legislation, instruments (e.g. tenure licence) or contract + No regulatory or punitive action	+ Minor breach of legislation, instruments or contract + Notification/report to; request for information by; and/or administrative/ warning notice from the regulator + LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator	+ Limited number of minor breaches of legislation, instruments or contract + Statutory notice from the regulator + LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator	+ Systemic minor breaches (or one moderate breach) of legislation, instruments or contract + Company charged with an offence with minor penalty/fine + LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases	+ Systemic moderate breaches (OR single material breach) of legislation, instruments or contract + Company charged with an offence with moderate penalty/fine	+ Material breaches of legislation, instruments or contract + Company or officers charged with an offence with material penalty/fine, or loss of tenure/operatorship

Likelihood		I	II	III	IV	V	VI
ALMOST CERTAIN (< 4 monthly) Occurs in almost all circumstances OR could occur *within days to weeks*	f	Low	Medium	High	Very High	Very High	Very High
LIKELY (4 monthly - 1 yearly) Occurs in most circumstances OR could occur *within weeks to months*	e	Low	Medium	High	High	Very High	Very High
OCCASIONAL (1 - 3 yearly) Has occurred before in Santos OR could occur *within months to years*	d	Low	Low	Medium	High	High	Very High
POSSIBLE (3 - 10 yearly) Has occurred before in the industry OR could occur *within the next few years*	c	Very Low	Low	Low	Medium	High	Very High
UNLIKELY (10 - 30 yearly) Has occurred elsewhere OR could occur *within decades*	b	Very Low	Very Low	Low	Low	Medium	High
REMOTE (30 - 100 yearly) Requires exceptional circumstances and is unlikely even in the long term OR only occurs as a *"one in 100 year event"*	a	Very Low	Very Low	Very Low	Low	Medium	Medium

Table C3 – Risk assessment and management

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
Achieve the completion criteria and habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Completion criteria and habitat quality improvements are not achieved.	Degradation of habitat.	D	IV	H	Implementation of this OAMP, including the management actions and monitoring program outlined in Section 6 and Section 7. Implementation of the adaptive management process outlined in Section 5. Obtain advice with the aim of identifying appropriate additional management interventions if interim performance targets are not achieved for one or more offset values by year 5,10 or 15. If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the offsets assessment guide. The revised OAMP will be submitted to the Commonwealth Government.	Management actions to support the improvement of the offset area condition, and thereby achieve completion criteria, will be implemented as outlined in this OAMP for the lifetime of the OAMP. Habitat quality assessment will be undertaken in year 1 and then every two years for the first six years, and then every three years thereafter. Interim habitat quality score performance targets are defined for years 5, 10, and 15.	B	IV	L	Monitoring of offset value habitat quality scores and condition of habitat will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Rapid monitoring events (Section 7.5.1). • Habitat quality assessments to determine habitat quality scores (Section 7.5.2). • Targeted fauna surveys (Section 7.5.4). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime to better support enhancement of offset values. • For offset values that have not achieved interim performance targets by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions. If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the offsets assessment guide. The revised OAMP will be submitted to the Commonwealth Government.
	Habitat or vegetation loss	Violation to the voluntary declaration and this	D	V	H	• Protection of the offset area via a Voluntary Declaration	Conditions of the Voluntary Declaration under Section	B	V	M	Reporting to the Commonwealth Government	Any activities in contravention of the	**Step 1: Investigate cause of trigger**

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
Maintain the extent of offset value habitat within the offset area.	through land clearing.	OAMP, resulting in a loss of biodiversity and extent of threatened species habitat.				under Sections 19E and 19F of the VMA, as described in Section 2.9.	19E and 19F of the VM Act will place for the life of EPBC 2012/6615. Restrictions outlined in Table 13 will therefore be implemented for the lifetime of the project and OAMP.				consistent with EPBC approval.	Voluntary Declaration and this OAMP.	• Investigate reasons why unapproved clearing occurred e.g. unauthorised access. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Addition fencing, signage and/or security for the offset area. • Restoration of the impacted area.
						Comply with the restrictions outlined in Table 13. Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in accordance with Sections 6.2.2, 6.2.4 and 6.2.5. Restoration of impacted areas subject to any unauthorised clearing.					Offset area inspections will be undertaken twice per year for the duration of the management period and will report on any major or noticeable changes to the extent of offset value habitat.	Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with the restrictions outlined in Section 6.2.	**Step 1: Investigate cause of trigger** • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately. • Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
Ensure that the livestock grazing restrictions for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Degradation of offset value habitat quality as a result of livestock grazing.	Over grazing induced suppression and displacement of native flora and fauna species, reflected in environmental monitoring results and annual reports.	E	III	H	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses and promote the establishment of native perennial grass species in accordance with Section 6.2.5. Annual biomass monitoring to inform strategic grazing regimes. Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.5.1 and 7.5.2 including an assessment of % cover of native perennial grasses.	Biomass monitoring will be undertaken twice a year, at the end of the wet season and end of the dry season. Offset area inspections and rapid monitoring events will be undertaken once and twice per year, respectively, for the duration of the management period and will report on any major or noticeable changes to livestock grazing regimes.	B	III	L	Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.5.1 and 7.5.2. These will include assessment of % cover of native perennial grasses.	Decrease in the richness and average % cover of native perennial grasses at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime. • Installing additional watering points for livestock to manage livestock in accordance with the grazing regime.
Minimise predation risk by wild dogs to threatened fauna species.	Predation of threatened fauna by wild dogs.	Reduction in the abundance and diversity of native fauna species within the offset area, as well as possible reduction in the population density and growth of threatened species.	D	III	M	Regular monitoring for pest animals will be undertaken in accordance with the methods detailed in Section 7.4 and pest animal control will be implemented following the results of monitoring in accordance with Section 6.2.7.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results. Frequency and duration of management will be appropriate to the target species biology, and extent of occurrence.	C	III	L	Undertake monitoring for wild dogs in accordance with Section 7.4.	An increase in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in the: – Catling* index for wild dogs, feral cats and/or foxes, and – relative abundance of feral pigs and horses. • Review adherence to pest management control measures as outlined in Section 6.2.7. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency and intensity of pest animal control.
Minimise predation risk by foxes to threatened fauna species.	Predation of threatened fauna by foxes.		D	III	M			C	III	L	Undertake monitoring for feral cats in accordance with Section 7.4.	An increase in Catling* Index for feral cats from year 1 and subsequent monitoring events.	
Minimise predation risk by feral cats to threatened fauna species.	Predation of threatened fauna by cats.		D	III	M			C	III	L	Undertake monitoring for foxes in accordance with Section 7.4.	An increase in Catling* Index for foxes from year 1 and subsequent monitoring events.	
Minimise degradation of offset value habitat by feral pigs.	Degradation of habitat by feral pigs.		D	III	M			C	III	L	Undertake monitoring for feral horses in accordance with Section 7.4.	An increase in the observed presence of feral horses across monitoring events.	
Minimise degradation of offset value habitat by feral horses.	Degradation of habitat by feral horses.		D	III	M			C	III	L	Undertake monitoring for feral pigs in accordance with Section 7.4.	An increase in mean feral pig abundance score from year 1 and subsequent monitoring events.	

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
													• Revising methods of pest animal control in accordance with DAF guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the OAMP and targeted pest animal control programs.
Manage invasive weed species to reduce degradation of offset value habitat.	Invasion of habitat by weed species, including exotic grasses.	An increase in either the abundance or diversity of weed species.	D	III	M	Regular weed monitoring will be undertaken in accordance with Section 7.3. Based on the results of monitoring events, weeds will be managed using biological, chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets, for the relevant weed species (see Section 6.2.6).	Weed treatment and control will be undertaken at optimal timing according to the lifecycle of the target species, i.e. before seeding. Frequency and duration of management will be appropriate to the target species biology, severity and extent of infestation.	C	III	L	Undertake weed monitoring in accordance with Section 7.3.	An increase in species richness and relative abundance of weed species at more than 20% of monitoring sites from year 1 and subsequent monitoring events. A new weed species is identified at one or more monitoring sites.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds. • Investigate potential sources or reasons for the occurrence of the new weed species. • Review adherence to weed management control measures as outlined in Section 6.2.6. • Review adherence to weed hygiene restrictions as outlined in Section 6.2.1. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Amending weed hygiene restrictions. • Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to. • Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld). • Increasing the frequency and intensity of weed control. • Updating weed control methods in the OAMP and targeted weed control programs.

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	Inappropriate fire regimes	Decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events as a result of fire management measures, or an unplanned fire.	D	IV	H	Fuel loads within the offset area will be managed through strategic livestock grazing and fuel hazard reduction burns as outlined in Section 6.2.5. Firebreaks will be established and maintained around the boundary of the offset area, with green firebreaks established where the offset area joins native vegetation. Firebreaks will be maintained at least annually in mid / late autumn and, or early spring to remove overhanging trees or fallen debris and dense vegetation.	If deemed necessary, fuel load management will be carried out when required during suitable climatic conditions, as outlined in 6.2.5.	B	IV	L	Habitat quality assessments to determine habitat quality scores will be undertaken in accordance with Section 7.5.2. Rapid monitoring events will be undertaken to assess the general condition of vegetation in accordance with Section 7.5.1.	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores. • Review adherence to the fire management. measures as outlined in Section 6.2.5. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass monitoring. • Increasing the frequency of weed control measures. • Amending the strategic grazing regime. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks. • Review timing and intensity of fuel hazard reduction burns in accordance with the REDD fire management guidelines and conservation advice for the particular offset value.
Regrowth Brigalow vegetation managed to meet the criteria for remnant status.	Regrowth Brigalow does not achieve remnant status within the OAMP timeframes	Selective thinning is not a successful action to achieve the desired stem count and/or improving condition of Brigalow TEC	D	III	M	Selective regrowth thinning of Brigalow TEC where regrowth of Brigalow vegetation (RE 11.9.5) occurs at >10,000 stems per hectare in accordance with Section 6.2.3.	Selective thinning will be undertaken as required based on the results of monitoring events (Section 7.5.5)	C	III	L	Habitat quality assessments (Section 7.5.2). Brigalow regrowth assessment (Section 7.5.5).	Brigalow regrowth exceeds 10,000 stems per hectare based on previous monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reasons why stem density is >10,000 stems/ha and whether management intervention is required. mechanical thinning is effective and appropriate. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency thinning activities. • Revise the type of thinning method used.
Achieve the interim performance targets and completion criteria for each offset value within	Interim performance targets are not achieved for	Offset fails to achieve the interim performance targets and completion criteria within the	E	III	H	Monitoring of the offset area will be undertaken in accordance with Section 7 including:	Management methods and actions will occur during seasonally suitable timing, in collaboration with the	B	III	L	Monitoring of the offset area will be undertaken in accordance with Section 7 including:	Interim performance targets are not achieved for one or more offset	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
5, 10, 15 and 20 years, respectively.	offset values by year 5, 10 or 15. Completion criteria are not achieved for offset values by year 20.	anticipated 5-, 10-, 15- and 20-year timeframes, respectively.				• Offset area inspections (Section 7.1). • Offset value assessments (Section 7.5). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 7.5.5).	landholder and contractor undertaking the scope of work. Monitoring will occur in accordance with the implementation schedule, see Section 9.				• Offset area inspections (Section 7.1). • Offset value assessments (Section 7.5) The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values.

Appendix D

Interim performance targets and completion criteria for the Bottle Tree offset area

Table D1 – Interim performance targets and completion criteria for the Bottle Tree offset area for Stage 8 acquittal under EPBC 2012/6615

MNES	Baseline habitat quality score	Interim performance targets			Completion criteria
		Year 5	Year 10	Year 15	Year 20
Threatened ecological communities					
Brigalow TEC (Moderate quality)	4	Increase in the habitat quality score from baseline score of 4. The anticipated improvement is expected to range between 4.5 and 5. Bioclimatic variables and their relevant influences in achieving this improvement will be discussed in the annual compliance report. Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports.	Increase in the habitat quality score from year 5. The anticipated improvement is expected to range between 5 and 5.5. Bioclimatic variables and their relevant influences in achieving this improvement will be discussed in the annual compliance report. Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports.	Increase in the habitat quality score from year 10. The anticipated improvement is expected to range between 5.5 and >6. Bioclimatic variables and their relevant influences in achieving this improvement will be discussed in the annual compliance report. Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports.	Improve the quality of habitat to achieve a score of at least 6 Habitat quality scores will be calculated in accordance with the site condition and site context attributes under the GTDTHQ (version 1.2; DEHP 2017) at the same monitoring sites. The results will be presented and discussed in the relevant compliance and offset reports. Areas of regrowth Brigalow TEC meet the requirement for remnant vegetation under the relevant Queensland legislation. Under the VM Act the following criteria would need to be met: • covering more than 50% of the undisturbed predominant canopy; and • averaging more than 70% of the vegetation's undisturbed height; and • composed of species characteristic of the vegetation's undisturbed predominant canopy.
Threatened fauna species					
Collared Delma	3	Increase in the habitat quality score from baseline score of 3	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 5
Yakka Skink	3	Increase in the habitat quality score from baseline score of 3	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 5
Dunmall's Snake	4	Increase in the habitat quality score from baseline score of 4	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 6
Red Goshawk	4	Increase in the habitat quality score from baseline score of 4	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 6
South-eastern Long-eared Bat	4	Increase in the habitat quality score from baseline score of 4	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 6

Appendix E

Overall Fuel Hazard Assessment Guide

Department of Sustainability and Environment

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management

report no. 82

State Government Victoria

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management, report no. 82

By Francis Hines, Kevin G Tolhurst, Andrew AG Wilson and Gregory J McCarthy

This publication was produced with the support of the Attorney-General's Department of the Australian Government, who part funded this project through the Natural Disaster Resilience Grants Program.

Images have been provided by Department of Sustainability and Environment – Victoria, Department of Environment and Heritage – South Australia, Country Fire Service – South Australia, Department of Conservation and Environment – Western Australia and Christian Pearson – Misheye. Katy Friend drew the illustrations.

Cover image: Elaine – Atchison Rd Fire, Victoria, January 2008. Bark Hazard – Extreme, Elevated Fuel Hazard – Moderate, Near-surface Fuel Hazard – Low, Surface Fuel Hazard – Very High. Overall Fuel Hazard – Extreme. Fire burning under FFDI 17 – High.

Published by the Victorian Government Department of Sustainability and Environment
Melbourne, July 2010

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Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

Printed by Stream Solutions
Printed on 100% Recycled paper

ISBN 978-1-74242-676-1 (print)
ISBN 978-1-74242-677-8 (online)

For more information contact the DSE Customer Service Centre 136 186

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1. About this guide

1.1 Purpose

The main purpose of this guide is to allow people to:

- make a rapid, visual assessment of fuel arrangement, and
- gain an understanding of how this will affect the chances of controlling a bushfire.

1.2 Audience

This guide has been principally designed to provide information on fuel arrangement to be used by:

- firefighters to assess the difficulty of controlling a bushfire.

Information on fuel arrangement may also be used by:

- asset owners and managers to assess potential bushfire risks to assets
- land and fire managers to provide a measurable objective and trigger for fuel management in fire management plans
- personnel to identify which key attributes and fuel layers are contributing the most to the hazard
- personnel to plan and conduct planned burns
- personnel to assess the effectiveness of planned burning or mechanical hazard reduction
- fire behaviour analysts to produce fire-spread predictions and community warnings.

Those who use the guide for these other purposes need to be mindful of its limitations and how the results are applied and interpreted.

1.3 What fuel is assessed

This guide is for assessing fine fuels that burn in bushfires. Fine fuels are the fuels that burn in the continuous flaming zone at the fire's edge. They contribute the most to the fire's rate of spread and flame height. Typically, they are dead plant material, such as leaves, grass, bark and twigs thinner than 6mm thick, and live plant material thinner than 3mm thick. Once ignited, these fine fuels generally burn out within two minutes.

This guide focuses on assessing the key structural layers of the fine fuel complex, in particular those of bark, elevated, near-surface and surface fuels.

1.4 How the fuel is assessed

Each fuel layer is assessed simply and visually. Assessing the fuel takes only a few minutes and is based on the premise that the eye is better able to integrate local variations in fuel than systematic measurement. Each fuel layer is assessed in turn and given a hazard rating. Particular emphasis is placed on how the fuel is arranged within each of these layers. The hazard ratings are then combined to produce an Overall Fuel Hazard Rating that ranges from Low to Extreme.

1.5 Why fuel arrangement is more important than fuel load

The image below highlights the effect that changing the arrangement of the fuel can have on fire behaviour. Both fires were ignited at the same time in the same way. Both fires are burning in the same fuel load, approximately two broadsheets of newspaper over a 20cm diameter area. The fuel on the right was laid flat and has little vertical orientation. The fuel on the left was crumpled up, which gave it more vertical orientation and exposed more of the surface to the air. As a result, the fire on the left shows significantly greater flame height and the fuel is consumed much faster.

The simple difference in the arrangement of the fuel significantly affects the resulting fire behaviour. The effect would not be discerned if the fuel assessment was based purely on fuel load. An assessment of fuel hazard takes into account the fuel arrangement. It gives a better indication of potential fire behaviour and suppression difficulty.

1.6 Suppression difficulty is not just about fire behaviour

This guide has been mainly developed to allow people to assess the impact of fuel arrangement on suppression difficulty. An assessment of suppression difficulty (how hard it is to control a bushfire) is not based solely on the anticipated fire behaviour. Many other factors affect the chances of a firefighting operation succeeding, including resources, fire size and terrain.

In order to consider the impact of fuels, the other factors need to be treated as if they are constant. The factors that have been held constant are referred to as the Reference Extended First Attack Conditions. Further detail on these conditions is contained in Appendix 1.

1.7 Basis of the Overall Fuel Hazard classification

A comprehensive explanation of this guide is contained in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep.).

This assessment guide updates and builds on work previously published by Wilson (1992a, 1992b, 1993), McCarthy *et al*. (1998a, 1998b, 1998c, 1999, 2001), the Department of Environment and Heritage (2006) and Gould *et al*. (2007a, 2007b).

Classifying Overall Fuel Hazard is complex, with few available measurements. Therefore, we have relied on the perceptions of experienced fire personnel (e.g. fire behaviour specialists, fire managers and firefighters). The collective experience of these personnel is vast, with a broad geographic base across Australia.

1.8 Need for continual learning and development

Although our knowledge about fuels has many gaps, this guide is based on the best available information and experience. The authors acknowledge that this guide will need to change and improve as more information is obtained.

Observers of firefighting operations can improve future editions of this guide by carefully recording what they see. Observations, comments and feedback can be emailed to fire.monitoring@dse.vic.gov.au.

2. How to use the guide

This guide has been kept concise and should not be considered as a standalone document. To produce reliable and consistent results requires extra knowledge which may be gained through local hands-on training in fuel assessment.

2.1 Application

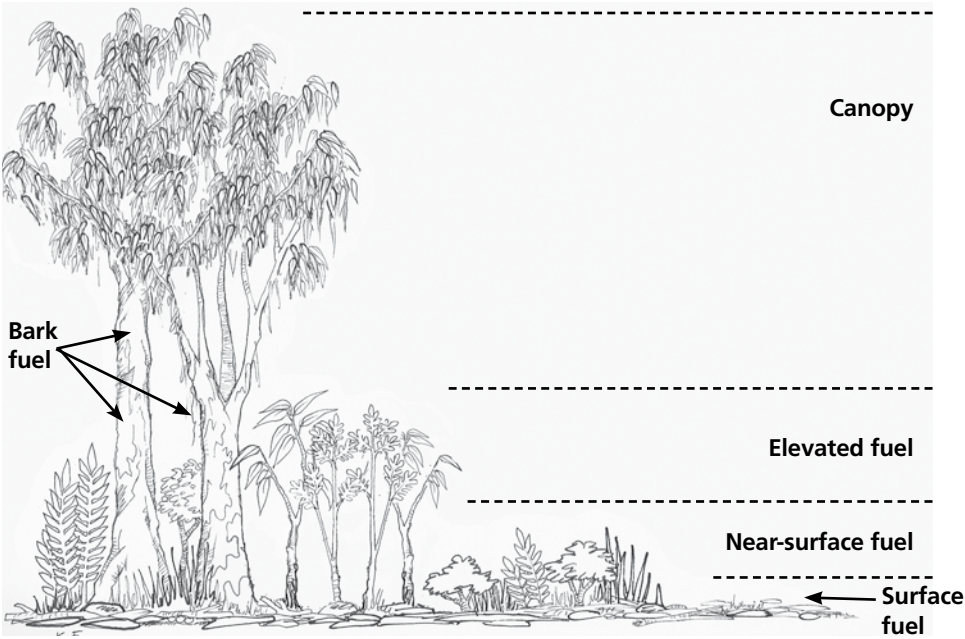
This guide is a tool for rapidly assessing fuel arrangement and its effect on the chances of controlling a bushfire. It may also be used for a range of other fire management purposes, as shown in the table below. Users of this guide should understand the underlying assumptions and limitations before applying it, particularly if applying it for purposes other than the assessment of suppression difficulty.

Application	Methodology
Assess suppression difficulty	Assess the fuels in which the fire may occur or is actually occurring.
Assess fuels for predicting potential risk to assets	Assess the fuels immediately adjacent to the asset as part of an assessment of possible radiant heat loads and defendable space. Assess the fuels further away from the asset; paying particular attention to areas that may generate spotting, such as ridges. Assessments should be focused, particularly in the direction of likely fire attack.
Assess the need for, or success of, fuel management activities	Assess the average fuels across the nominated area by sampling within major vegetation types, slopes and aspects.
Plan and conduct planned burns	Assess the variability in fuels across the nominated area by sampling within major vegetation types, slopes and aspects. Pay particular attention to areas where the burn may escape, such as the tops of gullies, ridge tops and areas adjacent to planned burn boundaries.
Assess fuels for predicting fire behaviour	Assess the fuel values needed as inputs for the appropriate fire behaviour model.

2.2 Fuel layers

Fuel in forests, woodlands and shrublands can be divided into four layers, each based on its position in the vegetation profile (Fig 2.1). This guide focuses on assessing the key structural layers of the fine fuel complex, those of bark, elevated, near-surface and surface fuels.

Figure 2.1 Fuel layers and bark



Use the following descriptions to determine how to separate vegetation into fuel layers.

Layer	Description	Contribution to suppression difficulty
Canopy	• Crowns of the tallest layer of trees. • Under some conditions canopy fuels can play a significant role in fire behaviour and suppression difficulty. Currently, however, these fuels are not assessed as part of Overall Fuel Hazard.	
Bark fuel	• Bark on tree trunks and branches, from ground level to canopy.	Spotting
Elevated fuel	• Fuels are mainly upright in orientation. • Generally most of the plant material is closer to the top of this fuel layer. • Sometimes contains suspended leaves, bark or twigs. • Fuels that have a clear gap between them and the surface fuels. • Can be highly variable in ground coverage. • Low-intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.	Influences the flame height and rate of spread of a fire.
Near-surface fuel	• Live and dead fuels, effectively in touch with the ground, but not lying on it. • Fuel has a mixture of vertical and horizontal orientation. • Bulk of the fuels are closer to the ground than to the top of this layer, or are distributed fairly evenly from the ground up. • Sometimes contains suspended leaves, bark or twigs. • Coverage may range from continuous to having gaps many times the size of the fuel patch. • Low-intensity fire (flame height of less than 0.5m) will consume most or all of this fuel. • Fuel in this layer will always burn when the surface fuel layer burns.	Influences the rate of spread and flame height of a fire.
Surface fuel (litter)	• Leaves, twigs, bark and other fine fuel lying on the ground. • Predominantly horizontal in orientation.	Influences the rate of spread of a fire.

This guide is for assessing fine fuels only. Coarse fuels including logs are not considered. See Section 1.3 for further details.

The descriptions of the fuel layers exclude references to species' names or common vegetation forms, such as shrubs. During a plant's life it may transition back and forth between different layers. For example, juvenile bracken fern can be classified as near-surface fuel before becoming elevated fuel as it matures. Once it dies and collapses it may become near-surface fuel again.

2.3 Assessment based on key attributes of fuel hazard

A fuel hazard rating of Low, Moderate, High, Very High or Extreme is assigned to each fuel layer by assessing it against the key attributes listed below.

Key attribute	
Horizontal continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel beside it. Identifies which of surface, near-surface or elevated fuels will determine the average flame height.
Vertical continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel above it.
Amount of dead material in the layer	Determines how much dead material is present to burn and thus help with igniting the live (green) fuels.
Thickness of the fuel pieces	Determines whether the fuel pieces will burn in the flaming front of the fire.
Total weight of fine fuel	Determines the weight of fine fuel contributing to the flaming front of the fire.

The descriptions in the hazard assessment tables do not cover all possible combinations of the key attributes. Users will need to exercise judgement and make an assessment using all key attributes when actual conditions fit between the descriptions.

2.4 Using the descriptions and photographs

This is **not** a photographic guide for assessing fuels. The **descriptions** for each of the key attributes should be used as the basis for determining the fuel hazard rating. Photographs cannot adequately show all of the key attributes that are important in determining fuel hazard. The photographs are provided to illustrate **some** of the key attributes for each fuel hazard rating. They do not represent all possible variations of that particular hazard rating.

2.5 Area of assessment

Within an area of interest fuels are assessed in small patches or plots. The size and number of plots depends on the reason for assessing the fuels. Some applications (such as for input into fire behaviour models) may require a more rigorous and systematic approach to sampling. Other applications (such as assessing fuel hazard during firefighting operations) will necessitate a more rapid informal approach. For whatever purpose the guide is being used it is recommended that the following principles be applied:

- Any assessment of fuels should try to assess the variability in fuels across an area by assessing the fuels at multiple plots.
- The size and number of plots should reflect the level of reliability required of the results.
- For surface, near-surface and elevated fuel layers the result of assessing the plot should reflect the average state of that fuel layer.
- For bark hazard the result of assessing the plot should be based on the trees with the highest rating.
- Always record with the result the name and the version of the guide used.

2.6 Tips for assessing fuel hazard

The process of assessing fuel hazard using this guide is largely subjective. Implementing the following techniques will help to improve accuracy and reliability:

- Identify and agree on examples of the highest rating of fuel hazard for each layer that occur locally. These examples should be used as benchmarks.
- Conduct assessments in pairs of observers and regularly change assessment pairs.
- Assessors should be no more than one hazard rating apart when assessing each layer (e.g. Low or Medium, not Low or High).
- Use different assessors to re-assess completed work and provide feedback.

2.7 Vesta fire behaviour predictions

In dry eucalypt forest with a litter and shrub understorey the *Field guide – fuel assessment and fire behaviour prediction in dry eucalypt forest* (Gould *et al.* 2007b) provides a systematic method for assessing fuel and predicting fire behaviour (rate of spread, flame height, and spotting). The Project Vesta fuel hazard scoring system is similar to the Victorian system developed by Wilson (1992a, 1992b, 1993) and revised by McCarthy *et al*. (1999). The scale that underlies the Vesta fuel hazard scores is directly related to fire behaviour. These scores, along with height measurements of various fuel layers, are needed as inputs into the fire behaviour prediction tables in Gould *et al*. (2007b). Section 9.3 contains a table for translating the fuel hazard rating for each fuel layer into Vesta fuel hazard scores.

2.8 Effect on fire behaviour

Each table for assessing fuel hazard contains information on the effect that the fuel arrangement is likely to have on fire behaviour. This effect is for weather conditions equivalent to a Forest Fire Danger Index (FFDI) of 25 (McArthur 1973). An FFDI of 25 can be achieved in many ways. For the purposes of this guide the specific conditions required to achieve this are:

Temperature: 33°C	Relative Humidity: 25%	Wind Speed: 20km/h
Drought Factor: 10	Slope: 0°	

If weather conditions vary from those listed above the effect on fire behaviour will also vary.

2.9 Fuel assessment data sheet

Appendix 2 contains a sample field data sheet that can be used when assessing fuels.

3. Bark fine fuel

3.1 Identification

Bark fuel is the bark on tree trunks and branches. Bark lying on or near the ground or draped over understorey plants is considered to be surface, near-surface or elevated fuel.

3.2 Identifying bark types

The key attributes for assessing the effect of bark on suppression difficulty are shown below:

Key attribute	Determines	How it is assessed
Ease of ignition	• How readily the bark will ignite. • Whether the fire will burn up the trunk and into the branches of the tree.	Thickness, size and shape of bark pieces.
How bark is attached	• How likely the bark is to break off the tree.	How easily the bark breaks off the tree.
Quantity of combustible bark	• Volume of potential embers that a fire may generate.	Relative quantity of combustible bark.
Size-to-weight ratio of the bark pieces	• How far the wind is likely to carry bark pieces once they break off the tree.	Thickness, size and shape of bark pieces.
Burn out time	• Length of time a piece of bark will stay ignited once it breaks off the tree.	Thickness, size and shape of bark pieces.

Descriptions of trees have been separated into three broad bark types using three of these key attributes – ease of ignition, burn out time and size-to-weight ratio:

1. Fine fibrous barks, including stringybarks
2. Ribbon or candle barks
3. Other bark types, including smooth, platy, papery and coarsely fibrous. The reason for describing these types in some detail is to help observers distinguish them from the above two types.

3.3 Identifying Stringybark and other fine fibrous bark types

Contribution to suppression difficulty	• Bark types that can produce massive quantities of embers and short distance spotting.
Physical description	• Bark is fine fibrous material with easily visible fibres less than 1mm thick covering the whole trunk. • Bark fibres resemble the fine fibres that are twisted together to form natural string. • Old bark is retained on the trunk of the tree for decades, forming a relatively spongy fibrous mass with deep vertical fissures. • Outer bark may weather to a greyish colour, while underlying bark retains its original colour. • Bark may form large strands when peeled off. • Fine, hairlike pieces also break off from the tree when it is rubbed.
Ease of ignition	• Bark is very flammable (can be easily lit with a match when dry). • Fires will readily climb the tree and branches.
How bark is attached	• Young or new bark is held tightly to the trunk. • As bark ages it becomes less tightly held. • Old, long-unburnt bark is held very loosely.
Quantity of combustible bark	• Bark on old, long-unburnt stringybarks can be more than 10cm in depth. During fires it can produce massive quantities of embers.
Size-to-weight ratio	Burning pieces of bark tend to be either: • Very fine lightweight fibres that will be carried for less than 100m. • Small lightweight wads (about the size of a thumb) that will be carried for less than 300m. • Very large wads (bigger than a fist) that fall close to the tree.
Burn out time	• Very fine fibres of bark that will burn out within one minute. • Small wads of bark that will burn out within 2–3 minutes. • Very large wads of bark that will burn for up to 10 minutes.
Hazard accumulation	• Bark hazard can reach Extreme. • Bark hazard increases over time as the thickness and looseness of the old bark increases. • Repeated low intensity fires (<0.5m flame height) may produce a 'black sock' effect on the base of the trunk, but this may have limited effect in reducing the overall quantity of bark and the hazard.

Examples

Table 3.1 Assessing the hazard of fine fibrous bark types including stringybarks

Only use this table if at least 10% of the trees in a forest have fine fibrous bark. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[1]
How bark is attached	**Quantity of combustible bark**		
This hazard rating cannot occur when only this bark type is present.		Low	
Bark tightly held. Requires substantial effort to break off bark by hand.	Very little combustible bark. Entire trunk almost completely black or charred.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Bark is mostly tightly held with a few pieces loosely attached.	Limited amount of combustible bark. 50–90% of trunk charred. Most of the bark is charred, especially on the lower part of the trunk.	High	Infrequent spotting. Fires will climb some of these trees.
Many pieces of bark loosely held. Deep fissures present in bark.	Large amounts of combustible bark. 10–50% of trunk charred. Upper parts of the tree may not be charred at all.	Very High	Substantial spotting. Fires will climb most of these trees.
Outer bark on trees is weakly attached. Light hand pressure will break off large wads of bark. Deep fissures present in bark.	Huge amounts of combustible bark. <10% of trunk charred. Minimal evidence of charring.	Extreme	Quantity of spotting generated makes fire control very difficult or impossible. Fires will climb virtually all these trees.

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as being the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

1 FFDI 25 is a Forest Fire Danger Index of 25 (McArthur 1973). Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.2 Examples of Stringybarks and other fine fibrous bark hazard

Low	This hazard rating cannot occur when only this bark type is present.
Moderate	
High	
Very High	
Extreme	

The photos above show some of the variation possible within each bark hazard rating.

3

3.4 Identifying ribbon or candle bark types

Effect on suppression difficulty	• Bark types that can produce substantial quantities of spotting at distances greater than 2km. Will also produce short distance spotting.
Physical description	• Trees characterised by the annual shedding of old bark layers, exposing the smooth new bark underneath. • Bark is shed in the form of long strips or ribbons of bark. • Long strips of bark curl tightly inwards to form a candle-like shape (see image lower right). • Bark strips 50cm or more in length fall off and often drape around the trunk and over branches and surrounding shrubs. • Strips of bark are usually less than 2mm thick. • Bark is shed at various times of the year so that the trunk may have a mottled appearance.
Ease of ignition	• Bark is moderately flammable (can be lit with a cigarette lighter when dry). • Fires will climb up ribbons of bark.
How bark is attached	• Bark strips may drape over, or be weakly attached to, the trunk and branches.
Quantity of combustible bark	• Large quantities of bark can be retained in upper trunk and head of the tree.
Size-to-weight ratio	• Bark pieces are relatively light for their large size. • Easily transported by strong updrafts – may travel up to 30km downwind.
Burn out time	• Bark can burn and smoulder within the curled up ribbons for longer than 10 minutes.
Hazard accumulation	• Bark hazard never exceeds Very High. • Bark hazard tends to increase over the long term as ribbons accumulate on the tree. • A low intensity fire (flame height of less than 0.5m) may not reduce the hazard in this bark type.

Example

Note: Loose ribbon or candle-like bark that is retained on the trunk near ground level is not included in the assessment of ribbon or candle bark types. It is usually:
- firmly attached to the trunk of the tree
- consumed in place by a surface fire.

This bark is considered in 'Other bark types' and can also be considered as near-surface fuel.

Smooth-bark trees also shed bark as slabs or flakes. These bark types are considered in 'Other bark types'.

Table 3.3 Assessing the hazard of ribbon or candle bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site.

Key attribute Amount of combustible bark	Hazard rating	Effect on fire behaviour (at FFDI 25)[2]
This hazard rating cannot occur when only this bark type is present.	Low	
No long ribbons of bark present. Trunk and branches of trees almost entirely smooth.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Long ribbons of bark present on upper trunk (>4m above ground) and in head of trees. Lower trunk mainly smooth.	High	Infrequent spotting. Fires will climb some of these trees.
Long ribbons of bark in the head and upper trunk with: • ribbons hanging down to ground level or, • flammable bark covers trunk.	Very High	Substantial spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.	Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

2 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.4 Examples of ribbon or candle bark hazard

Low	This hazard rating cannot occur when only this bark type is present.
Moderate	
High	
Very High	
Extreme	This hazard rating cannot occur when only this bark type is present.

3.5 Identifying other bark types

This bark type includes all other bark types not included in the previous two types. As a result, many different tree species are grouped together. This grouping is based on the ease of ignition, burn out time and size-to-weight ratio of the bark, rather than on botanical values. These other bark types can produce limited quantities of short distance spotting.

This bark type group has been divided into several subgroups. These subgroups are described in some detail to help observers distinguish them from the other two main bark types.

3.5.1 Ironbarks and Platy barks

Physical description	• Trees characterised by layers of old, coarse bark retained on the trunk and branches. • Bark becomes rough, compacted and furrowed with age • Bark feels very abrasive when rubbed by hand. • Bark pieces tend to be more than 2mm thick when they break off. • There may be little or no evidence of charring on the bark following planned burns.
Hazard accumulation	• Bark hazard never exceeds Moderate.

Example

3.5.2 Coarsely fibrous barks

Physical description	• Trees characterised by short strand fibrous bark. • Layers of old dead bark are retained on the trunk and branches. • Unlike stringybark trees, the bark on these trees forms only short strands or chunks when peeled off. • Evidence of charring on the bark may last for up to 10 years.
Hazard accumulation	• Bark hazard never exceeds High. • Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.3 Papery barks

Physical description

- Shrubs and trees growing from 2m to 30m tall, often with flaky shedding bark.
- Old bark is retained on the trunk and branches and builds up into a thick spongy mass.
- Bark layers tend to split allowing sheets of bark to become loose and eventually peel off.
- Evidence of charring on the bark may last for up to 10 years.

Hazard accumulation

- Bark hazard never exceeds High.
- Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.4 Slab bark, smooth bark and small flakes

Physical description

- Trees characterised by the annual shedding of old bark layers, exposing the smooth living bark underneath.
- Bark shed is often seasonal and often annual.
- Species where the old bark tends to peel into large slabs (<50cm in length) or small flakes when shed.
- Most of the bark falls off the tree soon after it is shed.
- Some small amounts of bark may be retained on the stem or branches for several months before falling off, leading to a mottled effect.
- The mottled effect leads to discontinuous bark fuel up the tree.

Hazard accumulation

- Bark hazard never exceeds Moderate.
- Bark hazard tends to be seasonal.

Example

Table 3.5 Assessing the hazard of other bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[3]
How bark is attached	**Quantity of combustible bark**		
No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.		Low	No bark present that could contribute to fire behaviour.
Bark rubs off by hand with firm pressure.	Limited amount of combustible bark.	Moderate	Spotting generally does not hinder fire control. Fires will climb some of these trees.
Light hand pressure will break bark off.	Large amounts of combustible bark.	High	Infrequent spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.		Very High	
This hazard rating cannot occur when only this bark type is present.		Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

3 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

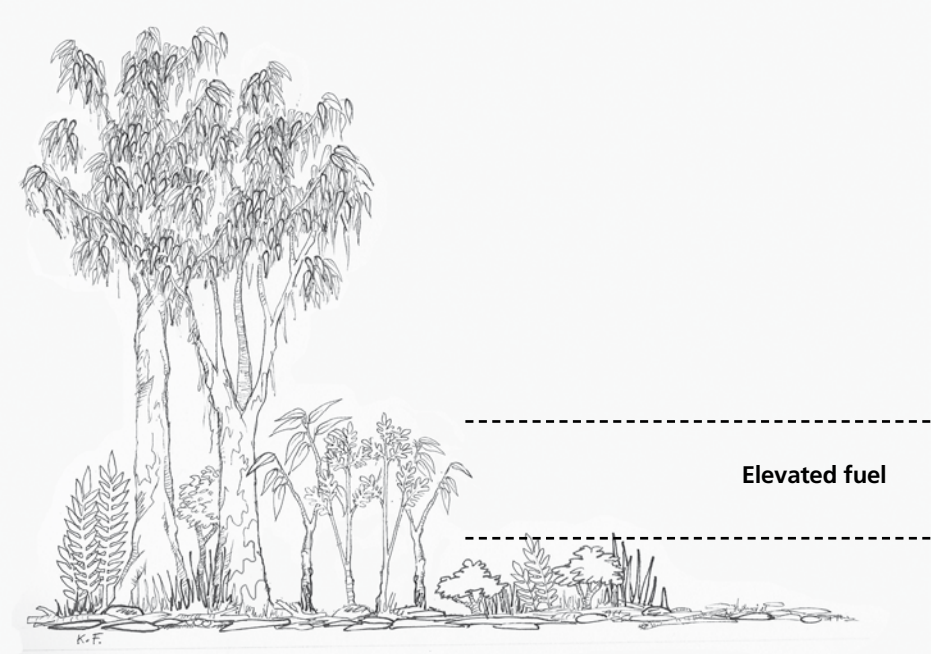
Table 3.6 Examples of other bark types

Low	No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.	
Moderate		
High		
Very High	Does not occur when this is the only bark type present on a site.	
Extreme	Does not occur when this is the only bark type present on a site.	

4. Elevated fine fuel

4.1 Identification

- Fuels are mainly upright in orientation
- Generally most of the plant material is closer to the top of this layer
- Sometimes contains suspended leaves, bark or twigs
- Fuels that have a clear gap between them and the surface fuels
- Elevated fuel can be highly variable in ground coverage
- A low intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.



4.2 Assessment

The elevated fuel hazard is highest when the:

- foliage, twigs and other fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and/or horizontal and vertical continuity that promotes the spread of flames
- live foliage has low fuel moisture content.

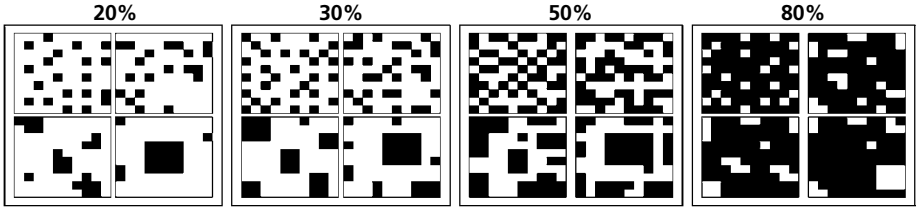
Table 4.1 Assessing elevated fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes					Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[4]
Plant Cover	% dead	Vertical continuity	Vegetation density	Thickness of fuel pieces		
<20% or low flammability species	<20%		Easy to walk in any direction without needing to choose a path between shrubs.		Low	Little or no effect.
20–30%	<20%	Most of the fine fuel is at the top of the layer.	Easy to choose a path through but brush against vegetation occasionally.		Moderate	Does not sustain flames readily.
30–50%	<20%	Most of the fine fuel is at the top of the layer.	Moderately easy to choose a path through, but brush against vegetation most of the time.		High	Causes some patchy increases in the flame height and/or rate of spread of a fire.
50–80%	20–30%	Continuous fine fuel from the bottom to the top of the layer.	Need to carefully select path through.	Mostly less than 1–2mm thick.	Very High	Elevated fuels mostly dictate flame height and rate of spread of a fire.
>70%	>30%	Continuous fine fuel from the bottom to the top of the layer.	Very difficult to select a path through. Need to push through vegetation.	Large amounts of fuel <2mm thick.	Extreme	Elevated fuels almost entirely determine the flame height and rate of spread of a fire.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



4 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 4.2 Examples of elevated fine fuel hazard

Low	Elevated fuel absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

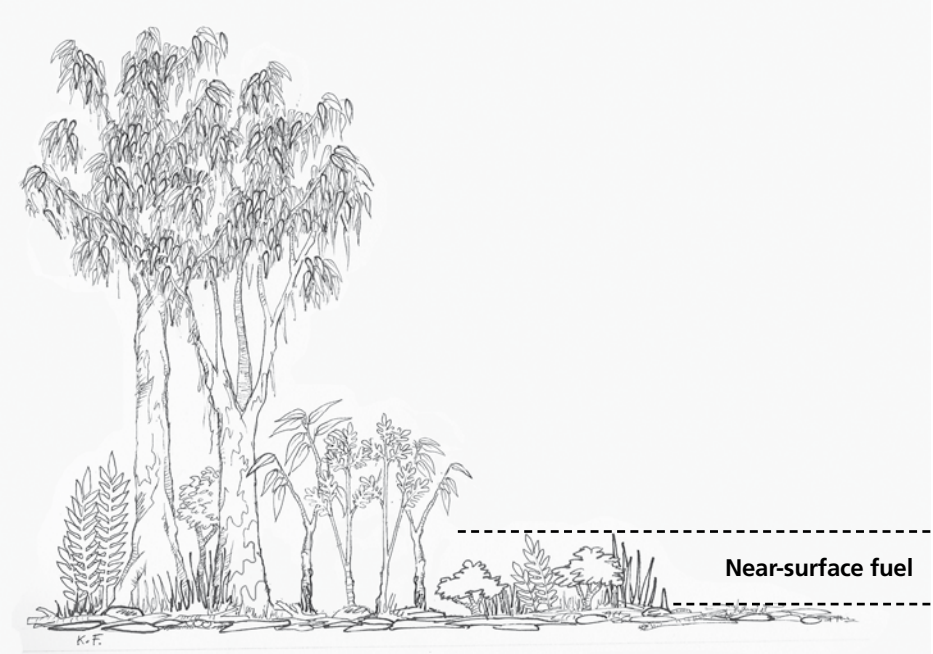
Assess elevated hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of elevated fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the elevated fuel height (m) should be the average of 10 measurements taken along a 300m walk-through. Measure the typical height from ground level.

5. Near-surface fine fuel

5.1 Identification

- Live and dead fuels effectively in touch with the ground but not lying on it
- Fuel has a mixture of vertical and horizontal orientation
- Either the bulk of the fuels is closer to the ground than the top of this layer, or is distributed fairly evenly from the ground up
- Sometimes contains suspended leaves, bark or twigs
- Coverage may range from continuous to having gaps many times the size of the fuel patch
- A low intensity fire (flame height of less than 0.5m) will consume most or all of this fuel
- Fuel in this layer will always burn when the surface fuel layer burns.



5.2 Assessment

The near-surface fuel hazard is highest when the:

- foliage, twigs and other fine fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and /or horizontal and vertical continuity, that promotes the spread of flames
- live foliage has low fuel-moisture content.

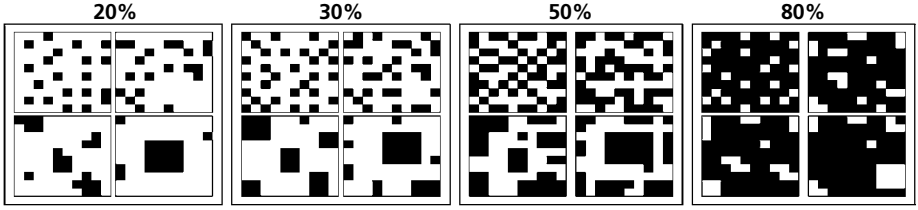
Table 5.1 Assessing near-surface fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[5]
Plant cover	% dead	Horizontal connectivity		
<10%	<10%	Near-surface fuel is absent or virtually absent.	Low	Little or no effect.
10–20%	<20%	Gaps many times the size of fuel patches.	Moderate	Occasionally increases flame height.
20–40%	>20%	Gaps between fuel patches are greater than the size of fuel patches. Starting to obscure logs and rocks.	High	Contributes to surface fire spread and causes patchy increase to flame height.
40–60%	>30%	Fuel patches are equal to or larger than the gaps between the fuel patches.	Very High	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.
>60%	>50%	Very small gaps between fuel patches. Logs and rocks obscured.	Extreme	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



5 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 5.2 Examples of near-surface fine fuel hazard

Low	Near-surface fuel is absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

Assess near-surface hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of near-surface fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the near-surface fuel height (cm) should be the average of 10 measurements taken over a 300m walk through. Measure the typical height from ground level.

6. Surface fine fuel

6.1 Identification

- Leaves, twigs, bark and other fine fuel lying on the ground
- Predominantly horizontal in orientation
- Usually contributes the most to fuel load or quantity
- Includes the partly decomposed fuel (duff) on the soil surface.

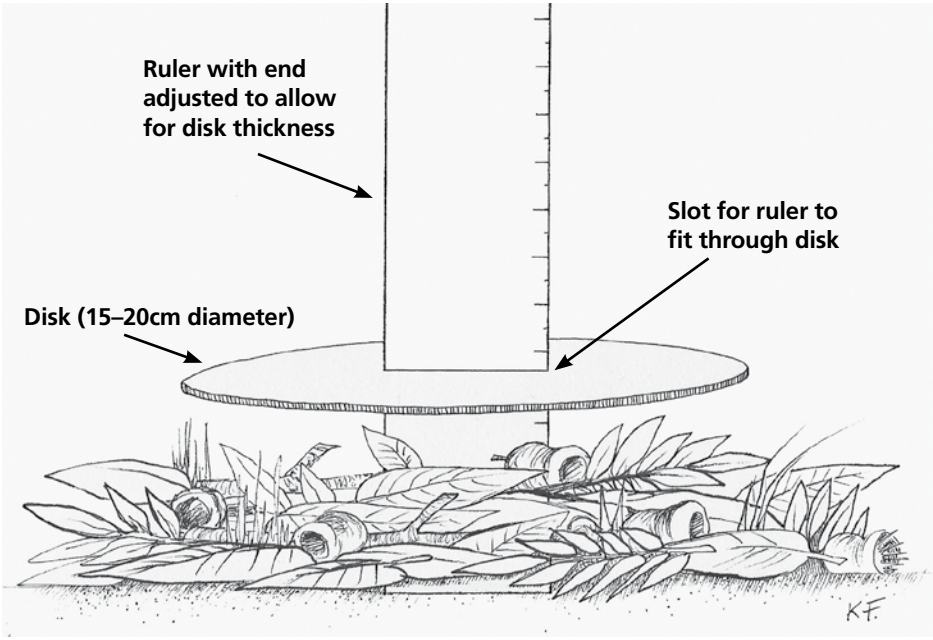
6.2 Assessment

The surface fine fuel hazard is highest when the:

- litter pieces are well connected
- surface litter cover is high, with minimal interruption from rocks, logs or patches of bare soil
- surface litter has substantial depth (greater than 30mm).

6.3 Measurement

Surface litter-bed depth should be measured using a simple depth gauge, as pictured below. This follows the methodology described in McCarthy (2004) and McCarthy *et al*. (1999).



Litter depth should be measured in areas where near-surface fuels do not obscure the litter. Fuel depth is measured using a 15cm circular disk with a ruler through a slot in its centre. To use this gauge, a small gap is made in the litter bed down to mineral soil, then the end of the ruler is placed resting on the mineral soil surface. The disk is pushed down with light pressure until its whole perimeter is in contact with the fuel. Light pressure can be described as 'enough pressure to hold a tennis ball under water'. The ruler is read off level with the top of the disk. Note that the end of the ruler needs to be adjusted to match the thickness of the disk.

Five measurements of litter bed depth should be made at each site. The average of these measurements is one of the attributes that can be used to determine the surface fine fuel hazard.

Table 6.1 Assessing surface fine fuel hazard

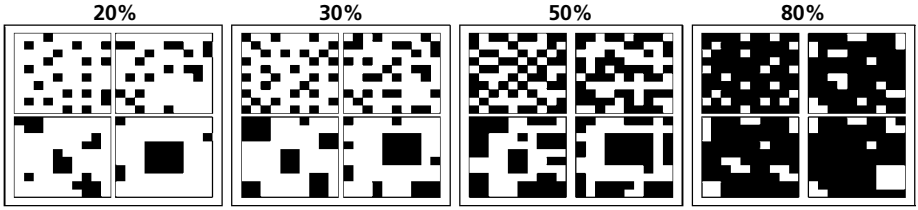
To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[6]
Horizontal connectivity	Surface litter cover	Litter-bed depth		
Litter poorly interconnected. Large areas of bare soil or rock. More soil than litter. Soil surface readily visible through litter bed.	<60%	Very thin litter layer <10mm	Low	Surface fires will not spread.
Litter well connected. Some areas of bare soil or rock. Soil surface occasionally visible through litter bed.	60–80%	Thin litter layer 10–25mm	Moderate	Litter connected well enough to allow fire spread to overcome bare patches.
Litter well connected. Little bare soil.	80–90%	Established litter with layers of leaves ranging from freshly fallen to decomposing. 20–30mm	High	Surface fires spread easily with a continuous fire edge.
Litter completely connected.	>90%	Thick litter layer 25–45mm	Very High	Surface fires spread easily. Increasing flame depth and residence time.
Litter completely connected.	>95%	Very thick layer of litter >35mm	Extreme	Surface fires spread easily. Increasing flame depth and residence time.

Assess surface hazard over a plot 10m in radius. Assessing multiple plots will give better results. For each plot litter bed depth should be an average of five measurements (McCarthy 2004) or more.

See Section 9.3 for application of surface fuel hazard ratings for the Vesta fire behaviour tables.

The following visual guide can be used to assist in assessing surface litter cover. Each quarter of any one square has the same percent cover.



6 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 6.2 Examples of surface fine fuel hazard

Low		
Moderate		
High		
Very High		
Extreme		

7. Determining the combined surface and near-surface fine fuel hazard rating

Assessments of surface and near-surface fuels must be combined together before an Overall Fuel Hazard rating can be determined. The near-surface fuel rating is used to adjust the surface fine fuel hazard rating, according to Table 7.1.

To determine the effect of near-surface fine fuel hazard:

1. Select the **surface fuel hazard rating** from column 1
2. Select the **near-surface fuel hazard rating** from column 2
3. Select the resulting **combined rating** value 3
4. Use this value to determine the Overall Fuel Hazard rating using the Table 8.1.

Table 7.1 Determining the combined surface and near-surface fine fuel hazard rating

1 Surface fine fuel hazard rating	2 Near-surface fine fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
	3 Combined surface and near-surface fine fuel hazard rating				
Low	L	L	M	H	VH
Moderate	M	M	H	VH	E
High	H	VH	VH	VH	E
Very High	VH	VH	E	E	E
Extreme	E	E	E	E	E

8. Determining Overall Fuel Hazard

Overall Fuel Hazard = (sum of the influences of) Bark Hazard + Elevated Fine Fuel Hazard + Combined Surface and Near-surface Fine Fuel Hazard.

The following table is used to combine the assessed levels of Bark, Elevated and Combined Surface and Near-surface Fuel Hazard to give an Overall Fuel Hazard rating.

To determine the Overall Fuel Hazard rating:

1. Select the row that corresponds to the **Bark Hazard** ❶
2. Select the row that corresponds to the **Elevated Fine Fuel Hazard** ❷
3. Select the column that corresponds to the assessed level of **Combined Surface and Near-surface Fine Fuel Hazard** ❸
4. Identify where these two intersect and this will provide you with the corresponding Overall Fuel Hazard rating.

Table 8.1 Determining the Overall Fuel Hazard rating

❶ Bark Hazard	❷ Elevated Fine Fuel Hazard	❸ Combined Surface and Near-surface Fine Fuel Hazard *				
		L	M	H	VH	E
Low or Moderate	L	L	M	M	H	H
	M	L	M	M	H	H
	H	L	M	H	VH	VH
	VH	VH	VH	VH	VH	VH
	E	E	E	E	E	E
High	L	L	M	H	H	H
	M	L	M	H	H	H
	H	L	H	H	VH	VH
	VH	VH	VH	VH	VH	E
	E	E	E	E	E	E
Very High or Extreme	L	L	VH	VH	VH	E
	M	M	VH	VH	E	E
	H	M	VH	E	E	E
	VH	E	E	E	E	E
	E	E	E	E	E	E

* Combined Surface and Near-surface Fine Fuel Hazard is a measure of the Surface Fine Fuel Hazard adjusted to account for the level of near-surface fine fuel (see Table 7.1).

9. Interpreting and applying Overall Fuel Hazard

9.1 Chances of extended first attack success

The chances of extended first attack being successful[1] for a fire ignited in these fuels under the reference extended first attack conditions (Appendix 1) is approximately as follows:

Table 9.1 Chances of extended first attack success

GFDI[2]	FFDI[3]	Overall Fuel Hazard rating[4]				
		Low	Moderate	High	Very High	Extreme
0–2	0–5					
3–7	6–11					
8–20	12–24					
20–49	25–49					
50–74	50–74					
75–99	75–99					
100+	100+					

Chance of extended first attack success is greater than 95% (almost always succeeds)

Chance of extended first attack success is between 95% and 50% (succeeds most of the time)

Chance of extended first attack success is between 49% and 10% (fails most of the time)

Chance of extended first attack success is less than 10% (almost always fails)

Notes:

1. Extended first attack is deemed successful when a fire is controlled by 0800hrs the day after ignition and at less than 400 hectares.
2. GFDI is the Grass Fire Danger Index at the time of ignition and is assumed to be the highest GFDI expected before 0800hrs the next day.
3. FFDI is the Forest Fire Danger Index at the time of ignition and is assumed to be the highest FFDI expected before 0800hrs the next day.
4. Chance of success is for a fire ignited in fuels with this Overall Fuel Hazard rating.
5. Predicted outcomes will differ if the conditions vary from those listed in the reference extended first attack conditions.
6. Predicted outcomes based on expert opinion and informed by work carried out by Wilson (1992b, 1993), McCarthy *et al*. (1998a, 2001) and Plucinski *et al*. (2007).

9.2 Indicative fuel loads (t/ha)

In the absence of local data obtained by sampling fuel loads destructively the following table of indicative fuel load data from Project Vesta and Victorian studies may be useful. These tonnes per hectare figures may be applied to the Forest Fire Danger Meter Mark V (McArthur 1973) for predicting forward rate of spread and flame height for forest fires.

Table 9.2 Indicative fuel loads (t/ha)

Fuel	Fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
Bark	0	1	2	5	7
Elevated	0–1	1–2	2–3	3–5	5–8
Near-surface	1–2	2–3	3–4	4–6	6–8
Surface	2–4	4–10	8–14	12–20	16–20+

9.3 Determining Vesta fuel hazard scores

The following table translates fuel hazard ratings for each fuel layer into Project Vesta fuel hazard scores. These scores can be used with the fire behaviour prediction tables in publications such as Gould *et al*. (2007b).

To determine the Vesta fuel hazard score:

1. Select the row that corresponds to the fuel hazard rating for required fuel layer (1)
2. Select the Vesta fuel hazard score column that corresponds to the same layer (2)
3. Identify where these two intersect and this will provide you with the corresponding Vesta fuel hazard score.

Table 9.3 Determining Vesta fuel hazard scores

	Vesta fuel hazard score (2)			
Fuel hazard rating (1)	**Surface**	**Near-surface**	**Elevated**	**Bark**
Low	1	1	1	0
Moderate	2	2	2	1
High	3	3	3	2
Very High	3.5	3.5	3.5	3
Extreme	4	4	4	4

Notes:

- Surface and near-surface hazard score and near-surface height (cm) is required for fire spread prediction.
- Rate of spread and elevated fuel height (m) is required for flame height prediction.
- Rate of spread, surface and bark fuel hazard scores are required for prediction of spotting distance.

Acknowledgements

This Fuel Hazard Assessment Guide updates and continues to develop work previously conducted by a number of authors. Andrew Wilson laid the foundations for this guide, with the conceptual framework presented in Research Report No. 31; and the visual guides for assessing the influence of bark and elevated fuels on suppression difficulty in the *Eucalypt Bark Hazard Guide and Elevated Fuel Guide* (Reports 32 and 35, respectively). Greg McCarthy (2004) detailed a method for rapidly assessing surface fine fuels in Research Report No. 44.

These three techniques were brought together in the first three editions of the *Overall Fuel Hazard Guide* (McCarthy, Tolhurst and Chatto, 1998b, 1998c, 1999). A subsequent unpublished edition of the guide, produced by Kevin Tolhurst (2005), provided greater detail on the assessment of near-surface fuels. In 2006, Mike Wouters adapted the guide for South Australian conditions, and incorporated the preliminary results from Project Vesta (CSIRO and Department of Conservation and Environment, Western Australia). Further information and results from the final Project Vesta report (Gould *et al.* 2007a) have also been incorporated.

Thanks to Lachie McCaw (Department of Environment and Conservation, Western Australia), Mike Wouters (Department of Environment and Heritage, South Australia), Jim Gould and Miguel Cruz (CSIRO) for their advice and comments during the production of this guide. Thanks must also go to the many other people across Australia who have provided comments and feedback during the production of the guide.

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Appendix 1. Reference extended first attack conditions

This guide assesses the impact of fuels in suppressing a fire during extended first attack, using local resources. Several factors affect the success of an extended first attack. Therefore, to consider the impact of fuels alone, the other factors must be treated as if they were constant. Table A1 below adapted from Wilson (1993) summarises reference extended first attack conditions for four fuel types.

Table A1. Revised reference extended first attack conditions

Fuel type	Forest fuels	Grass fuels	Mallee and scrub fuels	Heath fuels
Examples of typical resources (on scene within the designated arrival time)	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters	5 x 4WD heavy tankers (4000l) each with 5 firefighters	Small dozer (D4) or tractor with scrub roller 1 to 2 small 4WD tankers (400l) 6 firefighters	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters
Extended attack resources	Potential additional resources deployed to the fire during extended first attack may include heavy tankers, large plant (dozers, graders or tractors) and fire bombing aircraft.			
Arrival time	Within 60 minutes of detection			
Suppression workload	A single fire			
Topography and terrain	Burning on level ground with good access			
Fuel availability[1]	MDF is 10 or AFF is 1.0	100% grass curing	MDF is 10 or AFF is 1.0	
Wind speed[2]	20km/h	30km/h		20km/h
Fire danger rating system[3]	McArthur FFDI	McArthur GFDI	McArthur FFDI	

Notes:

1. MDF (McArthur Drought Factor) is calculated using the Forest Fire Danger Meter (McArthur 1973) and is a measure of the short-term availability of forest fuels. AFF (Available Fuel Factor) is used in Western Australia to define the proportion of litter fuel available for burning (Sneeuwjagt & Peet 1998).
2. Wind speed is measured at 10m height in the open above ground level.
3. FFDI is the McArthur Forest Fire Danger Index, GFDI is the McArthur Grass Fire Danger Index.

The rationale for the reference first attack conditions is documented in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep).

Appendix 2. Sample fuel assessment field work form v3

Date Assessed:	Assessors:
Sampling Location:	Veg Type:

Plot Information			
Plot No.			
Zone:			
Easting (GDA94 MGA UTM):			
Northing (GDA94 MGA UTM):			

Canopy height (Assess over a 20m radius)			
Average Height to Top of Canopy:	m	m	m
Average Height to Base of Canopy:	m	m	m

Bark fuel (Assess over a 20m radius)															
Stringybark Fuel Hazard:	NP	M	H	VH	E	NP	M	H	VH	E	NP	M	H	VH	E
Ribbon Bark Fuel Hazard:	NP	M	H	VH		NP	M	H	VH		NP	M	H	VH	
Other Bark Fuel Hazard:	L	M	H			L	M	H			L	M	H		

Select the Bark Hazard rating from above that will be used to determine Overall Fuel Hazard. (Only use the Stringybark hazard rating if more than 10% of the trees are Stringybark **AND** it has the highest rating. Otherwise use the bark with next highest rating.)

Bark Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Elevated fuel layer (Assess over a 10m radius)															
Elevated % Cover:	%					%					%				
Elevated % Dead	%					%					%				
Elevated Fuel Ave Height (m)	m					m					m				
Elevated Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Near-surface fuel layer (Assess over a 10m radius)															
Near-surface % Cover:	%					%					%				
Near-surface % Dead	%					%					%				
NS Average Height (cm):	cm					cm					cm				
NS Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

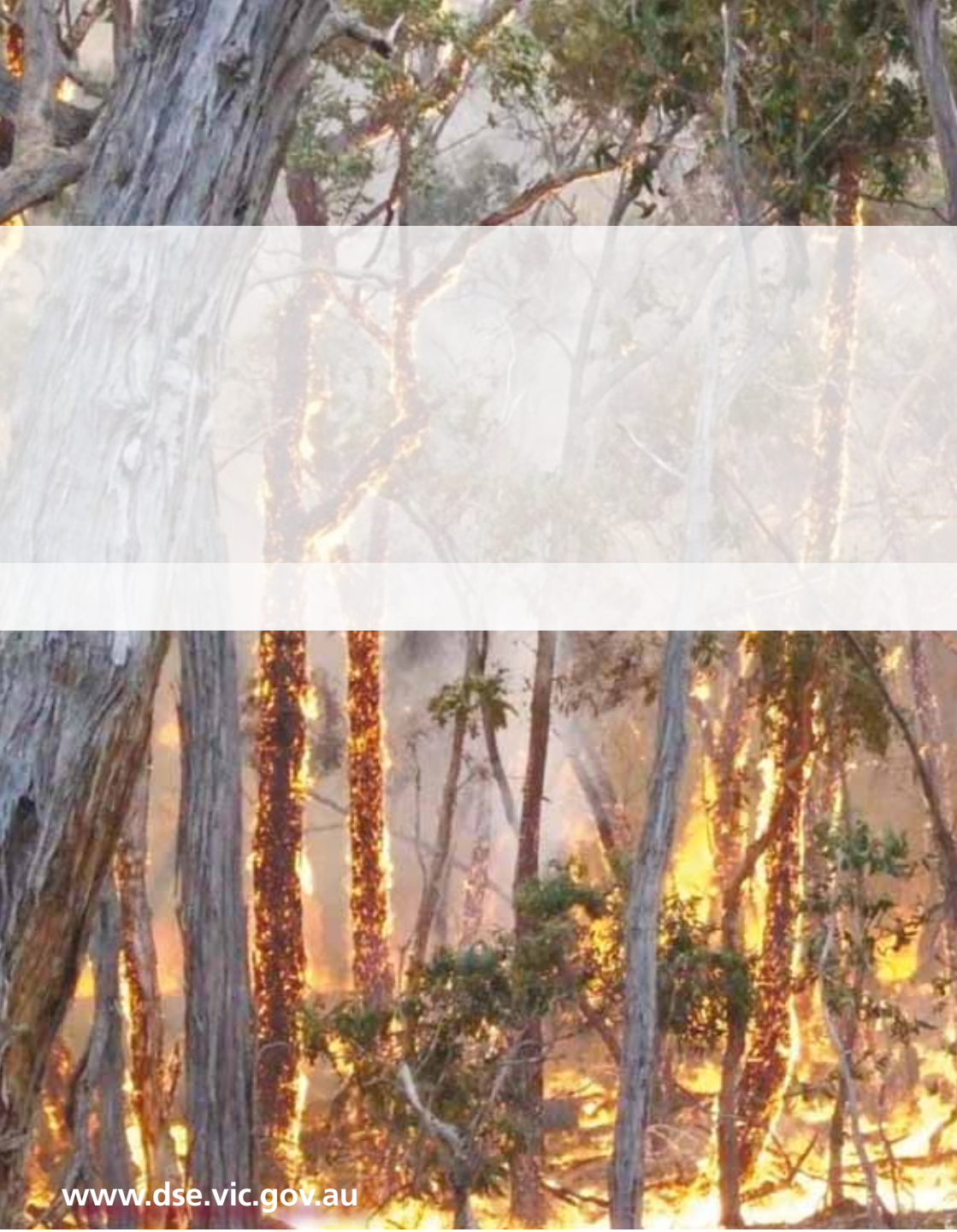
Surface fuel layer (Assess over a 10m radius)															
Surface Litter % Cover:	%					%					%				
Average Litter Depth (mm):	mm					mm					mm				
Surface Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Combined Surface and Near-surface Fine Fuel Hazard calculation (refer Section 7)															
Combined Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Overall Fuel Hazard calculation (refer Section 8)															
Overall Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Are the plots representative of the average fuels across the sampling location?	Yes	No

If no, explain any significant difference between plots. For example, wet gully runs through the sampling area, no plots were located in this gully.



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Appendix F

MNES habitat quality score method

Calculation of a habitat quality score for each MNES considers three attributes:

- site condition
- site context
- species stocking rate.

Site condition

The site condition score for each MNES is calculated generally in accordance with the site condition assessment method outlined in Section 5 of the GTDTHQ (version 1.2; DEHP 2017). Site condition is determined through a field-based assessment of 13 ecological attributes to describe the structure and function of the vegetation community, compared to the expected range for a relatively undisturbed community (i.e. RE benchmark).

The results of the field-based assessment are scored based on the scoring guide provided in the GTDTHQ to determine the site condition score for each MNES at each relevant monitoring site out of 80.

Site context

The method to calculate site context for a site is based on the site context assessment method provided in the GTDTHQ. The following components were assessed through a GIS desktop analysis at each relevant monitoring site for each MNES:

- Patch size: the size of the patch/assessment unit being assessed and any directly connecting suitable/known habitat and remnant vegetation. To calculate the patch size score:
  - Measure the area of vegetation in which the assessment unit is contained and add on all other directly connecting areas of suitable or known habitat for the threatened species or community and remnant vegetation. Suitable or known habitat will be based on mapped vegetation comprising regional ecosystems known or likely to support the MNES value based on the conservation advice or other species-specific sources endorsed by Queensland and/or Commonwealth Governments. Where the connecting patch comprises an RE that is known or suitable habitat, then 100% of the area of that RE is attributed to the total patch size area. Where the connecting RE is not considered known or suitable habitat (i.e. non-compliant RE); however, is a remnant RE, only 10% of the area of that RE is attributed to the total patch size area sum. The reduced weighting for non-compliant REs acknowledges the importance of these REs in contributing to the overall patch size through its contribution to potential dispersal of species, and the supporting role of these REs for maintaining connectivity to potential source meta-populations.
  - Determine the score for this attribute by matching with the class ranges in Table F1.
- Connectedness: measure the proportion of the assessment unit's boundary which is connected to suitable/known habitat and remnant vegetation. To calculate the connectedness score:
  - Measure the percentage of suitable/known habitat and remnant vegetation along the boundary of the assessment unit.
  - Determine the score for this attribute by matching with the class ranges in Table F1.
- Context: measure the percentage of suitable/known habitat and remnant vegetation within a 1 km buffer around the site/assessment unit. To calculate the context score:
  - Create a 1 km buffer around the monitoring site.
  - Measure the percentage cover of remnant vegetation within the buffer area.
  - Determine the score for this attribute by matching with the thresholds Table F1.
  - Ecological corridors: to calculate the ecological corridor score:
  - Determine the proximity of the site to state, bioregional, regional or sub-regional corridors (terrestrial or riparian).

– Determine the score from Table F1 based on whether the site is located within (wholly or partly); shares a common boundary with; or is not within a corridor.

Table F1 - Site context scoring guide

Attribute	Scoring guide					
Size of Patch	Score	0	2	5	7	10
	Description	<5 ha	5-25 ha	26-100 ha	101-200 ha	>200 ha
Connectedness	Score	0	2		4	5
	Description	0-10%	>10%-<50%		50-75%	>75% or >500 ha
Context	Score	0	2		4	5
	Description	<10%	>10-30%		>30-75%	>75%
Ecological corridors	Score	0	4		6	
	Description	Not within	Sharing a common boundary		Within (whole or part)	

The total site context score for each MNES at each relevant monitoring site is calculated out of 26.

Species habitat index

A quantitative method is used to determine the species habitat index score for each fauna and flora MNES based on the species habitat index assessment method used as part of the GTDTHQ.

Table F2 to Table F9 summarise the method for calculating species habitat index score out of 50 for Collared Delma, Yakka Skink, Dunmall's Snake, Red Goshawk, and South-eastern Long-eared Bat. Each sub-component of species habitat index scoring method is tailored for each MNES to consider species-specific habitat requirements and threats in accordance with conservation advices and other species-specific sources endorsed by Queensland and/or Commonwealth governments.

In the absence of the GTDTHQ including a species habitat index for flora species, the habitat condition scores for Brigalow TEC included a species presence index out of three, whereby: 0 = absent/not confirmed, 2 = single confirmed specimen, 3 = multiple confirmed specimens. The habitat condition score was then calculated as a combination of site condition and site context for the RE assessment unit (representing 60% of the score), with species stocking rate converted to a score out of 3 and contributing 40%.

Table F2 - Species habitat index scoring for Collared Delma

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting some damage to critical microhabitat including deep cracks in clay soils, fallen timber and logs. However, some microhabitat still occurs on site in patches. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species. • No foxes and/or feral cats observed or known within the vicinity of the site. Successful active pest animal management implemented on site.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for coarse woody debris OR leaf litter. • Highly disturbed ground layer.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. small skinks and geckos.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes coarse woody debris AND/OR leaf litter. • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. small skinks and geckos.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.

Component	Level	Score	Description
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower-than-average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table F3 - Species habitat index scoring for Yakka Skink

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. Overgrazing by livestock resulting in irreversible damage to microhabitat including logs, dense leaf litter and fallen bark. • Overgrazing by livestock resulting in irreversible damage to microhabitat including coarse woody debris, dense leaf litter and decorticated bark. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.

Component	Level	Score	Description
			• Site is actively managed for conservation purposes to enhance habitat for threatened species. • No foxes and/or feral cats observed or known within the vicinity of the site. Successful active pest animal management implemented on site.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for coarse woody debris OR leaf litter. • Highly disturbed ground layer.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND 50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. soft plant materials and fruits and a wide variety of invertebrates.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes coarse woody debris AND leaf litter. • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. soft plant materials and fruits and a wide variety of invertebrates.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 OR >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range OR • Site has very few records for migratory species.
	Likely to be critical to species' survival Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival:	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND

Component	Level	Score	Description
	Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.		• The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • The population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table F4 - Species habitat index scoring for Dunmall's Snake

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural landuse and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting some damage to critical microhabitat including deep cracks in clay soils, fallen timber and logs. However, some microhabitat still occurs on site in patches. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species. • No foxes and/or feral cats observed or known within the vicinity of the site. Successful active pest animal management implemented on site.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. small skinks and geckos.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat.

Component	Level	Score	Description
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >90% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower-than-average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table F5 - Species habitat index scoring Red Goshawk

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development, timber production or agricultural land use and/or subject to ongoing degradation. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Site is mostly cleared and does not support habitat for prey species such as medium sized birds.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site may have a history of clearing; however patches of remnant forest and regrowth occur frequently providing suitable habitat for prey (i.e. medium sized birds).
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) to allow for recruitment of native species. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees AND/OR <10% tree canopy cover. • Prey species rarely observed and habitat does not support a viable population of prey (medium sized birds).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes large trees AND/OR >10%-<50% (or >200%) tree canopy cover. • Prey species observed and habitat supports a viable population of prey (medium sized birds).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes large trees AND/OR >50-<200% tree canopy cover. • Prey species observed frequently and habitat supports a healthy population of prey (medium sized birds).
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for large trees, AND • Very few or no occurrences of large, mature trees near a watercourse for nesting.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for large trees, AND • Infrequent occurrences of large, mature trees near a watercourse for nesting.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for large trees, AND • Frequent occurrences of large, mature trees near a watercourse for nesting.
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.

Component	Level	Score	Description
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table F9 - Species habitat index scoring South-eastern Long-eared Bat

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development, timber production or agricultural land use and/or subject to ongoing degradation. No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Overgrazing resulting in a lack of understorey habitat that supports invertebrate prey.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. Active fire management and/or low risk of uncontrolled fire on site, including from adjacent properties. • Strategic livestock grazing resulting in some degradation to the understory habitat that supports invertebrate prey however, patches of habitat occur on site. • Active fire management and/or low risk of uncontrolled fire on site, including on adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. Active fire management, with controlled burns on site and low risk of uncontrolled fire on site, including from adjacent properties. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) allowing for recruitment of native saplings. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees. OR • <10% tree canopy cover.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark value for large trees, OR • >10% - <50% tree canopy cover.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark value for large trees, OR • >50% - <200% tree canopy cover.

Component	Level	Score	Description
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees. • Limited evidence of dead trees and/or hollows for roosting.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark value for large trees. • Evidence of some dead trees and/or hollows for roosting.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark value for large trees. • Evidence of dead trees and/or hollows for roosting.
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • The population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Appendix B

Kentucky Offset Area Management Plan

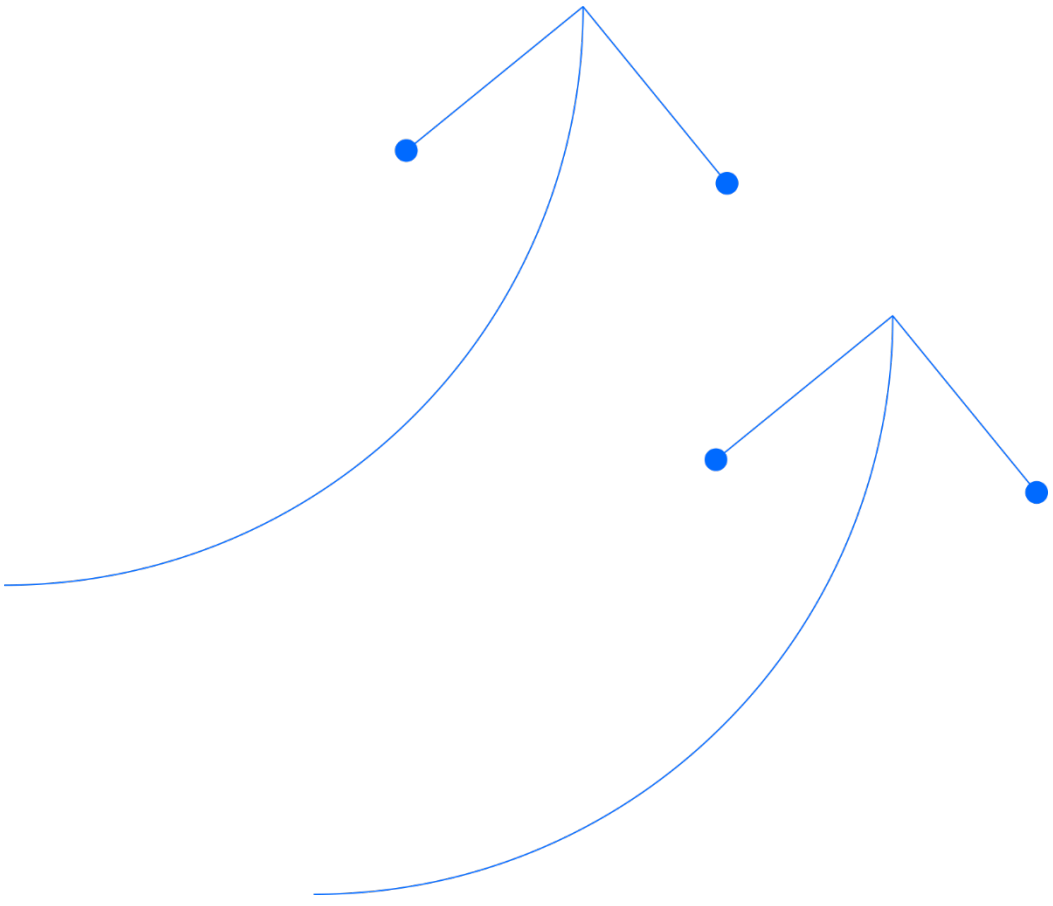
Santos

SANTOS GLNG KENTUCKY OFFSET AREA MANAGEMENT PLAN

EPBC Act Approval 2012/6615 (Stage 8)

Document Number: 0007-650-EMP-0046

31 October 2025



Date	Rev	Reason For Issue	Reviewed	Endorsed	Approved
9 May 2025	0	For DCCEEW submission	AB	AB	DG
31 October 225	1	Updated based on DCCEEW review	JK	AB	DG

Declaration of Accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or document to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulation 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed [redacted]

Full Name (please print) [redacted]

Organisation (please print) Santos Ltd

Date 31 / 10 / 2025

Santos

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Abbreviations

Acronym	Description
CSG	Coal Seam Gas
DAF	Department of Agriculture and Forestry (Qld)
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEHP	Department of Environment and Heritage Protection (DEHP); now Department of Environment, Science and Innovation
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EMP	Environmental Management Plan Guidelines
GFD	Gas Fields Development
GTP	Gas Transmission Pipeline
GIS	Geographic Information System
GLNG	Gladstone Liquefied Natural Gas
GTDTHQ	*Guide to Determining Terrestrial Habitat Quality*
MNES	Matters of National Environmental Significance
OAG	*Offsets Assessment Guide*
OAMP	Offset Area Management Plan
PMAV	Property Map of Assessable Vegetation
RE	Regional Ecosystem
REDD	Reginal Ecosystem Description Database
SEVT	Semi-evergreen vine thicket
spp	species
TEC	Threatened Ecological Community
VM Act	*Vegetation Management Act 1999* (Qld)

Executive Summary

This offset area management plan (OAMP) has been prepared to address the offset requirements for matters of national environmental significance (MNES) associated with Stage 8 of the Gas Fields Development (GFD) Project in accordance with the Santos Gladstone Liquefied Natural Gas (GLNG) Project *Environment Protection and Biodiversity Conservation Act 1999* (Cth; EPBC Act) approval EPBC 2012/6615.

Santos will draw down on a 40.11 hectare (ha) area of the existing 4,302.0 ha offset area secured on the Kentucky property (Lot 1 WT37) to partially acquit MNES offset requirements for Stage 8 of the GFD Project under EPBC 2012/6615 (Table ES 1). The remaining 3,261.9 ha of offset area on Kentucky is currently being used to acquit offset obligations for the Gas Transmission Pipeline Project (EPBC 2008/4096), GLNG Project (EPBC 2008/4059) and Stage 5, 6 and 7 of the GFD Project (EPBC 2012/6615).This OAMP relates to the 40.11 ha offset area required to partially acquit Stage 8 of EPBC 2012/6615, as calculated in accordance with the EPBC Act *Offsets Assessment Guide* (OAG) to support the overall conservation gain of the offset area.

The Kentucky property is located within the Santos GLNG Project tenements approximately 50 kilometres north-east of Injune and contiguous with Expedition (Limited Depth) National Park to the east and Lonesome Holding (proposed National Park) to the north. The property is mapped within a state conservation corridor. Key desktop and field surveys of the Kentucky property have been completed to confirm the presence of offset values and suitability to satisfy the Project's offset obligations as follows:

- 2010
  - Preliminary desktop assessment of biodiversity offset values (Ecofund 2010).
  - Detailed field assessment undertaken by Boobook Ecological Consulting (Boobook), in May 2010, to ground truth vegetation and confirm presence of environmental values (Boobook 2011).
- 2015
  - Further refine ground-truthed and potential regional ecosystem (RE) types and their extent as well as confirming location of potential areas to support biodiversity offsets based on examination of high-resolution aerial photography provided for the property by Santos (Boobook 2015).
- 2020 (January to May)
  - Update fine-scale RE mapping and BioCondition assessments (Boobook 2020a).
  - Targeted flora and fauna surveys and habitat assessments (Boobook 2020a).

The outcome of this OAMP is to partially acquit the offset obligations for Stage 8 under EPBC 2012/6615. The Kentucky offset area will be managed and monitored, based on an adaptive management framework, to achieve the interim performance targets and completion criteria presented in Table ES2.

The key management actions to be implemented include:

- restricting access to the offset area,
- management and restoration of regrowth threatened ecological community,
- maintenance and upgrades of existing access tracks, fencing and firebreaks,
- fire management through strategic grazing and fuel hazard reduction burns,
- weed management, and
- pest animal management.

Ongoing monitoring events will be undertaken to assess the effectiveness of the management actions and progress of the offset area in achieving the interim performance targets and completion criteria, including:

- biannual offset area inspections,
- biomass monitoring,
- fuel load monitoring,
- weed monitoring,
- pest animal monitoring,
- rapid monitoring events,

- habitat quality assessments, and
- photo monitoring.

Annual reports will be prepared to detail progress of the offset area in achieving the interim performance targets and completion criteria for each management year including the results of management and monitoring activities completed.

The offset area is protected via a Voluntary Declaration under Section 19E and 19F of the Queensland *Vegetation Management Act 1999* (Qld) (Table ES 1). The Voluntary Declaration will remain in place for the life of EPBC 2012/6615.

Table ES1 – Summary of the Kentucky offset area and acquittal for Stage 8 of EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Habitat within the Kentucky offset area (ha)	Offset area (ha)				% acquittal of Stage 8[2]	Surplus area (ha)[3]
				Approved for Phases 1 and 2 under EPBC 2008/4059	Approved under EPBC 2008/4096	Approved for Stages 5, 6 and 7 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615		
Threatened fauna species									
Collared Delma (*Delma torquata*)	V	49.49	3,784.6	2,398.5	0	1,283.58	40.11	8.90	0
Yakka Skink (*Egernia rugosa*)	V	39.99	3,936.5	2,488.5	0	1,335.25	40.11	11.01	0
Dunmall's Snake (*Furina dunmalli*)	V	49.98	3,996.7	2,438.5	0	1,335.25	40.11	8.81	0
Red Goshawk (*Erythrotriorchis radiatus*)	E	25.61	3,996.7	1,600.0	0	435.86	0	0	0
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	V	32.11	3,689.5	1,955.0	0	384.19	0	0	0
Northern Quoll (*Dasyurus hallucatus*)	E	26.11	3,995.6	145.0	0	435.86	0	0	0
Koala (*Phascolarctos cinereus*)	E	36.56	3,689.5	0	0	1,283.58	40.11	9.88	0
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	50.48	3,996.7	2,378.5	0	1,335.25	40.11	8.73	0
Large-eared Pied Bat (*Chalinolobus dwyeri*)	E	32.61	3,996.7	860.0	0	435.86	0	0	0

[1] E = Endangered; V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties.
[3] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 6 of this OAMP to understand how areas are accounted for in each stage.

Table ES2 – Interim performance targets and completion criteria for the Kentucky offset area for Stage 8 of EPBC 2012/6615

MNES	Baseline habitat quality score (/10)	Interim performance targets			Completion criteria
		Year 5	Year 10	Year 15	Year 20
Threatened fauna species					
Collared Delma	8 (8.1)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
Yakka Skink	7 (7.2)	Increase in the habitat quality score from baseline score of 7	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 8
Dunmall's Snake	8 (8.2)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
Koala	8 (8.0)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
South-eastern Long-eared Bat	8 (7.7)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9

1. Introduction

The Santos Gladstone Liquefied Natural Gas (GLNG) Project involves the development of Coal Seam Gas (CSG) resources in the Surat and Bowen Basins in Queensland, to supply gas via a 430 kilometre (km) gas transmission pipeline (GTP) to the liquefied natural gas (LNG) Facility located on Curtis Island. Throughout the development of the Santos GLNG Project and in accordance with Santos GLNG Project approvals, potentially impacted environmental values are systematically identified and assessed and in order of preference are avoided, minimised or mitigated.

The Santos GLNG Project is required to provide environmental offsets for significant residual impacts on matters of national environmental significance (MNES) in accordance with approvals granted under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Cth; EPBC Act).This offset area management plan (OAMP) has been prepared to address partial acquittal of the MNES significant residual impacts associated with Stage 8 of the Gas Fields Development (GFD) Project under the GLNG Project approval EPBC 2012/6615 (herein referred to as Stage 8), outlined in Table 1, on the Kentucky offset area (Figure 1).

Table 1 – Impacted MNES required to be offset for Stage 8 of the GFD Project under EPBC 2012/6615

MNES	Status under EPBC Act	Disturbance area (ha)
Threatened ecological communities		
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC)[1]	Endangered	0.51
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community (SEVT TEC)[1]	Endangered	0.50
Threatened fauna species		
Collared Delma (*Delma torquata*)	Vulnerable	49.49
Yakka Skink (*Egernia rugosa*)	Vulnerable	39.99
Dunmall's Snake (*Furina dunmalli*)	Vulnerable	49.98
Red Goshawk (*Erythrotriorchis radiatus*)[1]	Endangered	25.61
Black-breasted Button-quail (*Turnix melanogaster*)[1]	Vulnerable	0.50
Squatter Pigeon (southern) (*Geophaps scripta scripta*)[1]	Vulnerable	32.11
Northern Quoll (*Dasyurus hallucatus*)[1]	Endangered	26.11
Koala (*Phascolarctos cinereus*)	Endangered	36.56
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	Vulnerable	50.48
Large-eared Pied Bat (*Chalinolobus dwyeri*)[1]	Endangered	32.61

[1] Offset requirements for these MNES are acquitted on other properties for Stage 8.

1.1. Purpose

This OAMP is written consistent with the *Environmental Management Plan* (EMP) *Guidelines* (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2024), and provides a detailed management and monitoring framework for the Kentucky offset area in accordance with the requirements for Stage 8 of EPBC 2012/6615 as presented in Table 2. The following table (Table 3) details how this OAMP satisfies the requirements of a comprehensive EMP, and how the following information in this plan aligns with the EMP Guidelines set by DCCEEW (2024).

Table 2 – Approval conditions satisfied through this OAMP

Condition number	Condition	How the conditions are met
EPBC Act Approval 2012/6615		
11	The approval holder must ensure that environmental offsets comply with the principles of the EPBC Act *Environmental Offsets Policy*.	Offsets to compensate for significant residual impacts associated with Stage 8 of the GFD Project will be delivered in accordance with the principles of the EPBC Act *Environmental Offsets Policy*. An offset area will be secured on Kentucky to partially acquit offset obligations for the MNES matters outlined in Table 1. The Kentucky offset area has been identified to comply with the requirements for an offset under the EPBC Act *Environmental Offsets Policy* as detailed in Section 2.9 of this OAMP.
12	The approval holder may carry out the action in project stages. The approval holder must deliver environmental offsets for residual significant impacts to matters of national environmental significance for each project stage.	The action will be carried out in stages. An offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with Stage 8 of the GFD Project.
13	The approval holder must submit an Offset Management Plan for the Minister's written approval. The Offset Management Plan may be prepared and submitted to the Minister for written approval in stages. If the approval holder submits the Offset Management Plan in stages, each version of the Offset Management Plan must address the known and predicted impacts of the completed, current, and next proposed project phases.	An offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with Stage 8 of the GFD Project. This OAMP for the Kentucky offset area is submitted as part of the offset plan to address Stage 8 of the GFD Project. A reconciliation of impacts for Stage 1-7 of the GFD Project is included in the offset plan.
14	The Offset Management Plan must include: a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities; b. results from pre-disturbance surveys and/or an alternative approved methodology (if used) for the project phase as required under conditions 4 and 5; c. details of the offset areas required to address predicted residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities for the project phase; d. a survey and description of the current condition (prior to any management activities) of each offset area proposed, including existing vegetation (the baseline condition). This must include a shapefile of each offset property boundary; e. information about how the offset areas provide connectivity with other relevant habitats and biodiversity corridors, including a map depicting the offset areas in relation to other habitats and biodiversity corridors; f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary); g. a description of the management measures that will be implemented for the protection of EPBC threatened species, EPBC migratory species and EPBC communities, including a discussion of how measures outlined take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans; h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria; i. a description of potential risks to the successful implementation of the plan, and a description of the contingency measures that would be implemented to mitigate against these risks; j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and k. the proposed legal mechanism for securing the offset.	The Kentucky offset area is proposed to be secured to partially acquit offset requirements for Stage 8 of the GFD Project. An OAMP for the Kentucky offset area has been developed in accordance with the requirements outlined in condition 14. A summary of how each requirement has been addressed is provided below. a. The method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities is discussed in the offset plan, submitted in conjunction with this OAMP. b. Details of the relevant field assessments within the Stage 8 GFD Project development area are provided in the offset plan, submitted in conjunction with this OAMP. c. A summary of the significant residual impacts associated with Stage 8 of the GFD Project is provided in Table 1 of this OAMP and the offset plan. A summary of the offset area required to acquit the Stage 8 offset requirements is provided in the offset plan, with a summary of the proposed offset area on Kentucky and how it partially acquits the Stage 8 offset requirements provided in Section 2.6 of this OAMP. In accordance with the EPBC Act *Environmental Offsets Policy* the proposed offset areas required to be secured for the MNES were determined using the *Offsets Assessment Guide* (OAG) as described in Section 2.6. d. A summary of the ecological field surveys undertaken on the Kentucky offset area is described in Section 2.4. Details of the baseline ecological condition are provided in Section 2.5 and Appendix A of this OAMP. e. Details on the connectivity and the landscape context are provided in Section 2.2. f. Individual completion criteria have been developed for the MNES as part of the environmental outcomes to be achieved for the Kentucky offset area (Section 4). In addition, specific management objectives and performance criteria have been developed which will provide the basis for achieving the MNES completion criteria. The complete adaptive management process for this OAMP is encapsulated in Table 11 and includes management actions, monitoring events, adaptive management triggers and corrective actions that have been assigned to each management objective and performance criteria. g. Management measures to be implemented as part of this OAMP have been developed to address key threats known or with the potential to occur within the Kentucky offset area identified as part of detailed field surveys and take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans. A summary of the known and potential threats and proposed management measures are detailed in Section 6. h. The monitoring program to measure the effectiveness of the management measures and progress against the performance and completion criteria is detailed in Section 7. i. Risks to the successful implementation of this plan are included in the risk assessment presented in Appendix C. j. The timing for implementation of the management and monitoring program are provided in Section 9. k. Details on how the Kentucky offset area for Stage 8 of the GFD Project has been legally secured are provided in Section 2.8 of this OAMP.

Condition number	Condition	How the conditions are met
15	The currently approved Offset Management Plan must be implemented by the approval holder.	Once approved, this OAMP will be implemented.
16	The approval holder must register and legally secure offsets for the first project phase identified in the Offset Management Plan within two years of commencement of the first project phase.	Details on how the Kentucky offset area for Stage 8 of the GFD Project has been legally secured are provided in Section 2.8.
17	The approval holder must register and legally secure offsets for a project phase which are sufficient to acquit the residual significant impacts of that project phase.	Details on how the Kentucky offset area for Stage 8 of the GFD Project has been legally secured are provided in Section 2.8.
18	If the approval holder submits the Offset Management Plan in stages, the approval holder must prepare and submit an updated Offset Management Plan for each subsequent project phase, for written approval by the Minister. The updated Offset Management Plan must: a. include the information required for the Offset Management Plan at condition 14 for the next project phase; b. include a reconciliation of actual and predicted but yet to be actualised residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities against offsets secured for the commenced project phases. Secured offsets in excess of requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases may be subtracted from the obligations required for subsequent project phases. Any shortfall in secured offsets relative to the requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases must be added to the obligations required for the next project phase; and c. demonstrate how the offset builds on offsets already secured for previous project phases and will contribute to a larger strategic offset for cumulative project impacts.	An updated version of this OAMP will be submitted for any subsequent stages of the GFD project.
19	The approval holder must not commence the project phase until the Offset Management Plan, updated for that project phase has been approved by the Minister in writing.	This OAMP is submitted for the approval of the Minister. Stage 8 will not commence until this OAMP for the project stage has been approved.

Table 3 – Alignment of OAMP with EMP Guidelines

Key content	Reference within OAMP	Reference to EMP Guidelines
Conditions of approval	Section 1, Table 2 details the approval conditions satisfied through this OAMP.	Section 3, page 8
Property information and baseline data	Section 2 describes the Kentucky property, Sub-Section 2.4 lists the history of ecological surveys undertaken at the Kentucky property, including baseline surveys, and Sub-Section 2.5 describes the ground-truthed environmental values of the property.	Section 3
Offset values	Section 3 describes and details the offset values of this OAMP, and Section 4 lists the associated environmental outcomes.	Section 3
Adaptive management framework and program	Section 5 describes the adaptive management framework to be applied through this OAMP, and Section 4, Table 10 details the interim performance targets. Section 6, Table 11 describes the management program.	Section 3, page 11-12
Management program entailing objectives, triggers, and actions	Section 6, Table 13 details the management objectives, performance targets, method of management actions, and measurable milestones of progression in terms of monitoring actions, monitoring timing and frequency, management triggers and corrective actions.	Section 3, page 11-12
A detailed monitoring program	Section 7 breaks down the monitoring program into six sub-sections, and details the program timing, frequency, methods.	Section 3, page 11-12
A detailed monitoring and implementation schedule	Section 9, Table 20 summaries the overall schedule of the monitoring program inclusive of timing, activity, location of activity, method and reliability of method.	Section 3, page 11-12
Risk assessment and management actions to avoid, mitigate and manage risks	Section 6, Table 13 identifies risks which have been identified as potentially impeding to the outcomes of environmental management objectives.	Section 4, pages 13-14
Risk matrix	Table C3 in Appendix C applies a risk matrix including residual risk rating following mitigation measures, management triggers and corrective actions.	Section 4, pages 13-14
Maintenance of monitoring records	Section 8 details the reporting obligations of this OAMP and how information will be stored for the lifetime of the approval.	Section 3, page 9

148°30'0"E
149°0'0"E
149°30'0"E
25°0'0"S
25°30'0"S
26°0'0"S
26°30'0"S

Phiara Downs Nature Refuge
Mount Nicholson State Forest
Serocold State Forest
Carnarvon Highway
Nuga Nuga National Park
Expedition National Park
Theodore State Forest
Palmgrove National Park (scientific)
Carnarvon National Park
PL 451
PL 236
Bandana State Forest
PL 235
PL 450
PL 440
PL 1062
PPL 166
Presho State Forest
Eden State Forest
PL 420
Expedition (Limited Depth) National Park
Boxvale State Forest
PL 1059
PL 1017
Gwambagwine State Forest
PL 421
PL 234
PL 233
Howe State Forest
Forrest State Forest
1WT37
Belington Hut State Forest
PL 90
Doonkuna State Forest
PL 457
PL 91
Beilba State Forest
PL 232
Expedition Resources Reserve
PL 92
Stephenton State Forest
PL 1012
Hallett State Forest
PL 100
PL 99
Moorabinda Nature Refuge
Walhallow State Forest
Dinoun State Forest
Taboonbay State Forest
Gubberamunda State Forest 1
Gubberamunda State Forest 3
Gubberamunda State Forest 2
Woodduck State Forest
Emu State Forest
Combabula State Forest
PL 1019
PL 322
PL 314
PL 1020
PL 1021
PL 313
PL 315
Yuleba State Forest

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Location diagram

Figure 1
Project Context

- Kentucky
- Santos PLs
- Santos Petroleum Pipeline Licences

Statewide Corridors

- Regional
- State

Protected areas

- National Park
- National Park (scientific)
- State Forest
- Resources Reserve
- Nature Refuge

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0 10 20 30
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 Scale: 1:550,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Statewide Corridors v1.6
- Protected areas
- Resource licenses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMP\sl\Kentucky\Kentucky_OAMP_mapping_20250501.aprx

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2. Kentucky Property

2.1. Property overview

Kentucky (Lot 1 WT37) is a 4,368 ha property located approximately 50 km east north-northeast of Injune in south central Queensland (Figure 1). The property is owned by Santos and was acquired primarily for its potential environmental offset values for the Santos GLNG Project. Kentucky is situated within Subregion 20 (Arcadia) of the Brigalow Belt South Bioregion (Sattler and Williams 1999) within the jurisdiction of the Maranoa Regional Council. Access to the property is via the Beilba Road, east of the Carnarvon Developmental Road between Injune and Rolleston. Current land uses on the property include cattle grazing, activities associated with CSG exploration and production as well as areas dedicated to environmental offsets. The Santos GLNG pipeline also traverses the property in a roughly south-north direction; however, has been excluded from all assessment and offset areas discussed as part of this OAMP (Figure 2).

The property lies within rugged terrain and contains large vegetation remnants that are contiguous with Expedition (Limited Depth) National Park to the east and Lonesome Holding (proposed National Park) to the north. The property is located entirely within the Dawson River Catchment, part of the Fitzroy River Basin, with the major watercourses being the Dawson River and Baffle Creek. The topography is varied and is comprised mainly of hills, ridges, plateaux and steep scarps, with sandstone of the Precipice and Evergreen Formations forming the underlying geology. Small alluvial flats occur beside the Dawson River. Baffle Creek and its associated tributaries have associated deep gorges which provide a visually spectacular landscape.

Prior to Santos' ownership, vegetation clearing on the property was most extensive in the southern one-third of the property, between Baffle Creek and a steep plateau scarp to the north, for former pastoral development and use. Historical thinning and/or clearing of woody vegetation had also occurred on lowlands associated with the Dawson River in the north of the property. Evidence of historical wildfire, and possibly controlled burning for pastoral purposes, is present throughout the property, with some Brigalow and other communities showing severe fire damage.

Table 4 summarises Kentucky landholder and property details.

Table 4 – Kentucky landholder and property details

Landholder and Property Details	
Registered Owner/s on Title:	Total GNG Australia Santos GLNG Pty Ltd PAPL (Downstream) Pty Ltd KGLNG Liquefaction Pty Ltd
ABN/ACN:	ABN 12 131 271 648 (Santos GLNG Pty Ltd)
Postal Address:	PO Box 329, Roma Queensland 4455
Lot on plan(s):	Lot 1 WT37
Address:	764 Beilba Rd, Beilba Queensland
Tenure:	Freehold
Area:	4,368 ha
Primary Local Government Area:	Maranoa Regional Council

Permits	
Petroleum and gas production permit	PL 90 and PL 91 Santos Toga Pty Ltd, expires 29 Nov 2029
Infrastructure permit	PPL 166 Santos GLNG Pty Ltd, expires 17 Nov 2051

148°50'0"E 148°52'0"E 148°54'0"E

25°32'0"S 25°34'0"S 25°36'0"S

Dawson River
Gratz Gully
Lambing Flat Creek
Baffle Creek
Johnson Gully
Dismal Gully

SANTOS

Figure 2
Property Overview

Kentucky
Kentucky offset area

Watercourse
Major watercourse
Creekline
Minor drainage line
Drainage contour

2012/6615 offset area
GLNG GFD 2012/6615 Stage 5
GLNG GFD 2012/6615 Stage 6
GLNG GFD 2012/6615 Stage 7
GLNG GFD 2012/6615 Stage 8

2008/4096 offset area
GLNG GTP 2008/4096
GLNG GTP 2008/4096 Future habitat areas

2008/4059 offset area
GLNG 2008/4059 Phase 1
GLNG 2008/4059 Phase 2
GLNG 2008/4059 Rehabilitation Offset

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0 1 2
Kilometres

Date: 3/05/2025 Coordinate System: GDA2020 Scale: 1:35,000@A3

Location diagram

Queensland
Brisbane

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S. Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Kentucky\Kentucky_OAMP_mapping_20250501.aprx

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2.2. Connectivity

The Kentucky property is mapped within a state biodiversity corridor (Figure 1). Biodiversity corridors have been mapped as part of the Queensland Government's Biodiversity Planning Assessments which assess the biodiversity significance of land in a bioregion. The mapping of corridors within the Brigalow Belt Bioregion, in which the Kentucky property is located, has focused on those corridors that link adjacent bioregions or connect wildlife refugia. Corridors identified as of state significance are considered of the greatest importance at the bioregional scale. As illustrated in Figure 1, the state conservation corridor runs along the eastern portion of the property as part of the contiguous tract of remnant vegetation including Expedition (Limited Depth) National Park.

2.3. Climate

The Kentucky property is characterised by a hotter wet season (typically November to March) and a cooler dry season (typically April to October) (see Figure 3). Weather records from the Injune weather station (#43015), approximately 50 km south-west of Kentucky, show the mean monthly rainfall for the period 1961-1990 ranges from 24.9 millimetres (mm) (September) to 94.6 mm (January) (Bureau of Meteorology [BoM] 2024). Mean monthly maximum temperatures range from 19.6 degrees Celsius (°C) (July) to 33.7°C (January) and mean monthly minimum temperatures range from 3°C (July) to 19.2°C (January) (BoM 2024).

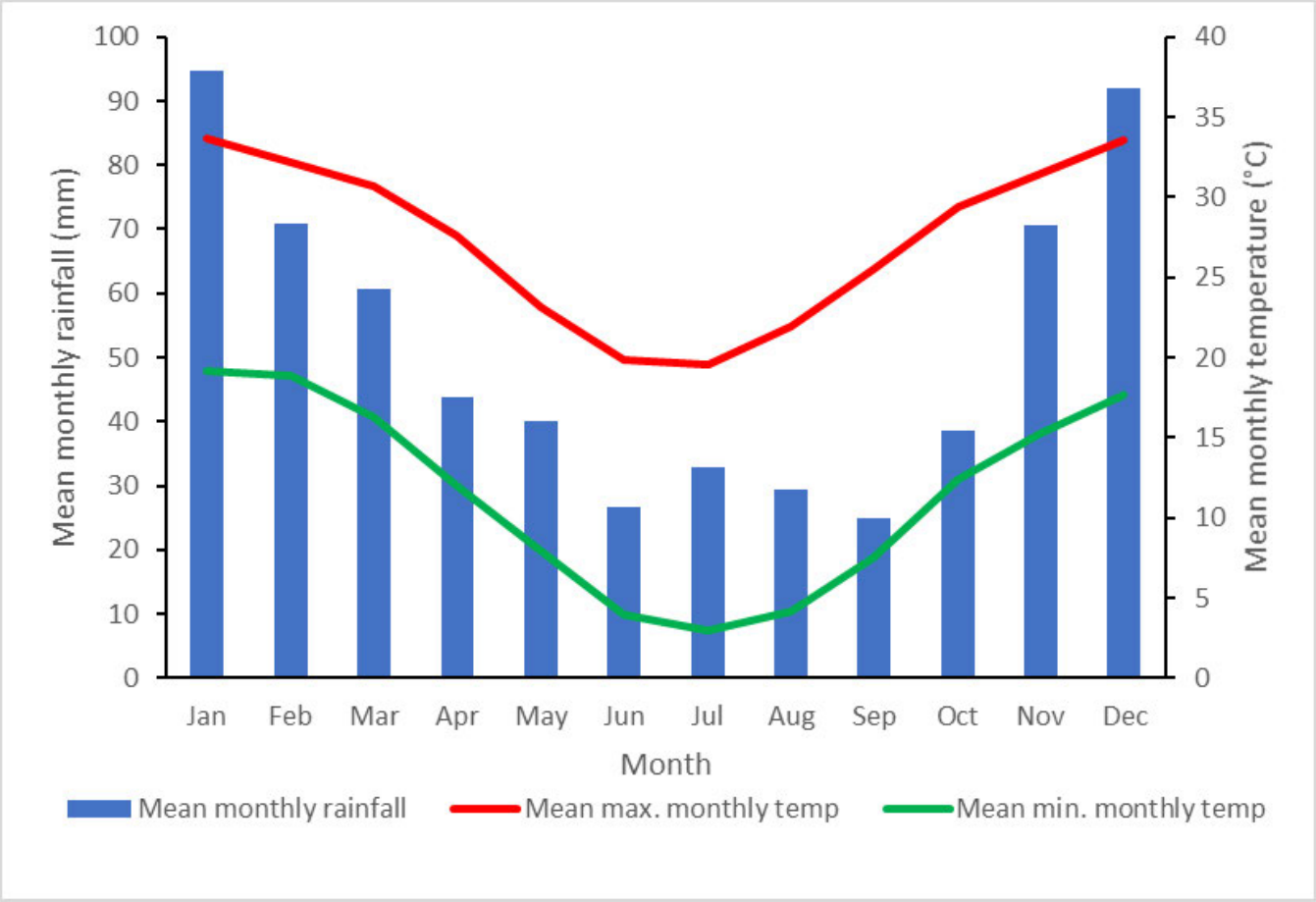

Figure 3 – Mean monthly temperature and rainfall records from Injune Post Office weather station (ID: 43015) 1961-1990 (www.bom.gov.au)

2.4. On-ground property assessments

Santos has dedicated the majority of the Kentucky property for environmental offsets (4,302.0 ha; herein referred to as the offset area) with the exception of the area excluded for the Santos GLNG pipeline and associated infrastructure (65.9 ha). A combination of desktop and detailed on-ground assessments of the offset area have been undertaken to confirm the suitability of the area to satisfy the Project's offset obligations. The key desktop and field surveys of the offset area completed to date are summarised below:

- 2010
  - Preliminary desktop assessment of biodiversity offset values (Ecofund 2010).
  - Detailed field assessment undertaken by Boobook, in May 2010, to ground truth vegetation and confirm presence of environmental values (Boobook 2011).
- 2015
  - Further refine ground-truthed and potential regional ecosystem (RE) types and their extent as well as confirming location of potential areas to support biodiversity offsets based on examination of high-resolution aerial photography provided for the property by Santos (Boobook 2015).
- 2020 (January to May)
  - Update large-scale RE mapping across the offset area including verification of presence and extent of remnant and regrowth vegetation communities and threatened ecological communities (TECs) (Boobook 2020a). For each area of potential TEC an assessment of vegetation survey data was made against TEC threshold criteria.
  - BioCondition assessments within the offset area in accordance with the BioCondition methodology (Eyre *et al*. 2015). Scores for BioCondition sites were calculated in accordance with Eyre *et al*. (2015) which compares the values obtained at each survey site with values in the benchmark document for that particular RE (Queensland Herbarium 2019). Photo monitoring sites were established at all BioCondition assessment sites.
  - Updated RE-based predictive habitat mapping for EPBC Act-listed threatened flora and fauna species confirmed, likely or potentially present within the offset area based on the results of field surveys including microhabitat assessments were conducted at each BioCondition site combined with ecologist knowledge.
  - Targeted fauna surveys to assess fauna species richness for the endangered and vulnerable species as summarised in Table 5 below.
  - Incidental searches for threatened flora species listed under the EPBC Act and/or Queensland *Nature Conservation Act 1992* were carried out at vegetation assessment sites and during meanders in targeted habitat types, including remnant and non-remnant vegetation.
  - The timing (season) and duration of the survey period during summer and autumn coincided with good conditions for the identification of spring-summer growing and flowering herbaceous plant species. However, the recent (and continuing) rainfall events that fostered good conditions for plant growth and detectability followed a protracted period of extraordinarily low rainfall which had prevailed over most of the previous two years. These conditions were almost certain to have impacted on the detectability of fauna: for many groups (e.g. reptiles, birds), animals would have left the property or died, and it is likely that this impact continued at least partially into the survey period as animal population responses lag to some extent, depending on the taxa involved. For example, it was noted during the survey that small ground-dwelling reptiles were scarce (Boobook 2020a).

Table 5 – Survey techniques for threatened species potentially present within the offset area (Boobook 2020a)

Species	Survey methods	Survey effort
Collared Delma (*Delma torquata*)	Diurnal active searches	14 diurnal searches, 2 x 30 min = 14 person/hours
Yakka Skink (*Egernia rugosa*)	Diurnal active searches	14 diurnal searches, 2 x 30 min = 14 person/hours
Dunmall's Snake (*Furina dunmalli*)	Diurnal active searches Nocturnal active searches	14 diurnal searches, 2 x 30 min = 14 person/hours 11 nocturnal searches, 2 x 1.0-2.5 hr = 29 person/hrs
Red Goshawk (*Erythrotriorchis radiatus*)	Scans for soaring birds Nest searches on watercourses Driving traverses	1 site for 2 person/hrs 6 sites for 10 person/hrs Minimum 2hrs/20km per day for 10 days = 20hrs/200km
Black-breasted Button-quail (*Turnix melanogaster*)	Diurnal searches of SEVT for birds and/or platelets	8 person/hrs in 4 SEVT patches
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	Active/flushing searches of woodland habitat Waterhole searches Driving traverses	14 diurnal searches, 2 x 30min = 14 person/hours 6 x 15 min searches Minimum 2hrs/20km per day for 10 days = 20hrs/200km
Northern Quoll (*Dasyurus hallucatus*)	Diurnal searches (on foot) of denning habitat for scats Nocturnal spotlight searches (on foot) Camera traps in rocky habitat (outcrops and cliff lines)	10 diurnal searches, 2 x 30min = 10 person/hours 11 nocturnal searches, 2 x 1.0-2.5 hr = 29 person/hrs 47 camera trap-nights
Koala (*Phascolarctos cinereus*)	Nocturnal spotlight searches (on foot) Nocturnal spotlight searches (driven) Diurnal searches (on foot) for animals, scats, scratches	11 nocturnal searches, 2 x 1.0-2.5 hr = 29 person/hrs 2 hrs/5 km per night for 3 nights = 6 hrs/15 km 14 diurnal searches, 2 x 30 min = 14 person/hours
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	Harp trapping in potential habitat	20 harp trap-nights
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Harp trapping in potential habitat Anabat recording in potential habitat	20 harp trap-nights 12 Anabat nights (sunset to sunrise)

2.5. Ground truthed vegetation and habitat mapping

Based on the results of detailed ecological field assessments, ground-truthed vegetation (Figure 4) within the offset area has been classified as remnant vegetation, vegetation consistent with RE (advanced regrowth) or non-remnant vegetation (Santos 2014). Within the 4,302.0 ha offset area approximately 3,996.9 ha of vegetation (3,305.4 ha of remnant and 691.5 ha of regrowth) was mapped, the remaining is considered non-remnant.

The suitability of areas of vegetation as fauna habitat was determined by the presence and abundance of microhabitat features relevant to the needs of individual species or groups of species (e.g. terrestrial reptiles; Boobook 2020a). The results of detailed field assessments were combined with ecologist knowledge to develop RE-based predictive habitat mapping for EPBC Act-listed threatened flora and fauna species confirmed, likely or potentially present within the offset area. This assessment also considered the habitat mapping rules for the Santos GLNG Project area outlined in the *Predictive Habitat Mapping Rules for Selected MNES Fauna Species within the Roma, Fairview and Arcadia Gas Fields* report (Boobook 2020b).

2.5.1. Vegetation description

Table 6 provides a summary of the ground-truthed RE mapped on the offset area.

Soils at the offset area are predominantly sandy loams and duplex soils. These support vegetation communities dominated by ironbark (*Eucalyptus* species [spp.]). Sandy lithosols on plateau crests support shrubby open forests and woodlands of *Eucalyptus, Corymbia* and *Acacia* spp. Smaller areas of clay loam soils derived from fine-grained sediments are present on hill slopes and small valleys: these support Poplar Box (*E. populnea*), Mountain Coolibah (*E. orgadophila*), Brigalow (*A. harpophylla*) and semi-evergreen vine thicket (SEVT) communities. The Dawson River, at the extreme north of the offset area, features deep sandy to silty loam alluvium on riverbanks and associated floodplain which support riparian open forest of Queensland Blue Gum (*E. tereticornis*), Rough-barked Apple (*Angophora floribunda*) and Weeping Bottlebrush (*Melaleuca viminalis*); and grassy woodlands of Poplar Box and/or Silver-leaved Ironbark (*E. melanophloia*). There is only limited development of these alluvial or riparian communities on Baffle Creek, which for much of its extent at the offset area is narrowly bounded by steep sandstone cliffs. Grey Gums (*E. major, E. longirostrata*) are present on escarpment slopes and within gorges (Boobook 2020a).

2.5.2. Habitat description

Table 7 summarises the mapping rules and total area of potential habitat for MNES within the offset area based on the results of detailed field assessments (Boobook 2020a).

An additional description of the offset area for each MNES is provided in Section 3.

148°50'0"E 148°52'0"E 148°54'0"E

25°32'0"S 25°34'0"S 25°36'0"S

Dawson River

Gratz Gully

1WT37

Lambing Flat Creek

Baffle Creek

Johnson Gully

Ground truthed RE

- 11.3.2
- 11.3.25
- 11.3.27
- 11.3.39
- 11.9.2
- 11.9.2 (regrowth)
- 11.9.4
- 11.9.5
- 11.9.5 (regrowth)
- 11.9.10
- 11.10.3
- 11.10.7
- 11.10.7 (regrowth)
- 11.10.8
- 11.10.11 (regrowth)
- 11.10.13
- 11.10.13 (regrowth)
- Future habitat areas approved under 2008/4059

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Location diagram

Figure 4
Ground-truthed vegetation

- Kentucky property
- Kentucky offset area
- Property access track
- Fence

Watercourse

- Major watercourse
- Creekline
- Minor drainage line
- Drainage contour

CO2 AUSTRALIA

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0 1 2
Kilometres

Date: 3/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:35,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Kentucky\Kentucky_OAMP_mapping_20250501.aprx

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Table 6 – Ground-truthed RE mapped within the Kentucky offset area

RE	Description	Type	Kentucky offset area (ha)					
			Approved for Phase 1 and 2 under EPBC 2008/4059	Approved under EPBC 2008/4096	Approved for Stage 5 and 6 under EPBC 2012/6615	Approved for Stage 7 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615	Total area
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Remnant	30.32	-	-	-	-	30.32
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Remnant	11.67	-	-	-	-	11.67
11.3.27	Freshwater wetlands	Remnant	1.03	-	-	-	-	1.03
11.3.39	*Eucalyptus melanophloia* +/- *E. chloroclada* open woodland on undulating plains and valleys with sandy soils	Remnant	46.73	-	-	-	-	46.73
11.9.10	*Eucalyptus populnea* open forest with a secondary tree layer of *Acacia harpophylla* and sometimes *Casuarina cristata* on fine-grained sedimentary rocks	Remnant	60.34	-	-	-	-	60.34
11.9.2	*Eucalyptus melanophloia* +/- *E. orgadophila* woodland on fine-grained sedimentary rocks	Regrowth	41.71	-	-	-	-	41.71
		Remnant	107.76	-	-	-	-	107.76
11.9.4	Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks	Remnant	22.73	19.79	-	-	-	42.52
11.9.5		Remnant	67.78	-	-	-	-	67.78

RE	Description	Type	Kentucky offset area (ha)					
			Approved for Phase 1 and 2 under EPBC 2008/4059	Approved under EPBC 2008/4096	Approved for Stage 5 and 6 under EPBC 2012/6615	Approved for Stage 7 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615	Total area
	Acacia harpophylla and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks.	Regrowth	3.33	-	-	-	-	3.33
11.10.3	*Acacia catenulata* or *A. shirleyi* open forest on coarse-grained sedimentary rocks. Crests and scarps	Remnant	29.17	-	-	51.67	-	80.84
11.10.7	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	Regrowth	421.45	-	-	-	-	421.45
		Remnant	1,314.32	-	-	-	-	1,314.32
11.10.8	Semi-evergreen vine thicket in sheltered habitats on medium to coarse-grained sedimentary rocks	Remnant	4.96	-	-	-	-	4.96
11.10.11	*Eucalyptus populnea, E. melanophloia* +/- *Callitris glaucophylla* woodland on coarse-grained sedimentary rocks	Regrowth	3.58	-	-	-	-	3.58
11.10.13	*Eucalyptus* spp. and/or *Corymbia* spp. open forest on scarps and sandstone tablelands	Remnant	419.44	-	806.50	311.16	-	1,537.10
		Regrowth	15.45	-	92.89	73.03	40.11	221.48
Non-remnant		-	-	-	-	-	-	305.35
Total		**-**	**2,601.77**	**19.79**	**899.39**	**435.86**	**40.11**	**4,302.27**

Table 7 – Extent of suitable habitat available on the Kentucky offset area for MNES

MNES	Potentially suitable RE	Habitat mapping rules	Mapped extent of potential habitat (ha)
Threatened fauna species			
Collared Delma (*Delma torquata)*	11.3.2, 11.3.39, 11.9.2, 11.9.10, 11.10.7, 11.10.11, 11.10.13	Mapped General Habitat includes all areas of remnant and regrowth vegetation of the nominated RE.	General: 3,784.6
Yakka Skink (*Egernia rugosa*)	Essential Habitat: 11.3.2, 11.3.39, 11.9.2, 11.10.7, 11.10.11 General Habitat: 11.9.5, 11.9.10, 11.10.3, 11.10.13	Mapped Essential Habitat is based on known records within the nominated RE and includes all remnant and regrowth vegetation of the nominated RE. Mapped General Habitat includes all remnant and regrowth vegetation of the nominated RE. This may include sub-optimal habitat.	Essential: 1,965.7 General: 1,970.7
Dunmall's Snake (*Furina dunmalli)*	11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, 11.10.13	Mapped General Habitat includes all remnant and regrowth vegetation of the nominated RE.	General: 3,996.7
Red Goshawk (*Erythrotriorchis radiatus*)	11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, 11.10.13	This species requires tall trees close to permanent water for nest sites but may forage at a distance from this habitat. Mapped General Habitat includes all areas of remnant and regrowth vegetation of the nominated RE.	General: 3,996.7
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.10, 11.10.7, 11.10.11, 11.10.13	Mapped General Habitat includes all areas of remnant and regrowth vegetation of the nominated RE.	General: 3,689.5
Northern Quoll (*Dasyurus hallucatus*)	11.3.2, 11.3.25, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, 11.10.13	Mapped Essential Habitat includes all nominated RE within 1 km of shelter habitat (extensive areas of dissected sandstone with deep crevices and caves).	Essential: 3,995.6

MNES	Potentially suitable RE	Habitat mapping rules	Mapped extent of potential habitat (ha)
Koala (*Phascolarctos cinereus*)	11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.10, 11.10.7, 11.10.11, 11.10.13	Mapped habitat includes all remnant and regrowth vegetation of RE dominated by Myrtaceae species.	Essential: 3,689.5
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, 11.10.13	Mapped General Habitat includes all areas of remnant and regrowth vegetation that may be suitable for foraging or shelter.	General: 3,996.7
Large-eared Pied Bat (*Chalinolobus dwyeri*)	11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, 11.10.13	Mapped Essential Habitat includes all areas of remnant and regrowth vegetation of the nominated RE within 5 km of potentially suitable shelter habitat.	Essential: 3,996.7

2.6. Offset area

The offset area is 4,302.0 ha and comprises the majority of the 4,367.9 ha property, as illustrated in Figure 4. The Santos GLNG pipeline and associated infrastructure is located within the remaining 65.9 ha and has been excluded from the offset area and this OAMP. The offset area includes:

- 19.79 ha to acquit offset requirements under EPBC 2008/4096 (conditions 15-22) and the GTP SSMP.
- 2,601.59 ha to acquit offset obligations under EPBC 2008/4059 plus 305.34 ha of future habitat area that will support threatened species in the future following appropriate management (approved by the Department of Agriculture, Water and the Environment 23 March 2021; however, was provided in addition to acquitting MNES offset obligations under EPBC 2008/4059 to support the overall conservation gain of the offset area).
- 806.45 ha to partially acquit offset obligations under Stage 5 of EPBC 2012/6615.
- 92.88 ha to partially acquit offset obligations under Stage 6 of EPBC 2012/6615.
- 435.84 ha to partially acquit offset obligations under Stage 7 of EPBC 2012/6615.
- 40.11 ha to partially acquit offset obligations under Stage 8 of EPBC 2012/6615.

Table 8 provides a summary of the offset area to acquit the current MNES offset requirements for Stage 8 under EPBC 2012/6615.

The results of the detailed field assessments including the ground-truthed RE mapping and fauna habitat associations discussed in Section 2.5, were used to inform the suitability to acquit the MNES offset requirements.

The minimum offset area required to be secured for the MNES was determined in accordance with the EPBC Act OAG.

A baseline habitat quality score for the MNES offset value was determined generally in accordance with the *Guide to Determining Terrestrial Habitat Quality* (GTDTHQ) (version 1.2; Department of Environment and Heritage Protection [DEHP] 2017) based on the results of the detailed field assessments (Section 2.4). The baseline habitat quality score was used to inform the OAG for the MNES under EPBC 2012/6615. The habitat quality score will be used as a measure to assess the success of the OAMP through the interim performance targets and completion criteria outlined in Section 4. A detailed summary of the baseline habitat quality scores for the MNES is provided in Appendix A.

2.7. Development and land use

Santos has committed to excluding any development for the Project from the offset area.

The areas on the Kentucky property outside of the offset area may be utilised for petroleum and/or farming infrastructure and facilities; however, no infrastructure will be located within the offset area or impact the offset area's ability to achieve the completion criteria outlined in this OAMP.

Prior to being acquired by Santos GLNG, the Kentucky property was formerly utilised for grazing purposes. The following ancillary infrastructure is still present on the property and will be maintained ongoing without impact to the offset area:

- Cattle yards, and
- Kentucky house.

Table 8 – Summary of the Kentucky offset area and acquittal for Stage 8 of EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Habitat within the Kentucky offset area (ha)	Offset area (ha)				% acquittal of Stage 8[2]	Surplus area (ha)[3]
				Approved for Phases 1 and 2 under EPBC 2008/4059	Approved under EPBC 2008/4096	Approved for Stages 5, 6 and 7 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615		
Threatened fauna species									
Collared Delma (*Delma torquata*)	V	49.49	3,784.6	2,398.5	0	1,283.58	40.11	8.90	0
Yakka Skink (*Egernia rugosa*)	V	39.99	3,936.5	2,488.5	0	1,335.25	40.11	11.01	0
Dunmall's Snake (*Furina dunmalli*)	V	49.98	3,996.7	2,438.5	0	1,335.25	40.11	8.81	0
Red Goshawk (*Erythrotriorchis radiatus*)	E	25.61	3,996.7	1,600.0	0	435.86	0	0	0
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	V	32.11	3,689.5	1,955.0	0	384.19	0	0	0
Northern Quoll (*Dasyurus hallucatus*)	E	26.11	3,995.6	145.0	0	435.86	0	0	0
Koala (*Phascolarctos cinereus*)	E	36.56	3,689.5	0	0	1,283.58	40.11	9.88	0
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	50.48	3,996.7	2,378.5	0	1,335.25	40.11	8.73	0
Large-eared Pied Bat (*Chalinolobus dwyeri*)	E	32.61	3,996.7	860.0	0	435.86	0	0	0

[1] E = Endangered; V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties.
[3] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 6 of this OAMP to understand how areas are accounted for in each stage.

2.8. Offset protection

The Kentucky offset area is protected by a Voluntary Declaration under Section 19E and 19F of the Queensland *Vegetation Management Act 1999* (VM Act) and declared an area of high nature conservation value. The Voluntary Declaration is registered on the property title and will be binding on current and future landowners.

A Voluntary Declaration under the VM Act is an authorised legally binding mechanism and is considered appropriate to legally secure MNES values and protect the area from vegetation clearing. The offset area is mapped as a Category A area on the Property Map of Assessable Vegetation (PMAV). A Category A area on a PMAV is described as an "Area subject to compliance notices, offsets and voluntary declarations".

The Voluntary Declaration will remain in place for the life of EPBC 2012/6615. The Voluntary Declaration may only be removed in accordance with the provisions of the VM Act or if the chief executive of the Queensland Department of Resources considers it necessary.

The Voluntary Declaration and offset area coordinates for the declared area are provided in Appendix B.

In addition, once areas of regrowth vegetation on the Kentucky property have reached the requirements to achieve remnant status, Santos will apply to these areas reclassified as remnant vegetation in accordance with the relevant Queensland legislation. Santos will notify DCCEEW within 30 business days of the reclassification occurring.

2.9. EPBC Act Environmental Offset Policy

Table 9 outlines how the Stage 8 GFD Project offset obligations partially acquitted on the offset area meet the requirements of the EPBC Act *Environmental Offsets Policy*.

Table 9 – Assessment against Principles of the Offset Policy

Principle	How the principle is met in this offset proposal
1. deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The offset area partially acquits MNES offset requirements for Stage 8 under EPBC 2012/6615 as outlined in Table 8. The remaining will be acquitted elsewhere. The offset area will be managed and monitored to improve the viability of habitat for threatened species. This will include the management of regrowth vegetation to become self-sustaining functional remnant vegetation communities. This OAMP sets out specific management objectives with interim performance targets and completion criteria. Management actions are outlined with accompanying adaptive management triggers and corrective actions in the event that monitoring identifies that interim performance targets are not attained or completion criteria are not attained and/or maintained. The offset area will be managed and monitored from approval of the OAMP for a minimum of 20 years. It is anticipated that the completion criteria will be achieved within a 20-year period.
2. be built around direct offsets but may include other compensatory measures	MNES offset obligations under EPBC 2012/6615 will be acquitted through the delivery of direct land-based offsets on the offset area and additional land-based offset areas to be secured by Santos.
3. be in proportion to the level of statutory protection that	The threatened status of the impacted protected matter is considered in the OAG in calculating the area of the offset to be provided.

Principle	How the principle is met in this offset proposal
applies to the protected matter	
4. be of a size and scale proportionate to the residual impacts on the protected matter	The size of the offset area to be secured for offset obligations has been calculated in accordance with the OAG (Santos 2025).
5. effectively account for and manage the risks of the offset not succeeding	This OAMP has been developed in consideration of known and identified threats to the offset value to manage the risk of failing to the achieve the completion criteria and overall environmental outcomes for the offset area. Threats to the offset site are managed through the implementation of the management measures discussed in Section 6, including: • Fire prevention and management • Weed monitoring and control • Clearing protection • Management of grazing • Restricted access. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans etc.) and identification of potential site-specific risks based on the results of field surveys and discussions with the landholder. The results of the risk assessment, presented in Appendix C, have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions. If the offset cannot attain and maintain the completion criteria then additional offsets will be provided to compensate for the impact and the failed offset (see Section 5.2.4).
6. be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	The environmental outcomes proposed to be achieved through the implementation of this OAMP are based on additional management and monitoring measures conducted as part of business as usual on the Kentucky property. For example, under the Queensland *Biosecurity Act 2014* a person has a general biosecurity obligation to: take all reasonable and practical steps to prevent or minimise each biosecurity risk. The steps proposed in this OAMP are above reasonable and practical steps required to control feral animals and weeds in central Queensland. Now that the Voluntary Declaration has been secured over the offset area, environmental laws prevent other land uses inconsistent with this OAMP being approved over this part of the property.
7. be efficient, effective, timely, transparent, scientifically robust and reasonable	The offset area has been identified to be suitable using an evidence based and scientifically robust approach. The environmental outcomes to be achieved through this OAMP will be delivered progressively over 20 years. The offset area has been legally secured through a Voluntary Declaration under the VM Act therefore any vegetation clearing contravention of this OAMP is not permissible without specific Queensland government approval.

Principle	How the principle is met in this offset proposal
	The preparation and implementation of this OAMP supports the efficient, effective, timely, transparent and scientifically robust approach to providing offsets.
8. have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	This OAMP includes a detailed monitoring program which will assess the effectiveness of the management actions undertaken and the progress of the offset area in achieving the environmental outcomes. The results of all management and monitoring programs will be included in annual reports (Section 8.1). An implementation schedule for monitoring and management is provided in Section 9 which will be reviewed at least annually to ensure the timely implementation of this OAMP.

3. Offset Values

The following sections provide a description of the offset area that will be managed as part of this OAMP for each MNES offset value. Figure 5 and Figure 6 present the MNES offset areas on Kentucky.

3.1. Collared Delma

Habitat for Collared Delma within the offset area comprises RE 11.3.2, 11.3.39, 11.9.2, 11.9.10, 11.10.7, 11.10.11, and 11.10.13.

Habitat for Collared Delma is present over much of the Kentucky property, especially in areas of remnant and regrowth vegetation that have not recently been heavily cleared (the northern two thirds of the property).

Collared Delma is known to occur in REs on land zones 3, 9 and 10 (Brigalow Belt Reptiles Workshop 2010), and appears to require rocks, timber, bark or other surface debris for shelter (DCCEEW 2025a). It tends to prefer eucalypt woodlands and open forest that provides these suitable microhabitat features (Brigalow Belt Reptiles Workshop 2010). Potential habitat within the offset area is widespread throughout the property with many of the eucalypt woodlands and forests providing adequate fallen timber, rocks and/or groundcover (Boobook 2020a).

3.2. Yakka Skink

Habitat for Yakka Skink within the offset area comprises REs 11.3.2, 11.3.39, 11.9.2, 11.10.7, 11.10.11, 11.9.5, 11.9.10,11.10.3, and 11.10.13.

Habitat for the Yakka Skink on Kentucky extends across most of the property where woodland and scrub vegetation are present. The species is commonly found under partly buried rocks and logs or in abandoned animal burrows (Brigalow Belt Reptiles Workshop 2010; DCCEEW 2025d). Remnant vegetation along the Dawson River in the north and other large tracts of remnant and regrowth vegetation throughout the property (particularly Narrow-leaved Ironbark [*Eucalyptus crebra*] woodland) provide variable cover of woody debris and ground litter. Older growth communities contain good structure in the form of developed shrub and ground layers and fallen timber and deep leaf litter (Boobook 2020a).

3.3. Dunmall's Snake

Habitat for Dunmall's Snake within the offset area comprises REs 11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, and 11.10.13.

Habitat for Dunmall's Snake can be found over much of the Kentucky property, especially in areas of remnant and regrowth vegetation that have not recently been heavily cleared (the northern two thirds of the property).

Dunmall's Snake occurs in a variety of open dry sclerophyll woodlands and forests (typically dominated by *Eucalyptus, Acacia* and *Callitris* spp.) and on a broad range of land zones (Brigalow Belt Reptiles Workshop 2010; DCCEEW 2025f). The species is associated with partly buried rocks and boulders, fallen timber and root cavities for shelter (DCCEEW 2025f). Areas comprising abundant fallen timber, large rocks and extensive rock crevice habitat are particularly prevalent along patches of Brigalow and SEVT understorey. Several eucalypt woodlands throughout the property are also associated with suitable microhabitat features. These areas are considered to provide suitable foraging and shelter habitat for Dunmall's Snake. One individual has been recorded within the offset area encountered during nocturnal active searching (spotlighting) in regrowth of RE 11.9.2 (Boobook 2020a).

3.4. Red Goshawk

Habitat for Red Goshawk within the offset area comprises REs 11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, and 11.10.13.

Breeding habitat is intact tall forest associated with major drainage lines; however, the species may often forage much further away from these areas (DCCEEW 2025e). General habitat was identified throughout the entirety of the offset area, and the site is within the species known range (Boobook 2015).

3.5. Squatter Pigeon (southern)

Habitat for Squatter Pigeon (southern) within the offset area comprises RE 11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.10, 11.10.7, 11.10.11, 11.10.13.

Squatter Pigeon (southern) favours open-forests to sparse, open-woodlands and scrub that are mostly dominated by Eucalyptus, Corymbia, Acacia or Callitris species and are close to water bodies or watercourses (DCCEEW 2025g). General habitat for the species has been identified across the majority of the offset area (Boobook 2015). The offset area is also within known range of the species, with historical records within the Kentucky property and 10 km of the site (Boobook 2015).

3.6. Northern Quoll

Habitat for Northern Quoll within the offset area comprises REs 11.3.2, 11.3.25, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, and 11.10.13.

This species is dependent on the presence of suitable shelter habitat in the form of caves and deep crevices in extensive rock formations (commonly sandstone) and forages in associated woodland and forest habitat (DCCEEW 2025c). The offset area is characterised by rugged topography and is comprised mainly of hills, ridges, plateaux, and steep scarps (Boobook 2015). General habitat for the species, defined by all remnant and mature regrowth vegetation containing potentially suitable den sites, covers the offset area (Boobook 2015). The offset area is located within the species historical range (Boobook 2015).

3.7. Koala

Habitat for Koala within the offset area comprises RE 11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.10, 11.10.7, 11.10.11, and 11.10.13.

Koala habitat is broadly defined as eucalypt forests and woodlands or shrubland with emergent eucalypt species and can include both remnant and regrowth communities, provided adequate mature Koala food trees are present (DCCEEW 2025i). Potential habitat for Koala within the offset area is widespread. Characteristic scratches were detected on the bark of Grey Gums (*Eucalyptus major*) in RE 11.10.13 and *Eucalyptus tereticornis* in REs 11.3.25 and 11.3.27 as part of targeted field surveys from January to May 2020. Scats of this species have also previously been reported from the property in RE 11.10.11 (*Eucalyptus populnea* regrowth) (Boobook 2020a).

3.8. South-eastern Long-eared Bat

Habitat for South-eastern Long-eared Bat within the offset area comprises REs 11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, and 11.10.13.

South-eastern Long-eared Bat is known to occur in a variety of dry forest habitats including River Red Gum (*Eucalyptus camaldulensis*), open woodland, mallee, Brigalow and other arid and semi-arid habitats (DCCEEW 2025h). The preferred habitat is mallee and *Callitris* woodlands (Pennay *et al*. 2011), and habitats that have a distinct canopy with a dense, cluttered understorey (Turbill and Ellis 2006). Surveys have suggested the species

requires large tracts of forest to occur (Turbill *et al*. 2008). The species typically roosts in dead trees, dead spouts of living trees or under bark (New South Wales National Parks and Wildlife Service [NSW NPWS] 2003; DCCEEW 2025h). The majority of Kentucky is considered to provide suitable habitat for South-eastern Long-eared Bat and contains several REs with an understorey of *Callitris* (Boobook 2020a).

3.9. Large-eared Pied Bat

Habitat for Large-eared Pied Bat within the offset area comprises REs 11.3.2, 11.3.25, 11.3.27, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.10, 11.10.3, 11.10.7, 11.10.8, 11.10.11, and 11.10.13.

This species requires a combination of sandstone cliffs/escarpments to provide roosting habitat that is adjacent to fertile woodlands, preferably box gum or river/rainforest corridors for foraging (DCCEEW 2025a). The offset is characterised by rugged topography and is comprised mainly of hills, ridges, plateaux and steep scarps and is within the known range of the species (Boobook 2015). General habitat was identified throughout the entirety of the offset area.

MNES habitat - South-eastern Long-eared Bat, Dunmall's Snake, Large-eared Pied Bat, Red Goshawk

Dawson River
Gratz Gully
Lambing Flat Creek
Dawson River
Baffle Creek
Dismal Gully

MNES habitat

South-eastern Long-eared Bat, Dunmall's Snake, Large-eared Pied Bat & Red Goshawk

MNES habitat - Koala, Squatter Pigeon, Collared Delma

Dawson River
Gratz Gully
Lambing Flat Creek
Dawson River
Baffle Creek
Dismal Gully

MNES habitat

Koala, Squatter Pigeon & Collared Delma

Koala & Squatter Pigeon only

SANTOS

Location diagram

Figure 5
MNES habitat

Kentucky
Offset area

Watercourse

Major watercourse
Creekline
Minor drainage line
Drainage contour

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:55,000@A3

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Kentucky\Kentucky_OAMP_mapping_20250501.aprx

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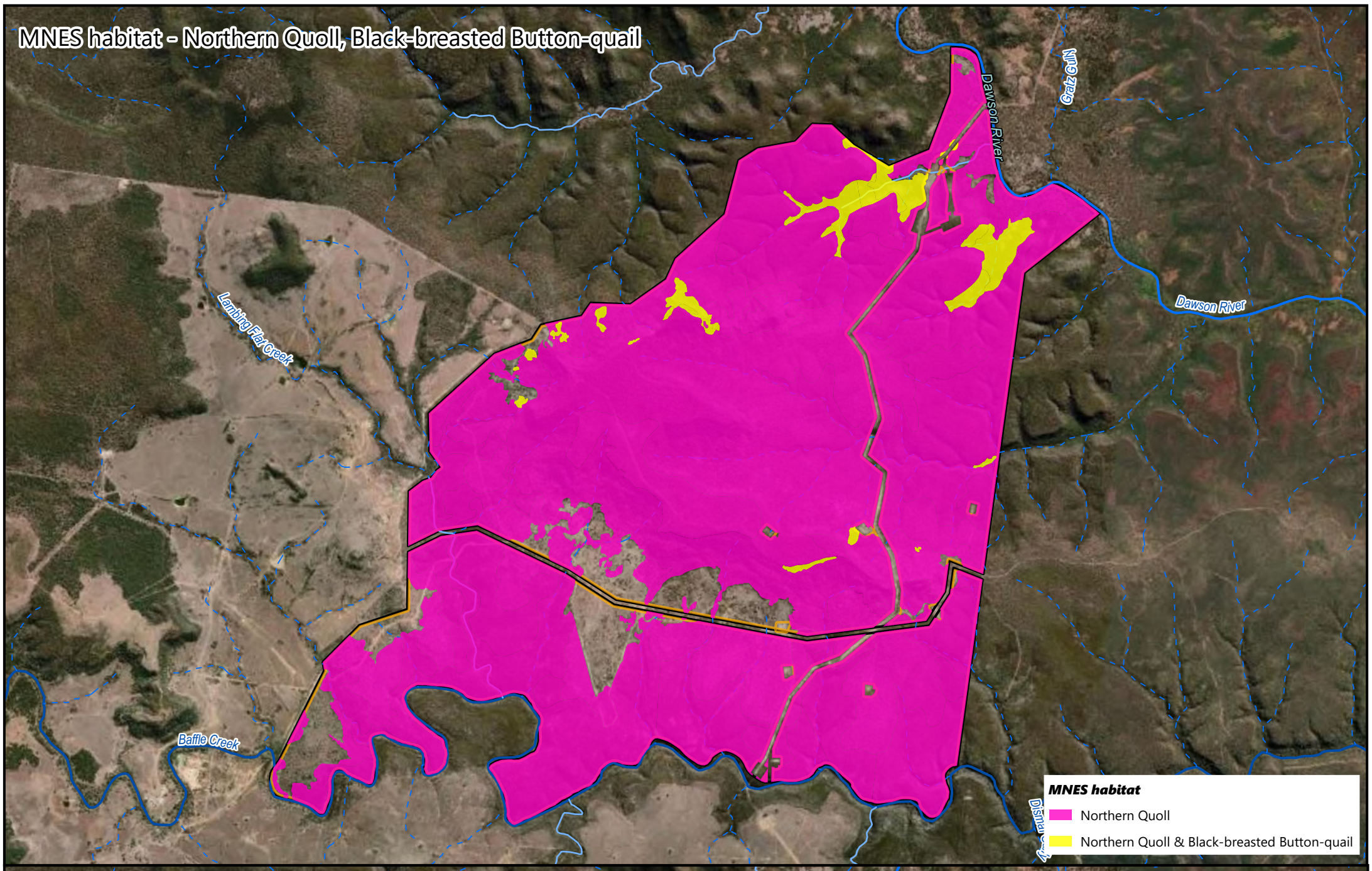
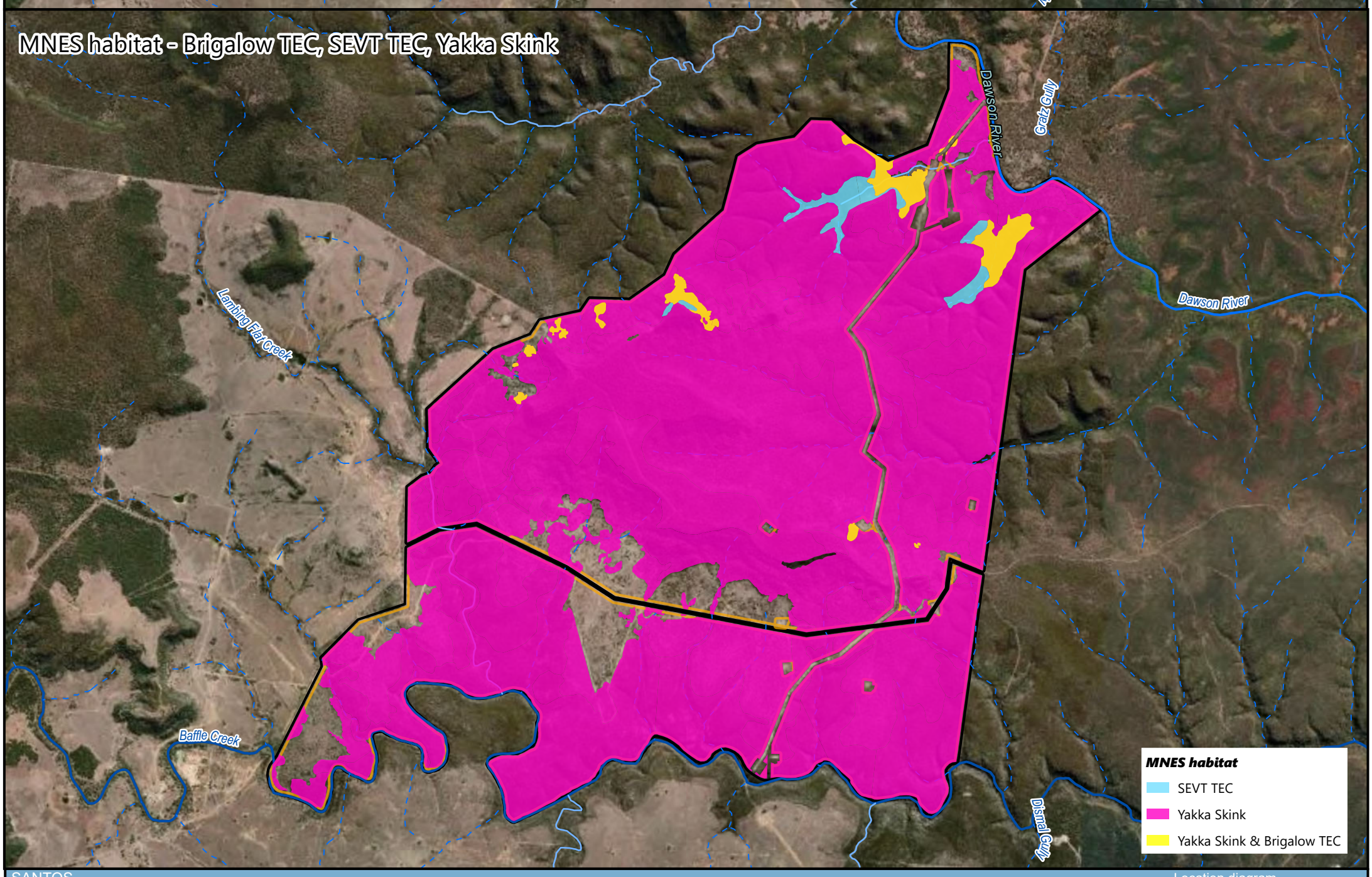
MNES habitat - Northern Quoll, Black-breasted Button-quail



MNES habitat - Brigalow TEC, SEVT TEC, Yakka Skink



SANTOS

Location diagram

Figure 6
MNES habitat

Kentucky - 1WT37
Offset area

Watercourse
Major watercourse
Creekline
Minor drainage line
Drainage contour

N

0 1 2
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:55,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMP\s\Kentucky\Kentucky_OAMP_mapping_20250501.aprx

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4. Environmental Outcomes to be Achieved

The outcome of this OAMP will partially acquit the Stage 8 offset obligations for the GFD Project under EPBC Approval 2012/6615 in accordance with the EPBC Act *Environmental Offset Policy*.

Progress towards achieving these outcomes will be measured against the interim performance targets and criteria defined in Table 10 below based on the proposed habitat quality score to be achieved for each MNES in the OAGs for Stage 8 under EPBC 2012/6615 (Santos 2025).

A summary of all the interim performance targets and completion criteria for the Kentucky offset area related to each of the MNES offset areas secured under EPBC 2008/4096, 2008/4059 and 2012/6615 is provided in Appendix D.

Table 10 – Interim performance targets and completion criteria for the Kentucky offset area for Stage 8 under EPBC 2016/6615

MNES	Baseline habitat quality score (/10)	Interim performance targets			Completion criteria
		Year 5	Year 10	Year 15	Year 20
Threatened fauna species					
Collared Delma (*Delma torquata*)	8 (8.1)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
Yakka Skink (*Egernia rugosa*)	7 (7.2)	Increase in the habitat quality score from baseline score of 7	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 8
Dunmall's Snake (*Furina dunmalli*)	8 (8.2)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
Koala (*Phascolarctos cinereus*)	8 (8.0)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	8 (7.7)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9

5. Approach to Management

5.1. Adaptive management

This OAMP is based on an adaptive management approach which involves 'flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood' (National Research Council 2004).

Adaptive management includes two key phases:

- Establishment of the key components of a management framework including engaging stakeholders, developing clear and measurable objectives and performance criteria, identification and selection of potential management actions and the development of monitoring protocols which enable the evaluation of progress towards achieving objectives, and which will effectively contribute to the adaptive management decision making process, and
- An iterative learning phase which involves utilisation of the management framework to learn about the natural resource system and iteratively adapt management strategies and approaches based on what is learned (Williams 2011).

The management of natural systems involves uncertainty which can affect the success of the management measures in achieving the objectives and performance criteria. Williams (2011) and Williams and Brown (2016) identify four kinds of uncertainty, outlined as follows, with how they have been addressed through the development of this OAMP:

- environmental variation:
  - caused by external factors that act upon natural systems, but which are not influenced by the resource conditions and dynamics, for example variation in rainfall or temperature,
  - largely outside of the control of the manager (Williams 2011), and
  - influence is considered in the analysis of the effectiveness of the adaptive management approach, the analysis of the ability to achieve and maintain performance criteria and when considering the need for corrective actions.
- partial observability:
  - includes potential uncertainty arising from variation in the collection of data during monitoring events, and from being unable to completely observe the natural system in its entirety (Williams and Brown 2016), and
  - addressed in this OAMP through the development of a monitoring program based on scientifically tested and repeatable methods.
- partial controllability:
  - relates to the difference between the intended effect of the management measures to be implemented through this OAMP and the actual effect of their implementation on the ground (Williams and Brown 2016), and
  - addressed through adherence to an adaptive management approach including regular monitoring of conformance with performance criteria, assessment of adaptive management triggers, the implementation of corrective actions, review and amendments to the OAMP, and reporting to ensure that management measures are being effectively implemented on the ground.
- structural and process uncertainty:
  - concerns a lack of knowledge or understanding regarding biological and ecological processes and relationships, and differing views regarding how natural systems respond to management (Williams and Brown 2016), and

– addressed through the adaptive management approach. Following the results of ongoing management, monitoring and reporting, the OAMP will be reviewed and updated as required to incorporate learnings, updated conservation advice and best practice management techniques.

5.2. OAMP adaptive management framework

5.2.1. Risk assessment

The adaptive management process for this OAMP is supported by a risk assessment through which the known and potential risks for each offset value have been evaluated. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans, etc.) and identification of potential site-specific risks. As presented in Appendix C, the risk assessment included an assessment of the likelihood and consequence for each identified risk, both with and without the implementation of control strategies. The results of the risk assessment have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions.

Implementation of the adaptive management process aims to reduce the risk of the identified threats occurring to ensure that the overall outcome sought by this OAMP are achieved.

5.2.2. Adaptive management process

The adaptive management process for this OAMP includes the following key components:

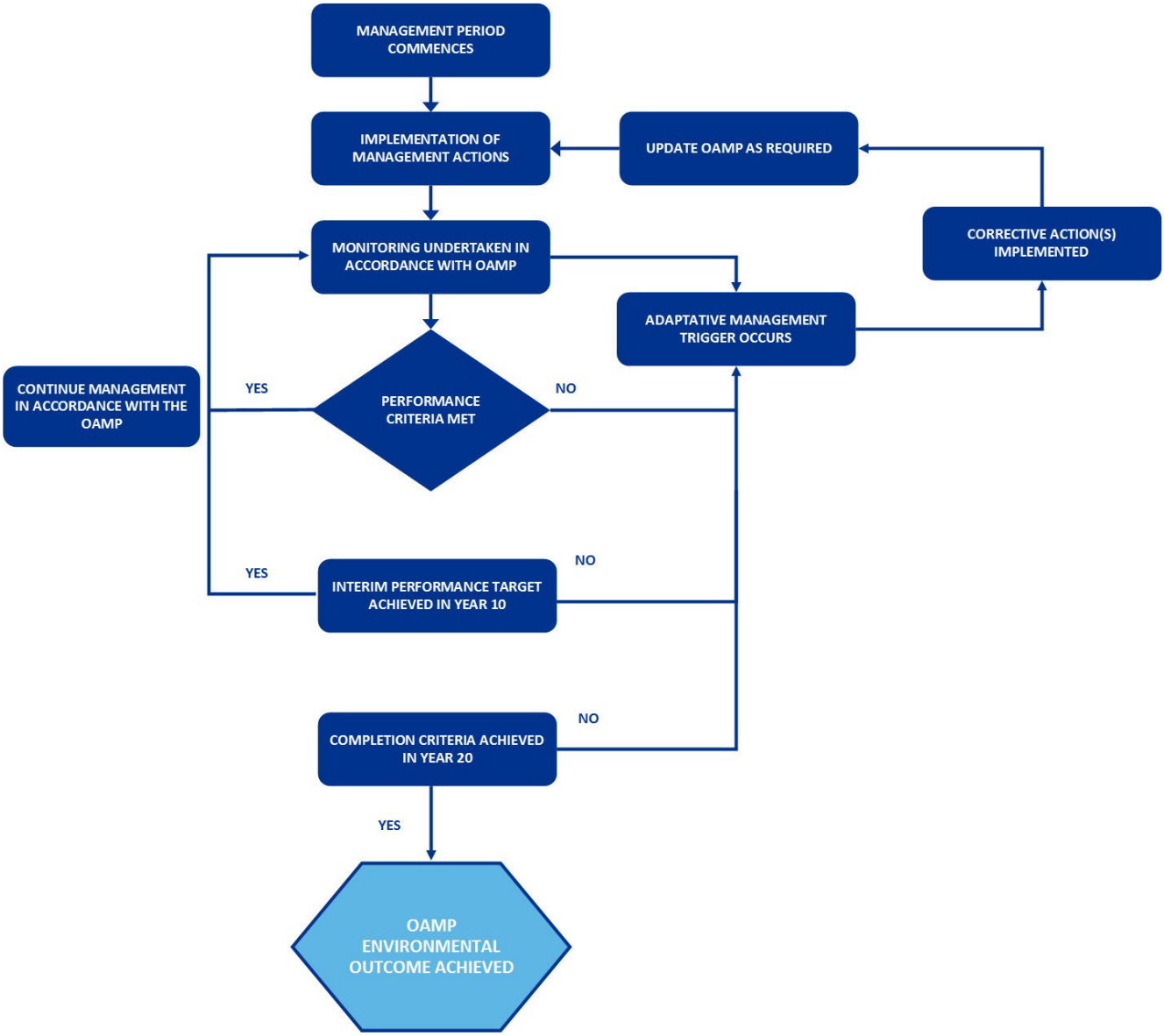
- **identified threats to offset values** – known and potential threats to the offset values have been identified as part of the risk assessment process
- **relevant offset values** – MNES or other offset matter for which the identified threat is relevant have been indicated
- **management objectives** – management objectives have been developed to address each identified threat to the offset values, and to ensure that the interim performance targets and completion criteria are attained
- **performance criteria** – assessable criteria have been defined to measure adherence to the management objectives
- **management action** – specific management actions have been identified to ensure that the performance criteria and management objectives are satisfied, and which will ultimately result in attainment of the interim performance targets and completion criteria
- **monitoring** – a combination of qualitative and quantitative methodologies has been included to assess whether management actions are meeting the performance criteria and management objectives, and ultimately, whether the OAMP is supporting the delivery of the interim performance targets and completion criteria
- **adaptive management trigger** – measurable events or parameters have been identified which, when triggered, indicate that a performance criterion has not been satisfied, instigating the implementation of contingency plans and corrective actions
- **corrective actions** – a two-step process has been established to identify the likely cause of the non-compliance with the performance criteria and allow for identification of suitable corrective actions. Corrective actions include the implementation of a feasible, appropriate and effective action to address the identified issue and ensure the performance criteria is satisfied.

Figure 7 illustrates the ongoing adaptive management cycle of implementation, learning and review, with the aim of achieving the interim performance targets and completion criteria. Through the implementation of this adaptive management process, it is anticipated that the interim performance targets and completion criteria will be attained and maintained for the life of the approval.

5.2.3. Timing for implementation of the OAMP

The offset area will be managed and monitored until the interim performance targets and completion criteria are achieved. It is anticipated that through the adaptive management approach, interim performance targets and completion criteria will be achieved within the proposed 20-year management period. However, if the interim performance targets and/or completion criteria for offset values have not been achieved within the anticipated timeframes, management and monitoring will continue beyond the 20-year management period in accordance with this OAMP until the completion criteria have been achieved. Once attained, completion criteria will be maintained for at least the life of the EPBC Act approval relevant to this OAMP.

Figure 7 – Process for implementation of the OAMP



5.2.4. Risk of offset failure

Based on the adaptive approach to management and the proposed management and monitoring program, it is considered that the management objectives, interim performance targets and completion criteria will be successfully achieved.

In the unlikely event that the interim performance targets are not achieved for one or more offset values by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions.

It should be noted that unavoidable temporary perturbations such as severe drought, or insect/fungal pest invasion that may cause a temporary decrease in metrics such as canopy or shrub cover from which the community still may recover within the next 5-year period should not preclude assessment of a satisfactory increase in ecological condition by the completion date.

If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements. The revised OAMP will be submitted to the Commonwealth Government.

6. Management Program

6.1. Management objectives

A summary of the management objectives and performance criteria for the offset area is presented in Table 11, and the complete adaptive management process for this OAMP is encapsulated in Table 13. The management measures provided in Table 12 take into account the information in the relevant conservation advices, recovery plans and threat abatement plans for each MNES. Management actions, monitoring events, adaptive management triggers and corrective actions have been assigned to each management objective and performance criteria.

Table 11 – Summary of the management objectives and performance criteria

Management objectives	Performance criteria
Achieve the completion criteria including habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events so as to achieve the scores in the completion criteria. Achieve structural and floristic components for a vegetation community to be reclassified as remnant.
Maintain the extent of offset value habitat within the offset area	No unapproved and/or intentional clearing of habitat within the offset area, with the exception of clearing that is required for fencing, access, firebreaks and public safety as outlined in Table 14.
Ensure that the livestock grazing restrictions outlined in Section 6.2.4 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events.
	Biomass levels of 2,500 kilograms per ha (kg/ha) are retained at each of the monitoring sites at the end of the dry season.
	Livestock are only observed to be grazing in the offset area during strategic grazing event/s.
Minimise predation risk by wild dogs to threatened fauna species.	Reduction in Catling* Index for wild dogs from year 1 and subsequent monitoring events.
Minimise predation risk by feral cats to threatened fauna species.	Reduction in Catling* Index for feral cats from year 1 and subsequent monitoring events.
Minimise predation risk by foxes to threatened fauna species.	Reduction in Catling* Index for foxes from year 1 and subsequent monitoring events.
Minimise degradation of offset value habitat by feral horses.	Reduction in the observed presence of feral horse on the property.
Minimise degradation of offset value habitat by feral pigs.	Reduction in mean feral pig abundance score from year 1 and subsequent monitoring events.

Management objectives	Performance criteria
Manage invasive weed species to reduce degradation of offset value habitat.	A decrease in species richness and relative abundance of weed species at 80% of monitoring sites from year 1 and subsequent monitoring events. No new weed species are identified at any monitoring site (based on year 1 and subsequent monitoring data).
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	No unplanned fire within the offset area. Increase in habitat quality scores as a result of implementation of any fire management measures.
Achieve the interim performance targets and completion criteria for each offset value within 5, 10 and 20 years, respectively.	The interim performance targets are achieved for all offset values by year 5, 10 or 15. The completion criteria are achieved for all offset values by year 20.

* Catling index provides a measure of relative abundance of wild dogs, foxes and feral cats within the offset area. The Catling index will be measured as the percentage of camera nights in which the pest species was observed as part of fauna camera monitoring for the species, as outlined in Section 6.2.6.

Table 12 – Recovery actions for each MNES and their associated threats

MNES	Threats	Recovery/management actions
Threatened fauna species		
Collared Delma (*Delma torquata)*	Threats to the species have been determined based on conservation advice (DCCEEW 2025b): • Alteration of ground cover as a consequence of unsuitable fire regime. • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Predation by feral predators (e.g., cats, foxes, wild dogs). • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025b): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Pest animal management and monitoring (see Sections 6.2.6 and 7.4). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.3).
Yakka Skink (*Egernia rugosa*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025d): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Destruction of potential shelter habitat associated with rabbit warren ripping. • Predation by feral predators (e.g., cats, foxes, pigs). • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Destruction of potential shelter habitat associated with rabbit warren ripping.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025d): • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.6 and 7.4). • Weed management and monitoring (see Sections 6.2.5 and 7.3). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Biomass monitoring (see Section 7.2).

MNES	Threats	Recovery/management actions
	• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	
Dunmall's snake (*Furina dunmalli)*	Threats to the species have been determined based on conservation advice (DCCEEW 2025f): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Predation by feral predators (e.g., cats, foxes, pigs). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025f): • Pest animal management and monitoring (see Sections 6.2.6 and 7.4). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.3). • Fire management and fuel hazard monitoring (see Sections 6.2.4 and 7.2.2).
Red Goshawk (*Erythrotriorchis radiatus*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025e): • Loss of suitable foraging habitat through land clearing and effects associated with fragmentation of large contiguous patches of forest and woodland, particularly large trees in alluvial valleys. • Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity. • Potential of reduced prey (e.g., medium sized birds) as a consequence of unsuitable fire regime.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025e): • Exclusion of cattle from the offset area (see Section 6.2.3). • Fire management and fuel hazard monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2).
Squatter pigeon (*Geophaps scripta scripta*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025g):	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025g):

MNES	Threats	Recovery/management actions
	• Change in ground layer composition as a consequence of grazing and ecosystem engineering actions by rabbits (e.g. burrowing, soil turnover). • Predation by feral predators (e.g., cats, foxes). • Change in ground layer composition and trampling ground nests as a consequence of livestock grazing and feral horse browsing, especially in grassy, alluvial areas. • Change in ground layer composition, including thickening of understorey structure, as a consequence of unsuitable fire regime.	• Pest animal management and monitoring (see Sections 6.2.6 and 7.4). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.3).
Northern Quoll (*Dasyurus hallucatus*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025c): • Poisoning through ingestion of cane toads (*Rhinella marina*). • Loss of ground cover as a consequence of unsuitable fire, resulting in risk of increased predation and/or reduced food. • Loss of ground cover as a consequence of livestock grazing. • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Predation by feral predators (e.g., cats, foxes, wild dogs). • Poisoning through 1080 baiting.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025c) and recovery objectives outlined in Hill and Ward (2010): • Pest animal management and monitoring (see Sections 6.2.6 and 7.4). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.3).
Koala (*Phascolarctos cinereus*)	Threats to the species have been determined based on conservation advice and the Recovery Plan (DCCEEW 2025i): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025i): • Exclusion of cattle within offset areas (see Section 6.2.3).

MNES	Threats	Recovery/management actions
	• Mortality due to vehicle collision. • Predation by feral predators, particularly wild or domesticated dogs. • Alteration of the structure of suitable habitat, including loss of primary feed trees, as well as direct mortality as a consequence of unsuitable fire regime. • Evidence for the presence of disease within the population (i.e., *Chlamydia pecorum*).	• Restricting unauthorised entry into the offset area and managing access tracks and movement of vehicles within the offset area (see Sections 6.2.1 and 6.2.2). • Pest animal management and monitoring (see Section 6.2.6 and 7.4). • Weed management and monitoring (see Sections 6.2.5 and 7.3). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Biomass monitoring (see Section 7.2).
South-eastern long-eared bat (*Nyctophilus corbeni*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025h): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Alteration of the structure of suitable habitat (e.g. mix of shrubby and open structure habitat) including loss of hollow-bearing trees as a consequence of unsuitable fire regime. • Impacts on understorey habitat as a consequence of livestock grazing, impacting habitat for understorey invertebrate prey. • Competition for hollows from native fauna species (e.g., parrots and cockatoos) and non-native fauna species (e.g., European honeybees, common myna), especially where hollows are limited.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025h): • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.6 and 7.4). • Weed management and monitoring (see Sections 6.2.5 and 7.3). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Biomass monitoring (see Section 7.2).
Large-eared pied bat (*Chalinolobus dwyeri)*	Threats to the species have been determined based on conservation advice and the Recovery Plan (DCCEEW 2025a): • Potential of reduced foraging opportunities and flying invertebrate productivity as a consequence of unsuitable fire regime. • Predation by feral predators (e.g., foxes)	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025a): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2).

MNES	Threats	Recovery/management actions
	• Loss of sandstone roosting/maternity sites, whether through occupation by pest animal species (e.g., goats) or impacts to structural integrity from uncontrolled wildfire.	• Pest animal management and monitoring (see Sections 6.2.6 and 7.4).

Table 13 – Management objectives, performance criteria, adaptive management triggers and corrective actions

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
Achieve the completion criteria including habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events to achieve the scores in the completion criteria. Achieve structural and floristic components for a vegetation community to be reclassified as remnant.	Implementation of the management actions and adaptive management framework as outlined in this OAMP.	Repeatable, measurable BioCondition monitoring at fixed monitoring locations to calculate comparable Habitat Quality scores in accordance with GTDTHQ (version 1.2; DEHP 2017) over the lifetime of the OAMP.	Fixed transects were established and assessed as part of the baseline in 2020 (see Figure 9). Transect locations were randomly stratified and are representative of offset values across vegetation communities and condition.	BioCondition assessments will be undertaken at each of the transects in year 1 and then every two years for the first six years, and then every three years thereafter.	Monitoring of offset value habitat quality scores and condition of habitat will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Rapid monitoring events (Section 7.5.1). • Habitat quality assessments to determine habitat quality scores (Section 7.5.2). • Targeted fauna surveys (Section 7.5.4). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime to better support enhancement of offset values. • For offset values that have not achieved interim performance targets by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions. • If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the OAG. The revised OAMP will be submitted to the Commonwealth Government.
Maintain the extent of offset value habitat within the offset area.	No unapproved and/or intentional clearing of habitat within the offset area, with the exception of clearing that is required for fencing, access, firebreaks and public safety as outlined in Table 14.	Protection of the offset area via a Voluntary Declaration under Section 19E and 19F of the VM Act, as described in Section 2.8.	The offset area will be legally protected from unapproved vegetation clearing activities through compliance with the Voluntary Declaration under Section 19E and 19F of the VM Act, and declared an area of high nature conservation	The entirety of the offset area is subject to the conditions of the Voluntary Declaration under the VM Act.	Restrictions outlined in Table 14 will be implemented for the lifetime of the project and OAMP.	Offset area inspections will be undertaken twice per year for the duration of the management period and will report on any major or noticeable changes to the extent of offset value habitat. Reporting to the Commonwealth Government	Any activities in contravention of the Voluntary Declaration and this OAMP.	**Step 1: Investigate cause of trigger** • Investigate reasons why unapproved clearing occurred e.g. unauthorised access • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Addition fencing, signage and/or security for the offset area. • Restoration of the impacted area.

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
			value. See Section 2.8.			consistent with EPBC approval.		
		Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in accordance with Sections 6.2.2, 6.2.3, and 6.2.4 If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be planned, recorded and monitored.	Compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks will also be assessed as part of offset area inspections (Table 14, Section 6.2).				Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with the restrictions outlined in Section 6.2.1.	**Step 1: Investigate cause of trigger** • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately. • Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.
Ensure that the livestock grazing restrictions outlined in Section 6.2.4 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events.	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses and promote the establishment of native perennial grass species in accordance with Section 6.2.4.	Best practice management for strategic livestock grazing within the offset area will be undertaken as follows: • livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover, and • within the offset area a minimum of 2,500 kg/ha of biomass will be retained at	The precise location of strategic livestock grazing will occur at the discretion of the landholder and/or property manager of whom is responsible for cattle management. Environmentally sensitive areas such as SEVT will be avoided.	Strategic livestock grazing effort (i.e. the number of cattle and their exposed time to an area) will be managed at the discretion of the landholder and/or property manager of whom is responsible for cattle management.	Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.5.1 and 7.5.2. These will include assessment of % cover of native perennial grasses and incidental flora surveys. Monitoring will report on locations where strategic grazing effort is being either under or over utilised.	Decrease in the richness and average % cover of native perennial grasses at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime. • Installing additional watering points for livestock to manage livestock in accordance with the grazing regime.
	Biomass levels of 2,500 kg/ha are retained at each of the monitoring sites at the end of the dry season.	Implementation of a strategic grazing regime to protect and maintain environmental values in				Biomass monitoring will be undertaken in accordance with Section 7.2.	Biomass monitoring results indicate less than 2,500 kg/ha of biomass is present at any of the monitoring sites at	**Step 1: Investigate cause of trigger** • Investigate the reason for biomass being less than 2,500 kg/ha. • Re-evaluate the strategic grazing regime to assess the suitability of grazing to ensure no less than an average of 2,500 kg/ha of biomass is retained at the end of the dry season. • Identify appropriate corrective actions.

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
		accordance with Section 6.2.4.	the end of the dry season. See Section 6.2.4 for more detail.				the end of the dry season.	**Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Removal of stock or spelling grazing from the area of the offset in which less than 2,500 kg/ha of biomass was identified. • Review adherence to livestock grazing restrictions in Section 6.2.4. • Where relevant, amending livestock management practices in the OAMP, including amending stocking rates, and/or duration and/or frequency of strategic grazing events.
Minimise predation risk by feral animals to threatened fauna species.	Reduction in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	Implement control actions for wild dogs in accordance with Section 6.2.6.	• Ground baiting • Foot hold traps • Shooting	The requirement for and location of pest animal management will be strategically and safely designed, informed by pest animal monitoring results.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results.	Pest monitoring activities will be undertaken every two years, post wet season. Motion sensor cameras will be placed within the offset area along tracks and will be left in place for a minimum of three consecutive nights. Analysis of the camera footage will be undertaken to determine the percentage of camera nights with animal captures for each species observed. This percentage represents the Catling index (Mitchell and Balogh 2007b, 2007c). Monitoring methods are detailed in Section 7.4.	An increase in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in the: – Catling* index for wild dogs, feral cats and/or foxes. – Relative abundance of feral pigs and horses. • Review adherence to pest management control measures as outlined in Section 6.2.6. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency and intensity of pest animal control. • Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the OAMP and targeted pest animal control programs.
	Reduction in Catling* Index for feral cats from year 1 and subsequent monitoring events.	Implement control actions for feral cats in accordance with Section 6.2.6.	• Ground baiting • Trapping • Shooting				An increase in Catling* Index for feral cats from year 1 and subsequent monitoring events.	
	Reduction in Catling* Index for foxes from year 1 and subsequent monitoring events.	Implement control actions for foxes in accordance with Section 6.2.6.	• Night shooting • Poisoning • Trapping				An increase in Catling* Index for foxes from year 1 and subsequent monitoring events.	
Minimise degradation of offset value habitat by feral horse and feral pigs	Reduction in the observed presence of feral horse on the property.	Implement control actions for feral horses in accordance with Section 6.2.6.	Relocation through mustering or trapping.	The requirement for and location of pest animal management will be strategically and safely designed, informed by	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results.	The presence of or signs of horses will be documented during offset area inspections, twice yearly.	An increase in the observed presence of feral horses across monitoring events.	
	Reduction in mean feral pig abundance score	Implement control actions for feral	• Trapping • Shooting • Poisoning			Pest monitoring activities will be undertaken every two	An increase in mean feral pig abundance score	

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
	from year 1 and subsequent monitoring events.	pigs in accordance with Section 6.2.6.		pest animal monitoring results.		years, post wet season. Assessment for the presence or absence of feral pig signs as a measure of abundance will be undertaken at permanent monitoring transects which have been randomly stratified across the offset area in environments that are more regularly impacted.	from year 1 and subsequent monitoring events.	
Manage invasive weed species to reduce degradation of offset value habitat.	A decrease in species richness and relative abundance of weed species at 80% of monitoring sites from year 1 and subsequent monitoring events. No new weed species are identified at any monitoring site (based on year 1 and subsequent monitoring data).	Implement weed control actions in accordance with Section 6.2.5. Adhere to weed hygiene restrictions in accordance with Table 14.	Weed treatment methods will be suitable to the target weed species and may include biological, chemical, or mechanical control. See Section 6.2.5 for more detail.	The results of weed monitoring activities will inform the location for weed treatment and control.	Weed treatment and control will be undertaken at optimal timing according to the lifecycle of the target species, i.e. before seeding.	The offset area will be monitored for weeds every two years (post wet season) to determine the species richness and abundance, for the duration of the management period. See Section 7.3 for more detail.	An increase in species richness and relative abundance of weed species at more than 20% of monitoring sites from year 1 and subsequent monitoring events. A new weed species is identified at one or more monitoring sites.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds. • Investigate potential sources or reasons for the occurrence of the new weed species. • Review adherence to weed management control measures as outlined in Section 6.2.5. • Review adherence to weed hygiene restrictions as outlined in Section 6.2.1. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Amending weed hygiene restrictions. • Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to. • Revising weed control methods in accordance with the Biosecurity Act 2014 (Qld). • Increasing the frequency and intensity of weed control. • Updating weed control methods in the OAMP and targeted weed control programs.
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	No unplanned fire within the offset area. Increase in habitat quality scores as a result of implementation of any fire	All fire management measures to be implemented in accordance with the program outlined in Section 6.2.4.	Monitor and control fuel loads, where required. Fuel loads will be managed through implementation of the following:	Fuel load management will be carried out where safe and practicable. Precise location will be determined in collaboration	If deemed necessary, fuel load management will be carried out when required during suitable climatic conditions.	Fuel loads will be monitored as a result of Habitat quality assessments to determine habitat quality scores, in accordance with Section 7.5.2.	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value from	**Step 1: Investigate cause of trigger** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores. • Review adherence to the fire management measures as outlined in Section 6.2.4. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s**

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
	management measures.		• maintained fire breaks, • controlled grazing regimes; and, • fuel hazard reduction burns. All management methods will be undertaken in compliance with Section 6.2.4.	with the landholder and a suitability qualified ecologist to assist the avoidance of sensitive habitats such as SEVT.		Rapid monitoring events will be undertaken to assess the general condition of vegetation in accordance with Section 7.5.1.	baseline and subsequent monitoring events.	The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass monitoring. • Increasing the frequency of weed control measures. • Amending the strategic grazing regime. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks. • Review timing and intensity of fuel hazard reduction burns in accordance with the Regional Ecosystem Description Database (REDD) fire management guidelines and conservation advice for the particular offset value.
Achieve the interim performance targets and completion criteria for each offset value within 5, 10, 15 and 20 years, respectively.	The interim performance targets are achieved for all offset values by year 5, 10 or 15. The completion criteria are achieved for all offset values by year 20.	All management actions outlined in Section 6 will be implemented to ensure that the interim performance targets and completion criteria are achieved.	All management control actions detailed in Section 6 will be implemented where necessary and practicable.	Management methods and actions will take place where required within the Offset area.	Management methods and actions will occur during seasonally suitable timing, in collaboration with the landholder and contractor undertaking the scope of work.	All monitoring activities detailed in Section 7 will be implemented and completed as per the implementation schedule in Section 9.	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values.

6.2. Management actions

6.2.1. General restrictions

Table 14 details the restrictions to be implemented for the offset area to ensure the completion criteria and management objectives are met.

Table 14 – Offset area restrictions

Restrictions	Details
Weed hygiene	• Weed hygiene measures will be implemented to prevent the movement of weed material into the offset area. • All persons entering the offset area will be required to ensure vehicles and equipment are weed free. • All contractors entering the offset area must hold a current weed hygiene certificate or equivalent for all vehicles and equipment. • Evidence is to be provided on request to the Santos land advisor of the Kentucky property that vehicles, slashers or any machinery implementing management actions are clean prior to entry to minimise potential weed spread.
Vehicles	• Vehicle movement will be limited to designated access tracks in the offset area and access will be restricted to authorised personnel only. • Vehicles will travel to track conditions to minimise the risk of vehicle strike to fauna.
Vegetation clearing	• Clearing will be excluded from the offset area through demarcation and protection by means of Voluntary Declaration under the VM Act. Clearing for timber gathering and development will also be excluded. • Clearing of native vegetation will not be permitted within the offset area as part of any management and monitoring activities associated with this OAMP, except for clearing that is required for: – maintenance of access tracks and/or fire breaks – fence construction and maintenance, and – ensuring public safety or as directed by emergency management response personnel in the event of unplanned fire or other emergency or associated procedure. • If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be appropriately planned, recorded and monitored. • Machinery will not be allowed on site after heavy or prolonged rainfall events until after the site has dried to allow for safe movement of traffic.
Unauthorised access or use	• Access into the offset area will be restricted to authorised personnel only. • The offset area will be demarcated as an exclusion zone in the Santos GIS. • Signs will be installed in prominent locations (i.e. at access points into the offset area) which recognise that the areas are protected for conservation purposes. The signs will advise that access into the offset area is restricted to authorised personnel only. • The property will be suitably fenced to restrict access by unauthorised persons.

Restrictions	Details
	• At no time can persons access the site without first approaching the Santos land advisor of the Kentucky property and informing them of their intent. • When entering and leaving the property, the land advisor must be advised. • Contractors will only be permitted to access the property following the direct engagement by Santos.

6.2.2. Access tracks

Existing access tracks will be utilised to facilitate necessary management, maintenance and monitoring activities as part of this OAMP. If existing access tracks become impassable (through erosion or vegetation regrowth), maintenance activities of these tracks (e.g. grading) will be prioritised over alternative track alignments. Gully crossings are likely to be subject to periodic, ongoing maintenance because of erosion following rain events.

Existing and new access tracks will be no wider than 5 metres (m) and vegetation disturbance will be minimised.

6.2.3. Fencing

To assist with management of livestock control for weed and fuel load management, existing fencing will be maintained, as presented in Figure 8.

Any additional fencing required to be installed will comprise of a 4-wire fence consisting of 3 strand 1.57HT barb with a plain high tensile wire at the top, wood and/or steel posts at 7 m spacing, a strainer post every 100 m and 1 gate located every 1 km. This type of fencing is also considered appropriate to facilitate the fauna movement across the property. Importantly, the movement of the species being offset will not be impeded by the proposed fencing design.

Any vegetation disturbance associated with new fence construction will be minimised in accordance with Table 14.

Regular inspections of all fencing will be undertaken in accordance with Section 7.1, and repairs to the fences will be made as required.

6.2.4. Fire management

A planned and co-ordinated fire management strategy will be implemented to:

- minimise the risk and impacts of unplanned fire (by monitoring and controlling fuel loads, if required) especially to fire sensitive Brigalow (Acacia harpophylla dominant and co-dominant) TEC and Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions TEC, and
- improve habitat quality through:
  - controlling weeds and fuel loads,
  - supporting development of structural components of habitat for offset values (e.g. recruitment of native plants, establishment of fire sensitive native herbs and groundcover, important microhabitat including fallen logs and leaf litter, and increased understorey), and
  - promoting germination and recruitment of Eucalypt species and other species characteristic of the specific RE.

Unplanned fire risk will be managed through:

- establishment and regular maintenance of firebreaks (Figure 8),
- monitoring and managing fuel loads primarily through the implementation of a controlled grazing regime (Section 6.2.4), and
- fuel hazard reduction burns (if required; Section 6.2.4).

148°50'0"E 148°52'0"E 148°54'0"E

25°32'0"S 25°34'0"S 25°36'0"S

Dawson River
Gratz Gully
Hut Road
Dam
Candlesticks Road
Dawson River
Dawson River
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Lambing Flat Creek
West Baffle
Brigalow Dam
Top Dam
Holding Dam
House Dam
Powerline Dam
Road Dam
Range Dam
East Baffle
Kentucky 16 Dam
Kates Dam
Baffle Creek
Baffle Creek
Fairview Road
Fairview Road
Fairview Road
Fairview Road
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Dam
Johnson Gully
Turkey Nest
Dam
Dam
Dismal Gully
House Dam

SANTOS

Location diagram

Figure 8
Property Infrastructure

Kentucky
Offset area

Infrastructure

Property access track
Fence
Dam / waterhole

Watercourse

Major watercourse
Creekline
Minor drainage line
Drainage contour

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 3/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:35,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMP\sKentucky\Kentucky_OAMP_mapping_20250501.aprx

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Where possible, firebreaks will be established and maintained around the boundary of the offset area, with green firebreaks established where the offset area joins native vegetation, see Figure 8. Firebreaks will be maintained at least annually in mid / late autumn and, or early spring to remove overhanging trees or fallen debris and dense vegetation. Firebreak maintenance will be undertaken to a width of up to 10 m.

Strategic grazing

The Kentucky property has in the past been managed as an open grazing enterprise where the focus has been on production and sustaining a viable income from domestic stock.

Strategic grazing within the offset area will be used to manage fuel loads and control exotic weeds and pasture grasses such as *Cenchrus ciliaris*. As increasing grazing intensity is correlated with an increase in weedy cover (Franks 2002), and a decrease in native grass species richness, grazing will be permitted in the offset area on a managed and limited basis to control weeds and reduce fuel loads.

Best practice management for strategic livestock grazing within the offset area will be undertaken as follows:

0) livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover, and

1) within the offset area a minimum of 2,500 kg/ha of biomass will be retained at the end of the dry season.

To minimise erosion and subsequent impacts on water quality, strategic grazing will be excluded where rainfall causes inundated or waterlogged soils. The location and extent of strategic grazing areas will be reviewed annually based on the results of management and monitoring events.

The suitability of conditions for undertaking a grazing event will be informed by biomass monitoring events as described in Section 7.2.

Fuel hazard reduction burns

The aim of fuel hazard reduction burns is to manage excess fuel loads, to initiate regeneration of eucalypt communities and to create habitat with a mosaic of different fire frequencies and times since fire.

Fire management, through fuel hazard reductions burns will be guided by conservation advice documentation (e.g. for MNES) and the REDD (Queensland Herbarium 2023), which provides recommendations for fire management for each of the component RE (Table 15), guidelines published in Fire and Biodiversity Monitoring Manual published by South East Queensland Fire and Biodiversity Consortium (2002), local regional fire plans, regional fire authorities and local knowledge of fire behaviour.

Hazard reduction burns will be considered if fuel hazard ratings within the offset area are unable to be maintained below extreme in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix E) through the implementation of strategic grazing and weed control. However, the location and timing for fuel hazard reduction burns will be informed by the results of biomass monitoring (Section 7.2) and fuel load monitoring (Section 7.2.2) in conjunction with the results of habitat quality assessments and considering the REDD fire management guidelines for the vegetation community and MNES conservation advice.

In general, fire management will be undertaken in a mosaic pattern at the appropriate time of year when:

- soil and fuel moisture levels are high, ideally following minimum of 40 mm of rainfall,
- ambient temperature and wind speed are low,
- atmospheric humidity is high,
- the risk of long-term impacts/high intensity fire is low, and/or
- plants approach a more active growing phase.

Table 15 – Fire management guidelines for each component RE

RE	Associated TEC	Fire Exclusion?	Fire Management
11.3.2	Poplar Box TEC	No	• Conduct a low to moderate burn every 6-10 years. • Timing for burning should be late wet to early dry season when there is good soil moisture, early storm season or after good spring rains. • Burn less than 30% of the area in any year. • Burn under conditions of good soil moisture and when plants are actively growing. Sometimes a small amount of wind may move the fire front quickly so that burn intensity is not too severe to destroy habitat trees.
11.3.25	-	No	• Conduct a low intensity burn every 3-5 years primarily during the early dry season. • Protection of this RE also relies on fire management of adjacent vegetation communities with numerous small fires throughout the year so that wildfires will be limited in extent. • In some situations it may be best not to burn as this RE is often critical habitat for fauna and flora species. • If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants. • If riparian areas need to be burnt to reduce fuel loads then burning should occur when there is good soil moisture and active growth.
11.3.27	-	No	• Depending on position in the landscape, protection of this RE relies on broad-scale fire management of surrounding country, with numerous small fires throughout the year so that wildfires will be very limited in extent. • In some situations it may be best not to burn as this RE is often critical habitat for fauna and flora species. • If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants. • If riparian areas need to be burnt to reduce fuel loads then burning should occur when there is good soil moisture and active growth.
11.3.39	-	No	• Conduct low to moderate intensity burn in late wet to early dry season when there is good soil moisture every 6-10 years. • Restrict to less than 30% in any year. Management of this vegetation type should be based on maintaining vegetation composition, structural diversity, fauna habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfire. Maintaining a fire mosaic will help ensure protection of habitat and mitigate against wildfires.

RE	Associated TEC	Fire Exclusion?	Fire Management
11.9.2	-	No	• Conduct low to moderate intensity burns in the late wet to early dry season when there is good soil moisture every 6-10 years. • Restrict to less than 30% in any year. • Burn under conditions of good soil moisture and when plants are actively growing. Management of this vegetation type should be based on maintaining vegetation composition, structural diversity, fauna habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfire. Maintaining a fire mosaic will help ensure protection of habitat and mitigate against wildfires.
11.9.4	SEVT TEC	Yes	• Protection from fire is necessary. • Maintain fire management of surrounding country with numerous small fires throughout the year so that fires will be very limited in extent. • Maintenance of fire breaks may be appropriate on flat country, but natural features will be useful as breaks in 'wild' country. • Fuel reduction in the surrounding vegetation under low fire danger conditions and/or revegetation of cleared areas reduce the risk of damaging wildfires. • Maintain or re-establish native vegetation communities adjacent to this ecosystem. Grazing may be useful in managing fuel loads created by introduced grasses such as *Cenchrus ciliaris*.
11.9.5	Brigalow TEC	Yes	• Protection from fire is necessary. • High intensity fires will cause damage to overstorey. • Maintain fire management of surrounding country so that any fires will be very limited in extent. Frequent fire at the edge of this community keeps fuel loads low. • The invasion of exotic grasses such as *Cenchrus ciliaris* increases the risk from fire. Grazing may be an option for reducing fuel loads in Brigalow TEC.
11.9.10	-	Yes	• Protection from fire is necessary. • Maintain fire management of surrounding country so that wildfires will be very limited in extent. Frequent fire at the edge of this RE keeps fuel loads low.

RE	Associated TEC	Fire Exclusion?	Fire Management
11.10.3	-	Yes	• Protection from fire is necessary. • Maintain fire management of surrounding country with numerous small fires throughout the year so that fires will be very limited in extent. • There is typically not enough ground vegetation within this RE to carry a fire.
11.10.7	-	No	• Conduct a moderate to high burn every 6-10 years. • Timing for burning should be during late wet to early dry season when there is good soil moisture, early storm season or after good spring rains. • Burn less than 10-30% of the area in any year. • Burn surrounding vegetation under conditions of good soil moisture and when plants are actively growing throughout the year so that fires will be very limited in extent. • Best protection from fire is through the creation of a multi-aged mosaic in surrounding vegetation and perimeter burning.
11.10.8	-	Yes	• Protection from fire is necessary. • Protection primarily relies on broad-scale management of surrounding country with numerous small fires throughout the year so that wildfires will be very limited in extent.
11.10.11	-	No	• Conduct moderate intensity burns in the late wet to early dry season when there is good soil moisture every 3-5 years. • Burn less than 30% in any year.
11.10.13	-	Yes	• Protection from fire is necessary. • Burn surrounding country only under conditions of good soil moisture and when plants are actively growing. • Will be difficult to burn owing to a lack of ground fuel that normally occurs in this RE.

6.2.5. Weed management

Weed management in the offset area will aim to minimise the introduction, establishment and spread of restricted and prohibited pest plants under the *Biosecurity Act 2014* (Qld) and other invasive species not regulated under the *Biosecurity Act 2014*, that present a threat to vegetation communities and species habitat in the offset area. Weed management will focus on reducing the extent of existing weeds as well as minimising the risk of introduction of additional weed species to the offset areas.

Ecological assessments of the Kentucky property (Section 2.4) identified a small number of *Opuntia* spp. (Prickly pear [*Opuntia stricta*], Tree Pear [*Opuntia tomentosa*], Tiger Pear [*Opuntia aurantiaca*]); however, the species/populations were deemed to cause no measurable threat to the site or management objectives. In addition, it was noted that the existing biological control measures for the *Opuntia* spp. were quite effective and that little, if any, further management of these species would be required (Boobook 2015).

Parthenium (*Parthenium hysterophorus*) presents a high potential for introduction to the property, due to its presence in the surrounding region (known to occur in the southern arcadia valley) and ability to disperse.

Reductions in the extent of *Cenchrus ciliaris*, Green Panic (*Panicum maximum* var. *trichoglume*) and *Parthenium hysterophorus* are most effectively achieved by maximising the competitive advantage of native ground cover species. This requires native species richness and abundance to be maximised. In historically grazed environments the most effective way to ensure high species richness is through conservatively managed cattle grazing (Fensham 1998). Conservative cattle grazing requires maintenance of enough biomass to maximise grass growth and appropriate spelling to allow for native species to set seed.

Accordingly, a strategic grazing regime will be implemented to reduce the presence and biomass of exotic pasture grasses in the offset areas (refer to Section 6.2.4). To supplement this, weeds will be managed using biological, chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets, for the relevant weed species.

Biological control measures will continue to be used to manage *Opuntia* spp.; however, the species will not be completely eradicated from the Kentucky property. For the biological control measures currently in place to remain effective, a small number of plants are required to remain on site.

6.2.6. Pest animal management

Pest animals present or that have the potential to occur on or within the immediate vicinity of the Kentucky property and pose the following threats:

- predation of fauna by foxes, cats and wild dogs, and
- erosion and degradation of habitat and competition by pigs and feral horses.

Pest animal control activities will be undertaken to minimise the introduction of pest animals and control existing pest animal populations. Control methods utilised will be in accordance with the *Biosecurity Act 2014*. Table 16 provides examples of approved species-specific pest animal control measures recommended by the Queensland and Commonwealth governments. Results of pest animal assessments will be reviewed following each reporting event to inform the need for, location and timing of species-specific control measures in subsequent years.

Table 16 – Examples of species-specific control methods for pest animal species

Species	Status under *Biosecurity Act 2014*	Example control method	Reference
Wild dog (*Canis familiaris*)	Category 3,4,6	• Ground baiting • Foot hold traps • Shooting	(DAF 2024a)

Species	Status under *Biosecurity Act 2014*	Example control method	Reference
Fox (*Vulpes vulpes*)	Category 3,4,5,6	• Ground baiting • Trapping • Shooting	(DAF 2024b)
Feral cat (*Felis catus*)	Category 3,4,6	• Night shooting • Poisoning • Trapping	(DAF 2023a)
Pig (*Sus scrofa*)	Category 3,4,6	• Trapping • Shooting • Poisoning	(DAF 2023b)
Feral horse (*Equus caballus*)	-	Relocation through mustering or trapping	(DAF 2022)

7. Monitoring

The results of the monitoring program outlined in the following sections will be used to inform operational management decisions, including adaptive implementation of this OAMP to ensure the performance criteria and management objectives, and ultimately interim performance targets and completion criteria are met.

The monitoring results will also be used to assess adherence to performance criteria, and to determine when corrective actions are required to be implemented. The results will also be compared to those from previous monitoring events to assess change over time and to inform the ongoing implementation of the OAMP.

7.1. Offset area inspections

The aim of offset area inspections is to enable a general assessment of the offset area to identify any potential issues that may require remedial action to be undertaken. Inspections will be undertaken twice per year for the duration of the management period to assess the following:

- condition of fencing, gates and signs and existing gas field infrastructure,
- condition of access tracks,
- condition of firebreaks,
- compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks,
- incidence of erosion within offset area, particularly around permanent and semi-permanent water bodies or areas subject to inundation or waterlogging,
- damage/degradation resulting from pest animal activity within the offset area,
- signs of land degradation and over-grazing,
- presence of weed/invasive species,
- exclusion of livestock, and
- incidental fauna observations and any additional risks to offset values (i.e. evidence of vehicle strike).

7.2. Biomass monitoring

Biomass monitoring for fire management will be undertaken twice a year, at the end of the wet season and end of the dry season, to:

- determine the risk of fire to the offset site, and
- inform fire management strategies to control fuel loads.

Biomass is at its greatest at the end of the wet season (around April) with fire risk greatest towards the end of the dry season (October). Biomass will be monitored within the offset areas using appropriate photo standards[1] which will be used to determine dry matter yields and subsequently fuel loads. Biomass monitoring will be undertaken at the same permanent weed monitoring sites established as part of the year 1 monitoring.

Fuel loads will be managed through strategic grazing events (see Section 6.2.4) if the biomass assessment at the end of the wet season shows that biomass is greater than 2,500 kg/ha within the offset area.

The stocking rate of these strategic grazing events will be determined through a feed budgeting assessment (see Section 7.2.1) undertaken prior to a grazing event in the offset area. A feed budgeting assessment is a recognised method of determining the stocking rate based on the amount of feed available and the amount of feed desired at the end of the grazing event (i.e. >2,500 kg/ha).

7.2.1. Feed budgeting assessment

The process for undertaking a feed budget assessment will include the following sequence of activities:

- Determine the current amount of feed present (kg/ha) using appropriate photo standards available on the Future Beef website[1].
- Determine the amount of feed desired (kg/ha) at the end of the grazing event.
- Calculate the total useable feed (kg/ha) by subtracting the feed desired from the feed present.
- Determine utilisation (i.e. the proportion of useable feed that livestock can use).
- Determine the feed available for the grazing animal (kg/ha) by multiplying the total useable feed by the utilisation rate.
- Calculate the safe stocking rate by:
  - determining the feed consumption per day (kg/day)
  - determining the number of days feed is required (days)
  - calculating the feed requirement per head (kg/hd) by multiplying the feed consumption per day by the number of days
  - calculating the stocking rate (ha/hd) by dividing the feed requirement per head by feed available, and
  - calculate the number of stock (head) by dividing the area of the paddock by the stocking rate.

The amount of feed available prior to the grazing event will be estimated using the appropriate photo standards available on the Future Beef website. The “Dry Season Feed Budget” worksheet will then be used to calculate the required stocking rate for the grazing event.

At the completion of the grazing event, photo standards will be used to assess ground cover and ecosystem biomass. Should the grazing event be required to be extended (e.g. as a result of additional rainfall and resultant grass growth and potential weed flowering), the feed budget assessment will be recalculated using the “Dry Season Feed Budget” worksheet.

7.2.2. Fuel load monitoring

Fuel load monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix E). Fuel load assessment monitoring will include a baseline survey in year 1 (post wet season; April), with ongoing fuel load assessment monitoring conducted every year at the same time and location as biomass monitoring post wet season. Monitoring will focus on assessing the key structural layers of the fine fuels that burn in bushfires, specifically bark, elevated fuels, near-surface fuels and surface fuels. This will allow for a rapid assessment of each fuel layer, which in in turn is given a hazard rating and are then combined to provide an overall fuel hazard rating of low, moderate, high, very high or extreme.

The fuel hazard rating will be monitored to compare any changes from previous assessments. In conjunction with results of habitat quality assessments, the results of the fuel load assessments will be used to determine if fuel hazard reduction burns are required within the offset area. Weed management and strategic grazing within the offset area will also be undertaken to maintain fuel hazard rating below extreme.

7.3. Weed monitoring

Weed monitoring sites will be randomly stratified, fixed monitoring sites representative of offset values and incorporating natural variability such as aspect (e.g. a mix of north-, east-, south- and west-facing monitoring sites) and community type (e.g. woodland, riparian). There will also be fixed monitoring sites at strategic trafficable areas (e.g. entry gates, creek crossings, stock watering points) to monitor potential introduction and/or irruptions of prohibited and restricted weed species.

[1] See https://futurebeef.com.au/knowledge-centre/pastures-forage-crops/pasture-photo-standards/.

The offset area will be monitored for weeds every two years (post wet season) to determine the species richness and abundance, for the duration of the management period. The results of this monitoring will inform the methods for weed treatment and control (see Section 6.2.5).

Non-native plant cover is also assessed as part of the habitat quality assessments detailed in Section 7.5.2, and the presence of weed species will also be recorded as part of the general offset area inspections (see Section 7.1), where noted.

7.4. Pest animal monitoring

The offset area will be monitored for evidence of pest animals every two years (post-wet season), including a baseline survey in year 1 of the distribution and abundance of pest animals.

Based on the results of year 1 surveys, pest animal monitoring sites will be established in year 1. Monitoring of pest animals will target areas of known impacts/movements (e.g. along topographic features, including creeks, pads, paths, ridge-tops and roads) to not only maximise the success of encountering pest animals, but target monitoring in environments that are more regularly impacted (e.g. drainage lines, moist gullies and around swamps and lagoons favoured by feral pigs; Hone 1995). The location of pest animal monitoring sites will be assessed prior to each monitoring event.

Pest animal monitoring will also be undertaken in association with and immediately prior to the pest animal control activities (Section 6.2.6). Initial monitoring results will determine the degree of effort required to control the pest population and post control monitoring will determine the degree of success of control operations.

Monitoring of pest animals will involve the deployment of motion sensing infra-red cameras as well as other techniques such as transect assessments as appropriate to determine pest animal species present in the offset area and indicative population numbers.

Methods for determining the presence and relative abundance for foxes, feral cats, wild dogs and feral pigs are presented in Table 17. Evidence of pest animals, including feral horses, will be documented during the offset area inspections (see Section 7.1).

Table 17 – Pest animal monitoring methodology

Pest animal	Methodology to be implemented
Fox	To assess the relative abundance of foxes, dogs and feral cats within the offset area, camera monitoring will be undertaken as follows to provide a measure of the Catling index for each species. The Catling index will be measured as the percentage of camera nights in which the pest species was observed. An increase or decrease in the Catling index value between subsequent monitoring events will represent an increase or a decrease in the relative abundance of pest species and a measure of the success of pest animal control. • fauna monitoring cameras will be placed in the offset area, • cameras will be placed along tracks and left in place for a minimum of three consecutive nights, and • an analysis of the camera footage will be undertaken to determine the percentage of camera nights with animal captures for each species observed. This percentage represents the Catling index (Mitchell and Balogh 2007b, 2007c).
Wild dog	
Feral cat	
Feral pig	An assessment of the presence or absence of feral pig signs[a] as a measure of the relative abundance of feral pigs within the offset area in accordance with Mitchell and Balogh (2007a) and Hone (1988), will be undertaken as follows:

Pest animal	Methodology to be implemented
	• nominate randomly stratified sites across the offset area in environments that are more regularly impacted (e.g. drainage lines, moist gullies, around swamps etc) • calculate an abundance score for each transect as the percentage of 'present' feral pig signs, and • calculate the mean abundance score (and variance) across all transects in the offset area. The average frequency of occurrence across the offset area will be used as an index of abundance and compared between subsequent monitoring events to assess the effectiveness of feral pig control. Furthermore, changes to scores for individual sites/transects can point to areas to target control activities. [a] Feral pig signs can include rooting, wallows, dung, footprints, travel pads, plant damage and tree rubs, as well as the physical presence of feral pigs.

7.5. Offset value assessments

7.5.1. Rapid monitoring events

Rapid monitoring events will be carried out each year monitoring events are not completed for habitat quality assessments (Section 7.5.2) and targeted fauna survey (Section 7.5.4).

These will be aligned with the offset area inspections (see Section 7.1) and carried out by suitably qualified ecologists during spring and early summer (October to January) to coincide with the optimal time of year for fauna in the Brigalow Belt Bioregion (Eyre *et al*. 2018).

During each rapid monitoring field assessment, the following will be conducted:

- Incidental fauna surveys including early morning and late evening bird surveys and other MNES fauna species will be conducted throughout the day by the ecologists.
- Photos will be taken at designated and fixed photo monitoring points as outlined in Section 7.5.3. The locations of the fixed photo monitoring points are shown in Figure 9.

7.5.2. Habitat quality assessment

A detailed baseline assessment of habitat quality was completed in April 2020, including establishment of BioCondition sites in all major vegetation communities.

Vegetation condition and habitat quality for each MNES will be assessed in accordance with the GTDTHQ (version 1.2; DEHP 2017) to measure the habitat quality of a land-based offset. The species habitat index component of the habitat quality score will be calculated based on the results of the targeted fauna surveys detailed in Section 7.5.4.

Fixed transects were established and assessed as part of the baseline in 2020 (see Figure 9). BioCondition assessments will be undertaken at each of the transects in year 1 and then every two years for the first six years, and then every three years thereafter. As part of year 1 monitoring activities, monitoring points will be marked with a capped stake and a GPS location will be recorded.

The results of habitat quality assessments for subsequent years will include summary data from previous reporting years, presented to allow trend analysis of each of the measured attributes and assess progress towards achieving the interim performance targets and completion criteria.

7.5.3. Photo monitoring

Photo monitoring is a qualitative analysis technique that provides the opportunity for visual time series analysis of changes in vegetation composition, structure and integrity. In areas where active management is being undertaken, photo monitoring offers a simple and effective visual means by which to capture the response of the vegetation to management actions. Photo monitoring will be conducted at all BioCondition sites presented in Figure 9, based on best practice photo monitoring techniques, see Appendix 4 of *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual Version 2.2.* (Eyre *et al*. 2015).

Photo monitoring will be undertaken as part of habitat quality assessments (Section 7.5.2) and rapid monitoring events (Section 7.5.1).

148°50'0"E
148°52'0"E
148°54'0"E
25°32'0"S
25°34'0"S
25°36'0"S

Dawson River
Craiz Gully
Lambing Flat Creek
Baffle Creek
Johnson Gully

KYB40
KYB41
KYB43
KYB42
KYB53
KYB48
KYB52
KYB49
KYB50
KYB47
KYB44
KYB20
KYB45
KYB21
KYB22
KYB46
KYB23
KYB28
KYB27
KYB37
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KYB17
KYB11
KYB16
KYB32
KYB03
KYB04
KYB06

Ground truthed RE

- 11.3.2
- 11.3.25
- 11.3.27
- 11.3.39
- 11.9.2
- 11.9.2 (regrowth)
- 11.9.4
- 11.9.5
- 11.9.5 (regrowth)
- 11.9.10
- 11.10.3
- 11.10.7
- 11.10.7 (regrowth)
- 11.10.8
- 11.10.11 (regrowth)
- 11.10.13
- 11.10.13 (regrowth)
- Future habitat areas approved under 2008/4059

SANTOS

Location diagram

Figure 9
Monitoring sites

- Kentucky
- Kentucky offset area
- Property access track
- Fence
- Habitat quality monitoring point

Watercourse

- Major watercourse
- Creekline
- Minor drainage line
- Drainage contour

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:35,000@A3

Queensland
Brisbane

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Kentucky\Kentucky_OAMP_mapping_20250501.aprx

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7.5.4. Targeted fauna surveys

Targeted fauna surveys will be conducted to assess the distribution and richness of the fauna offset values within the offset area. The targeted fauna survey will focus on the MNES species that are unlikely to be detected effectively during the rapid assessment surveys due to cryptic behaviour or localised habitat requirements. Targeted surveys will be undertaken generally in accordance with recommended surveys guidelines from the Queensland and Commonwealth governments and/or other reputable published guidelines. Table 18 provides a summary of the proposed methodology, search effort and timing for targeted surveys. It is important to note that the proposed survey methodology will be reviewed prior to each survey event and if considered necessary will be modified to ensure they are based on the ecology, habitat requirements and behavioural aspects of the species of interest.

Targeted fauna surveys will be carried out in conjunction with habitat quality assessments, every two years for the first six years, and then every three years thereafter.

Table 18 – Fauna species survey methods

Technique	Regime	Target and method
Elliot B (box trap) or cage trap	Four per site over four consecutive nights, checked early morning, reopened late afternoon.	Baited with a mixture of oats, peanut butter, vegetable oil and sardines. Placed within suitable micro-habitat for northern quoll.
Funnel trap	Six at each of five trap sites over four consecutive nights, checked early morning and afternoon.	Placed in pairs either side along a 30m drift-fence. Targeting Dunmall's Snake and collared delma.
Harp trap	Two per night for four consecutive nights, locations chosen based on presence of suitable flyways.	Targeting south-eastern long-eared bat, which is not identifiable by ultrasonic calls, and the large-eared pied bat.
Anabat	Three units overnight for four consecutive nights.	Left overnight on site near entrances to possible roost sites for large-eared Pied Bat, if considered present, and/or along flyways and near waterbodies.
Camera trap	10 over at least 14 consecutive nights.	Focused on stations baited with a mixture of oats, peanut butter, vegetable oil and sardines. Targeting northern quoll and yakka skink (Meek *et al*. 2014).
Spotlighting	On foot.	Targeting koala and Dunmall's snake.
Spotlighting	Rocky areas.	Targeting northern quoll and collared delma.
Spotlighting	By vehicle along tracks.	Targeting Dunmall's snake and koala.
Scat search	Conducted in habitat considered suitable for target species.	Targeting koala and northern quoll. The Spot Assessment Technique (SAT), or a variation, were used to survey for koalas within suitable habitat within the site.
Bird survey	At waterbodies.	Targeting squatter pigeon (southern).
Bird survey	Meander along watercourses during the day.	Targeting nest sites for red goshawk. Includes diurnal koala search.
Track traverse	By vehicle and on foot.	Targeting squatter pigeon (southern).

Technique	Regime	Target and method
Diurnal herpetofauna search	Late morning/early afternoon.	Conducted by two searchers, duration is determined by site-specific habitat quality and presence of suitable micro-habitat. Targeting collared delma, Dunmall's snake and yakka skink.

8. Reporting

8.1. Reporting

A report detailing the progress of the offset area in achieving the interim performance targets and completion criteria will be prepared for each management year. The report will be prepared by the suitably qualified ecologist of whom are awarded the scope of works for that monitoring year, and delivered to the approval holder, Santos within three months of every 12-month anniversary of the commencement of the action (22/03/2016). In compliance with clause 34 and 41 of the approval, Santos will publicly publish all monitoring reports on their website, and they will remain published for the lifetime of the approval (expiry 21/03/2066).

The report will contain, at a minimum:

- a description of the monitoring conducted, when it was conducted, and by whom,
- a discussion of the weather in the lead up to and during the monitoring,
- results of monitoring events conducted,
- an overview of the management actions implemented since the last report,
- a description of any performance criteria not met, any triggers that have been exceeded and the corrective actions that were implemented,
- an indication of any risks or potential threats that have become apparent to the management area since the development of this management plan, and activities to be undertaken to manage these threats and/or risks, and
- progress towards achieving the interim performance targets and completion criteria.

Monitoring and progress reports will be stored electronically by each the approval holder and the contractor undertaking and completing the scope of work. Field data will be stored as spatial data files (e.g. shapefile) by the contractor who is responsible for collecting the raw data, as well as detailed in the contents of the results or appendices section of the report. All data and reports pertaining to this OAMP will be stored for the lifetime of the approval.

8.2. Update of OAMP

The OAMP will be reviewed, audited and updated every 5 years. In addition, the OAMP will be updated in accordance with the principles of adaptive management, if required, to incorporate any changes identified through management activities, site visits and monitoring activities. This may include the revision of current management actions, identification of additional activities (including monitoring activities) and responses to adaptive management triggers, other environmental threats to the offset area and information obtained through research programs.

9. Implementation Schedule

Table 19 and Table 20 summarise the implementation schedule for the management, monitoring and reporting activities presented in this OAMP. Santos will be wholly responsible for the implementation of this OAMP and reporting on the performance of the offset area in meeting the offset obligations under EPBC Approval 2012/6615 and Section 4 of this OAMP.

Table 19 – Implementation of management actions

Activity		Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Related monitoring
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
General restrictions (Section 6.2.1)	Access, vehicles, vegetation clearing, weed hygiene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	At all times	General offset inspections (Section 7.1)
Access tracks (Section 6.2.2)	Maintenance/new tracks	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
Fencing (Section 6.2.3)	Construction of additional fencing to support livestock exclusion and strategic grazing	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
	Maintenance	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪		
Fire management (Section 6.2.4)	Fuel hazard reduction burns	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	Biomass monitoring (Section 7.2)
Grazing (Section 6.2.4)	Strategic grazing	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required based on the results of biomass monitoring, and informed by weed monitoring	Biomass monitoring (Section 7.2) Weed monitoring (Section 7.3)
Weed management (Section 6.2.5)	*Cenchrus ciliaris* and other weeds	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities in addition to strategic grazing to be undertaken as required	Weed monitoring (Section 7.3)
Pest animal management (Section 6.2.6)	Wild dog, feral cat, fox, pig and feral horse	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities to be undertaken as required	Pest animal monitoring (Section 7.4)
Reporting (Section 8)	Annual reporting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annual reports to be prepared each year. The OAMP will be reviewed, audited and updated every 5 years.	Reporting (Section 8)
	Update OAMP					▪					▪					▪					▪		

Table 20 – Offset Plan monitoring event schedule

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Location	Survey method/monitoring guidelines	Reliability
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				
Offset area inspections (Section 7.1)	Twice yearly inspections of the offset area to enable a general assessment of the offset area and identify any potential issues that may require remedial	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Inspections will be undertaken at least twice a year. Usually at the end of the wet season and the end of the dry season, with one	Inspections will encompass the entirety of the offset area as reasonably as practicable. Inspections will occur concurrently and opportunistically whilst completing other monitoring obligations.	See Section 7.1 for a list of potential issues to be inspected.	General assessment of the offset management areas to identify any potential issues that may require remedial action to be undertaken.

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Timing	Location	Survey method/monitoring guidelines	Reliability
	action. See Section 7.1 for the criteria to be assessed as part of each inspection.																					of the inspections occurring prior to the submission of the annual report.			
Biomass monitoring (Section 7.2)	Biomass monitoring for fire management and to inform strategic grazing regime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Twice every year at the end of the wet season (April) and towards the end of the dry season (October)	Biomass monitoring will be undertaken at the same permanent weed monitoring sites established as part of the year 1 monitoring.	Assessment against Future Beef photo standards (Section 7.2).	Methodology developed by the Queensland Government.
Fuel load monitoring (Section 7.2.2)	Assessment of the fuel hazard rating within the offset area to inform fire management strategies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually at the end of the wet season (April)	Fuel load assessment monitoring will be undertaken at the same time and location as biomass monitoring.	*Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix E).	Method developed by the Victorian Government.
Weed monitoring (Section 7.3)	Ongoing weed surveys to assess the effectiveness of weed control	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		Every two years post-wet season	Fixed weed monitoring sites will be randomly stratified throughout the offset area. Sites will represent the different offset values, incorporate natural variability, vegetation community type, as well as more trafficable areas which often aid in weed spread such as gates, tracks, and creeks.	NSW *Guidelines for Monitoring Weed Control and Recovery of Native Vegetation* (Auld 2009). Photo monitoring of selected sites to assess visual changes in weed species and infestations over time. The use of precision unmanned aerial vehicles (drone) technology, aerial imagery and/or remote sensing.	Assessment will be undertaken generally in accordance with published, reputable guidelines.
Pest animal monitoring (Section 7.4)	Ongoing pest animal surveys to assess the effectiveness of pest animal control	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		Every two years post-wet season	Pest animal monitoring plots will be randomly stratified across the offset area. Monitoring sites will be collocated with BioCondition Transects, where possible. Pest animal monitoring motion-sensor cameras will be placed in the same locations each consecutive monitoring period. Camera locations will be strategically chosen	Monitoring method outlined in Section 7.4.	Assessment undertaken generally in accordance with published monitoring techniques developed by the NSW Government.

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Timing	Location	Survey method/monitoring guidelines	Reliability
																							along tracks and drainage lines which are favoured by pest species.		
Offset value assessments (Section 7.5)	Rapid monitoring events		✓		✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		Each year monitoring events are not completed for habitat quality assessments (Section 7.5.2), targeted fauna survey (Section 7.5.4)	Rapid monitoring will encompass the entirety of the offset area as reasonably as practicable. Incidental flora and fauna observations will be recorded opportunistically whilst completing other monitoring obligations and traversing the site.	See Section 7.5.1	
	Assessment of vegetation condition and habitat quality	✓		✓		✓			✓			✓			✓			✓			✓	Every two years for the first six years following the 2020 baseline, and then every three years thereafter	Fixed BioCondition transects were established during the 2020 baseline surveys. Transect locations were randomly stratified to be representative of each RE and condition class, as well as allow for natural variability and be wholistically indicative of the offset area and offset values.	GTDTHQ (version 1.2; DEHP 2017)	Assessment undertaken in accordance with method developed by the Queensland Government and aligns with the EPBC Act *Environmental Offsets Policy* measure of 'habitat quality' and is intended to provide a consistent framework for environmental offsets in Queensland.
	Photo monitoring	✓		✓		✓			✓			✓			✓			✓			✓		Photo monitoring will be undertaken at each the 0 m and 50 m point of each BioCondition transect line.	Photos at each photo monitoring point will be taken in a north, east, south and westerly direction. A record of the photographs will be maintained, including GPS co-ordinates, date and time of each photograph and the direction in which the photograph was taken.	Based on best practice photo monitoring techniques, see Appendix 4 of *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual.* Version 2.2. (Eyre *et al*. 2015)
	Targeted fauna surveys	✓		✓		✓			✓			✓			✓			✓			✓		Targeted fauna surveys will be strategically designed and located to improve the probability of encountering MSES target species, as well as be	See methods outlined in Section 7.5.4.	Techniques for fauna surveys area based on recommended survey guidelines published by the Queensland and

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Timing	Location	Survey method/monitoring guidelines	Reliability
																							representative of the diversity of habitat type and condition within the offset area. Survey sites will be carefully selected at the discretion of the ecological team undertaking the survey.		Commonwealth governments.

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Appendix A

Baseline habitat quality score for Kentucky offset area

Table A1 – Baseline habitat quality score for Kentucky offset area (sites KYB01 – KYB21)

Site	KYB01	KYB02	KYB03	KYB04	KYB05	KYB06	KYB07	KYB08	KYB09	KYB10	KYB11	KYB12	KYB13	KYB14	KYB15	KYB16	KYB17	KYB18	KYB19	KYB20	KYB21
RE	11.10.7	11.10.13	11.10.7	11.3.25	11.10.7	11.3.25	11.10.13	11.10.13	11.9.2	11.10.7	11.10.11	11.10.7	11.10.13	11.10.7	11.10.7	11.10.13	11.10.7	11.10.3	11.9.5	11.10.13	11.10.3
Site type*	Rem	Rem	Reg	Rem	Reg	Rem	Rem	Reg	Reg	Reg	Reg	Reg	Reg	Rem	Reg	Reg	Rem	Rem	Rem	Rem	Rem
Site condition (/10)	8.1	7.6	6.9	6.4	4.8	6.6	8.9	5.4	7.2	7.1	7.9	6.2	6.9	9.1	6.5	5.7	7.6	7.8	8.6	7.9	7.6
Site context (/10)	10.0	10.0	3.0	2.0	7.0	7.0	9.5	9.0	3.0	9.0	0.0	6.0	9.0	9.5	9.5	9.0	10.0	10.0	10.0	10.0	10.0
Species habitat index /10																					
Collared Delma	8.2	8.2	6.2	2.4	6.2	2.4	8.2	6.2	6.2	6.2	6.2	6.2	6.2	8.2	6.2	6.2	8.2	8.2	4.2	8.2	8.2
Yakka Skink	6.6	6.6	4.8	2.4	4.8	2.4	3.6	3.6	4.8	5.6	5.6	5.6	3.6	5.6	5.6	3.6	5.6	3.6	4.2	3.6	3.6
Dunmall's Snake	8.2	8.2	6.2	8.2	6.2	8.2	8.2	6.2	6.2	6.2	6.2	6.2	6.2	8.2	6.2	6.2	8.2	8.2	8.2	8.2	8.2
Red Goshawk	6.2	6.2	4.0	8.8	4.0	8.8	4.0	4.0	4.0	4.0	4.0	4.0	4.0	6.2	4.0	4.0	6.2	6.2	6.2	6.2	6.2
Squatter Pigeon (southern)	8.2	8.2	8.2	8.2	8.2	8.2	6.2	6.2	8.2	8.2	8.2	8.2	6.2	8.2	8.2	6.2	8.2	-	-	6.2	-
Northern Quoll	8.2	8.2	4.8	6.6	4.8	6.6	7.2	6.2	4.8	4.8	4.8	4.8	4.8	6.6	4.8	5.6	6.6	6.6	6.6	7.2	6.0
Koala	8.4	8.4	5.6	10.0	6.2	3.4	6.2	3.4	6.2	6.2	6.2	6.2	6.2	8.4	6.2	3.4	8.4	5.2	5.2	7.2	5.2
South-eastern Long-eared Bat	7.2	7.2	3.6	9.8	3.6	9.8	7.2	3.6	3.6	3.6	3.6	3.6	3.6	7.2	3.6	3.6	7.2	7.2	7.2	7.2	7.2
Large-eared Pied Bat	7.2	7.2	6.2	7.2	6.2	7.2	7.2	6.2	6.2	6.2	6.2	6.2	6.2	7.2	6.2	6.2	7.2	7.2	7.2	7.2	7.2
Habitat quality score – fauna species /10 (site condition 30%, site context 30%, species habitat index 40%)																					
Collared Delma	8.7	8.6	5.5	3.5	6.0	5.0	8.8	6.8	5.5	7.3	4.8	6.1	7.2	8.9	7.3	6.9	8.6	8.6	7.3	8.6	8.6
Yakka Skink	8.1	7.9	4.9	3.5	5.5	5.1	7.0	5.8	5.0	7.1	4.6	5.9	6.2	7.8	7.0	5.9	7.5	6.8	7.3	6.8	6.7
Dunmall's Snake	8.7	8.6	5.5	5.8	6.0	7.4	8.8	6.8	5.5	7.3	4.8	6.1	7.2	8.9	7.3	6.9	8.6	8.6	8.9	8.6	8.6
Red Goshawk	7.9	7.8	4.6	6.1	5.1	7.6	7.1	5.9	4.7	6.4	4.0	5.3	6.4	8.1	6.4	6.0	7.8	7.8	8.1	7.8	7.8
Squatter Pigeon (southern)	8.7	8.6	6.3	5.8	6.8	7.4	8.0	6.8	6.3	8.1	5.6	6.9	7.2	8.9	8.1	6.9	8.6	-	-	7.8	-
Northern Quoll	8.7	8.6	4.9	5.2	5.5	6.7	8.4	6.8	5.0	6.7	4.3	5.6	6.7	8.2	6.7	6.7	7.9	8.0	8.2	8.2	7.7
Koala	8.8	8.6	5.2	6.5	6.0	8.1	8.0	5.7	5.5	7.3	4.8	6.1	7.2	9.0	7.3	5.8	8.6	7.4	7.7	8.2	7.4
South-eastern Long-eared Bat	8.3	8.2	4.4	6.5	5.0	8.0	8.4	5.8	4.5	6.3	3.8	5.1	6.2	8.5	6.2	5.9	8.2	8.2	8.5	8.2	8.2
Large-eared Pied Bat	8.3	8.2	5.5	5.4	6.0	7.0	8.4	6.8	5.5	7.3	4.8	6.1	7.2	8.5	7.3	6.9	8.2	8.2	8.5	8.2	8.2

Note: Data is only provided for REs that the threatened community or species is associated with.
* Site type: Rem = remnant; Reg = regrowth.

Table A2 – Baseline habitat quality score for Kentucky offset area (sites KYB22 – KYB42)

Site	KYB22	KYB23	KYB24	KYB25	KYB26	KYB27	KYB28	KYB29	KYB30	KYB31	KYB32	KYB33	KYB34	KYB35	KYB36	KYB37	KYB38	KYB39	KYB40	KYB41	KYB42
RE	11.10.13	11.10.13	11.10.7	11.10.7	11.9.2	11.9.4	11.9.5	11.9.2	11.10.8	11.9.2	11.10.7	11.9.2	11.10.13	11.10.13	11.9.5	11.9.5	11.9.2	11.10.3	11.3.25	11.3.2	11.3.27
Site type*	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Reg	Rem	Reg	Rem	Rem	Reg	Reg	Rem	Rem	Rem	Rem	Rem
Site condition (/10)	7.6	7.7	8.1	8.4	9.6	8.1	7.4	8.4	7.9	6.3	6.4	5.7	7.3	9.0	7.4	5.5	7.7	7.1	7.6	6.7	7.6
Site context (/10)	10.0	10.0	10.0	9.5	9.5	10.0	10.0	10.0	9.5	2.0	4.0	3.0	10	10	9.0	10.0	10.0	10.0	9.0	10.0	10.0
Species habitat index /10																					
Collared Delma	8.2	8.2	8.2	8.2	8.2	2.2	4.2	8.2	2.2	6.2	8.2	6.2	8.2	8.2	4.2	4.2	8.2	8.2	2.4	8.2	2.4
Yakka Skink	3.6	3.6	6.6	6.6	6.6	2.4	4.2	6.6	2.4	4.8	6.6	4.8	6.6	6.6	2.4	2.4	6.6	3.6	2.4	6.6	2.4
Dunmall's Snake	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	6.2	8.2	6.2	8.2	8.2	6.2	6.2	8.2	8.2	8.2	8.2	8.2
Red Goshawk	4	4	6.2	6.2	6.2	5.4	6.2	6.2	6.2	4	6.2	4	6.2	6.2	4	4	6.2	6.2	8.8	6.2	8.8
Squatter Pigeon (southern)	6.2	6.2	8.2	8.2	8.2	-	-	8.2	-	8.2	8.2	8.2	8.2	8.2	-	-	8.2	-	8.2	8.2	8.2
Northern Quoll	7.2	7.2	6.6	6.6	6.6	6.6	6.6	6.6	8.2	4.8	6.6	4.8	6.6	6.6	5.6	4.8	5.6	6.6	6.6	6.6	-
Koala	7.2	7.2	8.4	8.4	8.4	4.2	5.2	8.4	4.2	5.6	8.4	5.6	8.4	8.4	4.2	3.4	8.4	5.2	10.0	8.4	9.4
South-eastern Long-eared Bat	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	6.4	3.6	7.2	3.6	7.2	7.2	3.6	3.6	7.2	7.2	7.2	7.2	7.2
Large-eared Pied Bat	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	6.2	7.2	6.2	7.2	7.2	6.2	6.2	7.2	7.2	7.2	7.2	7.2
Habitat quality score – fauna species /10 (site condition 30%, site context 30%, species habitat index 40%)																					
Collared Delma	8.6	8.6	8.7	8.7	9.0	6.3	6.9	8.8	6.1	5.0	6.4	5.1	8.5	9.0	6.6	6.3	8.6	8.4	5.9	8.3	6.2
Yakka Skink	6.7	6.8	8.1	8.0	8.4	6.4	6.9	8.2	6.2	4.4	5.8	4.5	7.8	8.3	5.9	5.6	8.0	6.6	5.9	7.7	6.2
Dunmall's Snake	8.6	8.6	8.7	8.7	9.0	8.7	8.5	8.8	8.5	5.0	6.4	5.1	8.5	9.0	7.4	7.1	8.6	8.4	8.3	8.3	8.6
Red Goshawk	6.9	6.9	7.9	7.9	8.2	7.6	7.7	8.0	7.7	4.1	5.6	4.2	7.7	8.2	6.5	6.3	7.8	7.6	8.5	7.5	8.8
Squatter Pigeon (southern)	7.8	7.8	8.7	8.7	9.0	-	-	8.8	-	5.8	6.4	5.9	8.5	9.0	-	-	8.6	-	8.3	8.3	8.6
Northern Quoll	8.2	8.2	8.1	8.0	8.4	8.1	7.9	8.2	8.5	4.4	5.8	4.5	7.8	8.3	7.2	6.6	7.6	7.8	7.6	7.7	-
Koala	8.2	8.2	8.8	8.7	9.1	7.1	7.3	8.9	6.9	4.7	6.5	4.9	8.5	9.1	6.6	6.0	8.7	7.2	9.0	8.4	9.0
South-eastern Long-eared Bat	8.2	8.2	8.3	8.3	8.6	8.3	8.1	8.4	7.8	3.9	6.0	4.1	8.1	8.6	6.4	6.1	8.2	8.0	7.9	7.9	8.2
Large-eared Pied Bat	8.2	8.2	8.3	8.3	8.6	8.3	8.1	8.4	8.1	5.0	6.0	5.1	8.1	8.6	7.4	7.1	8.2	8.0	7.9	7.9	8.2

Note: Data is only provided for REs that the threatened community or species is associated with.
* Site type: Rem = remnant; Reg = regrowth.

Table A3 – Baseline habitat quality score for Kentucky offset area (sites KYB43 – KYB53)

Site	KYB43	KYB44	KYB45	KYB46	KYB47	KYB48	KYB49	KYB50	KYB51	KYB52	KYB53
RE	11.3.39	11.9.4	11.9.4	11.9.5	11.9.10	11.9.10	11.9.5	11.9.10	11.10.8	11.3.39	11.3.2
Site type*	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem
Site condition (/10)	5.7	6.4	7.6	9.1	6.9	7.6	8.3	9.6	8.1	9.1	7.8
Site context (/10)	9.5	10.0	10.0	10.0	10.0	9.5	10.0	9.5	10.0	10.0	10.0
Species habitat index /10											
Collared Delma	8.2	2.2	2.2	4.2	8.2	8.2	4.2	8.2	2.2	8.2	8.2
Yakka Skink	6.6	2.4	2.4	4.2	6.6	6.6	4.2	6.6	2.4	6.6	6.6
Dunmall's Snake	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Red Goshawk	6.2	5.4	5.4	6.2	6.2	6.2	6.2	6.2	5.4	6.2	6.2
Squatter Pigeon (southern)	8.2	3.4	3.4	3.4	8.2	8.2	3.4	8.2	3.4	8.2	8.2
Northern Quoll	6.6	8.2	8.2	7.2	5.6	5.6	7.2	5.6	8.2	6.6	6.6
Koala	8.4	4.2	4.2	5.2	7.2	8.4	5.2	8.4	4.2	8.4	8.4
South-eastern Long-eared Bat	7.2	6.4	6.4	7.2	7.2	7.2	7.2	7.2	6.4	7.2	7.2
Large-eared Pied Bat	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
Habitat quality score fauna species /10 (site condition 30%, site context 30%, species habitat index 40%)											
Collared Delma	7.8	5.8	6.2	7.4	8.3	8.4	7.4	9.0	6.3	9.0	8.6
Yakka Skink	7.2	5.9	6.2	7.4	7.7	7.8	7.2	8.4	6.4	8.4	8.0
Dunmall's Snake	7.8	8.2	8.6	9.0	8.3	8.4	8.8	9.0	8.7	9.0	8.6
Red Goshawk	7.0	7.1	7.4	8.2	7.5	7.6	8.0	8.2	7.6	8.2	7.8
Squatter Pigeon (southern)	7.8	6.3	6.6	7.1	8.3	8.4	6.8	9.0	6.8	9.0	8.6
Northern Quoll	7.2	8.2	8.6	8.6	7.3	7.4	8.4	8.0	8.7	8.4	8.0
Koala	7.9	6.6	7.0	7.8	7.9	8.5	7.6	9.1	7.1	9.1	8.7
South-eastern Long-eared Bat	7.4	7.5	7.8	8.6	7.9	8.0	8.4	8.6	8.0	8.6	8.2
Large-eared Pied Bat	7.4	7.8	8.2	8.6	7.9	8.0	8.4	8.6	8.3	8.6	8.2

Note: Data is only provided for REs that the threatened community or species is associated with.
* Site type: Rem = remnant; Reg = regrowth.

Appendix B

Kentucky Voluntary Declaration and offset area boundary co-ordinates

Declared Area Notice (2022/001902)

ss19E – 19L of the Vegetation Management Act 1999

Queensland Government

Department of **Resources**

1. Details of request

1.1. **Proponent's name:** Santos GLNG Pty Ltd, Papl (Downstream) Pty Ltd, Total GLNG Australia and KGLNG Liquefaction Pty Ltd.

1.2. **Date request received:** 28 June 2022.

1.3. **Request:** Declaration for an area of the land to be an area of high nature conservation value.

1.4. **Property description:** Lot 1 on WT37.

1.5. **Land tenure:** Freehold.

1.6. **Decision reference**: 2022/001902.

2. Declaration information

2.1. **Declaration made:**

2.1.1 The chief executive declares the area, identified on Declared Area Map 2022/001902, as an area of high nature conservation value in accordance with s19F(1)(a) of the *Vegetation Management Act 1999*.

2.1.2 The chief executive declares the area to be an area of high nature conservation value considering:

2.1.2.1 Implementation of the management plan for the area will help to conserve its' high nature conservation value (s19G(1)(a) of the *Vegetation Management Act 1999*); and

2.1.2.2 The area is an area that makes a significant contribution to the conservation of biodiversity (s19G(1)(b)(iv) of the *Vegetation Management Act 1999*).

2.1.3 The documents outlined in item 2.2 form part of this declaration.

2.2. **Declaration documents:**

The following documents form part of this declaration and must be read in conjunction with this notice:

- Declared Area Map DAM and coordinates 2022/001902
- Declared area management plan, 'Kentucky Offset Area - Voluntary Declaration Management Plan, prepared by Santos GLNG, revision 2, dated 02/03/2022.

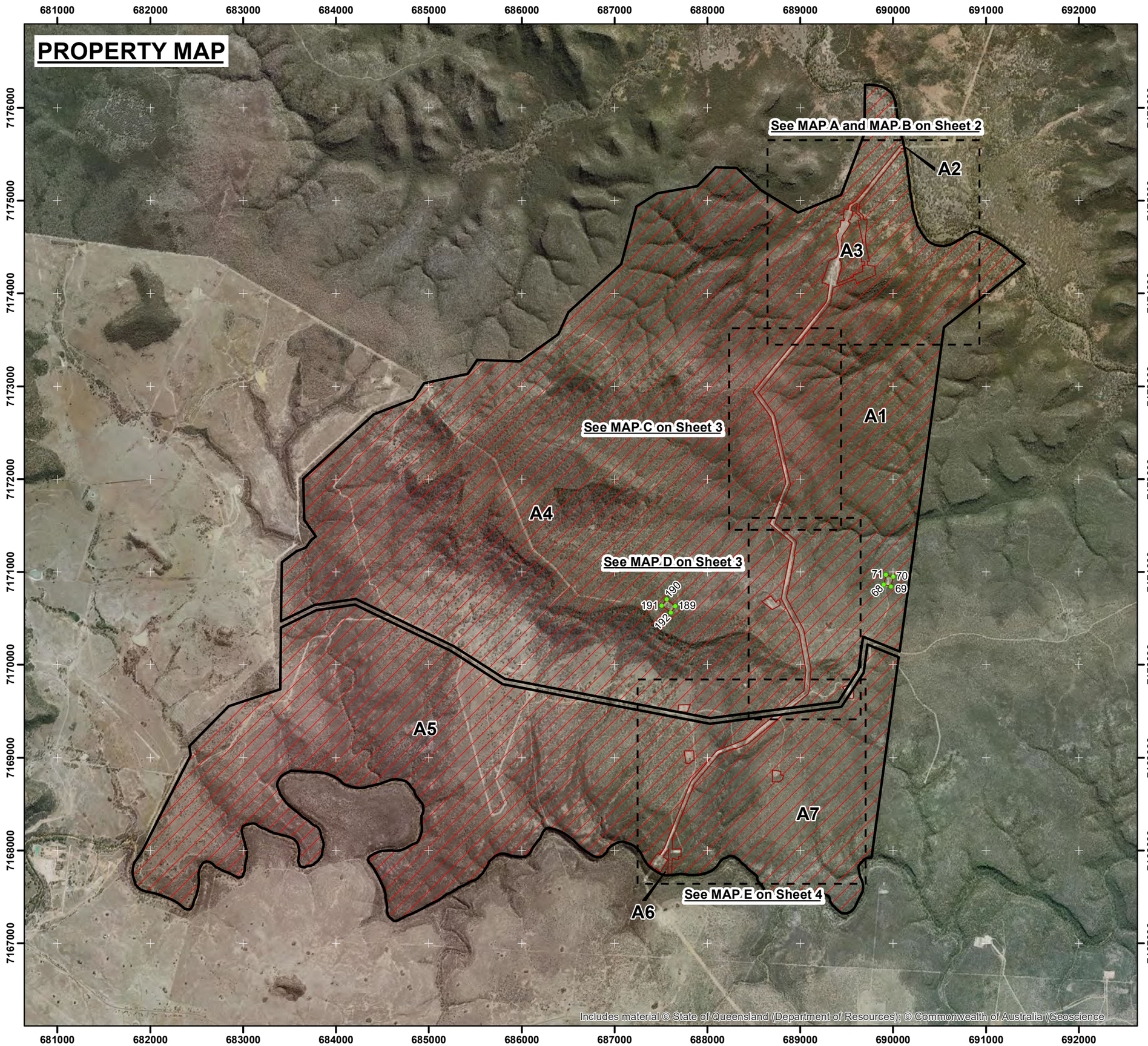
2.3. **Property Map of Assessable Vegetation**

In accordance with s20B(1)(a) of the *Vegetation Management Act 1999*, property map of assessable vegetation PMAV 2022/002029 has been made for the declared area.

2.4. **Date of declaration:** 09 February 2023

3. Delegated officer's signature

Bernadette Nicotra
Natural Resource Management Officer (VM2)



Declared Area Map

Sheet 1 of 4

DAM 2022/001902

LOT on PLAN
1WT37

Queensland Government

0 0.5 1 1.5 2 2.5 3
Kilometers

Scale: 1:40000
(original size A3)

N

LEGEND

- Derived Reference Points
- Subject Lot
- Declared Area (A1 to A7)

This plan must be read in conjunction with Declaration Notice 2022/001902

Notes:

Property boundary provided by Department of Resources.
The property boundaries shown on this map an are approximate only. They are not an accurate representation of the legal boundaries.

Map Information:
Horizontal Datum: GDA 2020
Projection: Universal Transverse Mercator - Zone 55

Digital Imagery: Surat_Basin_North_2020_20cm_SISP
Imagery Date: July to October 2020
Imagery Type: Digital Ortho- rectified Satellite

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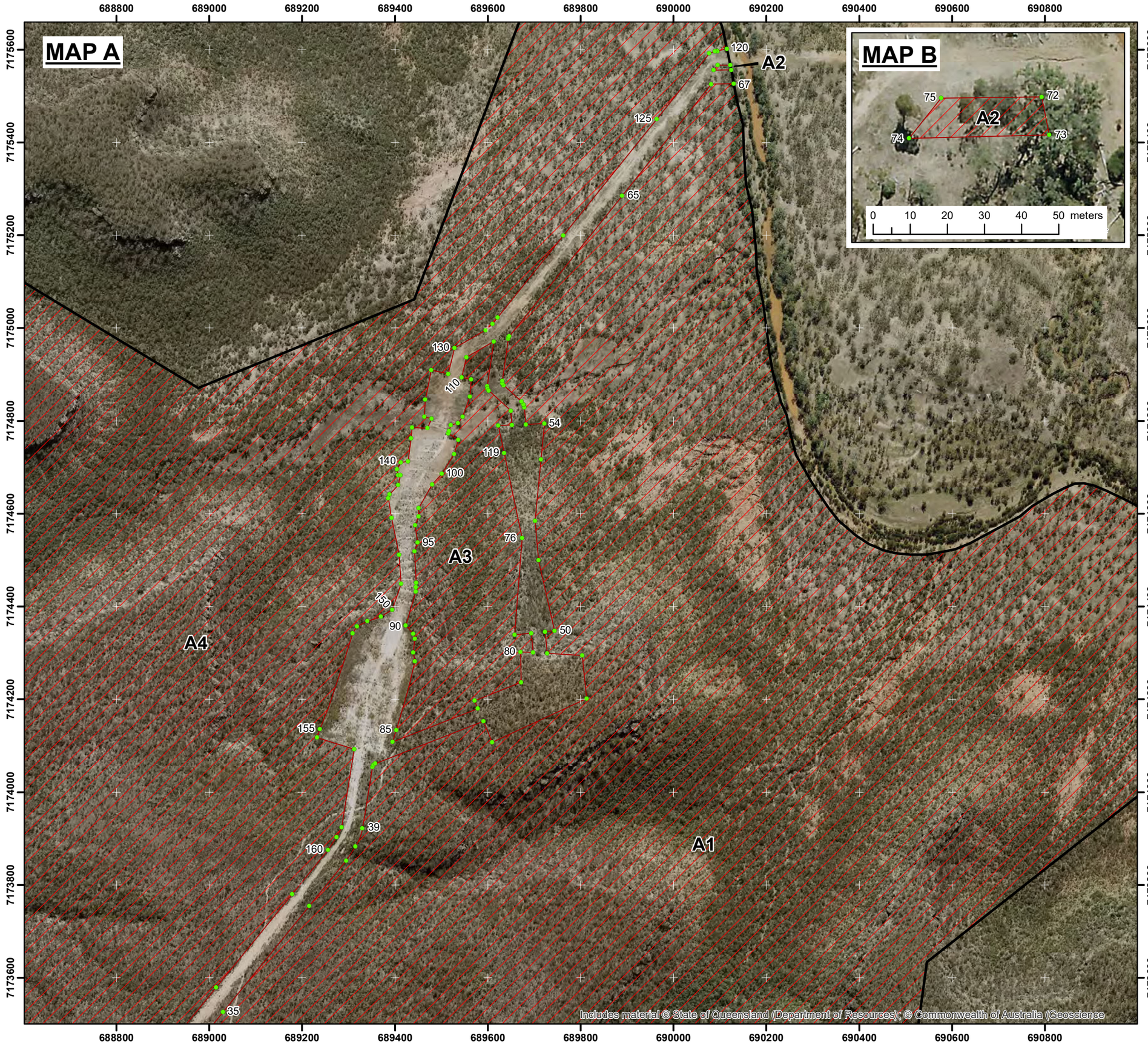
Map Prepared by: LMO

Map Preparation Date: 05/08/2022

This colour map must be reproduced in colour.



Declared Area Map

Sheet 2 of 4

DAM 2022/001902

LOT on PLAN
1WT37

Queensland Government

0 100 200 300 400 500 600
meters

Scale: 1:8000
(original size A3)

N

LEGEND

- Derived Reference Points
- Subject Lot
- Declared Area (A1 to A7)

This plan must be read in conjunction with Declaration Notice 2022/001902

Notes:

Property boundary provided by Department of Resources.
The property boundaries shown on this map an are approximate only. They are not an accurate representation of the legal boundaries.

Map Information:
Horizontal Datum: GDA 2020
Projection: Universal Transverse Mercator - Zone 55

Digital Imagery: Surat_Basin_North_2020_20cm_SISP
Imagery Date: July to October 2020
Imagery Type: Digital Ortho- rectified Satellite

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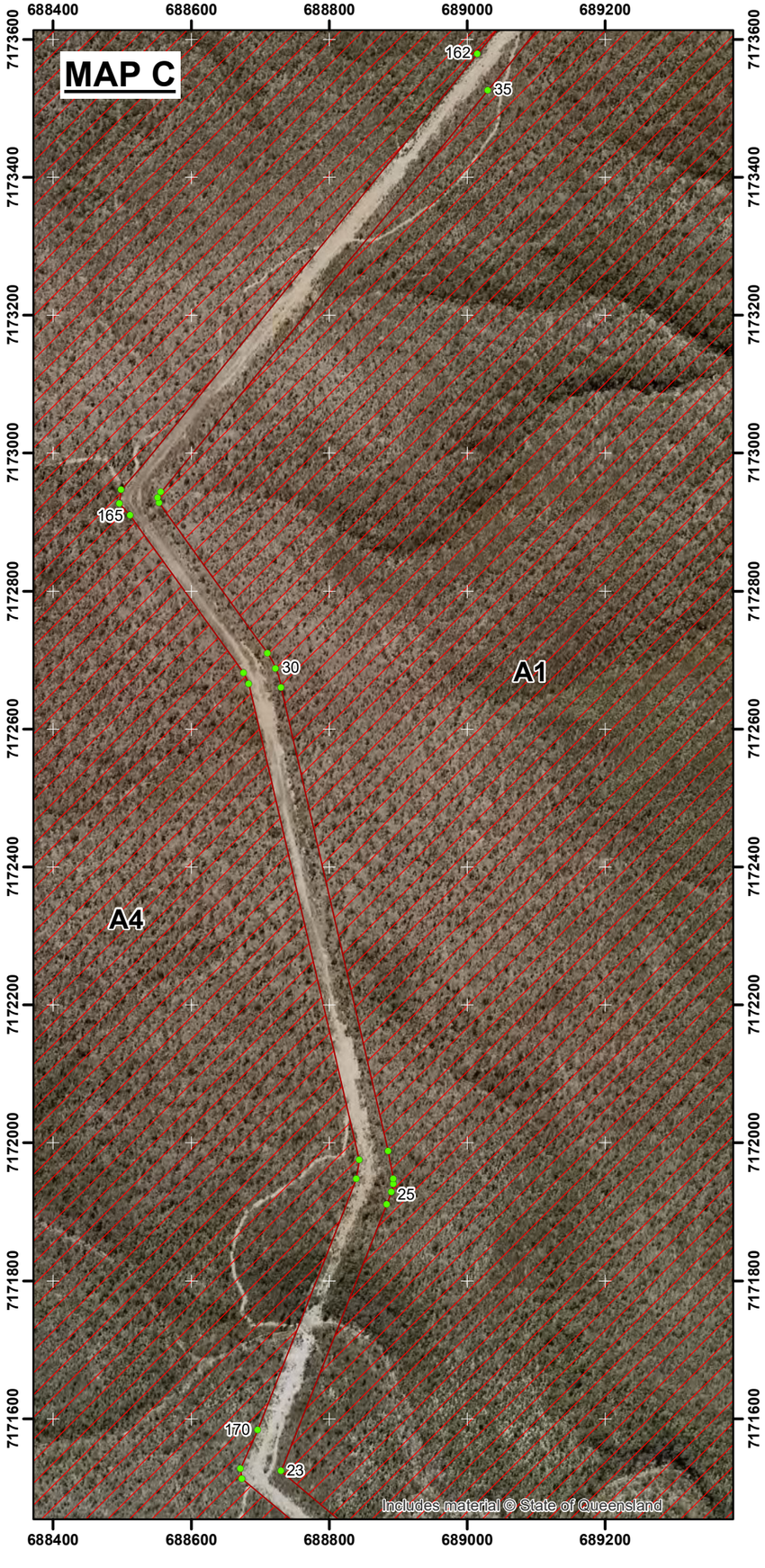

Declared Area Map

Sheet 3 of 4

DAM 2022/001902

LOT on PLAN
1WT37

Queensland Government

0 100 200 300 400 500 600
meters

Scale: 1:8000
(original size A3)

N

LEGEND

- Derived Reference Points
- Subject Lot
- Declared Area (A1 to A7)

This plan must be read in conjunction with Declaration Notice 2022/001902

Notes:

Property boundary provided by Department of Resources.
The property boundaries shown on this map an are approximate only. They are not an accurate representation of the legal boundaries.

Map Information:
Horizontal Datum: GDA 2020
Projection: Universal Transverse Mercator - Zone 55

Digital Imagery: Surat_Basin_North_2020_20cm_SISP
Imagery Date: July to October 2020
Imagery Type: Digital Ortho- rectified Satellite

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Map Prepared by: LMO

Map Preparation Date: 05/08/2022

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Declared Area Map

Sheet 4 of 4

Queensland Government

DAM 2022/001902

LOT on PLAN
1WT37

0 100 200 300 400 500 600
meters

Scale: 1:8000
(original size A3)

N

LEGEND

- Derived Reference Points
- Subject Lot
- Declared Area (A1 to A7)

This plan must be read in conjunction with Declaration Notice 2022/001902

Notes:

Property boundary provided by Department of Resources.
The property boundaries shown on this map an are approximate only. They are not an accurate representation of the legal boundaries.

Map Information:
Horizontal Datum: GDA 2020
Projection: Universal Transverse Mercator - Zone 55

Digital Imagery: Surat_Basin_North_2020_20cm_SISP
Imagery Date: July to October 2020
Imagery Type: Digital Ortho- rectified Satellite

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Map Prepared by: LMO

Map Preparation Date: 05/08/2022

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Attachment to Plan: DAM 2022-001902
Derived Reference Points
Datum: GDA2020, Projection: MGA Zone 55

Notes: Derived Reference Points are provided to assist in the location of area boundaries.
Responsibility for locating these boundaries lies solely with the landholder and delegated contractor(s).
Coordinates start at a point indicated on the accompanying plan and proceed sequentially when labels are not shown.

Part ID	Unique ID	Easting	Northing
A1	1	689523	7169778
A1	2	689456	7169759
A1	3	689473	7169731
A1	4	689480	7169711
A1	5	688907	7169537
A1	6	688908	7169537
A1	7	689075	7169676
A1	8	689088	7169691
A1	9	689094	7169712
A1	10	689115	7169928
A1	11	689115	7169942
A1	12	689114	7169958
A1	13	689045	7170342
A1	14	689041	7170361
A1	15	689032	7170385
A1	16	688851	7170720
A1	17	688941	7171170
A1	18	688931	7171172
A1	19	688953	7171279
A1	20	688957	7171303
A1	21	688956	7171324
A1	22	688944	7171344
A1	23	688730	7171524
A1	24	688883	7171911
A1	25	688890	7171928
A1	26	688893	7171940
A1	27	688893	7171948
A1	28	688885	7171988
A1	29	688730	7172660
A1	30	688722	7172688
A1	31	688710	7172710
A1	32	688553	7172928
A1	33	688551	7172936
A1	34	688556	7172943
A1	35	689030	7173526
A1	36	689215	7173754
A1	37	689295	7173852
A1	38	689315	7173882
A1	39	689330	7173921
A1	40	689351	7174054
A1	41	689354	7174058
A1	42	689358	7174061
A1	43	689591	7174152
A1	44	689610	7174107
A1	45	689813	7174202
A1	46	689803	7174294
A1	47	689728	7174299
A1	48	689724	7174345
A1	49	689724	7174345
A1	50	689744	7174347
A1	51	689709	7174500
A1	52	689701	7174584
A1	53	689714	7174717
A1	54	689722	7174794
A1	55	689682	7174792
A1	56	689679	7174829
A1	57	689677	7174836
A1	58	689672	7174842
A1	59	689634	7174877
A1	60	689631	7174881
A1	61	689631	7174886
A1	62	689644	7174977
A1	63	689645	7174980
A1	64	689646	7174982
A1	65	689889	7175285
A1	66	690081	7175526
A1	67	690130	7175527
A1	68	689902	7170864
A1	69	689979	7170844
A1	70	690001	7170945
A1	71	689925	7170966
A2	72	690122	7175567
A2	73	690124	7175557
A2	74	690087	7175556
A2	75	690095	7175567
A3	76	689674	7174547
A3	77	689657	7174339
A3	78	689694	7174343
A3	79	689698	7174301
A3	80	689671	7174302
A3	81	689672	7174237
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A3	83	689579	7174180
A3	84	689395	7174108
A3	85	689403	7174133
A3	86	689443	7174281
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A3	90	689423	7174359
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A3	94	689442	7174519
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A3	96	689443	7174575
A3	97	689451	7174594
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A3	99	689480	7174663
A3	100	689501	7174686
A3	101	689528	7174729
A3	102	689536	7174759
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A3	104	689516	7174779
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A3	106	689536	7174795
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A3	111	689554	7174937
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A3	116	689649	7174822
A3	117	689652	7174791
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A3	119	689635	7174730
A4	121	690094	7175597
A4	122	690094	7175597
A4	123	690089	7175597
A4	124	690077	7175592
A4	125	689964	7175450
A4	126	689763	7175199
A4	127	689621	7175022
A4	128	689610	7175009
A4	129	689595	7174996
A4	130	689528	7174957
A4	131	689515	7174901
A4	132	689478	7174910
A4	133	689465	7174846
A4	134	689463	7174809
A4	135	689479	7174804
A4	136	689470	7174784
A4	137	689437	7174785
A4	138	689435	7174762
A4	139	689428	7174712
A4	140	689413	7174710
A4	141	689404	7174695
A4	142	689407	7174683
A4	143	689412	7174683
A4	144	689407	7174661
A4	145	689388	7174641
A4	146	689385	7174633
A4	147	689393	7174590
A4	148	689409	7174511
A4	149	689413	7174449
A4	150	689394	7174393
A4	151	689370	7174378
A4	152	689341	7174368
A4	153	689318	7174357
A4	154	689309	7174342
A4	155	689238	7174135
A4	156	689232	7174117
A4	157	689312	7174092
A4	158	689285	7173924
A4	159	689274	7173902
A4	160	689256	7173875
A4	161	689179	7173780
A4	162	689015	7173578
A4	163	688498	7172946
A4	164	688496	7172927
A4	165	688511	7172909
A4	166	688676	7172681
A4	167	688683	7172665
A4	168	688843	7171975
A4	169	688839	7171948
A4	170	688696	7171583
A4	171	688671	7171527
A4	172	688673	7171513
A4	173	688913	7171311
A4	174	688794	7170711
A4	175	688987	7170352
A4	176	689061	7169944
A4	177	689040	7169718
A4	178	688806	7169524
A4	179	688806	7169524
A4	120	690115	7175601
A4	180	688684	7170741

Attachment to Plan: DAM 2022-001902
Derived Reference Points
Datum: GDA2020, Projection: MGA Zone 55

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Coordinates start at a point indicated on the accompanying plan and proceed sequentially when labels are not shown.

Part ID	Unique ID	Easting	Northing
A4	181	688585	7170681
A4	182	688697	7170593
A4	183	688781	7170641
A4	184	688781	7170674
A4	185	688778	7170689
A4	186	688767	7170697
A4	187	688750	7170694
A4	188	688739	7170672
A4	189	687654	7170630
A4	190	687562	7170703
A4	191	687508	7170637
A4	192	687605	7170563
A4	193	687683	7169495
A4	194	687783	7169488
A4	195	687816	7169568
A4	196	687688	7169567
A5	197	687750	7169071
A5	198	687769	7168933
A5	199	687798	7168936
A5	200	687836	7168961
A5	201	687836	7168966
A5	202	687858	7168968
A5	203	687853	7169071
A5	204	688720	7169452
A5	205	688420	7169203
A5	206	688406	7169194
A5	207	688282	7169144
A5	208	688158	7169094
A5	209	688121	7169081
A5	210	688098	7169069
A5	211	688080	7169052
A5	212	688061	7169026
A5	213	687856	7168781
A5	214	687828	7168748
A5	215	687816	7168728
A5	216	687535	7168024
A5	217	687487	7167951
A5	218	687467	7167968
A5	219	687438	7167936
A5	220	687381	7167850
A5	221	687405	7167830
A5	222	687407	7167829
A5	223	687394	7167810
A6	224	687431	7167785
A6	225	687447	7167808
A6	226	687490	7167765
A6	227	687575	7167896
A6	228	687526	7167927
A6	229	687571	7167996
A6	230	687575	7168003
A6	231	687582	7168019
A6	232	687573	7167730
A7	233	687613	7167734
A7	234	687619	7167918
A7	235	687629	7167911
A7	236	687650	7167907
A7	237	687661	7167897
A7	238	687692	7167904
A7	239	687689	7167933
A7	240	687716	7167933

Part ID	Unique ID	Easting	Northing
A7	241	687716	7168013
A7	242	687622	7168014
A7	243	687624	7168104
A7	244	687624	7168110
A7	245	687621	7168118
A7	246	687857	7168708
A7	247	687864	7168720
A7	248	687880	7168740
A7	249	687998	7168881
A7	250	688084	7168984
A7	251	688101	7169003
A7	252	688111	7169018
A7	253	688119	7169028
A7	254	688130	7169036
A7	255	688148	7169043
A7	256	688174	7169052
A7	257	688299	7169102
A7	258	688302	7169093
A7	259	688416	7169138
A7	260	688439	7169150
A7	261	688463	7169167
A7	262	688821	7169465
A7	263	689507	7169642
A7	264	689514	7169638
A7	265	689522	7169637
A7	266	689532	7169639
A7	267	689545	7169635
A7	268	689561	7169630
A7	269	689565	7169630
A7	270	689570	7169638
A7	271	689575	7169658
A7	272	689576	7169703
A7	273	689575	7169727
A7	274	689565	7169732
A7	275	688698	7168740
A7	276	688771	7168735
A7	277	688808	7168765
A7	278	688820	7168806
A7	279	688790	7168810
A7	280	688790	7168851
A7	281	688701	7168863

Appendix C

Risk assessment

Risk assessment summary

The following risk assessment assess the potential risk of failing to achieve the management objectives, interim performance targets and completion criteria for the offset area as outlined in this OAMP.

For each risk identified, the potential consequence of the risk (rated from 1 (no impact) to 6 (irreversible impact; Table C1) was assessed against the likelihood of that risk occurring (Table C2) to determine a risk rating. The risk rating was evaluated by using the matrix in Table C2.

The consequence and likelihood of each risk was first considered without the management measures in place to provide an initial risk rating. The consequence and likelihood of each risk occurring was then reassessed following the implementation of the management measures to provide a residual risk rating.

Table C3 provides the risk register which was used to document the findings of the risk assessment process.

Table C1 – Consequence rating relative to offset value

	Consequence
I	No impact to MNES Value
II	Small-scale impact to MNES
III	Moderate-scale impact to MNES
IV	Large-scale impact to MNES
V	Extensive population or community scale impact to MNES
VI	Irreversible impact to MNES

Table C2 – Likelihood classification and risk matrix

Santos Risk Matrix

Santos

Consequence							
	Safety	**Negligible Harm** + No bodily damage or minimal harm or impairment (hours to days)	**Minor Harm** + Short term impairment (days to weeks)	**Moderate Harm** + Temporary disablement or medium term impairment (weeks to months)	**Severe Harm** + Long term/life altering disablement or impairment	**Single Fatality OR Critical Life Threatening Injuries**	**Multiple Fatalities**
	Environment	+ No impact to Environmental Value (EV).	+ Small-scale impact to EV(s) of conservation significance + Potential surface or groundwater impact.	+ Moderate-scale impact to EV(s) of conservation significance + Localised surface or groundwater impact.	+ Large-scale impact to EV(s) of conservation significance + Moderate-scale surface water impact; + Localised impact to groundwater with potential or known beneficial use.	+ Extensive population or community scale impact to EV(s) of conservation significance + Extensive impact to other EV(s).	+ Irreversible impact to EV(s).
	Community & Reputation	+ No actual or potential community criticism + Details remain within Santos sites and/or offices	+ Minor level local community criticism (< week) + No reputation impact	+ Local community criticism (> week) or one-day community protest + Local company reputation impacted	+ State-level community criticism or protest over multiple days/locations + State-based company reputation impacted + Very short-term share price impact (< week)	+ National community criticism or large scale protest + Company reputation and approvals impacted + Shareholder intervention or short-term share price impact (< month)	+ Sustained national community criticism or widespread protest + Industry reputation and approvals impacted + Changes at executive/board level or long-term share price impact (> month)
	Financial (A$)	< $30k	$30k to $300k	$300k to $3m	$3m to $30m	$30m to $300m	> $300m
	Workforce	+ Will require some staff attention over several days. + No actual or potential impact to culture	+ Will require several days local management time. + Minor impact to employee engagement and limited staff turnover	+ Will require head office staff and take several weeks of site management time. + Moderate impact to employee engagement and staff turnover above industry average with some key roles	+ Will require several weeks of senior management time + Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession	+ Will require several months of senior management time + Impact to employee engagement (< 18 months), high staff turnover and attraction issues	+ Will require more than a year of senior management involvement and operations severely disrupted + Impact to employee engagement (> 18 months), significant key role turnover and attraction issues
	Compliance	+ Non-conformance with legislation, instruments (e.g. tenure licence) or contract + No regulatory or punitive action	+ Minor breach of legislation, instruments or contract + Notification/report to; request for information by; and/or administrative/ warning notice from the regulator + LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator	+ Limited number of minor breaches of legislation, instruments or contract + Statutory notice from the regulator + LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator	+ Systemic minor breaches (or one moderate breach) of legislation, instruments or contract + Company charged with an offence with minor penalty/fine + LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases	+ Systemic moderate breaches (OR single material breach) of legislation, instruments or contract + Company charged with an offence with moderate penalty/fine	+ Material breaches of legislation, instruments or contract + Company or officers charged with an offence with material penalty/fine, or loss of tenure/operatorship

Likelihood			I	II	III	IV	V	VI
	ALMOST CERTAIN (< 4 monthly) Occurs in almost all circumstances OR could occur *within days to weeks*	f	Low	Medium	High	Very High	Very High	Very High
	LIKELY (4 monthly - 1 yearly) Occurs in most circumstances OR could occur *within weeks to months*	e	Low	Medium	High	High	Very High	Very High
	OCCASIONAL (1 - 3 yearly) Has occurred before in Santos OR could occur *within months to years*	d	Low	Low	Medium	High	High	Very High
	POSSIBLE (3 - 10 yearly) Has occurred before in the industry OR could occur *within the next few years*	c	Very Low	Low	Low	Medium	High	Very High
	UNLIKELY (10 - 30 yearly) Has occurred elsewhere OR could occur *within decades*	b	Very Low	Very Low	Low	Low	Medium	High
	REMOTE (30 - 100 yearly) Requires exceptional circumstances and is unlikely even in the long term OR only occurs as a *"one in 100 year event"*	a	Very Low	Very Low	Very Low	Low	Medium	Medium

Table C3 – Risk assessment and management

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
Achieve the completion criteria including habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Completion criteria and habitat quality improvements are not achieved.	Degradation of habitat.	D	IV	H	Implementation of this OAMP, including the management actions and monitoring program outlined in Section 6 and Section 7. Implementation of the adaptive management process outlined in Section 5. Obtain advice with the aim of identifying appropriate additional management interventions if interim performance targets are not achieved for one or more offset values by year 5,10 or 15. If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the OAG. The revised OAMP will be submitted to the Commonwealth Government.	Management actions to support the improvement of the offset area condition, and thereby achieve completion criteria, will be implemented as outlined in this OAMP for the lifetime of the OAMP. Habitat quality assessment will be undertaken in year 1 and then every two years for the first six years, and then every three years thereafter. Interim habitat quality score performance targets are defined for years 5, 10, and 15.	B	IV	L	Monitoring of offset value habitat quality scores and condition of habitat will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Rapid monitoring events (Section 7.5.1). • Habitat quality assessments to determine habitat quality scores (Section 7.5.2). • Targeted fauna surveys (Section 7.5.4). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime to better support enhancement of offset values. • For offset values that have not achieved interim performance targets by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions. • If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the OAG. The revised OAMP will be submitted to the Commonwealth Government.
Maintain the extent of offset value habitat within the offset area.	Habitat or vegetation loss through land clearing.	A violation to the voluntary declaration and this OAMP, resulting in a loss of biodiversity and extent of threatened species habitat.	D	V	H	Protection of the offset area via a Voluntary Declaration under Section 19E and 19F of the VM Act, as described in Section 2.8.	Conditions of the Voluntary Declaration under Section 19E and 19F of the VM Act will place for the life of EPBC 2012/6615. Restrictions outlined in Table 14 will therefore be implemented for the lifetime of the project and OAMP.	B	V	M	Reporting to the Commonwealth Government consistent with EPBC approval.	Any activities in contravention of the Voluntary Declaration and this OAMP.	**Step 1: Investigate cause of trigger** • Investigate reasons why unapproved clearing occurred e.g. unauthorised access • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Addition fencing, signage and/or security for the offset area. • Restoration of the impacted area.

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
						Comply with the restrictions outlined in Table 14. Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in accordance with Sections 6.2.2, 6.2.3 and 6.2.4. Restoration of impacted areas subject to any unauthorised clearing.					Compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks will also be assessed as part of offset area inspections (Section 7.1).	Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with the restrictions outlined in Section 6.2.2, 6.2.3, and 6.2.4.	**Step 1: Investigate cause of trigger** • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately. • Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.
Ensure that the livestock grazing restrictions outlined in Section 6.2.4 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Degradation of habitat by livestock overgrazing.	Over grazing induced suppression and displacement of native flora and fauna species, reflected in environmental monitoring results and annual reports.	E	III	H	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses and promote the establishment of native perennial grass species in accordance with Section 6.2.4. Annual biomass monitoring to inform strategic grazing regimes. Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.5.1 and 7.5.2 including an assessment of % cover of native perennial grasses.	Biomass monitoring will be undertaken twice a year, at the end of the wet season and end of the dry season. Offset area inspections and rapid monitoring events will be undertaken once and twice per year, respectively, for the duration of the management period and will report on any major or noticeable changes to livestock grazing regimes.	B	III	L	Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.5.1 and 7.5.2. These will include assessment of % cover of native perennial grasses and incidental flora surveys.	Decrease in the richness and average % cover of native perennial grasses at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime. • Installing additional watering points for livestock to manage livestock in accordance with the grazing regime.

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
Minimise predation risk by feral animals to threatened fauna species.	Predation by wild dogs. Predation by feral cats. Predation by foxes.	Reduction in the abundance and diversity of native fauna species within the offset area, as well as possible reduction in the population density and growth of threatened species.	D	III	M	Regular monitoring for pest animals will be undertaken in accordance with the methods detailed in Section 7.4 and pest animal control will be implemented following the results of monitoring in accordance with Section 6.2.6.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results. Frequency and duration of management will be appropriate to the target species biology, and extent of occurrence.	C	III	L	Monitoring will assess the relative abundance of foxes, dogs and feral cats within the offset area. Camera monitoring will be undertaken every two years, post wet season, to provide a measure of the Catling index for each species. See Section 7.4.	An increase in Catling* Index for either wild dog, feral cat, or fox from year 1 and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in the: • Catling* index for wild dogs, feral cats and/or foxes. • Relative abundance of feral pigs and horses. • Review adherence to pest management control measures as outlined in Section 6.2.6. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency and intensity of pest animal control. • Revising methods of pest animal control in accordance with DAF guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the OAMP and targeted pest animal control programs.
Minimise degradation of offset value habitat by feral horse and feral pig.	Degradation of habitat by feral horses. Degradation of habitat by feral pigs.	Reduction in the species cover and diversity of native vegetation ground cover, as a result of impacts including but not limited to horse/pig trampling, grazing, and uprooting.	D	III	M	Regular monitoring for pest animals will be undertaken in accordance with the methods detailed in Section 7.4 and pest animal control will be implemented following the results of monitoring in accordance with Section 6.2.6.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results. Frequency and duration of management will be appropriate to the target species biology, and extent of occurrence.	C	III	L	The presence of, or signs of horses will be documented during offset area inspections, twice yearly. Pest monitoring activities will be undertaken every two years, post wet season. Assessment for the presence or absence of feral pig signs as a measure of abundance will be undertaken at permanent monitoring transects which have been randomly stratified across the offset area in environments that are more regularly impacted. See Section 7.4.	An increase in the observed presence of feral horses across monitoring events. An increase in mean feral pig abundance score from year 1 and subsequent monitoring events.	
Manage invasive weed species to reduce degradation of offset value habitat.	Invasion of habitat by weed species, including exotic grasses.	An increase in either the abundance or diversity of weed species.	D	III	M	Implement weed control actions in accordance with Section 6.2.5. Adhere to weed hygiene restrictions in accordance with Table 14.	Weed treatment and control will be undertaken at optimal timing according to the lifecycle of the target species, i.e. before seeding. Frequency and duration of management will be	C	III	L	The offset area will be monitored for weeds every two years (post wet season) to determine the species richness and abundance, for the duration of the management period.	An increase in species richness and relative abundance of weed species at more than 20% of monitoring sites from year 1 and subsequent	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds. • Investigate potential sources or reasons for the occurrence of the new weed species. • Review adherence to weed management control measures as outlined in Section 6.2.5.

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
						Regular weed monitoring will be undertaken in accordance with Section 7.3. Based on the results of monitoring events, weeds will be managed using biological, chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets, for the relevant weed species (see Section 6.2.5).	appropriate to the target species biology, severity and extent of infestation.				See Section 7.3 for more detail.	monitoring events. A new weed species is identified at one or more monitoring sites.	• Review adherence to weed hygiene restrictions as outlined in Section 6.2.1. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Amending weed hygiene restrictions. • Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to. • Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld). • Increasing the frequency and intensity of weed control. • Updating weed control methods in the OAMP and targeted weed control programs.
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	Inappropriate fire regimes.	Decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events as a result of fire management measures, or an unplanned fire.	D	IV	H	Fuel loads within the offset area will be managed through strategic livestock grazing and fuel hazard reduction burns as outlined in Section 6.2.4. Firebreaks will be established and maintained around the boundary of the offset area, with green firebreaks established where the offset area joins native vegetation. Firebreaks will be maintained at least annually in mid / late autumn and, or early spring to remove overhanging trees or fallen debris and dense vegetation.	If deemed necessary, fuel load management will be carried out when required during suitable climatic conditions, as outlined in 6.2.4.	B	IV	L	Fuel loads will be monitored as a result of habitat quality assessments to determine habitat quality scores, in accordance with Section 7.5.2. Rapid monitoring events will be undertaken to assess the general condition of vegetation in accordance with Section 7.5.1.	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores. • Review adherence to the fire management measures as outlined in Section 6.2.4. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass monitoring. • Increasing the frequency of weed control measures. • Amending the strategic grazing regime. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks. • Review timing and intensity of fuel hazard reduction burns in accordance with the Regional Ecosystem Description Database (REDD) fire management guidelines and conservation advice for the particular offset value.
Achieve the interim performance targets and completion	Interim performance targets are not achieved for offset values by	Offset fails to achieve the interim performance targets and completion criteria	E	III	H	All management actions outlined in Section 6 will be implemented to ensure that the interim performance targets	Management methods and actions will occur during seasonally suitable timing, in collaboration with the	B	III	L	Monitoring of the offset area will be undertaken in accordance with Section 7 including:	Interim performance targets are not achieved for one or more offset	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
criteria for each offset value within 5, 10, 15 and 20 years, respectively.	year 5, 10 or 15.	within the anticipated 5-, 10-, 15- and 20-year timeframes, respectively.				and completion criteria are achieved. Monitoring of the offset area will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Offset value assessments (Section 7.5). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	landholder and contractor undertaking the scope of work. Monitoring will occur in accordance with the implementation schedule, see Section 9.				• Offset area inspections (Section 7.1). • Offset value assessments (Section 7.5). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	• Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values.

Appendix D

Interim performance targets and completion criteria for the Kentucky offset area

Table D1 – Interim performance targets and completion criteria for the Kentucky offset area

MNES	Baseline habitat quality score (/10)	Interim performance targets			Completion criteria
		Year 5	Year 10	Year 15	Year 20
Threatened fauna					
Collared Delma	8 (8.1)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
Yakka Skink	7 (7.2)	Increase in the habitat quality score from baseline score of 7	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 8
Dunmall's Snake	8 (8.2)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
Red Goshawk	7 (7.2)	Increase in the habitat quality score from baseline score of 7	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 8
Squatter Pigeon (southern)	8 (8.1)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
Northern Quoll	8 (7.7)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
Koala	8 (8.0)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
South-eastern Long-eared Bat	8 (7.7)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9
Large-eared Pied Bat	8 (7.8)	Increase in the habitat quality score from baseline score of 8	Increase in the habitat quality score from year 5	Increase in the habitat quality score from year 10	Improve the quality of habitat to achieve a score of at least 9

Appendix E

Overall Fuel Hazard Assessment Guide

Department of Sustainability and Environment

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management

report no. 82

State Government Victoria

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management, report no. 82

By Francis Hines, Kevin G Tolhurst, Andrew AG Wilson and Gregory J McCarthy

This publication was produced with the support of the Attorney-General's Department of the Australian Government, who part funded this project through the Natural Disaster Resilience Grants Program.

Images have been provided by Department of Sustainability and Environment – Victoria, Department of Environment and Heritage – South Australia, Country Fire Service – South Australia, Department of Conservation and Environment – Western Australia and Christian Pearson – Misheye. Katy Friend drew the illustrations.

Cover image: Elaine – Atchison Rd Fire, Victoria, January 2008. Bark Hazard – Extreme, Elevated Fuel Hazard – Moderate, Near-surface Fuel Hazard – Low, Surface Fuel Hazard – Very High. Overall Fuel Hazard – Extreme. Fire burning under FFDI 17 – High.

Published by the Victorian Government Department of Sustainability and Environment
Melbourne, July 2010

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Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

Printed by Stream Solutions
Printed on 100% Recycled paper

ISBN 978-1-74242-676-1 (print)
ISBN 978-1-74242-677-8 (online)

For more information contact the DSE Customer Service Centre 136 186

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1. About this guide

1.1 Purpose

The main purpose of this guide is to allow people to:

- make a rapid, visual assessment of fuel arrangement, and
- gain an understanding of how this will affect the chances of controlling a bushfire.

1.2 Audience

This guide has been principally designed to provide information on fuel arrangement to be used by:

- firefighters to assess the difficulty of controlling a bushfire.

Information on fuel arrangement may also be used by:

- asset owners and managers to assess potential bushfire risks to assets
- land and fire managers to provide a measurable objective and trigger for fuel management in fire management plans
- personnel to identify which key attributes and fuel layers are contributing the most to the hazard
- personnel to plan and conduct planned burns
- personnel to assess the effectiveness of planned burning or mechanical hazard reduction
- fire behaviour analysts to produce fire-spread predictions and community warnings.

Those who use the guide for these other purposes need to be mindful of its limitations and how the results are applied and interpreted.

1.3 What fuel is assessed

This guide is for assessing fine fuels that burn in bushfires. Fine fuels are the fuels that burn in the continuous flaming zone at the fire's edge. They contribute the most to the fire's rate of spread and flame height. Typically, they are dead plant material, such as leaves, grass, bark and twigs thinner than 6mm thick, and live plant material thinner than 3mm thick. Once ignited, these fine fuels generally burn out within two minutes.

This guide focuses on assessing the key structural layers of the fine fuel complex, in particular those of bark, elevated, near-surface and surface fuels.

1.4 How the fuel is assessed

Each fuel layer is assessed simply and visually. Assessing the fuel takes only a few minutes and is based on the premise that the eye is better able to integrate local variations in fuel than systematic measurement. Each fuel layer is assessed in turn and given a hazard rating. Particular emphasis is placed on how the fuel is arranged within each of these layers. The hazard ratings are then combined to produce an Overall Fuel Hazard Rating that ranges from Low to Extreme.

1.5 Why fuel arrangement is more important than fuel load

The image below highlights the effect that changing the arrangement of the fuel can have on fire behaviour. Both fires were ignited at the same time in the same way. Both fires are burning in the same fuel load, approximately two broadsheets of newspaper over a 20cm diameter area. The fuel on the right was laid flat and has little vertical orientation. The fuel on the left was crumpled up, which gave it more vertical orientation and exposed more of the surface to the air. As a result, the fire on the left shows significantly greater flame height and the fuel is consumed much faster.

The simple difference in the arrangement of the fuel significantly affects the resulting fire behaviour. The effect would not be discerned if the fuel assessment was based purely on fuel load. An assessment of fuel hazard takes into account the fuel arrangement. It gives a better indication of potential fire behaviour and suppression difficulty.

1.6 Suppression difficulty is not just about fire behaviour

This guide has been mainly developed to allow people to assess the impact of fuel arrangement on suppression difficulty. An assessment of suppression difficulty (how hard it is to control a bushfire) is not based solely on the anticipated fire behaviour. Many other factors affect the chances of a firefighting operation succeeding, including resources, fire size and terrain.

In order to consider the impact of fuels, the other factors need to be treated as if they are constant. The factors that have been held constant are referred to as the Reference Extended First Attack Conditions. Further detail on these conditions is contained in Appendix 1.

1.7 Basis of the Overall Fuel Hazard classification

A comprehensive explanation of this guide is contained in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep.).

This assessment guide updates and builds on work previously published by Wilson (1992a, 1992b, 1993), McCarthy *et al*. (1998a, 1998b, 1998c, 1999, 2001), the Department of Environment and Heritage (2006) and Gould *et al*. (2007a, 2007b).

Classifying Overall Fuel Hazard is complex, with few available measurements. Therefore, we have relied on the perceptions of experienced fire personnel (e.g. fire behaviour specialists, fire managers and firefighters). The collective experience of these personnel is vast, with a broad geographic base across Australia.

1.8 Need for continual learning and development

Although our knowledge about fuels has many gaps, this guide is based on the best available information and experience. The authors acknowledge that this guide will need to change and improve as more information is obtained.

Observers of firefighting operations can improve future editions of this guide by carefully recording what they see. Observations, comments and feedback can be emailed to fire.monitoring@dse.vic.gov.au.

2. How to use the guide

This guide has been kept concise and should not be considered as a standalone document. To produce reliable and consistent results requires extra knowledge which may be gained through local hands-on training in fuel assessment.

2.1 Application

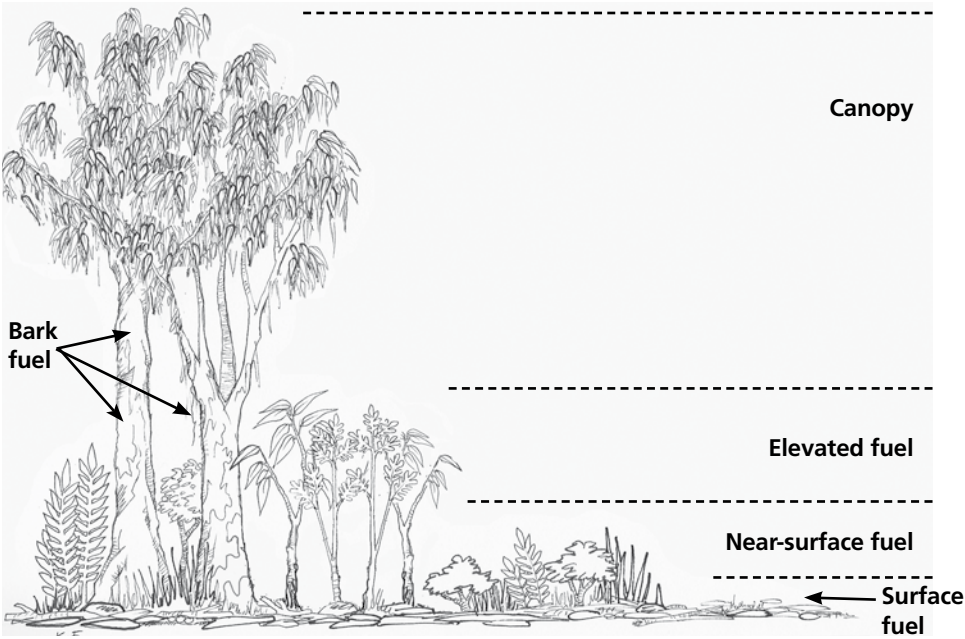
This guide is a tool for rapidly assessing fuel arrangement and its effect on the chances of controlling a bushfire. It may also be used for a range of other fire management purposes, as shown in the table below. Users of this guide should understand the underlying assumptions and limitations before applying it, particularly if applying it for purposes other than the assessment of suppression difficulty.

Application	Methodology
Assess suppression difficulty	Assess the fuels in which the fire may occur or is actually occurring.
Assess fuels for predicting potential risk to assets	Assess the fuels immediately adjacent to the asset as part of an assessment of possible radiant heat loads and defendable space. Assess the fuels further away from the asset; paying particular attention to areas that may generate spotting, such as ridges. Assessments should be focused, particularly in the direction of likely fire attack.
Assess the need for, or success of, fuel management activities	Assess the average fuels across the nominated area by sampling within major vegetation types, slopes and aspects.
Plan and conduct planned burns	Assess the variability in fuels across the nominated area by sampling within major vegetation types, slopes and aspects. Pay particular attention to areas where the burn may escape, such as the tops of gullies, ridge tops and areas adjacent to planned burn boundaries.
Assess fuels for predicting fire behaviour	Assess the fuel values needed as inputs for the appropriate fire behaviour model.

2.2 Fuel layers

Fuel in forests, woodlands and shrublands can be divided into four layers, each based on its position in the vegetation profile (Fig 2.1). This guide focuses on assessing the key structural layers of the fine fuel complex, those of bark, elevated, near-surface and surface fuels.

Figure 2.1 Fuel layers and bark



Use the following descriptions to determine how to separate vegetation into fuel layers.

Layer	Description	Contribution to suppression difficulty
Canopy	• Crowns of the tallest layer of trees. • Under some conditions canopy fuels can play a significant role in fire behaviour and suppression difficulty. Currently, however, these fuels are not assessed as part of Overall Fuel Hazard.	
Bark fuel	• Bark on tree trunks and branches, from ground level to canopy.	Spotting
Elevated fuel	• Fuels are mainly upright in orientation. • Generally most of the plant material is closer to the top of this fuel layer. • Sometimes contains suspended leaves, bark or twigs. • Fuels that have a clear gap between them and the surface fuels. • Can be highly variable in ground coverage. • Low-intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.	Influences the flame height and rate of spread of a fire.
Near-surface fuel	• Live and dead fuels, effectively in touch with the ground, but not lying on it. • Fuel has a mixture of vertical and horizontal orientation. • Bulk of the fuels are closer to the ground than to the top of this layer, or are distributed fairly evenly from the ground up. • Sometimes contains suspended leaves, bark or twigs. • Coverage may range from continuous to having gaps many times the size of the fuel patch. • Low-intensity fire (flame height of less than 0.5m) will consume most or all of this fuel. • Fuel in this layer will always burn when the surface fuel layer burns.	Influences the rate of spread and flame height of a fire.
Surface fuel (litter)	• Leaves, twigs, bark and other fine fuel lying on the ground. • Predominantly horizontal in orientation.	Influences the rate of spread of a fire.

This guide is for assessing fine fuels only. Coarse fuels including logs are not considered. See Section 1.3 for further details.

The descriptions of the fuel layers exclude references to species' names or common vegetation forms, such as shrubs. During a plant's life it may transition back and forth between different layers. For example, juvenile bracken fern can be classified as near-surface fuel before becoming elevated fuel as it matures. Once it dies and collapses it may become near-surface fuel again.

2.3 Assessment based on key attributes of fuel hazard

A fuel hazard rating of Low, Moderate, High, Very High or Extreme is assigned to each fuel layer by assessing it against the key attributes listed below.

Key attribute	
Horizontal continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel beside it. Identifies which of surface, near-surface or elevated fuels will determine the average flame height.
Vertical continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel above it.
Amount of dead material in the layer	Determines how much dead material is present to burn and thus help with igniting the live (green) fuels.
Thickness of the fuel pieces	Determines whether the fuel pieces will burn in the flaming front of the fire.
Total weight of fine fuel	Determines the weight of fine fuel contributing to the flaming front of the fire.

The descriptions in the hazard assessment tables do not cover all possible combinations of the key attributes. Users will need to exercise judgement and make an assessment using all key attributes when actual conditions fit between the descriptions.

2.4 Using the descriptions and photographs

This is **not** a photographic guide for assessing fuels. The **descriptions** for each of the key attributes should be used as the basis for determining the fuel hazard rating. Photographs cannot adequately show all of the key attributes that are important in determining fuel hazard. The photographs are provided to illustrate **some** of the key attributes for each fuel hazard rating. They do not represent all possible variations of that particular hazard rating.

2.5 Area of assessment

Within an area of interest fuels are assessed in small patches or plots. The size and number of plots depends on the reason for assessing the fuels. Some applications (such as for input into fire behaviour models) may require a more rigorous and systematic approach to sampling. Other applications (such as assessing fuel hazard during firefighting operations) will necessitate a more rapid informal approach. For whatever purpose the guide is being used it is recommended that the following principles be applied:

- Any assessment of fuels should try to assess the variability in fuels across an area by assessing the fuels at multiple plots.
- The size and number of plots should reflect the level of reliability required of the results.
- For surface, near-surface and elevated fuel layers the result of assessing the plot should reflect the average state of that fuel layer.
- For bark hazard the result of assessing the plot should be based on the trees with the highest rating.
- Always record with the result the name and the version of the guide used.

2.6 Tips for assessing fuel hazard

The process of assessing fuel hazard using this guide is largely subjective. Implementing the following techniques will help to improve accuracy and reliability:

- Identify and agree on examples of the highest rating of fuel hazard for each layer that occur locally. These examples should be used as benchmarks.
- Conduct assessments in pairs of observers and regularly change assessment pairs.
- Assessors should be no more than one hazard rating apart when assessing each layer (e.g. Low or Medium, not Low or High).
- Use different assessors to re-assess completed work and provide feedback.

2.7 Vesta fire behaviour predictions

In dry eucalypt forest with a litter and shrub understorey the *Field guide – fuel assessment and fire behaviour prediction in dry eucalypt forest* (Gould *et al.* 2007b) provides a systematic method for assessing fuel and predicting fire behaviour (rate of spread, flame height, and spotting). The Project Vesta fuel hazard scoring system is similar to the Victorian system developed by Wilson (1992a, 1992b, 1993) and revised by McCarthy *et al*. (1999). The scale that underlies the Vesta fuel hazard scores is directly related to fire behaviour. These scores, along with height measurements of various fuel layers, are needed as inputs into the fire behaviour prediction tables in Gould *et al*. (2007b). Section 9.3 contains a table for translating the fuel hazard rating for each fuel layer into Vesta fuel hazard scores.

2.8 Effect on fire behaviour

Each table for assessing fuel hazard contains information on the effect that the fuel arrangement is likely to have on fire behaviour. This effect is for weather conditions equivalent to a Forest Fire Danger Index (FFDI) of 25 (McArthur 1973). An FFDI of 25 can be achieved in many ways. For the purposes of this guide the specific conditions required to achieve this are:

Temperature: 33°C	Relative Humidity: 25%	Wind Speed: 20km/h
Drought Factor: 10	Slope: 0°	

If weather conditions vary from those listed above the effect on fire behaviour will also vary.

2.9 Fuel assessment data sheet

Appendix 2 contains a sample field data sheet that can be used when assessing fuels.

3. Bark fine fuel

3.1 Identification

Bark fuel is the bark on tree trunks and branches. Bark lying on or near the ground or draped over understorey plants is considered to be surface, near-surface or elevated fuel.

3.2 Identifying bark types

The key attributes for assessing the effect of bark on suppression difficulty are shown below:

Key attribute	Determines	How it is assessed
Ease of ignition	• How readily the bark will ignite. • Whether the fire will burn up the trunk and into the branches of the tree.	Thickness, size and shape of bark pieces.
How bark is attached	• How likely the bark is to break off the tree.	How easily the bark breaks off the tree.
Quantity of combustible bark	• Volume of potential embers that a fire may generate.	Relative quantity of combustible bark.
Size-to-weight ratio of the bark pieces	• How far the wind is likely to carry bark pieces once they break off the tree.	Thickness, size and shape of bark pieces.
Burn out time	• Length of time a piece of bark will stay ignited once it breaks off the tree.	Thickness, size and shape of bark pieces.

Descriptions of trees have been separated into three broad bark types using three of these key attributes – ease of ignition, burn out time and size-to-weight ratio:

1. Fine fibrous barks, including stringybarks
2. Ribbon or candle barks
3. Other bark types, including smooth, platy, papery and coarsely fibrous. The reason for describing these types in some detail is to help observers distinguish them from the above two types.

3.3 Identifying Stringybark and other fine fibrous bark types

Contribution to suppression difficulty	• Bark types that can produce massive quantities of embers and short distance spotting.
Physical description	• Bark is fine fibrous material with easily visible fibres less than 1mm thick covering the whole trunk. • Bark fibres resemble the fine fibres that are twisted together to form natural string. • Old bark is retained on the trunk of the tree for decades, forming a relatively spongy fibrous mass with deep vertical fissures. • Outer bark may weather to a greyish colour, while underlying bark retains its original colour. • Bark may form large strands when peeled off. • Fine, hairlike pieces also break off from the tree when it is rubbed.
Ease of ignition	• Bark is very flammable (can be easily lit with a match when dry). • Fires will readily climb the tree and branches.
How bark is attached	• Young or new bark is held tightly to the trunk. • As bark ages it becomes less tightly held. • Old, long-unburnt bark is held very loosely.
Quantity of combustible bark	• Bark on old, long-unburnt stringybarks can be more than 10cm in depth. During fires it can produce massive quantities of embers.
Size-to-weight ratio	Burning pieces of bark tend to be either: • Very fine lightweight fibres that will be carried for less than 100m. • Small lightweight wads (about the size of a thumb) that will be carried for less than 300m. • Very large wads (bigger than a fist) that fall close to the tree.
Burn out time	• Very fine fibres of bark that will burn out within one minute. • Small wads of bark that will burn out within 2–3 minutes. • Very large wads of bark that will burn for up to 10 minutes.
Hazard accumulation	• Bark hazard can reach Extreme. • Bark hazard increases over time as the thickness and looseness of the old bark increases. • Repeated low intensity fires (<0.5m flame height) may produce a 'black sock' effect on the base of the trunk, but this may have limited effect in reducing the overall quantity of bark and the hazard.

Examples

Table 3.1 Assessing the hazard of fine fibrous bark types including stringybarks

Only use this table if at least 10% of the trees in a forest have fine fibrous bark. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[1]
How bark is attached	**Quantity of combustible bark**		
This hazard rating cannot occur when only this bark type is present.		Low	
Bark tightly held. Requires substantial effort to break off bark by hand.	Very little combustible bark. Entire trunk almost completely black or charred.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Bark is mostly tightly held with a few pieces loosely attached.	Limited amount of combustible bark. 50–90% of trunk charred. Most of the bark is charred, especially on the lower part of the trunk.	High	Infrequent spotting. Fires will climb some of these trees.
Many pieces of bark loosely held. Deep fissures present in bark.	Large amounts of combustible bark. 10–50% of trunk charred. Upper parts of the tree may not be charred at all.	Very High	Substantial spotting. Fires will climb most of these trees.
Outer bark on trees is weakly attached. Light hand pressure will break off large wads of bark. Deep fissures present in bark.	Huge amounts of combustible bark. <10% of trunk charred. Minimal evidence of charring.	Extreme	Quantity of spotting generated makes fire control very difficult or impossible. Fires will climb virtually all these trees.

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as being the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

1 FFDI 25 is a Forest Fire Danger Index of 25 (McArthur 1973). Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.2 Examples of Stringybarks and other fine fibrous bark hazard

Low	This hazard rating cannot occur when only this bark type is present.		
Moderate			
High			
Very High			
Extreme			

The photos above show some of the variation possible within each bark hazard rating.

3

3.4 Identifying ribbon or candle bark types

Effect on suppression difficulty	• Bark types that can produce substantial quantities of spotting at distances greater than 2km. Will also produce short distance spotting.
Physical description	• Trees characterised by the annual shedding of old bark layers, exposing the smooth new bark underneath. • Bark is shed in the form of long strips or ribbons of bark. • Long strips of bark curl tightly inwards to form a candle-like shape (see image lower right). • Bark strips 50cm or more in length fall off and often drape around the trunk and over branches and surrounding shrubs. • Strips of bark are usually less than 2mm thick. • Bark is shed at various times of the year so that the trunk may have a mottled appearance.
Ease of ignition	• Bark is moderately flammable (can be lit with a cigarette lighter when dry). • Fires will climb up ribbons of bark.
How bark is attached	• Bark strips may drape over, or be weakly attached to, the trunk and branches.
Quantity of combustible bark	• Large quantities of bark can be retained in upper trunk and head of the tree.
Size-to-weight ratio	• Bark pieces are relatively light for their large size. • Easily transported by strong updrafts – may travel up to 30km downwind.
Burn out time	• Bark can burn and smoulder within the curled up ribbons for longer than 10 minutes.
Hazard accumulation	• Bark hazard never exceeds Very High. • Bark hazard tends to increase over the long term as ribbons accumulate on the tree. • A low intensity fire (flame height of less than 0.5m) may not reduce the hazard in this bark type.

Example

Note: Loose ribbon or candle-like bark that is retained on the trunk near ground level is not included in the assessment of ribbon or candle bark types. It is usually:
- firmly attached to the trunk of the tree
- consumed in place by a surface fire.

This bark is considered in 'Other bark types' and can also be considered as near-surface fuel.

Smooth-bark trees also shed bark as slabs or flakes. These bark types are considered in 'Other bark types'.

Table 3.3 Assessing the hazard of ribbon or candle bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site.

Key attribute Amount of combustible bark	Hazard rating	Effect on fire behaviour (at FFDI 25)[2]
This hazard rating cannot occur when only this bark type is present.	Low	
No long ribbons of bark present. Trunk and branches of trees almost entirely smooth.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Long ribbons of bark present on upper trunk (>4m above ground) and in head of trees. Lower trunk mainly smooth.	High	Infrequent spotting. Fires will climb some of these trees.
Long ribbons of bark in the head and upper trunk with: • ribbons hanging down to ground level or, • flammable bark covers trunk.	Very High	Substantial spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.	Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

2 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.4 Examples of ribbon or candle bark hazard

Low	This hazard rating cannot occur when only this bark type is present.		
Moderate			
High			
Very High			
Extreme	This hazard rating cannot occur when only this bark type is present.		

3.5 Identifying other bark types

This bark type includes all other bark types not included in the previous two types. As a result, many different tree species are grouped together. This grouping is based on the ease of ignition, burn out time and size-to-weight ratio of the bark, rather than on botanical values. These other bark types can produce limited quantities of short distance spotting.

This bark type group has been divided into several subgroups. These subgroups are described in some detail to help observers distinguish them from the other two main bark types.

3.5.1 Ironbarks and Platy barks

Physical description	• Trees characterised by layers of old, coarse bark retained on the trunk and branches. • Bark becomes rough, compacted and furrowed with age • Bark feels very abrasive when rubbed by hand. • Bark pieces tend to be more than 2mm thick when they break off. • There may be little or no evidence of charring on the bark following planned burns.
Hazard accumulation	• Bark hazard never exceeds Moderate.

Example

3.5.2 Coarsely fibrous barks

Physical description	• Trees characterised by short strand fibrous bark. • Layers of old dead bark are retained on the trunk and branches. • Unlike stringybark trees, the bark on these trees forms only short strands or chunks when peeled off. • Evidence of charring on the bark may last for up to 10 years.
Hazard accumulation	• Bark hazard never exceeds High. • Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.3 Papery barks

Physical description

- Shrubs and trees growing from 2m to 30m tall, often with flaky shedding bark.
- Old bark is retained on the trunk and branches and builds up into a thick spongy mass.
- Bark layers tend to split allowing sheets of bark to become loose and eventually peel off.
- Evidence of charring on the bark may last for up to 10 years.

Hazard accumulation

- Bark hazard never exceeds High.
- Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.4 Slab bark, smooth bark and small flakes

Physical description

- Trees characterised by the annual shedding of old bark layers, exposing the smooth living bark underneath.
- Bark shed is often seasonal and often annual.
- Species where the old bark tends to peel into large slabs (<50cm in length) or small flakes when shed.
- Most of the bark falls off the tree soon after it is shed.
- Some small amounts of bark may be retained on the stem or branches for several months before falling off, leading to a mottled effect.
- The mottled effect leads to discontinuous bark fuel up the tree.

Hazard accumulation

- Bark hazard never exceeds Moderate.
- Bark hazard tends to be seasonal.

Example

Table 3.5 Assessing the hazard of other bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[3]
How bark is attached	**Quantity of combustible bark**		
No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.		Low	No bark present that could contribute to fire behaviour.
Bark rubs off by hand with firm pressure.	Limited amount of combustible bark.	Moderate	Spotting generally does not hinder fire control. Fires will climb some of these trees.
Light hand pressure will break bark off.	Large amounts of combustible bark.	High	Infrequent spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.		Very High	
This hazard rating cannot occur when only this bark type is present.		Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

3 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

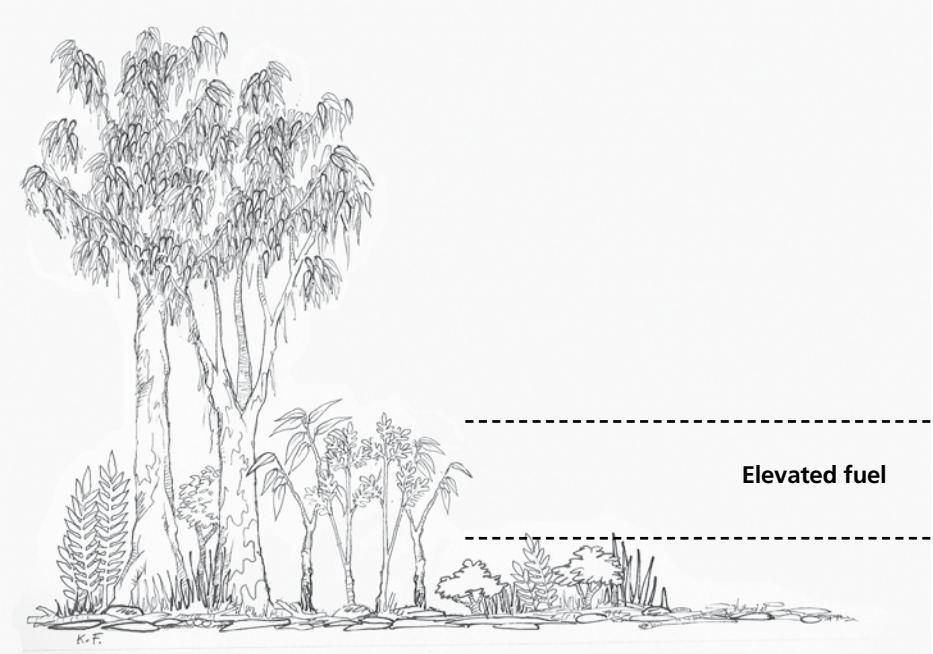
Table 3.6 Examples of other bark types

Low	No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.			
Moderate				
High				
Very High	Does not occur when this is the only bark type present on a site.			
Extreme	Does not occur when this is the only bark type present on a site.			

4. Elevated fine fuel

4.1 Identification

- Fuels are mainly upright in orientation
- Generally most of the plant material is closer to the top of this layer
- Sometimes contains suspended leaves, bark or twigs
- Fuels that have a clear gap between them and the surface fuels
- Elevated fuel can be highly variable in ground coverage
- A low intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.



4.2 Assessment

The elevated fuel hazard is highest when the:

- foliage, twigs and other fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and/or horizontal and vertical continuity that promotes the spread of flames
- live foliage has low fuel moisture content.

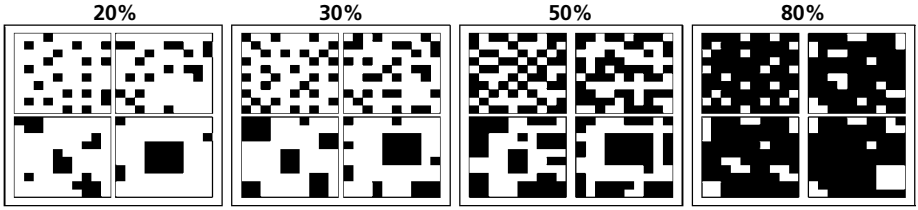
Table 4.1 Assessing elevated fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes					Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[4]
Plant Cover	% dead	Vertical continuity	Vegetation density	Thickness of fuel pieces		
<20% or low flammability species	<20%		Easy to walk in any direction without needing to choose a path between shrubs.		Low	Little or no effect.
20–30%	<20%	Most of the fine fuel is at the top of the layer.	Easy to choose a path through but brush against vegetation occasionally.		Moderate	Does not sustain flames readily.
30–50%	<20%	Most of the fine fuel is at the top of the layer.	Moderately easy to choose a path through, but brush against vegetation most of the time.		High	Causes some patchy increases in the flame height and/or rate of spread of a fire.
50–80%	20–30%	Continuous fine fuel from the bottom to the top of the layer.	Need to carefully select path through.	Mostly less than 1–2mm thick.	Very High	Elevated fuels mostly dictate flame height and rate of spread of a fire.
>70%	>30%	Continuous fine fuel from the bottom to the top of the layer.	Very difficult to select a path through. Need to push through vegetation.	Large amounts of fuel <2mm thick.	Extreme	Elevated fuels almost entirely determine the flame height and rate of spread of a fire.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



4 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 4.2 Examples of elevated fine fuel hazard

Low	Elevated fuel absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

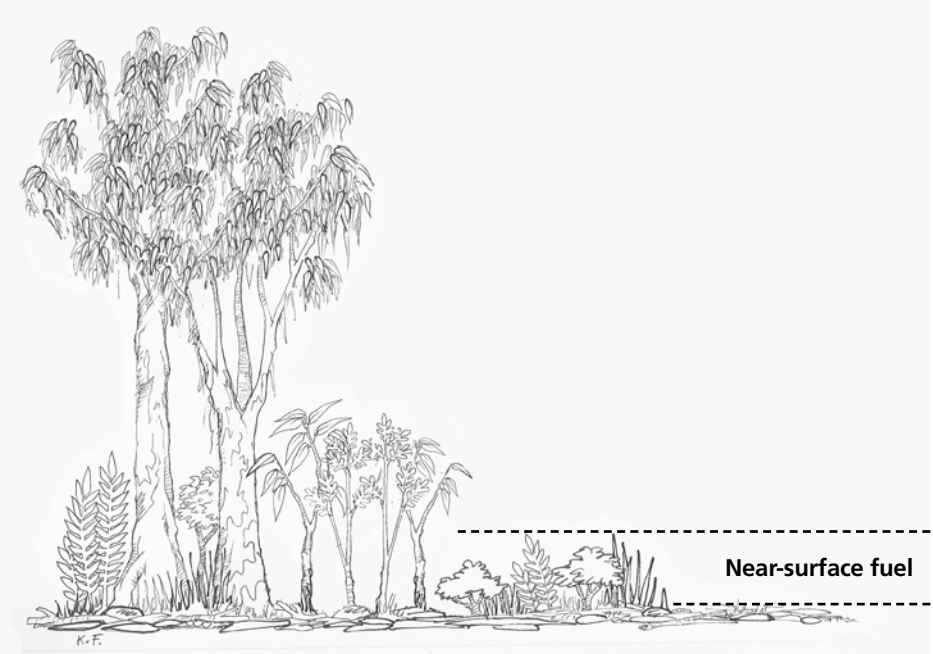
Assess elevated hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of elevated fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the elevated fuel height (m) should be the average of 10 measurements taken along a 300m walk-through. Measure the typical height from ground level.

5. Near-surface fine fuel

5.1 Identification

- Live and dead fuels effectively in touch with the ground but not lying on it
- Fuel has a mixture of vertical and horizontal orientation
- Either the bulk of the fuels is closer to the ground than the top of this layer, or is distributed fairly evenly from the ground up
- Sometimes contains suspended leaves, bark or twigs
- Coverage may range from continuous to having gaps many times the size of the fuel patch
- A low intensity fire (flame height of less than 0.5m) will consume most or all of this fuel
- Fuel in this layer will always burn when the surface fuel layer burns.



5.2 Assessment

The near-surface fuel hazard is highest when the:

- foliage, twigs and other fine fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and /or horizontal and vertical continuity, that promotes the spread of flames
- live foliage has low fuel-moisture content.

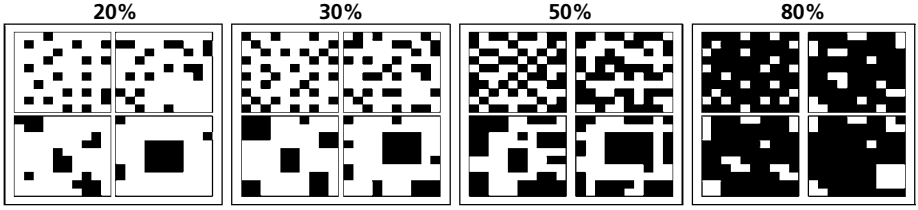
Table 5.1 Assessing near-surface fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[5]
Plant cover	% dead	Horizontal connectivity		
<10%	<10%	Near-surface fuel is absent or virtually absent.	Low	Little or no effect.
10–20%	<20%	Gaps many times the size of fuel patches.	Moderate	Occasionally increases flame height.
20–40%	>20%	Gaps between fuel patches are greater than the size of fuel patches. Starting to obscure logs and rocks.	High	Contributes to surface fire spread and causes patchy increase to flame height.
40–60%	>30%	Fuel patches are equal to or larger than the gaps between the fuel patches.	Very High	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.
>60%	>50%	Very small gaps between fuel patches. Logs and rocks obscured.	Extreme	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



5 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 5.2 Examples of near-surface fine fuel hazard

Low	Near-surface fuel is absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

Assess near-surface hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of near-surface fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the near-surface fuel height (cm) should be the average of 10 measurements taken over a 300m walk through. Measure the typical height from ground level.

6. Surface fine fuel

6.1 Identification

- Leaves, twigs, bark and other fine fuel lying on the ground
- Predominantly horizontal in orientation
- Usually contributes the most to fuel load or quantity
- Includes the partly decomposed fuel (duff) on the soil surface.

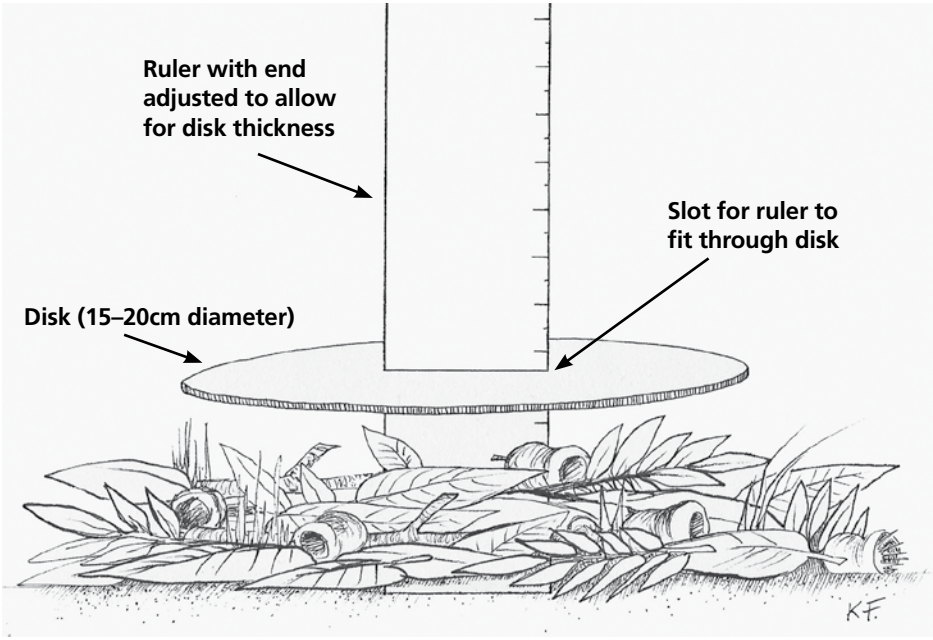
6.2 Assessment

The surface fine fuel hazard is highest when the:

- litter pieces are well connected
- surface litter cover is high, with minimal interruption from rocks, logs or patches of bare soil
- surface litter has substantial depth (greater than 30mm).

6.3 Measurement

Surface litter-bed depth should be measured using a simple depth gauge, as pictured below. This follows the methodology described in McCarthy (2004) and McCarthy *et al*. (1999).



Litter depth should be measured in areas where near-surface fuels do not obscure the litter. Fuel depth is measured using a 15cm circular disk with a ruler through a slot in its centre. To use this gauge, a small gap is made in the litter bed down to mineral soil, then the end of the ruler is placed resting on the mineral soil surface. The disk is pushed down with light pressure until its whole perimeter is in contact with the fuel. Light pressure can be described as 'enough pressure to hold a tennis ball under water'. The ruler is read off level with the top of the disk. Note that the end of the ruler needs to be adjusted to match the thickness of the disk.

Five measurements of litter bed depth should be made at each site. The average of these measurements is one of the attributes that can be used to determine the surface fine fuel hazard.

Table 6.1 Assessing surface fine fuel hazard

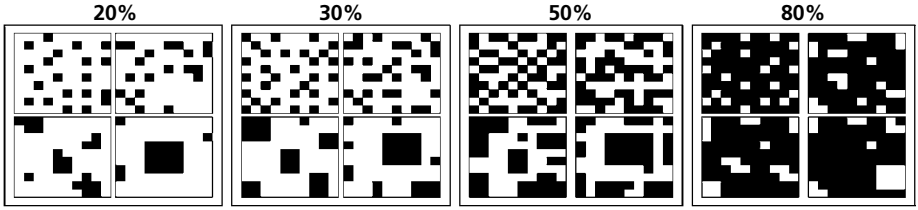
To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[6]
Horizontal connectivity	Surface litter cover	Litter-bed depth		
Litter poorly interconnected. Large areas of bare soil or rock. More soil than litter. Soil surface readily visible through litter bed.	<60%	Very thin litter layer <10mm	Low	Surface fires will not spread.
Litter well connected. Some areas of bare soil or rock. Soil surface occasionally visible through litter bed.	60–80%	Thin litter layer 10–25mm	Moderate	Litter connected well enough to allow fire spread to overcome bare patches.
Litter well connected. Little bare soil.	80–90%	Established litter with layers of leaves ranging from freshly fallen to decomposing. 20–30mm	High	Surface fires spread easily with a continuous fire edge.
Litter completely connected.	>90%	Thick litter layer 25–45mm	Very High	Surface fires spread easily. Increasing flame depth and residence time.
Litter completely connected.	>95%	Very thick layer of litter >35mm	Extreme	Surface fires spread easily. Increasing flame depth and residence time.

Assess surface hazard over a plot 10m in radius. Assessing multiple plots will give better results. For each plot litter bed depth should be an average of five measurements (McCarthy 2004) or more.

See Section 9.3 for application of surface fuel hazard ratings for the Vesta fire behaviour tables.

The following visual guide can be used to assist in assessing surface litter cover. Each quarter of any one square has the same percent cover.



6 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 6.2 Examples of surface fine fuel hazard

Low		
Moderate		
High		
Very High		
Extreme		

7. Determining the combined surface and near-surface fine fuel hazard rating

Assessments of surface and near-surface fuels must be combined together before an Overall Fuel Hazard rating can be determined. The near-surface fuel rating is used to adjust the surface fine fuel hazard rating, according to Table 7.1.

To determine the effect of near-surface fine fuel hazard:

1. Select the **surface fuel hazard rating** from column 1
2. Select the **near-surface fuel hazard rating** from column 2
3. Select the resulting **combined rating** value 3
4. Use this value to determine the Overall Fuel Hazard rating using the Table 8.1.

Table 7.1 Determining the combined surface and near-surface fine fuel hazard rating

1 Surface fine fuel hazard rating	2 Near-surface fine fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
	3 Combined surface and near-surface fine fuel hazard rating				
Low	L	L	M	H	VH
Moderate	M	M	H	VH	E
High	H	VH	VH	VH	E
Very High	VH	VH	E	E	E
Extreme	E	E	E	E	E

8. Determining Overall Fuel Hazard

Overall Fuel Hazard = (sum of the influences of) Bark Hazard + Elevated Fine Fuel Hazard + Combined Surface and Near-surface Fine Fuel Hazard.

The following table is used to combine the assessed levels of Bark, Elevated and Combined Surface and Near-surface Fuel Hazard to give an Overall Fuel Hazard rating.

To determine the Overall Fuel Hazard rating:

1. Select the row that corresponds to the **Bark Hazard** ❶
2. Select the row that corresponds to the **Elevated Fine Fuel Hazard** ❷
3. Select the column that corresponds to the assessed level of **Combined Surface and Near-surface Fine Fuel Hazard** ❸
4. Identify where these two intersect and this will provide you with the corresponding Overall Fuel Hazard rating.

Table 8.1 Determining the Overall Fuel Hazard rating

❶ Bark Hazard	❷ Elevated Fine Fuel Hazard	❸ Combined Surface and Near-surface Fine Fuel Hazard *				
		L	M	H	VH	E
Low or Moderate	L	L	M	M	H	H
	M	L	M	M	H	H
	H	L	M	H	VH	VH
	VH	VH	VH	VH	VH	VH
	E	E	E	E	E	E
High	L	L	M	H	H	H
	M	L	M	H	H	H
	H	L	H	H	VH	VH
	VH	VH	VH	VH	VH	E
	E	E	E	E	E	E
Very High or Extreme	L	L	VH	VH	VH	E
	M	M	VH	VH	E	E
	H	M	VH	E	E	E
	VH	E	E	E	E	E
	E	E	E	E	E	E

* Combined Surface and Near-surface Fine Fuel Hazard is a measure of the Surface Fine Fuel Hazard adjusted to account for the level of near-surface fine fuel (see Table 7.1).

9. Interpreting and applying Overall Fuel Hazard

9.1 Chances of extended first attack success

The chances of extended first attack being successful[1] for a fire ignited in these fuels under the reference extended first attack conditions (Appendix 1) is approximately as follows:

Table 9.1 Chances of extended first attack success

GFDI[2]	FFDI[3]	Overall Fuel Hazard rating[4]				
		Low	Moderate	High	Very High	Extreme
0–2	0–5					
3–7	6–11					
8–20	12–24					
20–49	25–49					
50–74	50–74					
75–99	75–99					
100+	100+					

Chance of extended first attack success is greater than 95% (almost always succeeds)

Chance of extended first attack success is between 95% and 50% (succeeds most of the time)

Chance of extended first attack success is between 49% and 10% (fails most of the time)

Chance of extended first attack success is less than 10% (almost always fails)

Notes:

1. Extended first attack is deemed successful when a fire is controlled by 0800hrs the day after ignition and at less than 400 hectares.
2. GFDI is the Grass Fire Danger Index at the time of ignition and is assumed to be the highest GFDI expected before 0800hrs the next day.
3. FFDI is the Forest Fire Danger Index at the time of ignition and is assumed to be the highest FFDI expected before 0800hrs the next day.
4. Chance of success is for a fire ignited in fuels with this Overall Fuel Hazard rating.
5. Predicted outcomes will differ if the conditions vary from those listed in the reference extended first attack conditions.
6. Predicted outcomes based on expert opinion and informed by work carried out by Wilson (1992b, 1993), McCarthy *et al*. (1998a, 2001) and Plucinski *et al*. (2007).

9.2 Indicative fuel loads (t/ha)

In the absence of local data obtained by sampling fuel loads destructively the following table of indicative fuel load data from Project Vesta and Victorian studies may be useful. These tonnes per hectare figures may be applied to the Forest Fire Danger Meter Mark V (McArthur 1973) for predicting forward rate of spread and flame height for forest fires.

Table 9.2 Indicative fuel loads (t/ha)

Fuel	Fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
Bark	0	1	2	5	7
Elevated	0–1	1–2	2–3	3–5	5–8
Near-surface	1–2	2–3	3–4	4–6	6–8
Surface	2–4	4–10	8–14	12–20	16–20+

9.3 Determining Vesta fuel hazard scores

The following table translates fuel hazard ratings for each fuel layer into Project Vesta fuel hazard scores. These scores can be used with the fire behaviour prediction tables in publications such as Gould *et al*. (2007b).

To determine the Vesta fuel hazard score:

1. Select the row that corresponds to the fuel hazard rating for required fuel layer (1)
2. Select the Vesta fuel hazard score column that corresponds to the same layer (2)
3. Identify where these two intersect and this will provide you with the corresponding Vesta fuel hazard score.

Table 9.3 Determining Vesta fuel hazard scores

	Vesta fuel hazard score (2)			
Fuel hazard rating (1)	**Surface**	**Near-surface**	**Elevated**	**Bark**
Low	1	1	1	0
Moderate	2	2	2	1
High	3	3	3	2
Very High	3.5	3.5	3.5	3
Extreme	4	4	4	4

Notes:

- Surface and near-surface hazard score and near-surface height (cm) is required for fire spread prediction.
- Rate of spread and elevated fuel height (m) is required for flame height prediction.
- Rate of spread, surface and bark fuel hazard scores are required for prediction of spotting distance.

Acknowledgements

This Fuel Hazard Assessment Guide updates and continues to develop work previously conducted by a number of authors. Andrew Wilson laid the foundations for this guide, with the conceptual framework presented in Research Report No. 31; and the visual guides for assessing the influence of bark and elevated fuels on suppression difficulty in the *Eucalypt Bark Hazard Guide and Elevated Fuel Guide* (Reports 32 and 35, respectively). Greg McCarthy (2004) detailed a method for rapidly assessing surface fine fuels in Research Report No. 44.

These three techniques were brought together in the first three editions of the *Overall Fuel Hazard Guide* (McCarthy, Tolhurst and Chatto, 1998b, 1998c, 1999). A subsequent unpublished edition of the guide, produced by Kevin Tolhurst (2005), provided greater detail on the assessment of near-surface fuels. In 2006, Mike Wouters adapted the guide for South Australian conditions, and incorporated the preliminary results from Project Vesta (CSIRO and Department of Conservation and Environment, Western Australia). Further information and results from the final Project Vesta report (Gould *et al.* 2007a) have also been incorporated.

Thanks to Lachie McCaw (Department of Environment and Conservation, Western Australia), Mike Wouters (Department of Environment and Heritage, South Australia), Jim Gould and Miguel Cruz (CSIRO) for their advice and comments during the production of this guide. Thanks must also go to the many other people across Australia who have provided comments and feedback during the production of the guide.

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Appendix 1. Reference extended first attack conditions

This guide assesses the impact of fuels in suppressing a fire during extended first attack, using local resources. Several factors affect the success of an extended first attack. Therefore, to consider the impact of fuels alone, the other factors must be treated as if they were constant. Table A1 below adapted from Wilson (1993) summarises reference extended first attack conditions for four fuel types.

Table A1. Revised reference extended first attack conditions

Fuel type	Forest fuels	Grass fuels	Mallee and scrub fuels	Heath fuels
Examples of typical resources (on scene within the designated arrival time)	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters	5 x 4WD heavy tankers (4000l) each with 5 firefighters	Small dozer (D4) or tractor with scrub roller 1 to 2 small 4WD tankers (400l) 6 firefighters	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters
Extended attack resources	Potential additional resources deployed to the fire during extended first attack may include heavy tankers, large plant (dozers, graders or tractors) and fire bombing aircraft.			
Arrival time	Within 60 minutes of detection			
Suppression workload	A single fire			
Topography and terrain	Burning on level ground with good access			
Fuel availability[1]	MDF is 10 or AFF is 1.0	100% grass curing	MDF is 10 or AFF is 1.0	
Wind speed[2]	20km/h	30km/h		20km/h
Fire danger rating system[3]	McArthur FFDI	McArthur GFDI	McArthur FFDI	

Notes:

1. MDF (McArthur Drought Factor) is calculated using the Forest Fire Danger Meter (McArthur 1973) and is a measure of the short-term availability of forest fuels. AFF (Available Fuel Factor) is used in Western Australia to define the proportion of litter fuel available for burning (Sneeuwjagt & Peet 1998).
2. Wind speed is measured at 10m height in the open above ground level.
3. FFDI is the McArthur Forest Fire Danger Index, GFDI is the McArthur Grass Fire Danger Index.

The rationale for the reference first attack conditions is documented in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep).

Appendix 2. Sample fuel assessment field work form v3

Date Assessed:	Assessors:
Sampling Location:	Veg Type:

Plot Information			
Plot No.			
Zone:			
Easting (GDA94 MGA UTM):			
Northing (GDA94 MGA UTM):			

Canopy height (Assess over a 20m radius)			
Average Height to Top of Canopy:	m	m	m
Average Height to Base of Canopy:	m	m	m

Bark fuel (Assess over a 20m radius)															
Stringybark Fuel Hazard:	NP	M	H	VH	E	NP	M	H	VH	E	NP	M	H	VH	E
Ribbon Bark Fuel Hazard:	NP	M	H	VH		NP	M	H	VH		NP	M	H	VH	
Other Bark Fuel Hazard:	L	M	H			L	M	H			L	M	H		

Select the Bark Hazard rating from above that will be used to determine Overall Fuel Hazard. (Only use the Stringybark hazard rating if more than 10% of the trees are Stringybark **AND** it has the highest rating. Otherwise use the bark with next highest rating.)

Bark Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Elevated fuel layer (Assess over a 10m radius)															
Elevated % Cover:	%					%					%				
Elevated % Dead	%					%					%				
Elevated Fuel Ave Height (m)	m					m					m				
Elevated Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Near-surface fuel layer (Assess over a 10m radius)															
Near-surface % Cover:	%					%					%				
Near-surface % Dead	%					%					%				
NS Average Height (cm):	cm					cm					cm				
NS Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

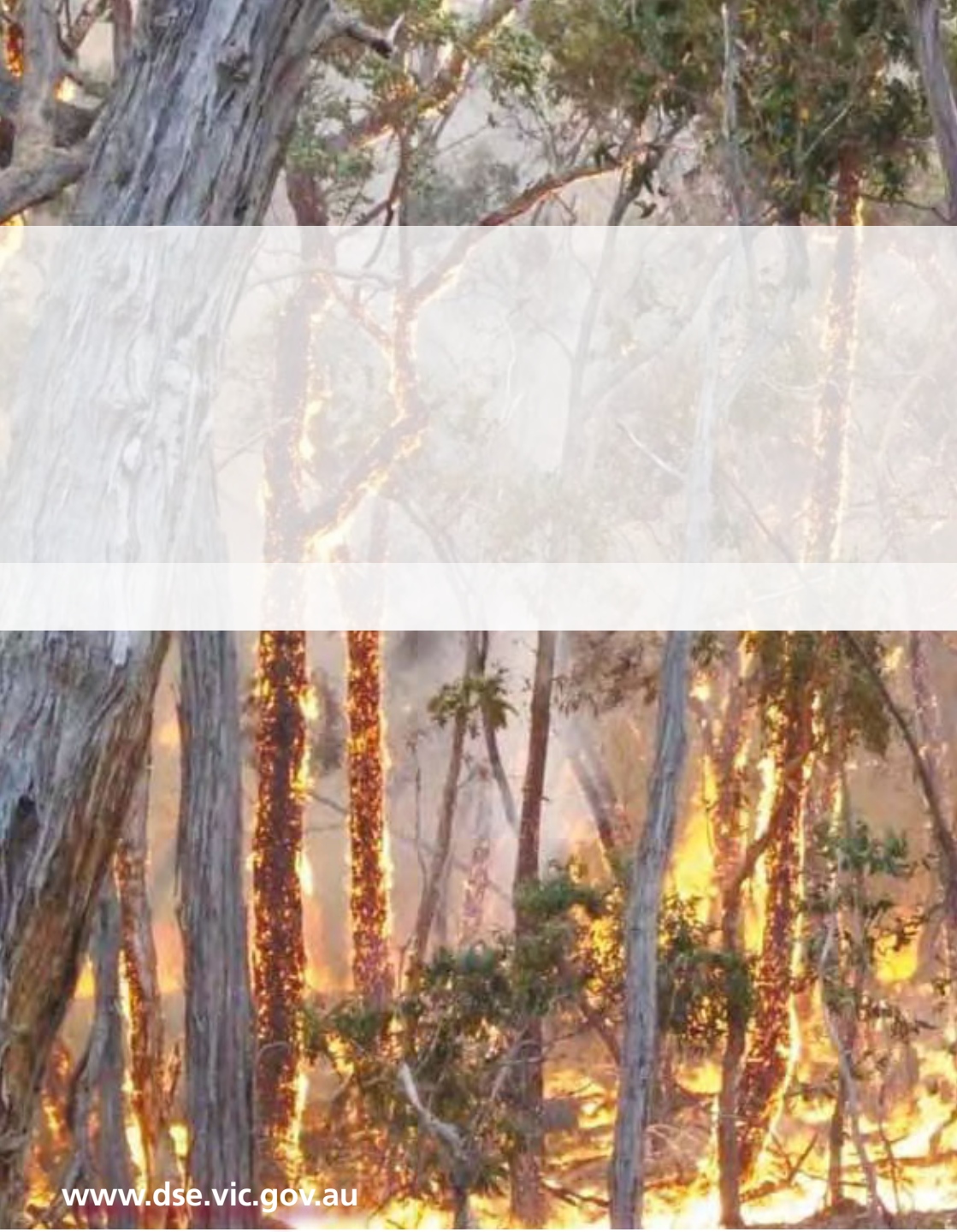
Surface fuel layer (Assess over a 10m radius)															
Surface Litter % Cover:	%					%					%				
Average Litter Depth (mm):	mm					mm					mm				
Surface Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Combined Surface and Near-surface Fine Fuel Hazard calculation (refer Section 7)															
Combined Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Overall Fuel Hazard calculation (refer Section 8)															
Overall Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Are the plots representative of the average fuels across the sampling location?	Yes	No

If no, explain any significant difference between plots. For example, wet gully runs through the sampling area, no plots were located in this gully.



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Appendix F

MNES habitat quality score method

Calculation of a habitat quality score for each MNES considers three attributes:

- site condition
- site context
- species stocking rate.

Site condition

The site condition score for each MNES is calculated generally in accordance with the site condition assessment method outlined in Section 5 of the GTDTHQ (version 1.2; DEHP 2017). Site condition is determined through a field-based assessment of 13 ecological attributes to describe the structure and function of the vegetation community, compared to the expected range for a relatively undisturbed community (i.e. RE benchmark).

The results of the field-based assessment are scored based on the scoring guide provided in the GTDTHQ to determine the site condition score for each MNES at each relevant monitoring site out of 80.

Site context

The method to calculate site context for a site is based on the site context assessment method provided in the GTDTHQ. The following components were assessed through a GIS desktop analysis at each relevant monitoring site for each MNES:

- Patch size: the size of the patch/assessment unit being assessed and any directly connecting suitable/known habitat and remnant vegetation. To calculate the patch size score:
  - Measure the area of vegetation in which the assessment unit is contained and add on all other directly connecting areas of suitable or known habitat for the threatened species or community and remnant vegetation. Suitable or known habitat will be based on mapped vegetation comprising regional ecosystems known or likely to support the MNES value based on the conservation advice or other species-specific sources endorsed by Queensland and/or Commonwealth Governments. Where the connecting patch comprises an RE that is known or suitable habitat, then 100% of the area of that RE is attributed to the total patch size area. Where the connecting RE is not considered known or suitable habitat (i.e. non-compliant RE); however, is a remnant RE, only 10% of the area of that RE is attributed to the total patch size area sum. The reduced weighting for non-compliant REs acknowledges the importance of these REs in contributing to the overall patch size through its contribution to potential dispersal of species, and the supporting role of these REs for maintaining connectivity to potential source meta-populations.
  - Determine the score for this attribute by matching with the class ranges in Table F1.
- Connectedness: measure the proportion of the assessment unit's boundary which is connected to suitable/known habitat and remnant vegetation. To calculate the connectedness score:
  - Measure the percentage of suitable/known habitat and remnant vegetation along the boundary of the assessment unit.
  - Determine the score for this attribute by matching with the class ranges in Table F1.
- Context: measure the percentage of suitable/known habitat and remnant vegetation within a 1 km buffer around the site/assessment unit. To calculate the context score:
  - Create a 1 km buffer around the monitoring site.
  - Measure the percentage cover of remnant vegetation within the buffer area.
  - Determine the score for this attribute by matching with the thresholds Table F1.
  - Ecological corridors: to calculate the ecological corridor score:

- Determine the proximity of the site to state, bioregional, regional or sub-regional corridors (terrestrial or riparian).
- Determine the score from Table F1. based on whether the site is located within (wholly or partly); shares a common boundary with; or is not within a corridor.

Table F1 – Site context scoring guide

Attribute	Scoring guide					
Size of Patch	Score	0	2	5	7	10
	Description	<5 ha	5-25 ha	26-100 ha	101-200 ha	>200 ha
Connectedness	Score	0	2		4	5
	Description	0-10%	>10%-<50%		50-75%	>75% or >500 ha
Context	Score	0	2		4	5
	Description	<10%	>10-30%		>30-75%	>75%
Ecological corridors	Score	0	4		6	
	Description	Not within	Sharing a common boundary		Within (whole or part)	

The total site context score for each MNES at each relevant monitoring site is calculated out of 26.

Species habitat index

A quantitative method is used to determine the species habitat index score for each fauna and flora MNES based on the species habitat index assessment method used as part of the GTDTHQ.

Table F2 to Table F10 summarise the method for calculating species habitat index score out of 50 for Collared Delma, Yakka Skink, Dunmall's Snake, Red Goshawk, Squatter Pigeon (southern), Northern Quoll, Koala, South-eastern Long-eared Bat and Large-eared Pied Bat. Each sub-component of species habitat index scoring method is tailored for each MNES to consider species-specific habitat requirements and threats in accordance with conservation advices and other species-specific sources endorsed by Queensland and/or Commonwealth governments.

Table F2 – Species habitat index scoring for Collared Delma

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting some damage to critical microhabitat including deep cracks in clay soils, fallen timber and logs. However, some microhabitat still occurs on site in patches. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species. • No foxes and/or feral cats observed or known within the vicinity of the site. Successful active pest animal management implemented on site.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for coarse woody debris OR leaf litter. • Highly disturbed ground layer.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. small skinks and geckos.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes coarse woody debris AND/OR leaf litter. • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. small skinks and geckos.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).

Component	Level	Score	Description
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower-than-average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table F3 – Species habitat index scoring for Yakka Skink

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. Overgrazing by livestock resulting in irreversible damage to microhabitat including logs, dense leaf litter and fallen bark. • Overgrazing by livestock resulting in irreversible damage to microhabitat including coarse woody debris, dense leaf litter and decorticated bark. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species. • No foxes and/or feral cats observed or known within the vicinity of the site. Successful active pest animal management implemented on site.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for coarse woody debris OR leaf litter. • Highly disturbed ground layer.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND 50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. soft plant materials and fruits and a wide variety of invertebrates.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes coarse woody debris AND leaf litter. • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. soft plant materials and fruits and a wide variety of invertebrates.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 OR >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide.

Component	Level	Score	Description
			• The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range OR • Site has very few records for migratory species.
	Likely to be critical to species' survival Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • The population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table F4 – Species habitat index scoring for Dunmall's Snake

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural landuse and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting some damage to critical microhabitat including deep cracks in clay soils, fallen timber and logs. However, some microhabitat still occurs on site in patches. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species. • No foxes and/or feral cats observed or known within the vicinity of the site. Successful active pest animal management implemented on site.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. small skinks and geckos.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >90% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide.

Component	Level	Score	Description
			• The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower-than-average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table F5 – Species habitat index scoring for Red Goshawk

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development, timber production or agricultural land use and/or subject to ongoing degradation. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Site is mostly cleared and does not support habitat for prey species such as medium sized birds.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site may have a history of clearing; however patches of remnant forest and regrowth occur frequently providing suitable habitat for prey (i.e. medium sized birds).
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) to allow for recruitment of native species. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees AND/OR <10% tree canopy cover. • Prey species rarely observed and habitat does not support a viable population of prey (medium sized birds).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes large trees AND/OR >10%-<50% (or >200%) tree canopy cover. • Prey species observed and habitat supports a viable population of prey (medium sized birds).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes large trees AND/OR >50-<200% tree canopy cover. • Prey species observed frequently and habitat supports a healthy population of prey (medium sized birds).
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for large trees, AND • Very few or no occurrences of large, mature trees near a watercourse for nesting.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for large trees, AND • Infrequent occurrences of large, mature trees near a watercourse for nesting.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for large trees, AND • Frequent occurrences of large, mature trees near a watercourse for nesting.
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.

Component	Level	Score	Description
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table F6 – Species habitat index scoring for Squatter Pigeon (southern)

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Habitat is not protected through legislation and/or is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to ground layer vegetation that provides foraging and breeding habitat. • No management of invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*). • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Removal of fallen timber.

Component	Level	Score	Description
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural land use. • Strategic pulse livestock grazing resulting in irreversible damage to ground layer vegetation that provide foraging and breeding habitat. • Some management of invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*). • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No foxes and/or feral cats observed or known within the vicinity of the site and no known or observed evidence of predation. Successful active pest animal management implemented on site. • Successful active weed management implemented on site. • Habitat protected as part of a legally binding mechanism for an offset and/or National Park and/or Nature Refuge, with management aimed at maintaining or improving habitat. • Livestock grazing excluded from habitat at all times (except for need for fuel load control through strategic grazing, if required). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for grass species richness OR native perennial grass cover <20% or >90%. • Habitat not within 3 km of permanent water source.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes grass species richness OR perennial grass cover 40-90%. • Habitat within 3 km of permanent water source.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for grass species richness OR perennial grass cover approximately 20-40%. • Habitat within 3 km of permanent water source.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for grass species richness OR perennial grass cover <20% or >90%. • Habitat not within 3 km of permanent water source.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for grass species richness OR perennial grass cover 40-90%. • Breeding habitat within 1 km of permanent water source or foraging habitat within 3 km of water source.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for grass species richness OR perennial grass cover 20-40%. • Breeding habitat within 1 km of permanent water source.
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR

Component	Level	Score	Description
			• Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Likely to be critical to species' survival Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation.

Table F7 – Species habitat index scoring for Northern Quoll

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Many cane toads present on site equally a high possibility of death by ingestion and poisoning. • Overgrazing by livestock resulting in irreversible damage to microhabitat such as fallen timber. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site OR pest management is using 1080 baiting. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting in some damage to critical microhabitat including fallen timber and logs. • Cane toads present on site but not in high numbers.

Component	Level	Score	Description
	previous, present and future management resulting in a moderate level of threat		• Foxes and/or feral cats observed on site or on adjacent properties, however pest animal management occurs on site. 1080 not used on site. • Active fire management and/or low risk of uncontrolled fire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No foxes and/or feral cats observed on site or on adjacent properties. Successful pest management occurs onsite without the use of 1080. • No cane toads present on site or very little activity recorded. • Site is actively managed for conservation purposes to enhance habitat for threatened species. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR <50% of the RE benchmark value for coarse woody debris AND/OR leaf litter. • Highly disturbed ground layer. • No rocky outcrops on site.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Some suitable denning sites (rocky outcrops, cliffs, rocks walls etc) found on site.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes coarse woody debris AND/OR leaf litter. • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. reptiles and small mammals. • Frequent denning sites (rocky outcrops, cliffs, rocks walls etc) found on site.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat (i.e. rocky outcrops, caves, rock crevices, logs or tree stumps, large hollow logs).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. rocky outcrops, caves, rock crevices, logs or tree stumps, large hollow logs).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. rocky outcrops, caves, rock crevices, logs or tree stumps, large hollow logs).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR

Component	Level	Score	Description
Role of site location to species overall population in the state	population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.		• Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple species records within the last 10 years within 15 km of the site and site contains high quality food, foraging and shelter habitat, AND • Site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation.

Table F8 – Species habitat index scoring for Koala

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Known presence of wild dogs on site and within adjacent properties and/or evidence of predation known or observed and. No active pest animal management on site. • Public vehicle access to site, with evidence of death through vehicle strike observed or likely. • Habitat is not protected through legislation and/or is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Wild dogs observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Restricted access to the site by authorised personnel only, with no public vehicle access. • Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural land use. • Active fire management and/or low risk of uncontrolled fire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented	15	• No wild dogs observed or known within the vicinity of the site and no known or observed evidence of predation. Successful active pest animal management implemented on site.

Component	Level	Score	Description
	system, with no edge effects, and no immediate threat from present or future management		• Restricted access to the site for authorised personnel only, with no public vehicle access. Reduced speed limits in place and/or driver awareness and/or signs to identify species habitat and/or exclusion fencing to prevent Koalas accessing road. • Habitat protected as part of a legally binding mechanism for an offset and/or National Park and/or Nature Refuge, with management aimed at maintaining or improving habitat. • Active fire management, with controlled burns on site and low risk of uncontrolled fire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Minimum of one eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, with limited foraging potential for the species.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Minimum of one eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, and provides known foraging habitat for the species including Koala food trees known to support Koalas within the region, AND • >50% of the RE benchmark for number of large trees attribute.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Minimum of two eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, and provides known foraging habitat for the species including Koala food trees known to support Koalas within the region, AND • >70% of the RE benchmark for attributes number of large trees, OR • 1 Koala food tree species known to support Koalas within the region that alone accounts for >50% of the canopy.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Minimum of one eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, with limited sheltering or dispersal habitat potential for the species.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Minimum of one eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, and provides known habitat for the species including emergent trees likely to support shelter and/or dispersal habitat for Koalas, AND • >50% of the RE benchmark for attributes number of large trees and/or canopy cover and/or canopy height.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Minimum of two eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, and provides known habitat for the species including emergent trees known to support shelter and/or dispersal habitat for Koalas, AND • >70% of the RE benchmark for at least two of the three following attributes: number of larger trees, canopy cover and canopy height
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.

Component	Level	Score	Description
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation.

Table F9 – Species habitat index scoring for South-eastern Long-eared Bat

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development, timber production or agricultural land use and/or subject to ongoing degradation. No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Overgrazing resulting in a lack of understorey habitat that supports invertebrate prey.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. Active fire management and/or low risk of uncontrolled fire on site, including from adjacent properties. • Strategic livestock grazing resulting in some degradation to the understory habitat that supports invertebrate prey however, patches of habitat occur on site. • Active fire management and/or low risk of uncontrolled fire on site, including on adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. Active fire management, with controlled burns on site and low risk of uncontrolled fire on site, including from adjacent properties. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) allowing for recruitment of native saplings.

Component	Level	Score	Description
			• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees. OR • <10% tree canopy cover.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark value for large trees, OR • >10% - <50% tree canopy cover.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark value for large trees, OR • >50% - <200% tree canopy cover.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees. • Limited evidence of dead trees and/or hollows for roosting.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark value for large trees. • Evidence of some dead trees and/or hollows for roosting.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark value for large trees. • Evidence of dead trees and/or hollows for roosting.
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival:	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND

Component	Level	Score	Description
	Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.		• The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • The population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table F10 – Species habitat index scoring for Large-eared Pied Bat

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development, timber production or agricultural land use and/or subject to ongoing degradation. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Foxes known on site and no active pest management in place.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting in some degradation to the understory habitat that supports invertebrate prey however, patches of habitat occur on site. • Active fire management and/or low risk of uncontrolled fire on site, including on adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) allowing for recruitment of native saplings. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees OR <10% tree canopy cover. • Little to no areas of suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark for attributes large trees OR >10%-<50% tree canopy cover. • Some areas of suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes large trees OR >50-<200% tree canopy cover. • Frequent areas of suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for large trees, AND/OR • Limited evidence of suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).

Component	Level	Score	Description
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark for large trees, AND/OR • Some infrequent suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for large trees, AND • Frequent suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape, OR • The site is likely to support only a small or relictual population of the species.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Appendix C

Cobbadah Offset Area Management Plan

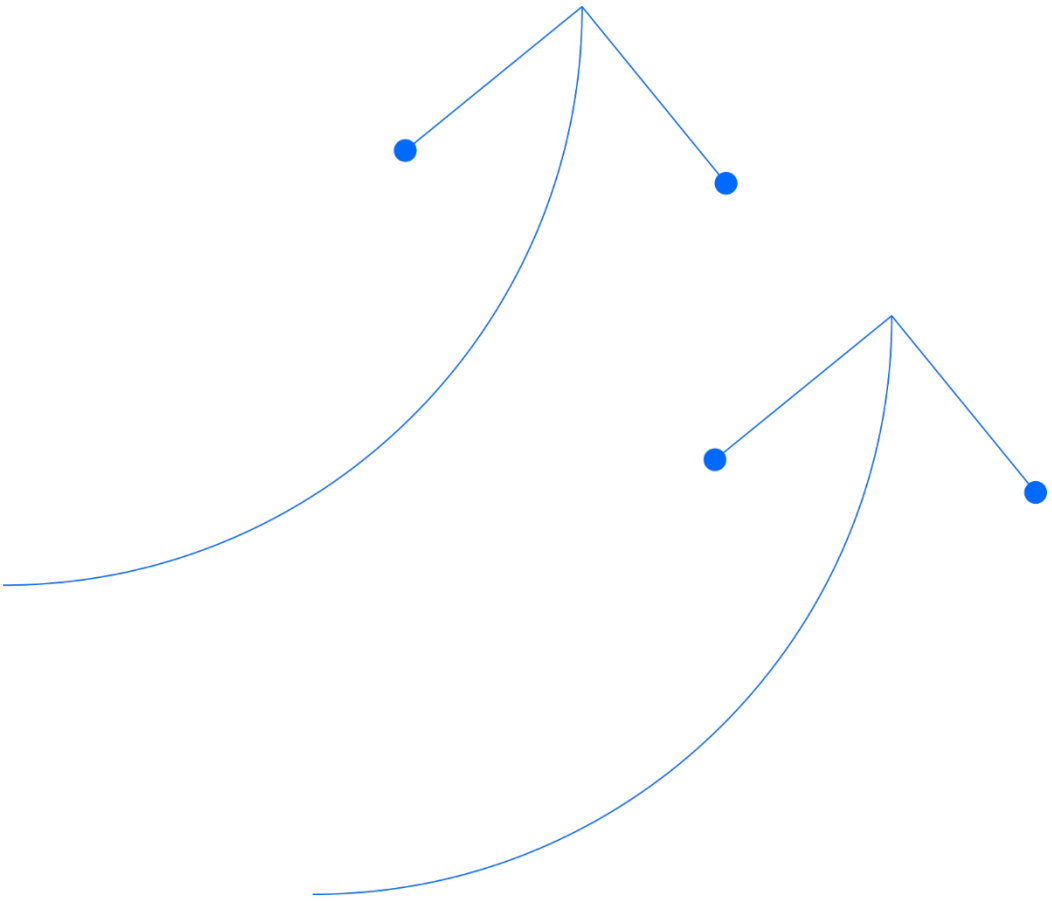
Santos

SANTOS GLNG COBBADAH OFFSET AREA MANAGEMENT PLAN

EPBC Act Approval 2012/6615 (Stage 8)

Document Number: 0007-650-EMP-0049

31 October 2025



Date	Rev	Reason For Issue	Reviewed	Endorsed	Approved
9 May 2025	0	Updated to consider Stage 8 and include remainder of Offset Deed area for DCCEEW submission	AB	AB	DG
31 October 2025	1	Updated based on DCCEEW review	JK	AB	DG

Declaration of Accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or document to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulation 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed [redacted]

Full Name (please print) [redacted]

Organisation (please print) Santos Ltd

Date 31 / 10 / 2025

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Abbreviations

Acronym	Description
BPA	Biodiversity Planning Assessment
CSG	Coal Seam Gas
DAF	Department of Agriculture and Forestry (Qld)
DCCEEW	Department of Climate Change, Energy, the Environment and Water
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
GIS	Geographical Information System
GLNG	Gladstone Liquefied Natural Gas
GTDTHQ	Guide to Determining Terrestrial Habitat Quality Version 1.2
GTP	Gas Transmission Pipeline
MNES	Matters of National Environmental Significance
OAG	Offsets assessment guide
OAMP	Offset Area Management Plan
PMAV	Property Map of Assessable Vegetation
RE	Regional Ecosystem
REDD	Reginal Ecosystem Description Database
SEVT	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions
spp	species
TEC	Threatened Ecological Community
VM Act	*Vegetation Management Act 1999* (Qld)

Executive Summary

This offset area management plan (OAMP) has been prepared to address the offset requirements for matters of national environmental significance (MNES) associated with Stage 8 of the Gas Fields Development (GFD) Project in accordance with the Santos Gladstone Liquefied Natural Gas (GLNG) Project *Environment Protection and Biodiversity Conservation Act 1999* (Cth; EPBC Act) approval EPBC 2012/6615 (herein referred to as the Stage 8 Project).

Within the Cobbadah property (Lots 35 SP140818 and 33 WT347), Santos has identified a 1,427 hectare (ha) area for environmental offsets (herein referred to as the offset area). Santos proposes to secure 1.0 ha of the offset area to partially acquit MNES offset requirements for the Stage 8 Project. The remaining 1,426 ha of offset area on Cobbadah is currently being used to acquit 557.9 ha offset obligations for Stage 5 of the GFD Project (EPBC 2012/6615) and includes 493.3 ha of surplus areas of suitable MNES habitat for Santos to drawdown on for future project offset acquittals (Table ES 1). This OAMP relates to the 1.0 ha offset area required to partially acquit Stage 8 under EPBC 2012/6615, as calculated in accordance with the EPBC Act *Offsets Assessment Guide* (OAG) to support the overall conservation gain of the offset area. The remaining obligations for the Stage 8 Project will be satisfied elsewhere.

The Cobbadah property is located approximately 120 kilometres (km) north-west of the project and 30 km west of Injune. The property is adjacent to the Great Dividing Range in the Brigalow Belt bioregion (Southern Downs subregion) and approximately 40 km southeast of Oakvale State Forest and 25 km south-west of Doonkuna State Forest. Desktop and field surveys of the Cobbadah property have been completed to confirm the presence of offset values and suitability to satisfy the Project's offset obligations as follows:

- January 2017
  - Preliminary desktop assessment of regional ecosystem (RE) mapping and potential biodiversity offset values.
  - Preliminary site visit for initial vegetation ground-truthing undertaken generally in accordance with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (version 3.2; Neldner *et al*. 2012).
- May 2017
  - Detailed field ecological assessments including:
    - refinement of ground-truthing of RE mapping.
    - baseline habitat quality assessments in accordance with the *Guide to Determining Terrestrial Habitat Quality* (GTDTHQ) (version 1.2; Department of Environment and Heritage Protection [DEHP] 2017).
    - incidental observations of any significant fauna and/or fauna habitat features, including habitat for potential threatened species.
- August 2020
  - Additional detailed field ecological assessments:
    - ground-truthing of RE mapping in additional areas on Cobbadah generally in accordance with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (version 5.1; Neldner *et al*. 2020).
  - baseline habitat quality assessments in accordance with the GTDTHQ (version 1.2; DEHP 2017).

The outcome of this OAMP is to partially acquit the offset obligations for the Stage 8 Project. The Cobbadah offset area will be managed and monitored, based on an adaptive management framework, to achieve the interim performance targets and completion criteria presented in Table ES 2 and ultimately achieve the requirements under EPBC approval 2012/6615.

The key management actions to be implemented include:

- restricting access to the offset area
- management and restoration of regrowth threatened ecological communities (TEC)
- maintenance and upgrades of existing access tracks, fencing and firebreaks

- fire management through strategic grazing and fuel hazard reduction burns
- weed management
- pest animal management.

Ongoing monitoring events will be undertaken to assess the effectiveness of the management actions and progress of the offset area in achieving the interim performance targets and completion criteria, including:

- biannual offset area inspections
- biomass monitoring
- fuel load monitoring
- weed monitoring
- pest animal monitoring
- rapid monitoring events
- habitat quality assessments
- photo monitoring.

Annual reports will be prepared to detail progress of the offset area in achieving the interim performance targets and completion criteria for each management year including the results of management and monitoring activities completed.

The offset area has been protected via a Voluntary Declaration under section 19E and 19F of the *Queensland Vegetation Management Act 1999* (including surplus areas identified in Table ES 1). The Voluntary Declaration will remain in place for the life of EPBC 2012/6615.

Table ES 1 – Summary of the Cobbadah offset area and acquittal for Stage 8 of EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Habitat within the Cobbadah offset area (ha)	Offset area (ha)		% acquittal of Stage 8[2]	Surplus area (ha)[3]
				Approved for Stage 5 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615		
Threatened ecological communities							
Brigalow TEC	E	0.51	74.6	72.2	-	-	2.4
SEVT TEC	E	0.50	486.3	-	1.0	18.01	485.3
Threatened fauna species							
Collared Delma (*Delma torquata*)	V	49.49	774.3	557.9	-	-	215.4
Dunmall's Snake (*Furina dunmalli*)	V	49.98	565.9	557.9	-	-	8.0
Yakka Skink (*Egernia rugosa*)	V	39.99	565.9	557.9	-	-	8.0
Koala (*Phascolarctos cinereus*)	E	36.56	491.3	485.7	-	-	5.6
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	50.48	1,052.2	557.9	-	-	493.3

[1] E = Endangered; V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties.
[3] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 5 of this OAMP to understand how areas are accounted for in each stage.

Table ES 2 – Interim performance targets and completion criteria for the Cobbadah offset area for Stage 8 of EPBC 2012/6615

MNES	Baseline habitat quality score	Interim performance target			Completion criteria
		Year 5	Year 10	Year 15	Year 20
Threatened ecological communities					
SEVT TEC	8 (8.0)	(8.2)	(8.4)	(8.6)	9

1. Introduction

The Santos Gladstone Liquefied Natural Gas (GLNG) Project involves the development of Coal Seam Gas (CSG) resources in the Surat and Bowen Basins in Queensland, to supply gas via a 430 kilometre (km) gas transmission pipeline (GTP) to the liquified natural gas (LNG) facility located on Curtis Island. Throughout the development of the Santos GLNG Project and in accordance with Santos GLNG Project approvals, potentially impacted environmental values are systematically identified and assessed and in order of preference are avoided, minimised or mitigated.

The Santos GLNG Project is required to provide environmental offsets for significant residual impacts on matters of national environmental significance (MNES) in accordance with approvals granted under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Cth; EPBC Act).

This offset area management plan (OAMP) has been prepared to address the acquittal of the MNES significant residual impacts for Stage 8 of the Gas Fields Development (GFD) Project under the GLNG Project approval EPBC 2012/6615 (herein referred to as the Stage 8 Project), outlined in Table 1, on the Cobbadah offset area (Figure 1).

Table 1 - Impacted MNES required to be offset for Stage 8 of the GFD Project under EPBC 2012/6615

MNES	Status under EPBC Act	Disturbance area (ha)
Threatened ecological communities		
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC)[1]	Endangered	0.51
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community (SEVT TEC)	Endangered	0.50
Threatened fauna species		
Collared Delma (*Delma torquata*)[1]	Vulnerable	49.49
Yakka Skink (*Egernia rugosa*)[1]	Vulnerable	39.99
Dunmall's Snake (*Furina dunmalli*)[1]	Vulnerable	49.98
Red Goshawk (*Erythrotriorchis radiatus*)[1]	Endangered	25.61
Black-breasted Button-quail (*Turnix melanogaster*)[1]	Vulnerable	0.50
Squatter Pigeon (southern) (*Geophaps scripta scripta*)[1]	Vulnerable	32.11
Northern Quoll (*Dasyurus hallucatus*)[1]	Endangered	26.11
Koala (*Phascolarctos cinereus*)[1]	Endangered	36.56
South-eastern Long-eared Bat (*Nyctophilus corbeni*)[1]	Vulnerable	50.48
Large-eared Pied Bat (*Chalinolobus dwyeri*)[1]	Endangered	32.61

[1] Offset requirements for these MNES are acquitted on other properties for Stage 8.

1.1. Purpose

This OAMP is written consistent with the *Environmental Management Plan* (EMP) *Guidelines* (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2024), and provides a detailed management and monitoring framework for the area identified on Cobbadah for environmental offsets (herein referred to as the offset area) in accordance with the requirements for Stage 8 of EPBC 2012/6615 as presented in Table 2 below. The following table (Table 3) details how this OAMP satisfies the requirements of a comprehensive EMP, and how the following information in this plan aligns with the EMP Guidelines set by DCCEEW (2024).

Table 2 - Approval conditions satisfied through this OAMP

Condition number	Condition	How the conditions are met
EPBC Act approval 2012/6615		
11	The approval holder must ensure that environmental offsets comply with the principles of the EPBC Act Environmental Offsets Policy.	Offsets to compensate for significant residual impacts associated with the Stage 8 Project will be delivered in accordance with the principles of the EPBC Act *Environmental Offsets Policy*. An offset area will be secured on Cobbadah and used to partially acquit offset obligations for the MNES matters outlined in Table 1. The Cobbadah offset area has been identified to comply with the requirements for an offset under the EPBC Act *Environmental Offsets Policy* as detailed in Section 2.8 of this OAMP.
12	The approval holder may carry out the action in project stages. The approval holder must deliver environmental offsets for residual significant impacts to matters of national environmental significance for each project stage.	The action will be carried out in stages. An offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with the Stage 8 Project.
13	The approval holder must submit an Offset Management Plan for the Minister's written approval. The Offset Management Plan may be prepared and submitted to the Minister for written approval in stages. If the approval holder submits the Offset Management Plan in stages, each version of the Offset Management Plan must address the known and predicted impacts of the completed, current, and next proposed project phases.	An offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with the Stage 8 Project. This OAMP for the Cobbadah offset area is submitted as part of the offset plan to address the Stage 5 Project. A reconciliation of impacts for Stages 1-7 of the GFD Project is included in the offset plan.
14	The Offset Management Plan must include: a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities; b. results from pre-disturbance surveys and/or an alternative approved methodology (if used) for the project phase as required under conditions 4 and 5; c. details of the offset areas required to address predicted residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities for the project phase; d. a survey and description of the current condition (prior to any management activities) of each offset area proposed, including existing vegetation (the baseline condition). This must include a shapefile of each offset property boundary; e. information about how the offset areas provide connectivity with other relevant habitats and biodiversity corridors, including a map depicting the offset areas in relation to other habitats and biodiversity corridors; f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary); g. a description of the management measures that will be implemented for the protection of EPBC threatened species, EPBC migratory species and EPBC communities, including a discussion of how measures outlined take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans; h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria; i. a description of potential risks to the successful implementation of the plan, and a description of the contingency measures that would be implemented to mitigate against these risks; j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and k. the proposed legal mechanism for securing the offset.	The Cobbadah offset area is proposed to be secured and used to partially acquit offset requirements for the Stage 8 Project. An OAMP for the Cobbadah offset area has been developed in accordance with the requirements outlined in condition 14. A summary of how each requirement has been addressed is provided below. a. The method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities is discussed in the offset plan, submitted in conjunction with this OAMP. b. Details of the relevant field assessments within the Stage 8 Project development area are provided in the offset plan, submitted in conjunction with this OAMP. c. A summary of the significant residual impacts associated with the Stage 8 Project is provided in Table 1 of this OAMP and the offset plan. A summary of the offset area required to acquit the Stage 8 Project offset requirements is provided in the offset plan, with a summary of the proposed offset area on Cobbadah and how it partially acquits the Stage 8 Project offset requirements provided in Section 2.6 of this OAMP. In accordance with the EPBC Act *Environmental Offsets Policy* the proposed offset areas required to be secured for the MNES were determined using the *Offsets assessment guide* (OAG) as described in Section 2.6. d. A summary of the ecological field surveys undertaken on the Cobbadah offset area is described in Section 2.4. Details of the baseline ecological condition are provided in Section 2.5 and Appendix B of this OAMP. e. Details on the connectivity and the landscape context are provided in Section 2.2. f. Individual completion criteria have been developed for the MNES as part of the environmental outcomes to be achieved for the Cobbadah offset area (Section 4). In addition, specific management objectives and performance criteria have been developed which will provide the basis for achieving the MNES completion criteria. The complete adaptive management process for this OAMP is encapsulated in Table 12 and includes management actions, monitoring events, adaptive management triggers and corrective actions that have been assigned to each management objective and performance criteria. g. Management measures to be implemented as part of this OAMP have been developed to address key threats known or with the potential to occur within the Cobbadah offset area identified as part of detailed field surveys and take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans. A summary of the known and potential threats and proposed management measures are detailed in Section 6.

Condition number	Condition	How the conditions are met
		h. The monitoring program to measure the effectiveness of the management measures and progress against the performance and completion criteria is detailed in Section 7. i. Risks to the successful implementation of this plan are included in the risk assessment presented in Appendix D. j. The timing for implementation of the management and monitoring program are provided in Section 9. k. Details on how the Cobbadah offset area has been legally secured are provided in Section 2.7 of this OAMP.
15	The currently approved Offset Management Plan must be implemented by the approval holder.	Once approved, this OAMP will be implemented.
16	The approval holder must register and legally secure offsets for the first project phase identified in the Offset Management Plan within two years of commencement of the first project phase.	Details on how the Cobbadah offset area has been legally secured are provided in Section 2.7.
17	The approval holder must register and legally secure offsets for a project phase which are sufficient to acquit the residual significant impacts of that project phase.	Details on how the Cobbadah offset area has been legally secured are provided in Section 2.7.
18	If the approval holder submits the Offset Management Plan in stages, the approval holder must prepare and submit an updated Offset Management Plan for each subsequent project phase, for written approval by the Minister. The updated Offset Management Plan must: a. include the information required for the Offset Management Plan at condition 14 for the next project phase; b. include a reconciliation of actual and predicted but yet to be actualised residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities against offsets secured for the commenced project phases. Secured offsets in excess of requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases may be subtracted from the obligations required for subsequent project phases. Any shortfall in secured offsets relative to the requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases must be added to the obligations required for the next project phase; and c. demonstrate how the offset builds on offsets already secured for previous project phases and will contribute to a larger strategic offset for cumulative project impacts.	An updated version of this OAMP will be submitted for any subsequent stages of the GFD project.
19	The approval holder must not commence the project phase until the Offset Management Plan, updated for that project phase has been approved by the Minister in writing.	This OAMP is submitted for the approval of the Minister. The Stage 8 Project will not commence until this OAMP for the project stage has been approved.

Table 3 - Alignment of OAMP with EMP Guidelines

Key content	Reference within OAMP	Reference to EMP Guidelines
Conditions of approval	Section 1, Table 2 details the approval conditions satisfied through this OAMP.	Section 3, page 8
Property information and baseline data	Section 2 describes the Cobbadah property, Sub-Section 2.4 lists the history of ecological surveys undertaken at the Cobbadah property, including baseline surveys, and Sub-Section 2.5 describes the ground-truthed environmental values of the property.	Section 3
Offset values	Section 3 describes and details the offset values of this OAMP, and Section 4 lists the associated environmental outcomes.	Section 3
Adaptive management framework and program	Section 5 describes the adaptive management framework to be applied through this OAMP, and Section 4, Table 9 details the interim performance targets. Section 6, Table 10 describes the management program.	Section 3, page 11-12
Management program entailing objectives, triggers, and actions	Section 6, Table 12 details the management objectives, performance targets, method of management actions, and measurable milestones of progression in terms of monitoring actions, monitoring timing and frequency, management triggers and corrective actions.	Section 3, page 11-12
A detailed monitoring program	Section 7 breaks down the monitoring program into six sub-sections, and details the program timing, frequency, methods.	Section 3, page 11-12

Key content	Reference within OAMP	Reference to EMP Guidelines
A detailed monitoring and implementation schedule	Section 9, Table 19 summaries the overall schedule of the monitoring program inclusive of timing, activity, location of activity, method and reliability of method.	Section 3, page 11-12
Risk assessment and management actions to avoid, mitigate and manage risks	Section 6, Table 12 identifies risks which have been identified as potentially impeding to the outcomes of environmental management objectives.	Section 4, pages 13-14
Risk matrix	Table D3 in Appendix D applies a risk matrix including residual risk rating following mitigation measures, management triggers and corrective actions.	Section 4, pages 13-14
Maintenance of monitoring records	Section 8 details the reporting obligations of this OAMP and how information will be stored for the lifetime of the approval.	Section 3, page 9

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148°30'0"E
149°0'0"E
25°0'0"S
25°30'0"S
26°0'0"S
26°30'0"S

Serocold State Forest
Carnarvon National Park
Nuga Nuga National Park
Mount Nicholson State Forest
Expedition National Park
Palmgrove National Park (scientific)
Presho State Forest
McLeay State Forest
Bandana State Forest
Forfar State Forest
Eden State Forest
Boxvale State Forest
Expedition (Limited Depth) National Park
Oakvale State Forest
Forrest State Forest
Howe State Forest
Belington Hut State Forest
Doonkuna State Forest
Beilba State Forest
Expedition Resources Reserve
Stephenton State Forest
Hallett State Forest
Moorabinda Nature Refuge
Mount Armour Nature Refuge
Waroonga State Forest
Taboonbay State Forest
Walhallow State Forest
Gubberamunda State Forest 3
Gubberamunda State Forest 2
Gubberamunda State Forest 1
Woodduck State Forest
Barabanbel State Forest 3
Barabanbel State Forest 1
Barabanbel State Forest 2

PL 451
PL 236
PL 440
PL 235
PL 450
PL 1062
PL 420
PL 1059
PL 1017
PPL 166
PL 421
PL 234
PL 233
PL 90
PL 91
PL 232
PL 92
PL 1012
PL 100
PL 99
PL 457
PL 1019
PL 322
PL 314
PL 1021
PL 1020
PL 315
PL 323
PL 313
PL 1123
PL 316
PL 317
PL 318

33WT347
35SP140818

Camarvon Highway
Warrego Highway
Raglan Street

SANTOS

Location diagram

Figure 1
Project context

- Cobbadah
- Santos PLs
- Santos Petroleum Pipeline Licences

Statewide Corridors
- Regional
- State

Protected areas
- National Park
- National Park (scientific)
- State Forest
- Resources Reserve
- Nature Refuge

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Statewide Corridors v1.6
- Protected areas
- Resource licenses
AUTHOR: J. Cousin

N

0 10 20 30
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 Scale: 1:52,500,000@A3

Queensland
Brisbane

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Cobbadah\Cobbadah_OAMP_mapping_20250416\Cobbadah_OAMP_mapping_20250416.aprx

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2. Cobbadah property

2.1. Property overview

Cobbadah (Lots 35 SP140818 and 33 WT347) is a 3,854 hectare (ha) freehold property located approximately 120 km north-west of the project and 30 km west of Injune (Figure 3). The property is located adjacent to the Great Dividing Range in the Brigalow Belt Bioregion (Southern Downs Subregion), approximately 40 km southeast of Oakvale State Forest and 25 km southwest of Doonkuna State Forest. The current primary land use on the property is cattle grazing.

The property is located entirely within the Dawson River Catchment, part of the Fitzroy River Basin, with all drainage channels on the property flowing into Hutton Creek which dissects the property, flowing from west to east. The topography is varied across the property, comprising early Tertiary Olivine basalt in upland areas capping Late Jurassic sandstone (Westbourne Formation and Springbok Sandstone) with lowland areas characterised by depositional alluvium. Elevation ranges between 460 metres (m) above sea level in the low-lying valleys, up to approximately 940 m in the south of the property. The high elevation in the south of the property is associated with Mount Hutton, which is located in the very southeast corner of Cobbadah.

Table 4 summarises Cobbadah landholder and property details.

Table 4 - Cobbadah landholder and property details

Landholder and Property Details	
Landholder Details	
Registered Owner/s on Title:	David John Chandler
ABN/ACN:	-
Postal Address:	1813 Ninderra Road, Hutton Creek, Queensland 4454
Primary contact person:	David and Puddy Chandler
Phone:	07 4626 1462
Email:	dagandpud2@bigpond.com
Property Description	
Lot on plan(s):	35 SP140818 and 33 WT347
Address:	“Cobbadah”, Injune, Queensland 4454
Tenure:	Freehold
Area:	3,854 ha
Primary Local Government Area:	Maranoa Regional Council
Permits	
Exploration permit	ATP2075, Denison Gas (Queensland) Pty Ltd. Expires 15/08/2030
Petroleum and gas production permit	PL45, Denison Gas (Queensland) Pty Ltd. Expires 25/08/2026

2.2. Connectivity

The Cobbadah property is mapped within a state conservation corridor (Figure 3). Conservation corridors have been mapped as part of the Queensland Government's Biodiversity Planning Assessments (BPA) which assess the biodiversity significance of land in a bioregion. The mapping of corridors within the Brigalow Belt Bioregion, in which the Cobbadah property is located, has focussed on those corridors that link adjacent bioregions or connect wildlife refugia.

Corridors identified as being of state significance are considered of the greatest importance at the bioregional scale. As illustrated in Figure 3, the state conservation corridor runs along the western side of Cobbadah that connects contiguous remnant vegetation to the south of Cobbadah (associated with Hutton Range) with state forest and Carnarvon National Park to the north.

2.3. Climate

The Cobbadah area is considered to have a humid subtropical climate (Cfa) in accordance with the Köppen-Geiger climate classification system (Beck et al. 2018). This climate is characterised by hot and humid summers, and cold to mild winters (Figure 2). Weather records from the Injune Post Office weather station (ID: 43015), approximately 23 km east of Cobbadah, show mean monthly rainfall for the period 1961 – 1990 ranges from 24.9 millimetres (mm) (September) to 94.6 mm (January), with a mean annual rainfall of 624.9 mm (BoM 2021). Mean monthly maximum temperatures range from 19.6 degrees Celsius (°C) and 33.7°C (July and January, respectively) and mean monthly minimum temperatures range from 3.0°C to 19.2°C (July and January, respectively) (BoM 2021).

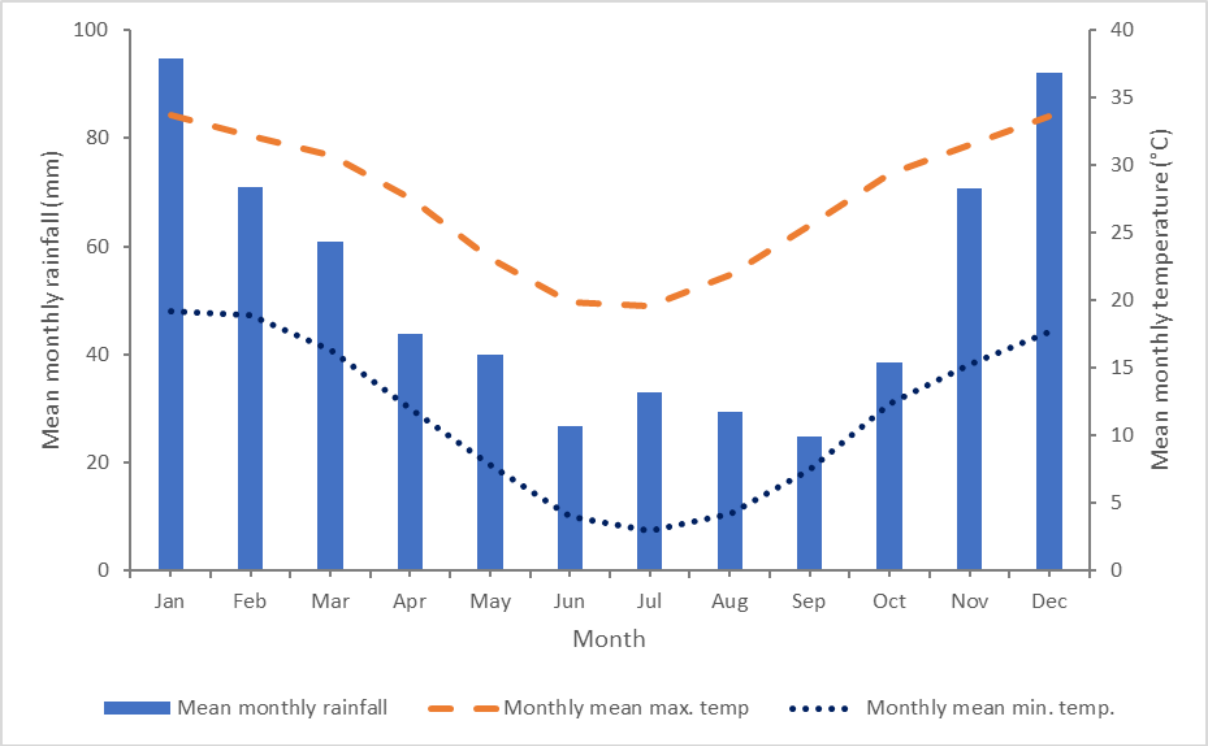

Figure 2 - Mean monthly temperature and rainfall records from Injune Post Office weather station (ID: 43015) 1961-1990 (BoM 2024)

148°18'0"E
148°19'0"E
148°20'0"E
148°21'0"E
148°22'0"E
148°23'0"E

25°45'0"S
25°46'0"S
25°47'0"S
25°48'0"S
25°49'0"S
25°50'0"S
25°51'0"S

33WT347
35SP140818
Hutton Creek (South Branch)

SANTOS

Figure 3
Property overview

Cobbadah
Cobbadah offset area

Watercourse
Creekline
Minor drainage line
Drainage contour

EPBC 2012/6615 offset area
Stage 5
Stage 8
Surplus offset areas

N

0 1 2
Kilometres

Location diagram
Queensland
Brisbane

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: J. Cousin

Date: 4/05/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:35,000@A3

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Cobbadah\Cobbadah_OAMP_mapping_20250416\Cobbadah_OAMP_mapping_20250416.aprx

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2.4. On ground property assessments

Within the Cobbadah property, Santos has identified a 1,427 ha area for environmental offsets (the offset area). A combination of desktop and detailed field assessments of the Cobbadah property have been undertaken over numerous years to assess the potential for offsets at Cobbadah. This includes a more recent assessment to confirm the suitability of the property to satisfy current and future project offset obligations. Desktop and field surveys of the Cobbadah property completed to date are summarised below:

- January 2017
  - Preliminary desktop assessment of regional ecosystem (RE) mapping and potential biodiversity offset values.
  - Preliminary site visit for initial vegetation ground-truthing undertaken generally in accordance with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (version 3.2; Neldner *et al*. 2012).
- May 2017
  - Detailed field ecological assessments including:
    - refinement of ground-truthing of RE mapping.
    - baseline habitat quality assessments in accordance with the *Guide to Determining Terrestrial Habitat Quality* (GTDTHQ) (version 1.2; Department of Environment and Heritage Protection [DEHP] 2017).
    - incidental observations of any significant fauna and/or fauna habitat features, including habitat for potential threatened species.
- August 2020
  - Additional detailed field ecological assessments:
    - ground-truthing of RE mapping in additional areas on Cobbadah generally in accordance with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (version 5.1; Neldner *et al*. 2020).
    - baseline habitat quality assessments in accordance with GTDTHQ (version 1.2; DEHP 2017).

2.5. Ground-truthed vegetation and habitat mapping

2.5.1. Vegetation description

Vegetation on Cobbadah varies from cleared paddocks dominated by pasture grasses (e.g. Buffel Grass [*Cenchrus ciliaris*]) in lowland areas subject to chemical and mechanical suppression of regrowth vegetation, to relatively intact remnant vegetation associated with ridge lines in the south, east and north, which have only been lightly impacted by cattle grazing. The structure of retained patches of lowland woodland remains relatively intact, even in the presence of intermittent cattle grazing (Figure 4). Table 5 and Figure 6 summarise the area of remnant and regrowth ground-truthed REs in the offset area.

While the large area of Poplar Box and Ironbark woodland in the centre of the site is grazed, it retains much of the remnant vegetation structure, with a mix of pasture and native grasses throughout. Areas of steep terrain (including areas of Brigalow and vine thicket) are less impacted by grazing, although there is evidence of weed encroachment from adjacent grazed paddocks and remnant vegetation. Poplar Box woodland on alluvial plains (RE 11.3.2) fringes Hutton Creek and associated ephemeral draining lines in the centre of Cobbadah (Figure 5).

Figure 4 - Lowland Poplar Box woodland on Cobbadah consistent with RE 11.9.7

Figure 5 - Poplar Box woodland on alluvial plains (RE 11.3.2) fringing a waterway in the centre of Cobbadah

Table 5 - Ground-truthed REs mapped within the Cobbadah offset area

RE	Description	Cobbadah offset area (ha)			
		Total area	EPBC 2012/6615 Stage 5 approved offset area	EPBC 2012/6615 Stage 8 proposed offset area	Surplus[1]
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	174.0	174.0	0	0
11.8.3	Semi-evergreen vine thicket on Cainozoic igneous rocks	208.4	0	1.0	208.4
11.8.5	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	169.9	101.3	0	68.6
11.9.2	*Eucalyptus melanophloia* +/- *E. orgadophila* woodland on fine-grained sedimentary rocks	110.7	107.3	0	3.4
11.9.4	Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks	168.6	0	0	168.6
11.9.4 regrowth		109.3	0	0	109.3
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	74.6	72.2	0	2.4
11.9.7	*Eucalyptus populnea*, *Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	105.2	103	0	2.2
11.9.11	*Acacia harpophylla* shrubland on fine-grained sedimentary rocks	87.9	0	0	87.9
Non-remnant		218.3	-	-	218.3
Total		**1,427.0**	**557.9**	**1.0**	**868.1**

[1] Of the 868.1 ha surplus area, 68.6 ha of RE 11.8.5, 87.9 ha of RE 11.9.11 and 218.3 ha of non-remnant vegetation does not contribute to MNES habitat on account of it being either inaccessible (RE 11.8.5) or not compliant with MNES habitat (RE 1.9.11 and non-remnant vegetation), leaving 493.3 ha as surplus MNES habitat.

148°18'0"E 148°19'0"E 148°20'0"E 148°21'0"E 148°22'0"E 148°23'0"E

25°45'0"S 25°46'0"S 25°47'0"S 25°48'0"S 25°49'0"S 25°50'0"S 25°51'0"S

Hutton Creek (South Branch)

SANTOS

Location diagram

Figure 6
Ground-truthed vegetation

- Cobbadah
- Cobbadah offset area
- Property access track
- Fence

Watercourse

- Creekline
- Minor drainage line
- Drainage contour

Ground-truthed RE

- 11.3.2
- 11.8.3
- 11.8.5
- 11.8.5 (>800m)
- 11.9.2
- 11.9.4
- 11.9.4 regrowth
- 11.9.5
- 11.9.7
- 11.9.11

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:35,000@A3

DATA SOURCE:
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- Cadastral data
- Watercourses
AUTHOR: J. Cousin

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Cobbadah\Cobbadah_OAMP_mapping_20250416\Cobbadah_OAMP_mapping_20250416.aprx

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2.5.2. Habitat description

Following the results of detailed field assessments, known habitat requirements for targeted species were assessed against on-ground microhabitat observations within each habitat type to categorise suitable habitat.

Table 6 provides a summary of the extent of predicted suitable habitat mapped on the Cobbadah offset area for relevant MNES based on the results of detailed field assessments. Additional information on the offset area for each MNES is provided in Section 3.

Table 6 - Extent of predicted suitable habitat on the Cobbadah offset area for MNES

MNES	Habitat description	Associated REs	Area (ha)
Threatened ecological communities			
Brigalow TEC	Open forest to woodland where *Acacia harpophylla* is the dominant or co-dominant species.	11.9.5	74.6
SEVT TEC	Dry seasonal subtropical rainforest with emergent Bottle Trees and thickets.	11.8.3, 11.9.4, 11.9.4 (regrowth),	486.3
Threatened fauna species			
Collared Delma (*Delma torquata*)	Eucalypt woodlands and open-forests with appropriate surface rocks and large woody debris.	11.3.2, 11.8.3, 11.8.5, 11.9.2, 11.9.5, 11.9.7	774.3
Dunmall's Snake (*Furina dunmalli*)	Eucalypt and Brigalow woodland containing suitable large fallen woody debris.	11.3.2, 11.8.5, 11.9.2, 11.9.5, 11.9.7	565.9
Yakka Skink (*Egernia rugosa*)	Woodland and open forest containing soils suitable for burrowing or containing large woody debris.	11.3.2, 11.8.5, 11.9.2, 11.9.5, 11.9.7	565.9
Koala (Phascolarctos cinereus)	Eucalypt woodlands containing appropriate Koala food trees.	11.3.2, 11.8.5, 11.9.2, 11.9.7	491.3
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	Forest and woodland with a distinct tree canopy.	11.3.2, 11.8.3, 11.8.5, 11.9.2, 11.9.4, 11.9.4 (regrowth), 11.9.5, 11.9.7	1,052.2

2.6. Offset area

The total offset area to be secured on the Cobbadah property is 1,427.0 ha, representing approximately 37% of the 3,852.8 ha property. The offset area includes:

- 557.9 ha to partially acquit the offset obligation for the Stage 5 Project under conditions 11 to 19 of EPBC Approval 2012/6615.
- 1.0 ha to partially acquit the offset obligation for the Stage 8 Project under conditions 11 to 19 of EPBC Approval 2012/6615.
- 493.3 ha of remaining surplus offset value comprising habitat for MNES and will be used by Santos to acquit future project offset requirements.
- 374.7 ha that does not currently contribute to MNES habitat, comprising the following:
  - 68.6 ha of RE 11.8.5 at the top of Mount Hutton, considered inaccessible.
  - 87.9 ha of RE 11.9.11 not currently considered compliant with any MNES.
  - 218.3 ha of non-remnant vegetation not currently considered compliant with any MNES.

Table 7 provides a summary of the Cobbadah offset area, including the area allocated to partially acquit the MNES offset requirements for the Stage 8 Project under EPBC 2012/6615 and area of surplus offset values available which will be used by Santos to acquit future project offset requirements.

The results of the detailed field assessments including the ground-truthed RE mapping and fauna habitat associations are discussed in Section 2.5 and were used to inform the suitability to acquit the MNES offset requirements. The minimum offset area required to be secured for the MNES was determined in accordance with the EPBC Act OAG, presented as part of *Santos GLNG Offset Plan and Acquittal Summary: EPBC Act Approval 2012/6615, Stage 8* (Santos 2025).

A baseline habitat quality score for each MNES offset value was determined generally in accordance with the GTDTHQ (version 1.2; DEHP 2017) and outlined in Appendix A based on the results of the detailed field assessments (Section 2.4). The baseline habitat quality score was used to calculate the minimum area required to be secured in the Cobbadah offset area for each MNES for the Stage 8 Project. The habitat quality score will be used as a measure to assess the success of the OAMP through the interim performance targets and completion criteria outlined in Section 4. A detailed summary of the baseline habitat quality scores for each MNES used in the OAGs is provided in Appendix B.

Table 7 - Summary of the Cobbadah offset area and acquittal for Stage 8 of EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Habitat within the Cobbadah offset area (ha)	Offset area (ha)		% acquittal of Stage 8[2]	Surplus area (ha)[3]
				Approved for Stage 5 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615		
Threatened ecological communities							
Brigalow TEC	E	0.51	74.6	72.2	-	-	2.4
SEVT TEC	E	0.50	486.3	-	1.0	18.01	485.3
Threatened fauna species							
Collared Delma (*Delma torquata*)	V	49.49	774.3	557.9	-	-	215.4
Dunmall's Snake (*Furina dunmalli*)	V	49.98	565.9	557.9	-	-	8.0
Yakka Skink (*Egernia rugosa*)	V	39.99	565.9	557.9	-	-	8.0
Koala (*Phascolarctos cinereus*)	E	36.56	491.3	485.7	-	-	5.6
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	50.48	1,052.2	557.9	-	-	493.3

[1] E = Endangered; V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties.
[3] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 5 of this OAMP to understand how areas are accounted for in each stage.

2.7. Offset protection

The offset area has been protected via a Voluntary Declaration under section 19E and 19F of the VM Act and declared as an area of high nature conservation value. The Voluntary Declaration will be registered on the property title and will be binding on current and future landowners.

A Voluntary Declaration under the VM Act is an authorised legally binding mechanism and is considered appropriate to legally secure MNES values and protect the area from vegetation clearing. The offset area is mapped as a Category A area on the Property Map of Assessable Vegetation (PMAV). A Category A area on a PMAV is described as an “Area subject to compliance notices, offsets and voluntary declarations”.

The Voluntary Declaration will remain in place for the life of EPBC 2012/6615. The Voluntary Declaration may only be removed in accordance with the provisions of the VM Act or if the chief executive the Queensland Department of Natural Resources, Mines and Energy considers it necessary.

Offset area coordinates for the declared area for the Voluntary Declaration are given in Appendix C.

2.8. EPBC Act Environmental Offset Policy

Table 8 outlines how the Stage 8 GFD Project offset obligations acquit on the Cobbadah offset area meet the requirements of the EPBC Act *Environmental Offsets Policy*.

Table 8 - Assessment against Principles of the Offset Policy

Principle	How the principle is met in this offset proposal
1. deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The Cobbadah offset area partially acquits MNES offset requirements for the Stage 8 Project under EPBC 2012/6615 as outlined in Table 7. The remaining will be acquitted on another property. The Cobbadah offset area will be managed and monitored to improve the quality of Brigalow TEC and viability of habitat for threatened fauna species. This will include the management of regrowth vegetation to become self-sustaining functional remnant vegetation communities. This OAMP sets out specific management objectives with interim performance targets and completion criteria. Management actions are outlined with accompanying adaptive management triggers and corrective actions in the event that monitoring identifies that interim performance targets are not attained or completion criteria are not attained and/or maintained. The offset area will be managed and monitored from approval of this OAMP for a minimum of 20 years. It is anticipated that the completion criteria will be achieved within a 20-year period.
2. be built around direct offsets but may include other compensatory measures	MNES offset obligations for the Stage 8 Project under EPBC 2012/6615 will be acquit through the delivery of direct land-based offsets on the Cobbadah offset area and additional land-based offset areas to be secured by Santos.
3. be in proportion to the level of statutory protection that applies to the protected matter	The threatened status of the impacted protected matters is considered in the OAG in calculating the area of the offset to be provided.

Principle	How the principle is met in this offset proposal
4. be of a size and scale proportionate to the residual impacts on the protected matter	The size of the area to be secured for offset obligations has been calculated in accordance with the OAG .
5. effectively account for and manage the risks of the offset not succeeding	This OAMP has been developed in consideration of known and identified threats to the offset values to manage the risk of failing to achieve the completion criteria and overall environmental outcomes for the offset area. Threats to the offset site are managed through the implementation of the management measures discussed in Section 6, including: • Fire prevention and management • Weed monitoring and control • Clearing protection • Management of grazing, and • Restricted access. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans etc.) and identification of potential site-specific risks based on the results of field surveys and discussions with the landholder. The results of the risk assessment, presented in Appendix D, have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions. If the offset cannot attain and maintain the completion criteria, then additional offsets will be provided to compensate for the impact and the failed offset (see Section 5.2.4).
6. be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	The environmental outcomes proposed to be achieved through the implementation of this OAMP are based on additional management and monitoring measures conducted as part of business as usual on the Cobbadah property. For example, under the *Biosecurity Act 2014* (Qld) a person has a general biosecurity obligation to: take all reasonable and practical steps to prevent or minimise each biosecurity risk. The steps proposed in this OAMP are above reasonable and practical steps required to control feral animals and weeds in central Queensland. Now that the Voluntary Declaration has been secured over the offset area, environmental laws prevent other land uses inconsistent with this OAMP being approved over this part of the property.
7. be efficient, effective, timely, transparent, scientifically robust and reasonable	The Cobbadah offset area has been identified to be suitable using an evidence based and scientifically robust approach. The environmental outcomes to be achieved through this OAMP will be delivered progressively over 20 years. The offset area has been legally secured through a Voluntary Declaration under the VM Act, therefore any vegetation clearing contravention of this OAMP is not permissible without specific Queensland government approval.

Principle	How the principle is met in this offset proposal
	The preparation and implementation of this OAMP supports the efficient, effective, timely, transparent and scientifically robust approach to providing offsets.
8. have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	This OAMP includes a detailed monitoring program which will assess the effectiveness of the management actions undertaken and the progress of the offset area in achieving the environmental outcomes. The results of all management and monitoring programs will be included in annual reports (Section 8.1). An implementation schedule for monitoring and management is provided in Section 9 which will be reviewed at least annually to ensure the timely implementation of this OAMP.

3. Offset Values

The following sections provide a description of the offset area and potential threats that will be managed as part of this OAMP for each MNES offset value. Figure 8 and Figure 9 present the MNES habitat areas in the Cobbadah offset area.

3.1. Brigalow TEC

Remnant Brigalow TEC is located in two discrete patches in the southern section of Cobbadah (Figure 9). These patches are largely characterised by remnant *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks (RE 11.9.5; Figure 7).

Figure 7 - Brigalow vegetation on Cobbadah consistent with RE 11.9.5 (Brigalow TEC)

While the property is currently used for livestock grazing, most areas of remnant Brigalow TEC show low or moderate evidence of impact from livestock grazing. There is evidence of widespread weeds and exotic pasture grasses in the vicinity of the offset area, especially *Cenchrus ciliaris*, with scattered populations of Parthenium (*Parthenium hysterophorus*) and Prickly Pear (*Opuntia spp.*).

3.2. SEVT TEC

Habitat in the offset area for SEVT TEC comprises areas of RE 11.8.3, 11.9.4, and 11.9.4 (regrowth) present in the south and north of the offset area (Figure 9).

SEVT TEC is generally restricted to hilly slopes and valley sides within the southern and northern parts of the Cobbadah offset area. These areas support suitable shrub/low tree layers and a thick leaf litter layer characterising this community. Areas in the south associated with RE 11.8.3 are characterised by often dense stands on exposed basalt boulders grading to sparsely vegetated scree slopes in the very south. In the north of the offset area, SEVT TEC offset habitat is represented by dense, diverse semi-evergreen vine thicket stands on fine-grained sandstone associated with RE 11.9.4. This includes areas of regrowth RE 11.9.4; which while dominated in places by an understorey of Buffel (*Cenchrus ciliaris*), shows ongoing recovery of the semi-

evergreen vine thicket including areas of regenerating native White Cedar (*Melia azedarach*) with diverse native understorey recruitment.

3.3. Collared Delma

Habitat for the Collared Delma within the offset area comprises areas of RE 11.3.2, 11.8.3, 11.8.5, 11.9.2, 11.9.5 and 11.9.7 (Figure 8).

The Collared Delma is known to occur in REs on land zones 3, 8, 9 and 10 (Boobook 2020; DCCEEW 2025b). The species occupies a range of eucalypt woodlands and open forests; and requires rocks, timber bark and other large woody debris for shelter (Wilson 2015; DCCEEW 2025b).

3.4. Dunmall's Snake

Habitat for Dunmall's Snake within the offset area comprises areas of RE 11.3.2, 11.8.5, 11.9.2, 11.9.5 and 11.9.7 (Figure 8).

The Dunmall's Snake occurs in a variety of habitats including forests and woodlands (including those dominated by Brigalow, Bull Oak and other *Acacia, Eucalyptus* and *Callitris* species) on clay loam, cracking clay soils and sandstone derived soil (DCCEEW 2025d). Rare observations have been made on the edge of dry vine scrub and in hard ironstone country (DCCEEW 2025d).

3.5. Yakka Skink

Habitat for the Yakka Skink within the offset area comprises areas of RE 11.3.2, 11.8.5, 11.9.2, 11.9.5 and 11.9.7 (Figure 8).

The Yakka Skink is known to occur in open dry sclerophyll forest, woodland and scrub and a within a wide variety of vegetation types within land zones 3, 4, 5, 7, 8, 9 and 10 (Boobook 2020; DCCEEW 2025c). The species is commonly found under partly buried rocks, logs, root cavities or in abandoned animal burrows (DCCEEW 2025c).

3.6. Koala

Habitat for the Koala within the offset area comprises areas of RE 11.3.2, 11.8.5, 11.9.2 and 11.9.7 (Figure 8).

Koala habitat can be broadly defined as any forest or woodland containing known Koala food trees, which are naturally abundant on fertile clay soils (DCCEEW 2025f). Koalas predominantly feed on *Eucalyptus* spp.; however, they are also known to consume other Myrtaceae species (DCCEEW 2025f). Koalas are also only considered to occupy such habitat at altitudes below 800 m above sea level (DCCEEW 2025f).

There are anecdotal records of Koala within the offset area, with the landowner having previously spotted the species along Hutton Creek in RE 11.3.2 habitat.

3.7. South-eastern Long-eared Bat

Habitat in the offset area for South-eastern Long-eared Bat comprises areas of RE 11.3.2, 11.8.3, 11.8.5, 11.9.2, 11.9.4, 11.9.4 (regrowth), 11.9.5 and 11.9.7 (Figure 8).

The species is known to occur in a variety of dry forest habitats including those dominated by River Red Gum, open woodland, mallee, Brigalow and other arid and semi-arid habitats, although the preferred habitat is mallee and *Callitris* woodlands (Pennay *et al*. 2011), and habitats that have a distinct canopy with a dense, cluttered understorey (Turbill and Ellis 2006). The species roosts in tree hollows, crevices or under loose bark (DCCEEW 2025e). Surveys suggest the species requires large tracts of forest to occur (Turbill *et al*. 2008).

South-eastern long-eared bat

Collared delma

Koala and squatter pigeon

Yakka skink and Dunmall's snake

Hutton Creek (South Branch)

SANTOS

Location diagram

Figure 8
MNES habitat 1

Cobbadah
Cobbadah offset area
MNES offset habitat

Watercourse
Creekline
Minor drainage line
Drainage contour

Threatened species records
Koala

CO2 AUSTRALIA

Queensland
Brisbane

0 1 2 3
Kilometres

Date: 8/05/2025 Coordinate System: GDA 1994 MGA Zone 55 Scale: 1:52,500,000@A3

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Brigalow TEC

SEVT TEC

Bertya opponens

Ooline

Hutton Creek (South Branch)

SANTOS

Location diagram

Figure 9
MNES habitat 2

Cobbadah
Cobbadah offset area
MNES offset habitat

Watercourse
Creekline
Minor drainage line
Drainage contour

Queensland
Brisbane

0 1 2 3
Kilometres

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4. Environmental Outcomes to be Achieved

The outcome of this OAMP will partially acquit the Stage 8 Project offset obligations under EPBC Approval 2012/6615 in accordance with the EPBC Act *Environmental Offset Policy*.

The specific environmental outcomes to be achieved for the offset on Cobbadah are defined as interim performance targets and completion criteria, detailed in Table 9, based on the proposed habitat quality score to be achieved for each MNES in the OAGs for Stage 8 under EPBC 2016/6615.

Appendix E provides a summary of the all the interim performance targets and completion criteria for the Cobbadah offset area.

Table 9 - Interim performance targets and completion criteria for the Cobbadah offset area

MNES	Baseline habitat quality score	Interim performance target		Completion criteria	
		Year 5	Year 10	Year 15	Year 20
Threatened ecological communities					
SEVT TEC	8 (8.0)	(8.2)	(8.4)	(8.6)	9

5. Approach to Management

5.1. Adaptive management

This OAMP is based on an adaptive management approach which involves 'flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood' (National Research Council 2004).

Adaptive management includes two key phases:

- establishment of the key components of a management framework including engaging stakeholders, developing clear and measurable objectives and performance criteria, identification and selection of potential management actions and the development of monitoring protocols which enable the evaluation of progress towards achieving objectives, and which will effectively contribute to the adaptive management decision making process
- an iterative learning phase which involves utilisation of the management framework to learn about the natural resource system and iteratively adapt management strategies and approaches based on what is learned (Williams 2011).

The management of natural systems involves uncertainty which can affect the success of the management measures in achieving the objectives and performance criteria. Williams (2011) and Williams and Brown (2016) identify four kinds of uncertainty, outlined as follows, with how they have been addressed through the development of this OAMP:

- environmental variation:
  - caused by external factors that act upon natural systems, but which are not influenced by the resource conditions and dynamics, for example variation in rainfall or temperature
  - largely outside of the control of the manager (Williams 2011)
  - influence is considered in the analysis of the effectiveness of the adaptive management approach, the analysis of the ability to achieve and maintain performance criteria and when considering the need for corrective actions.
- partial observability:
  - includes potential uncertainty arising from variation in the collection of data during monitoring events, and from being unable to completely observe the natural system in its entirety (Williams and Brown 2016)
  - addressed in this OAMP through the development of a monitoring program based on scientifically tested and repeatable methods.
- partial controllability:
  - relates to the difference between the intended effect of the management measures to be implemented through this OAMP and the actual effect of their implementation on the ground (Williams and Brown 2016)
  - address through adherence to an adaptive management approach including regular monitoring of conformance with performance criteria, assessment of adaptive management triggers, the implementation of corrective actions, review and amendments to the OAMP, and reporting to ensure that management measures are being effectively implemented on the ground.
- structural and process uncertainty:
  - concerns a lack of knowledge or understanding regarding biological and ecological processes and relationships, and differing views regarding how natural systems respond to management (Williams and Brown 2016)
  - addressed through the adaptive management approach. Following the results of ongoing management, monitoring and reporting, the OAMP will be reviewed and updated as required to incorporate learnings, updated conservation advice and best practice management techniques.

5.2. OAMP adaptive management framework

5.2.1. Risk assessment

The adaptive management process for this OAMP is supported by a risk assessment through which the known and potential risks for each offset value have been evaluated. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans etc) and identification of potential site-specific risks. As presented in Appendix D, the risk assessment included an assessment of the likelihood and consequence for each identified risk, both with and without the implementation of control strategies. The results of the risk assessment have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions.

Implementation of the adaptive management process aims to reduce the risk of the identified threats occurring to ensure that the overall outcome sought by this OAMP are achieved.

5.2.2. Adaptive management process

The adaptive management process for this OAMP includes the following key components:

- **identified threats to offset values** – known and potential threats to the offset values have been identified as part of the risk assessment process
- **relevant offset values** – MNES or other offset matter for which the identified threat is relevant have been indicated
- **management objectives** – management objectives have been developed to address each identified threat to the offset values, and to ensure that the interim performance targets and completion criteria are attained
- **performance criteria** – assessable criteria have been defined to measure adherence to the management objectives
- **management actio**n – specific management actions have been identified to ensure that the performance criteria and management objectives are satisfied, and which will ultimately result in attainment of the interim performance targets and completion criteria
- **monitoring** – a combination of qualitative and quantitative methodologies has been included to assess whether management actions are meeting the performance criteria and management objectives, and ultimately, whether the OAMP is supporting the delivery of the interim performance targets and completion criteria
- **adaptive management trigger** – measurable events or parameters have been identified which, when triggered, indicate that a performance criterion has not been satisfied, instigating the implementation of contingency plans and corrective actions
- **corrective actions** – a two-step process has been established to identify the likely cause of the non-compliance with the performance criteria and allow for identification of suitable corrective actions. Corrective actions include the implementation of a feasible, appropriate and effective action to address the identified issue and ensure the performance criteria is satisfied.

Figure 10 illustrates the ongoing adaptive management cycle of implementation, learning and review, with the aim of achieving the interim performance targets and completion criteria.

5.2.3. Timing for implementation of the OAMP

The offset area will be managed and monitored until the interim performance targets and completion criteria are achieved. It is anticipated that through the adaptive management approach, interim performance targets and completion criteria will be achieved within the proposed 20-year management period. However, if the interim performance targets and/or completion criteria for offset values have not been achieved within the anticipated timeframes, management and monitoring will continue beyond the 20-year management period in accordance

with this OAMP until the completion criteria have been achieved. Once attained, completion criteria will be maintained for at least the life of the EPBC Act approval relevant to this OAMP.

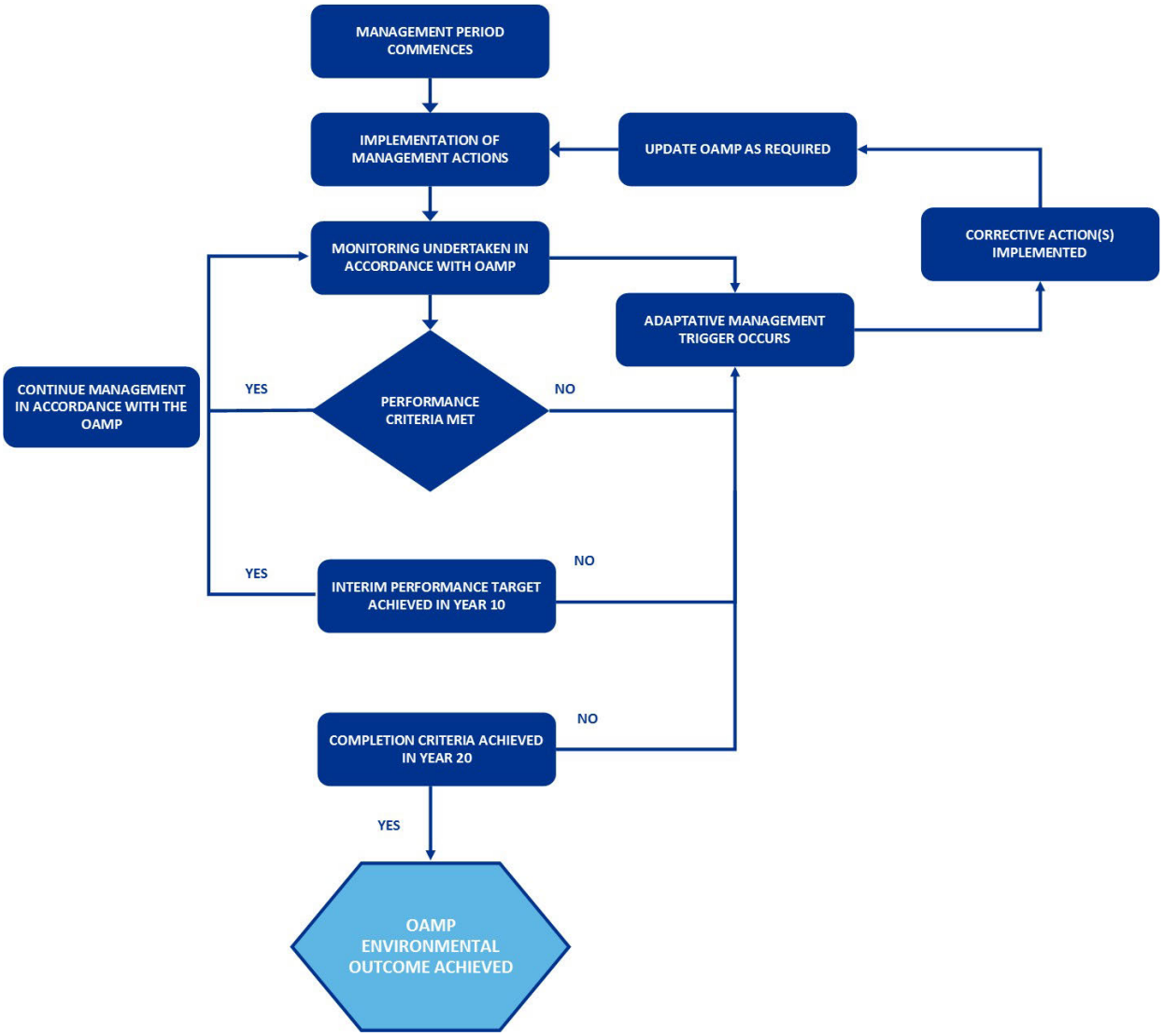

Figure 10 - Process for implementation of the OAMP

5.2.4. Risk of offset failure

Based on the adaptive approach to management and the proposed management and monitoring program, it is considered that the management objectives, interim performance targets and completion criteria will be successfully achieved.

In the unlikely event that the interim performance targets are not achieved for one or more offset values by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions.

It should be noted that unavoidable temporary perturbations such as severe drought, or insect/fungal pest invasion that may cause a temporary decrease in metrics such as canopy or shrub cover from which the community still may recover within the next 5-year period should not preclude assessment of a satisfactory increase in ecological condition by the completion date.

If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements. The revised OAMP will be submitted to the Commonwealth Government.

6. Management Program

6.1. Management objectives

A summary of the management objectives and performance criteria for the offset area is presented in Table 10 and the complete adaptive management process for this OAMP is encapsulated in Table 12. The management measures provided in Table 11 take into account the information in the relevant conservation advices, recovery plans and threat abatement plans for each MNES. Management actions, monitoring events, adaptive management triggers and corrective actions have been assigned to each management objective and performance criteria.

Table 10 - Summary of the management objectives and performance criteria

Management objectives	Performance criteria
Achieve the completion criteria and habitat quality improvements for offset values, which include the habitat quality scores in this OAMP.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events to achieve the scores in the completion criteria
Maintain the extent of offset value habitat within the offset area.	No unapproved/intentional clearing of habitat within the offset area, except for clearing that is required for fencing, access, firebreaks and public safety as outlined in Table 13.
Ensure that the livestock grazing restrictions outlined in Section 6.2.4 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events. Biomass levels of 2,500 kg/ha are retained at each of the monitoring sites at the end of the dry season. Livestock are only observed to be grazing in the offset area during strategic grazing event/s
Minimise predation risk by wild dogs to threatened fauna species.	Reduction in Catling* Index for wild dogs from year 1 and subsequent monitoring events.
Minimise predation risk by foxes to threatened fauna species.	Reduction in Catling* Index for foxes from year 1 and subsequent monitoring events.
Minimise predation risk by feral cats to threatened fauna species.	Reduction in Catling* Index for feral cats from year 1 and subsequent monitoring events.
Minimise degradation of offset value habitat by feral pigs.	Reduction in mean feral pig abundance score from year 1 and subsequent monitoring events.
Minimise degradation of offset value habitat by rabbits.	Maintain rabbit impact category as ‘acceptable’.
Manage invasive weed species to reduce degradation of offset value habitat.	A decrease in species richness and relative abundance of weed species at 80% of monitoring sites from year 1 and subsequent monitoring events.

Management objectives	Performance criteria
	No new weed species are identified at any monitoring site (based on year 1 and subsequent monitoring data).
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	No unplanned fire within the offset area. Increase in habitat quality scores as a result of implementation of any fire management measures.
Achieve the interim performance targets and completion criteria for each offset value within 5, 10, 15 and 20 years, respectively.	The interim performance targets are achieved for all offset values by years 5, 10 and 15. The completion criteria are achieved for all offset values by year 20.

* Catling index provides a measure of relative abundance of wild dogs, foxes and feral cats within the offset area. The Catling index will be measured as the percentage of camera nights in which the pest species was observed as part of fauna camera monitoring for the species, as outlined in Section 7.6.

Table 11 - Recovery actions for each MNES and their associated threats

MNES	Threats	Recovery/management actions
Threatened ecological communities		
Brigalow TEC	Threats to the TEC have been determined based on conservation advice and the Threat Abatement Plan (DCCEEW 2025a): • Clearing of regrowth vegetation. • Inappropriate fire regimes and management. • Pest plant infestation. • Potential knowledge gaps. • Increased grazing by livestock.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025a): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.4). • Strategic grazing for fuel load management (see Section 6.2.4). • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.6 and 7.6).
SEVT TEC	Threats to the TEC have been determined based on conservation advice and the Threat Abatement Plan (DCCEEW 2025g): • Clearing of regrowth vegetation. • Inappropriate fire regimes • Invasion by introduced pasture species. • Increased grazing by livestock. • Disturbance by pest animals.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025g): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.4). • Strategic grazing for fuel load management (see Section 6.2.4). • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.6 and 7.6).
Threatened fauna species		
Collared Delma (*Delma torquata)*	Threats to the species have been determined based on conservation advice (DCCEEW 2025b): • Alteration of ground cover as a consequence of unsuitable fire regime. • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Predation by feral predators (e.g., cats, foxes, wild dogs).	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025b): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.4). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2).

MNES	Threats	Recovery/management actions
	• Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.	• Pest animal management and monitoring (see Sections 6.2.6 and 7.6). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.5).
Dunmall's snake (*Furina dunmalli)*	Threats to the species have been determined based on conservation advice (DCCEEW 2025d): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Predation by feral predators (e.g., cats, foxes, pigs). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025d): • Pest animal management and monitoring (see Sections 6.2.6 and 7.6). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.5). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.4).
Yakka Skink (*Egernia rugosa*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025c): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Destruction of potential shelter habitat associated with rabbit warren ripping. • Predation by feral predators (e.g., cats, foxes, pigs). • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Destruction of potential shelter habitat associated with rabbit warren ripping.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025c): • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.6 and 7.6). • Weed management and monitoring (see Sections 6.2.5 and 7.5). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.4). • Biomass monitoring (see Section 7.2).

MNES	Threats	Recovery/management actions
	• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	
Koala (*Phascolarctos cinereus*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025f): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Mortality due to vehicle collision. • Predation by feral predators, particularly wild or domesticated dogs. • Alteration of the structure of suitable habitat, including loss of primary feed trees, as well as direct mortality as a consequence of unsuitable fire regime. • Evidence for the presence of disease within the population (i.e., *Chlamydia pecorum*).	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025f): • Exclusion of cattle from the offset area (see Section 6.2.3). • Restricting unauthorised entry into the offset area and managing access tracks and movement of vehicles within the offset area (see Sections 6.2.1 and 6.2.2). • Pest animal management and monitoring (see Sections 6.2.6 and 7.6). • Weed management and monitoring (see Sections 6.2.5 and 7.5). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.4). • Biomass monitoring (see Section 7.2).
South-eastern long-eared bat (*Nyctophilus corbeni*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025e): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Alteration of the structure of suitable habitat (e.g. mix of shrubby and open structure habitat) including loss of hollow-bearing trees as a consequence of unsuitable fire regime. • Impacts on understorey habitat as a consequence of livestock grazing, impacting habitat for understorey invertebrate prey. • Competition for hollows from native fauna species (e.g., parrots and cockatoos) and non-native fauna species (e.g., European honeybees, common myna), especially where hollows are limited.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025e): • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.6 and 7.6). • Weed management and monitoring (see Sections 6.2.5 and 7.5). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.4). • Biomass monitoring (see Section 7.2).

Table 12 - Management objectives, performance criteria, adaptive management triggers and corrective actions

Identified threats to offset values	Management objective	Performance criteria	Management action	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Degradation of habitat	Achieve the completion criteria and habitat quality improvements for offset values, which include the habitat quality scores in this OAMP.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events so as to achieve the scores in the completion criteria.	Implementation of the management actions and adaptive management framework as outlined in this OAMP.	Monitoring of offset value habitat quality scores and condition of habitat will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Rapid monitoring events (Section 7.7.1). • Habitat quality assessments to determine habitat quality scores (Section 7.7.2). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8.1).	Interim performance targets are not achieved for one or more offset values by year 5 or 10. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime to better support enhancement of offset values. • For offset values that have not achieved interim performance targets by year 5 or 10 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions. If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements. The revised OAMP will be submitted to the Commonwealth Government.

Identified threats to offset values	Management objective	Performance criteria	Management action	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Habitat loss through vegetation clearing	Maintain the extent of offset value habitat within the offset area.	No unapproved and/or intentional clearing of habitat within the offset area, with the exception of clearing that is required for fencing, access, firebreaks and public safety as outlined in Table 13.	Protection of the offset area via a Voluntary Declaration under section 19E and 19F of the VMA, as described in Section 2.7.	Reporting to the Commonwealth Government consistent with EPBC approval.	Any activities in contravention of the Voluntary Declaration and this OAMP.	**Step 1: Investigate cause of trigger** • Investigate reasons why unapproved clearing occurred e.g. unauthorised access. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Additional fencing, signage and/or security for the offset area. • Restoration of the impacted area.
			Comply with the restrictions outlined in Table 13. Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in accordance with Sections 6.2.2, 6.2.3 and 6.2.4. In the event that vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be planned, recorded and monitored.	Compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks will also be assessed as part of offset area inspections (Section 7.1).	Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with the restrictions outlined in Sections 6.2.2, 6.2.3 and 6.2.4.	**Step 1: Investigate cause of trigger** • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately. • Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.

Identified threats to offset values	Management objective	Performance criteria	Management action	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Degradation of habitat by livestock overgrazing	Ensure that the livestock grazing restrictions outlined in Section 6.2.4 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events.	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses and promote the establishment of native perennial grass species in accordance with Section 6.2.4.	Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.7.1 and 7.7.2. These will include assessment of % cover of native perennial grasses and incidental flora surveys.	Decrease in the richness and average % cover of native perennial grasses at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime. • Installing additional watering points for livestock to manage livestock in accordance with the grazing regime.
		Biomass levels of 2,500 kg/ha are retained at each of the monitoring sites at the end of the dry season.	Implementation of a strategic grazing regime to protect and maintain environmental values in accordance with Section 6.2.4.	Biomass monitoring will be undertaken in accordance with Section 7.2.	Biomass monitoring results indicate less than 2,500 kg/ha of biomass is present at any of the monitoring sites at the end of the dry season.	**Step 1: Investigate cause of trigger** • Investigate the reason for biomass being less than 2,500 kg/ha. • Re-evaluate the strategic grazing regime to assess the suitability of grazing to ensure no less than an average of 2,500 kg/ha of biomass is retained at the end of the dry season. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Removal of stock or spelling grazing from the area of the offset in which less than 2,500 kg/ha of biomass was identified.

Identified threats to offset values	Management objective	Performance criteria	Management action	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
						• Review adherence to livestock grazing restrictions in Section 6.2.4. • Where relevant, amending livestock management practices in the OAMP, including amending stocking rates, and/or duration and/or frequency of strategic grazing events.
		Livestock are only observed to be grazing in the offset area during strategic grazing event/s.	Existing fencing is maintained at all times as outlined in Section 6.2.3.	Offset area inspections to be undertaken at least annually (Section 7.1) and will include monitoring to assess the: • condition of fencing to identify any necessary maintenance requirements. • presence of livestock within the offset area.	Livestock are observed within the offset area when not permitted within that area. Damaged fencing is observed.	**Step 1: Investigate cause of trigger** • If livestock are identified in the offset area, remove stock immediately. • Inspect and evaluate fencing and identify the cause of livestock within the offset area. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Repairing fencing where required to ensure its condition is satisfactory to exclude livestock. • Constructing additional fencing should the current fencing be considered insufficient to exclude livestock.
Predation by wild dogs	Minimise predation risk by wild dogs to threatened fauna species.	Reduction in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	Implement control actions for wild dogs in accordance with Section 6.2.6.	Undertake monitoring for wild dogs in accordance with Section 7.6.	An increase in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in the: • Catling* index for wild dogs, feral cats and/or foxes. • relative abundance of feral pigs and horses. • Review adherence to pest management control measures as outlined in Section 6.2.6. • Identify appropriate corrective actions.
Predation by foxes	Minimise predation risk by foxes to threatened fauna species.	Reduction in Catling* Index for foxes from year 1 and subsequent monitoring events.	Implement control actions for foxes in accordance with Section 6.2.6.	Undertake monitoring for foxes in accordance with Section 7.6.	An increase in Catling* Index for foxes from year 1 and subsequent monitoring events.	
Predation by feral cats	Minimise predation risk by feral cats to threatened fauna species.	Reduction in Catling* Index for feral cats from year 1 and subsequent monitoring events.	Implement control actions for feral cats in accordance with Section 6.2.6.	Undertake monitoring for feral cats in accordance with Section 7.6.	An increase in Catling* Index for feral cats from year 1 and subsequent monitoring events.	
Degradation of habitat by feral pigs	Minimise degradation of offset value habitat by feral pigs.	Reduction in mean feral pig abundance score from year 1 and subsequent monitoring events.	Implement control actions for feral pigs in accordance with Section 6.2.6.	Undertake monitoring for feral pigs in accordance with Section 7.6.	An increase in mean feral pig abundance score from year 1 and subsequent monitoring events.	

Identified threats to offset values	Management objective	Performance criteria	Management action	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
Degradation of habitat by rabbits	Minimise degradation of offset value habitat by rabbits.	Maintain rabbit impact category as 'acceptable'.	Implement control actions for rabbits in accordance with Section 6.2.6.	Undertake monitoring for rabbits in accordance with Section 7.6.	Rabbit impact category measured as 'monitor closely', or 'unacceptable'.	**Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Increasing the frequency and intensity of pest animal control. • Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the OAMP and targeted pest animal control programs.
Invasion of habitat by weed species, including exotic grasses	Manage invasive weed species to reduce degradation of offset value habitat.	A decrease in species richness and relative abundance of weed species at 80% of monitoring sites from year 1 and subsequent monitoring events. No new weed species are identified at any monitoring site (based on year 1 and subsequent monitoring data).	Implement weed control actions in accordance with Section 6.2.5. Adhere to weed hygiene restrictions in accordance with Section 6.2.1.	Undertake weed monitoring in accordance with Section 7.4.	An increase in species richness and relative abundance of weed species at more than 20% of monitoring sites from year 1 and subsequent monitoring events. A new weed species is identified at one or more monitoring sites.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds. • Investigate potential sources or reasons for the occurrence of the new weed species. • Review adherence to weed management control measures as outlined in Section 6.2.5. • Review adherence to weed hygiene restrictions as outlined in Section 6.2.1. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Amending weed hygiene restrictions. • Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to.

Identified threats to offset values	Management objective	Performance criteria	Management action	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
						• Revising weed control methods in accordance with the Biosecurity Act 2014 (Qld). • Increasing the frequency and intensity of weed control. • Updating weed control methods in the OAMP and targeted weed control programs.
Inappropriate fire regimes	Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	No unplanned fire within the offset area. Increase in habitat quality scores as a result of implementation of any fire management measures.	All fire management measures to be implemented in accordance with the program outlined in Section 6.2.4.	Habitat quality assessments to determine habitat quality scores will be undertaken in accordance with Section 7.7.2. Rapid monitoring events will be undertaken to assess the general condition of vegetation in accordance with Section 7.7.1. Fuel load monitoring in accordance with Section 7.4.	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores. • Review adherence to the fire management measures as outlined in Section 6.2.4. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass and fuel load monitoring. • Increasing the frequency of weed control measures. • Amending the strategic grazing regime. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks. • Review timing and intensity of fuel hazard reduction burns in accordance with the Regional Ecosystem Description Database (REDD) fire management guidelines and conservation advice for the particular offset value.
Offset fails to achieve the interim performance targets and completion criteria within the anticipated 5, 10, 15-	Achieve the interim performance targets and completion criteria for each offset value within 5, 10, 15 and 20 years, respectively.	The interim performance targets are achieved for all offset values by years 5, 10 and 15.	All management actions outlined in Section 6 will be implemented to ensure that the interim performance targets	Monitoring of the offset area will be undertaken in accordance with Section 7 including: Offset area inspections (Section 7.1).	Interim performance targets are not achieved for one or more offset values by years 5, 10 or 15.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not

Identified threats to offset values	Management objective	Performance criteria	Management action	Monitoring	Trigger for adaptive management and corrective actions	Corrective actions
and 20-year timeframes, respectively.		The completion criteria are achieved for all offset values by year 20.	and completion criteria are achieved.	Offset value assessments (Section 7.7). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	Completion criteria are not achieved for one or more offset values by year 20.	achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values.

6.2. Management actions

6.2.1. General restrictions

Table 13 details the restrictions to be implemented for the offset area to ensure the completion criteria and management objectives are met.

Table 13 - Offset area restrictions

Restrictions	Details
Weed hygiene	• Weed hygiene measures will be implemented to prevent the movement of weed material into the offset area. • All persons entering the property and offset area will be required to ensure vehicles and equipment are weed free. • All contractors entering the property and offset area must hold a current weed hygiene certificate or equivalent for all vehicles and equipment. • Evidence is to be provided on request to the landowner and Santos environmental advisors that vehicles, slashers or any machinery implementing management actions are clean prior to entry to minimise potential weed spread.
Vehicles	• Vehicle movement will be limited to designated access tracks in the offset area and access will be restricted to authorised personnel only. • Vehicles will travel to track conditions to minimise the risk of vehicle strike to fauna.
Vegetation clearing	• Clearing will be excluded from the offset area through demarcation and protection by means of Voluntary Declaration under the VM Act. Clearing for timber gathering and development will also be excluded. • Clearing of native vegetation will not be permitted within the offset area as part of any management and monitoring activities associated with this OAMP, except for clearing that is required for: – maintenance of access tracks and/or fire breaks – fence construction and maintenance, and – ensuring public safety or as directed by emergency management response personnel in the event of unplanned fire or other emergency or associated procedure. • If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be appropriately planned, recorded and monitored. • Machinery will not be allowed on site after heavy or prolonged rainfall events until after the site has dried to allow for safe movement of traffic.
Unauthorised access or use	• Access into the offset area will be restricted to authorised personnel only. • Signs will be installed in prominent locations (i.e. at access points into the offset area) which recognise that the areas are protected for conservation purposes. The signs will advise that access into the offset area is restricted to authorised personnel only. • Property fencing will be maintained to restrict access by unauthorised persons. • At no time can persons access the site without first approaching the Santos Land Advisor of the Cobbadah property and informing them of their intent. • When entering and leaving the property, the Santos Land Advisor must be advised.

Restrictions	Details
	• Contractors will only be permitted to access the property following the direct engagement by Santos.

6.2.2. Access tracks

Existing access tracks will be utilised to facilitate necessary management, maintenance and monitoring activities as part of this OAMP. If existing access tracks become impassable (through erosion or vegetation regrowth), maintenance activities of these tracks (e.g. grading) will be prioritised over alternative track alignments.

Existing and new access tracks will be no wider than 5 m and vegetation disturbance will be minimised.

Low-lying areas and gully crossings are likely to be subject to periodic, ongoing maintenance and restriction of strategic grazing events should occur because of erosion following rain events. Some access tracks are steep and easily erodible, and will require ongoing maintenance, such as grading.

The property owners of Cobbadah will maintain access rights to the offset area and the access tracks within it.

6.2.3. Fencing

Current fencing on Cobbadah is in relatively good order and will be used to manage strategic grazing and access to the offset area. Existing fencing bounds the majority of the offset area as illustrated in Figure 11. The steep and rugged parts of the offset area are bordered by the Great Dividing Range (elevations upwards of 850 m above sea level) which provides a natural boundary between Cobbadah and adjoining properties and will not be fenced.

Where installation of additional fencing is required, it will be constructed to be fit for purpose and fauna friendly. Any vegetation disturbance associated with new fence construction will be minimised in accordance with Table 13.

Regular inspections of all fencing will be undertaken in accordance with Section 7.1, and repairs to the fences will be made as required.

6.2.4. Fire management

A planned and co-ordinated fire management strategy will be implemented to:

- minimise the risk and impacts of unplanned fire, especially to fire sensitive Brigalow TEC but also to other areas on Cobbadah (e.g. SEVT TEC) as well as adjoining land.
- improve habitat quality through:
  - controlling weeds and biomass levels
  - supporting development of structural components of habitat for offset values (e.g. recruitment of native plants, establishment of fire sensitive native herbs and groundcover, important microhabitat including fallen logs and leaf litter, and increased understorey), and
  - promoting germination and recruitment of eucalypt species and other species characteristic of the specific RE.

Unplanned fire risk will be managed through:

- establishment and regular maintenance of firebreaks
- monitoring and managing fuel loads primarily through the implementation of a strategic grazing regime, and
- fuel hazard reduction burns (if required).

Firebreaks are currently established along fence lines across the Cobbadah property, and narrower fire management access tracks are currently established on rugged steep slopes. Firebreaks will be maintained at least annually in mid / late autumn and, or early spring. Firebreak maintenance will be undertaken with a blade and/or shallow cultivation and/or slashing (green break) to a width of up to 10 m.

148°18'0"E 148°19'0"E 148°20'0"E 148°21'0"E 148°22'0"E 148°23'0"E

25°45'0"S 25°46'0"S 25°47'0"S 25°48'0"S 25°49'0"S 25°50'0"S 25°51'0"S

Hutton Creek (South Branch)

SANTOS

Location diagram

Figure 11
Infrastructure

Cobbadah
Cobbadah offset area
Cobbadah homestead

Infrastructure
Property access track
Fence
Watering point

Watercourse
Creekline
Minor drainage line
Drainage contour

CO2 AUSTRALIA

N

0 1 2
Kilometres

Queensland
Brisbane

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: J. Cousin

Date: 7/05/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:35,000@A3

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Cobbadah\Cobbadah_OAMP_mapping_20250416\Cobbadah_OAMP_mapping_20250416.aprx

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A comprehensive monitoring program will be undertaken as part of fire management activities to assess fuel loads (Section 7.4) and biomass levels (Section 7.2) to determine the risk of unplanned fire to the offset area and inform fire management strategies including strategic grazing and fuel hazard reduction burns.

Fire management within the Cobbadah property but outside of the offset area will remain the responsibility of the owner of Cobbadah.

Strategic grazing

Strategic grazing within the offset area will be used to manage fuel loads and control exotic weeds and pasture grasses such as *Cenchrus ciliaris*. As increasing grazing intensity is correlated with an increase in weedy cover (Franks 2002), and a decrease in native grass species richness, grazing will be permitted in the offset area on a managed and limited basis to control weeds and reduce fuel loads.

Best practice management for strategic livestock grazing within the offset area will be undertaken as follows:

- livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover, and
- within the offset area a minimum of 2,500 kg/ha of biomass will be retained at the end of the dry season.

The suitability of conditions for undertaking a grazing event will be informed by biomass monitoring events as described in Section 7.2. Following a wet season spell and prior to a strategic grazing event, a feed budgeting assessment will be undertaken. The feed budgeting assessment will determine the stocking rate based on the amount of feed available within pasture areas and the amount of feed desired in these areas at the end of the grazing event.

Further details of the method for undertaking biomass monitoring are provided in Section 7.2.

Fuel hazard reduction burns

The aim of fuel hazard reduction burns is to manage excess fuel loads, to initiate regeneration of eucalypt communities and to create habitat with a mosaic of different fire frequencies and times since fire.

Fire management, through fuel hazard reductions burns will be guided by conservation advice documentation (e.g. for MNES) and the REDD (Queensland Herbarium 2019), which provides recommendations for fire management for each of the component RE (Table 14), guidelines published in the Fire and Biodiversity Monitoring Manual published by the South East Queensland Fire and Biodiversity Consortium (SEQFBC) (SEQFBC 2002), local regional fire plans, regional fire authorities and local knowledge of fire behaviour.

Based on this advice, fire is to be excluded from areas of Brigalow TEC in the offset area. To reduce the risk of fire occurring within Brigalow TEC in the offset area, very cool fuel hazard reduction burns (trickle burns) in a rotational mosaic pattern may be conducted in adjacent areas, particularly in RE 11.8.5.

Hazard reduction burns will be considered if fuel hazard ratings within the offset area are unable to be maintained below extreme in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix E) through the implementation of strategic grazing and weed control. However, the location and timing for fuel hazard reduction burns will be informed by the results of biomass monitoring (Section 7.2) and fuel load monitoring (Section 7.4) in conjunction with the results of habitat quality assessments and considering the REDD fire management guidelines (Queensland Herbarium 2014) for the vegetation community and MNES conservation advices.

In general, where applicable, fire management will be undertaken in a mosaic pattern at the appropriate time of year when:

- soil and fuel moisture levels are high, ideally following minimum of 40 mm of rainfall
- ambient temperature and wind speed are low
- atmospheric humidity is high
- the risk of long-term impacts/high intensity fire is low, and/or
- when plants approach a more active growing phase.

Table 14 - Fire management guidelines for each RE in the Cobbadah offset area

RE	Associated MNES	Fire exclusion?	Fire management
11.9.5	Brigalow TEC Collared Delma Dunmall's Snake Yakka Skink Koala South-eastern Long-eared Bat	Yes	Protection from fire is necessary. High intensity fires will cause damage to overstorey. Maintain fire management of surrounding country so that any fires will be very limited in extent. Frequent fire at the edge of this community keeps fuel loads low. The invasion of exotic grasses such as *Cenchrus ciliaris* increases the risk from fire. Grazing may be an option for reducing fuel loads in Brigalow TEC.
11.8.3 11.9.4 11.9.4 (regrowth)	SEVT TEC Collared Delma South-eastern Long-eared Bat	Yes	Protection from fire is necessary. High intensity fires will likely cause irreparable damage. Maintain fire management of surrounding country so that any fires will be very limited in extent. Frequent fire at the edge of this community keeps fuel loads low.
11.3.2 11.8.5 11.9.2 11.9.7	Collared Delma Dunmall's Snake Yakka Skink Koala South-eastern Long-eared Bat	No	Undertake low to moderate intensity controlled burns every six to ten years. Burn under conditions of good soil moisture and when plants are actively growing, generally in the late wet to early dry season or early storm season or after good spring rains. Maintaining a fire mosaic will help ensure protection of habitat and mitigate against wildfires. As such restrict controlled burns to less than 30% of the community in any one year.

6.2.5. Weed management

Offset area weed management will minimise the introduction, establishment and spread of restricted and prohibited pest plants under the *Biosecurity Act 2014* (Qld) and other invasive species that present a threat to vegetation communities and species habitat in the offset area. Weed management within the offset area will focus on reducing the extent of the following existing weeds as well as minimising the risk of introduction of additional weed species to the offset areas:

- *Cenchrus ciliaris*
- *Parthenium hysterophorus* and
- *Opuntia* spp.

Field surveys completed to date confirmed evidence of widespread weeds and exotic pasture grasses, especially *Cenchrus ciliaris* within areas of remnant eucalypt woodland, with scattered populations of *Parthenium hysterophorus* and *Opuntia spp*. throughout the offset area.

Reductions in the extent of *Cenchrus ciliaris* and *Parthenium hysterophorus* are most effectively achieved by maximising the competitive advantage of native ground cover species. This requires native species richness and abundance to be maximised. In historically grazed environments the most effective way to ensure high species richness is through conservatively managed cattle grazing (Fensham 1998); to maintain enough biomass to maximise grass growth and appropriate spelling to allow for native species to set seed.

Accordingly, a strategic grazing regime will be implemented to reduce the presence and biomass of exotic pasture grasses in the offset areas (refer to Section 6.2.4). To supplement this, weeds will be managed using biological, chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets, for the relevant weed species.

A weed survey has been conducted in year 1 of the implementation of this OAMP to calculate the species richness and abundance of restricted, prohibited and other weed species, including exotic pasture grasses, at each monitoring site in accordance with Section 7.5. The results of the year one surveys inform the species-specific weed control measures, timing and location for ongoing weed management.

Species-specific control measures and timing for control activities will be reviewed based on the results of ongoing weed monitoring in the offset area.

Weed declaration certificates will completed for all offset monitoring and maintenance vehicles prior to entering the Cobbadah property.

6.2.6. Pest animal management

The following pest animals are present or have the potential to occur on or within the immediate vicinity of the Cobbadah property and pose the following threats:

- Predation of native fauna by foxes, cats and wild dogs.
- Erosion and degradation of habitat and competition by pigs and rabbits.

Pest animal control activities will be undertaken to minimise the introduction of pest animals and control existing pest animal populations in accordance with the *Biosecurity Act 2014* (Qld). Table 15 provides examples of approved species-specific pest animal control measures recommended by the Queensland and Commonwealth governments.

Results of pest animal monitoring (Section 7.6) will be reviewed following each management year to inform the need for, location and timing of species-specific control measures in subsequent years.

Table 15 - Examples of species-specific control methods for pest animal species

Species	Status under *Biosecurity Act 2014* (Qld)	Example control method	Reference
Wild dog (*Canis familiaris*)	Category 3,4,6	• Ground baiting • Shooting	DAF 2023a
Fox (*Vulpes vulpes*)	Category 3,4,5,6	• Ground baiting • Trapping • Shooting	DAF 2023b
Feral cat (*Felis catus*)	Category 3,4,6	• Night shooting • Poisoning • Trapping	DAF 2023c
Pig (*Sus scrofa*)	Category 3,4,6	• Trapping • Shooting • Poisoning	DAF 2023d
Rabbit (*Oryctolagus cuniculus*)	Category 3,4,5,6	• Baiting • Fumigation	DAF 2023e

Species	Status under *Biosecurity Act 2014* (Qld)	Example control method	Reference
		• Trapping • Shooting	

7. Monitoring

The results of the monitoring program outlined in the following sections will be used to inform operational management decisions, including adaptive implementation of this OAMP to ensure the performance criteria and management objectives, and ultimately interim performance targets and completion criteria are met.

The monitoring results will also be used to assess adherence to performance criteria, and to determine when corrective actions are required to be implemented. The results will also be compared to those from previous monitoring events to assess change over time and to inform the ongoing implementation of the OAMP.

7.1. Offset area inspections

The aim of offset area inspections is to enable a general assessment of the offset area to identify any potential issues that may require remedial action to be undertaken. Inspections will be undertaken twice per year for the duration of the management period to assess the following:

- condition of fencing, gates and signs
- condition of access tracks
- condition of firebreaks
- compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks
- incidence of erosion within offset area, particularly around permanent and semi-permanent water bodies or areas subject to inundation or waterlogging
- damage/degradation resulting from pest animal activity within the offset area
- signs of land degradation and over-grazing
- presence of weed/invasive species
- exclusion of livestock, and
- incidental fauna observations and any additional risks to offset values (i.e. evidence of vehicle strike).

7.2. Biomass monitoring

Biomass monitoring for fire management will be undertaken twice a year, at the end of the wet season and end of the dry season, to:

- determine the risk of fire to the offset site, and
- inform fire management strategies to control fuel loads.

Biomass is at its greatest at the end of the wet season (April) with fire risk greatest towards the end of the dry season (October). Biomass will be monitored within the offset areas using appropriate photo standards which will be used to determine dry matter yields and subsequently fuel loads. Biomass monitoring will be undertaken at the same permanent weed monitoring sites established as part of the year 1 surveying.

Biomass levels will be managed through strategic grazing events (see Section 6.2.4) if the biomass assessment at the end of the wet season shows that biomass is greater than 2,500 kg/ha.

The stocking rate of these strategic grazing events will be determined through a feed budgeting assessment (see Section 7.3) undertaken prior to a grazing event in the offset area. A feed budgeting assessment is a recognised method of determining the stocking rate based on the amount of feed available and the amount of feed desired at the end of the grazing event (i.e. >2,500 kg/ha).

7.3. Feed budgeting assessment

The process for undertaking a feed budget assessment will include the following sequence of activities:

- determine the current amount of feed present (kg/ha) using appropriate photo standards available on the Future Beef website[1].
- determine the amount of feed desired (kg/ha) at the end of the grazing event.
- calculate the total useable feed (kg/ha) by subtracting the feed desired from the feed present.
- determine utilisation (i.e. the proportion of useable feed that livestock can use).
- determine the feed available for the grazing animal (kg/ha) by multiplying the total useable feed by the utilisation rate.
- calculate the safe stocking rate by:
  - determining the feed consumption per day (kg/day)
  - determining the number of days feed is required (days)
  - calculating the feed requirement per head (kg/hd) by multiplying the feed consumption per day by the number of days
  - calculating the stocking rate (ha/hd) by dividing the feed requirement per head by feed available, and
  - calculate the number of stock (head) by dividing the area of the paddock by the stocking rate.

The amount of feed available prior to the grazing event will be estimated using the appropriate photo standards available on the Future Beef website. The “Dry Season Feed Budget” worksheet will then be used to calculate the required stocking rate for the grazing event.

At the completion of the grazing event, photo standards will be used to assess ground cover and ecosystem biomass. Should the grazing event be required to be extended (e.g. as a result of additional rainfall and resultant grass growth and potential weed flowering), the feed budget assessment will be recalculated using the “Dry Season Feed Budget” worksheet.

7.4. Fuel load monitoring

Fuel load monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix E). Fuel load assessment monitoring included a baseline survey in year 1 (post wet season), with ongoing fuel load assessment monitoring conducted every year at the same time and location as biomass monitoring post wet season. Monitoring will focus on assessing the key structural layers of the fine fuels that burn in bushfires, specifically bark, elevated fuels, near-surface fuels and surface fuels. This will allow for a rapid assessment of each fuel layer, which in in turn is given a hazard rating and are then combined to provide an overall fuel hazard rating of low, moderate, high, very high or extreme.

The fuel hazard rating will be monitored to compare any changes from previous assessments. In conjunction with results of habitat quality assessments, the results of the fuel load assessments will be used to determine if fuel hazard reduction burns are required within the offset area. Weed management and strategic grazing within the offset area will also be undertaken to maintain a fuel hazard rating below extreme.

7.5. Weed monitoring

Weed monitoring sites will be randomly stratified, fixed monitoring sites representative of offset values and incorporating natural variability such as aspect (e.g. a mix of north-, east-, south- and west-facing monitoring sites), community type – (e.g. woodland, riparian). There will also be fixed monitoring sites at strategic trafficable

[1] See https://futurebeef.com.au/knowledge-centre/pasture-photo-standards/.

areas (e.g. entry gates, creek crossings, stock watering points) to monitor potential introduction and/or irruptions of prohibited and restricted weed species.

The offset area will be monitored for weeds every two years (post wet season), to determine the species richness and abundance, for the duration of the management period. The results of this monitoring will inform the methods for weed treatment and control (see Section 6.2.5).

Non-native plant cover is also assessed as part of the habitat quality assessments detailed in Section 7.7.2, and the presence of weed species will also be recorded as part of the general offset area inspections (see Section 7.1), where noted.

7.6. Pest animal monitoring

The offset area will be monitored for evidence of pest animals every two years (post wet season), including a baseline survey in year 1 of the distribution and abundance of pest animals.

Based on the results of year 1 surveys, pest animal monitoring sites were established in year 1. Monitoring of pest animals will target areas of known impacts/movements (e.g. along topographic features, including creeks, pads, paths, ridge-tops and roads) to not only maximise the success of encountering pest animals, but target monitoring in environments that are more regularly impacted (e.g. drainage lines, moist gullies and around swamps and lagoons favoured by feral pigs; Hone 1995). The location of pest animal monitoring sites will be assessed prior to each monitoring event.

Pest animal monitoring will also be undertaken in association with and immediately prior to the pest animal control activities (Section 6.2.6). Initial monitoring results will determine the degree of effort required to control the pest population and post control monitoring will determine the degree of success of control operations.

Monitoring of pest animals will involve the deployment of motion sensing infra-red cameras as well as other techniques such as sand plots as appropriate to determine pest animal species present in the offset area and indicative population numbers.

Methods for determining the presence and relative abundance for foxes, wild dogs, feral cats, rabbits, and feral pigs are presented in Table 16. Evidence of pest animals, including feral horses, will be documented during the offset area inspections (see Section 7.1)

Table 16 - Pest animal monitoring methodology

Pest animal	Methodology to be implemented
Fox	To assess the relative abundance of foxes and feral cats within the offset area, camera monitoring will be undertaken as follows to provide a measure of the Catling index for each species. The Catling index will be measured as the percentage of camera nights in which the pest species was observed. An increase or decrease in the Catling index value between subsequent monitoring events will represent an increase or a decrease in the relative abundance of pest species and a measure of the success of pest animal control. • fauna monitoring cameras will be placed in the offset area • cameras will be placed along tracks and left in place for a minimum of three consecutive nights • an analysis of the camera footage will be undertaken to determine the percentage of camera nights with animal captures for each species observed. This percentage represents the Catling index (Mitchell and Balogh 2007b, c).
Wild dog	
Feral cat	

Pest animal	Methodology to be implemented
Feral pig	An assessment of the presence or absence of feral pig signs as a measure of the relative abundance of feral pigs within the offset area in accordance with Mitchell and Balogh (2007a) and Hone (1988), will be undertaken as follows: • nominate randomly stratified sites across the offset area in environments that are more regularly impacted (e.g. drainage lines, moist gullies, around swamps etc) • calculate an abundance score for each transect as the percentage of 'present' feral pig signs • calculate the mean abundance score (and variance) across all transects in the offset area. The average frequency of occurrence across the offset area will be used as an index of abundance and compared between subsequent monitoring events to assess the effectiveness of feral pig control. Furthermore, changes to scores for individual sites/transects can point to areas to target control activities. [a] Feral pig signs can include rooting, wallows, dung, footprints, travel pads, plant damage and tree rubs, as well as the physical presence of feral pigs
Rabbit	An assessment of rabbit impact in accordance with Cooke *et al*. (2008) will be undertaken as follows. Randomly stratified, permanent monitoring points assessing: • Rabbit abundance • Seedling abundance • Rabbit damage From this assessment, a 'corrected regeneration score' is calculated from the seedling abundance and rabbit damage score. This measure corrects for seedling regeneration as a function of observed rabbit damage and is subsequently used to calculate overall rabbit impact with the rabbit abundance score (refer to Cooke *et al*. [2008]). Overall rabbit impact is assigned as one of three categories – 'acceptable', 'monitor closely' or 'unacceptable', as determined from a combination of the score for rabbit abundance and the corrected regeneration score.

7.7. Offset value assessments

7.7.1. Rapid monitoring event

Rapid monitoring events will be carried out each year where there is not full monitoring of habitat quality (Section 7.7.2).

These will be aligned with the offset area inspections (see Section 7.1) and carried out by suitably qualified ecologists during spring and early summer (September – mid December).

During each rapid monitoring field assessment, the following will be conducted:

- Incidental fauna surveys will be conducted throughout the rapid monitoring events including early morning and late evening bird surveys and fauna surveys throughout the day.
- Photos will be taken at designated and fixed photo monitoring points as outlined in Section 7.7.3. The locations of the fixed photo monitoring locations will be the same as the habitat quality monitoring locations shown in Figure 12.

7.7.2. Habitat quality assessment

Vegetation condition and habitat quality for each MNES will be assessed in accordance with the GTDTHQ (version 1.2; DEHP 2017) and the methods outlined in Appendix A. In order to be consistent with the requirements under the EPBC Act guideline for the OAG the species habitat index component of the habitat quality score will be calculated based on the results of the targeted fauna surveys detailed in Section 7.7.4.

Habitat quality assessments were originally completed in May 2017 and August 2020 at 24 of the 30 monitoring locations presented in Figure 12. As part of year 1 monitoring activities in 2022 and prior to the finalisation of the offset area, habitat quality site assessments were completed at 19 monitoring points in a subset of the offset area (Figure 12) and marked with a capped stake and a GPS location recorded. As part of subsequent monitoring events, the 11 remaining monitoring sites throughout the balance of the offset area will be assessed, including five sites initially assessed between 2017 and 2020, and six sites to be established (refer to Figure 12).

The results of habitat quality assessments for subsequent years will include summary data from previous reporting years, presented to allow trend analysis of each of the measured attributes and assess progress towards achieving the interim performance targets and completion criteria.

7.7.3. Photo monitoring

Photo monitoring is a qualitative analysis technique that provides the opportunity for visual time series analysis of changes in vegetation composition, structure and integrity. In areas where active management is being undertaken, photo monitoring offers a simple and effective visual means by which to capture the response of the vegetation to management actions. Photo monitoring will be conducted at all habitat quality monitoring locations presented in Figure 12, in accordance with Appendix 4 of *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Assessment Manual* (version 2.2; Eyre *et al*. 2015).

Photo monitoring will be undertaken as part of habitat quality assessments (Section 7.7.2) and rapid monitoring events (Section 7.7.1).

7.7.4. Targeted fauna surveys

Targeted fauna surveys will be conducted to assess the distribution and richness of the fauna offset values within the offset area. The targeted fauna survey methods focus on the MNES species that are unlikely to be detected effectively during the rapid assessment surveys due to cryptic behaviour or localised habitat requirements. Targeted surveys will be undertaken generally in accordance with recommended survey guidelines from the Queensland and Commonwealth governments and/or other reputable published guidelines. Table 17 provides a summary if the proposed methodology, search effort and timing for targeted surveys. It is important to note that the proposed survey methodology will be reviewed prior to each survey event and if considered necessary will be modified to ensure they are based on the ecology, habitat requirements and behavioural aspects of the species of interest.

Targeted fauna surveys were carried out in conjunction with habitat quality assessments in year 1 and will be undertaken every two years for the first six years, and then every three years thereafter.

Table 17 - Fauna species survey methods

Technique	Regime	Target and method
Funnel trap	Six at each of five trap sites over four consecutive nights, checked early morning and afternoon.	Placed in pairs either side along a 30 m drift-fence. Targeting Dunmall's Snake and Collared Delma.

Technique	Regime	Target and method
Harp trap	Two per night for four consecutive nights, locations chosen based on presence of suitable flyways.	Targeting South-eastern Long-eared Bat, which is not identifiable by ultrasonic calls.
Camera trap	10 over at least 14 consecutive nights.	Focused on stations baited with a mixture of oats, peanut butter, vegetable oil and sardines. Targeting Yakka Skink. (Meek *et al*. 2014).
Spotlighting	On foot.	Targeting Koala and Dunmall's Snake.
Spotlighting	Rocky areas.	Targeting Collared Delma.
Spotlighting	By vehicle along tracks.	Targeting Dunmall's Snake and Koala.
Scat search	Conducted in habitat considered suitable for target species.	Targeting Koala. The Spot Assessment Technique (SAT), or a variation, were used to survey for Koalas within suitable habitat within the site.
Bird survey	Meander along watercourses during the day.	Diurnal Koala search.
Diurnal herpetofauna search	Late morning/early afternoon.	Conducted by two searchers, duration is determined by site-specific habitat quality and presence of suitable micro-habitat. Targeting Collared Delma, Dunmall's Snake and Yakka Skink.

148°18'0"E 148°19'0"E 148°20'0"E 148°21'0"E 148°22'0"E 148°23'0"E

25°45'0"S 25°46'0"S 25°47'0"S 25°48'0"S 25°49'0"S 25°50'0"S 25°51'0"S

COB08 COB09 COB10 COB30 COB28 COB27 COB29 COB11

Hutton Creek (South Branch)

COB20 COB19 COB21 COB22 COB13 COB15 COB06 COB14 COB16 COB12 COB05 COB07

COB17 COB18 COB23 COB25 COB26 COB03 COB01 COB04 COB24 COB02

SANTOS

Location diagram

Figure 12
Monitoring sites

Cobbadah
Cobbadah offset area
Property access track

Watercourse
Creekline
Minor drainage line
Drainage contour

Ground-truthed RE
11.3.2
11.8.3
11.8.5
11.8.5 (>800m)
11.9.2
11.9.4
11.9.4 regrowth
11.9.5
11.9.7
11.9.11

BioCondition sites
Existing site
Existing site (not monitored as part of Year 1)
New site (to be established)

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 8/05/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:35,000@A3

Queensland
Brisbane

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: J. Cousin

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Cobbadah\Cobbadah_OAMP_mapping_20250416\Cobbadah_OAMP_mapping_20250416.aprx

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8. Reporting

8.1. Reporting

A report detailing the progress of the offset area in achieving the interim performance targets and completion criteria will be prepared for each management year by the suitably qualified ecologist responsible for conducting the monitoring. The report will contain, at a minimum:

- A description of the monitoring conducted, when it was conducted, and by whom
- A discussion of the weather in the lead up to and during the monitoring
- Results of monitoring events conducted
- An overview of the management actions implemented since the last report
- A description of the performance criteria not met, any triggers that have been exceeded and the corrective actions that were implemented;
- An indication of any risks or potential threats that have become apparent to the management area since the development of this management plan, and activities to be undertaken to manage these threats and/or risks.
- Progress towards achieving the interim performance targets and completion criteria.

8.2. Update of OAMP

The OAMP will be reviewed, audited and updated every 5 years. In addition, the OAMP will be updated in accordance with the principles of adaptive management, if required, to incorporate any changes identified through management activities, site visits and monitoring activities. This may include the revision of current management actions, identification of additional activities (including monitoring activities) and responses to adaptive management triggers, other environmental threats to the offset area and information obtained through research programs.

9. Implementation Schedule

Table 18 and Table 19 summarise the implementation schedule for the management, monitoring and reporting activities presented in this OAMP. Santos will be wholly responsible for the implementation of this OAMP and reporting on the performance of the offset area in meeting the offset obligations under EPBC Approval 2012/6615 and Section 4 of this OAMP.

Table 18 - Implementation of management actions

Activity		Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Related monitoring
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
General restrictions (Section 6.2.1)	Access, vehicles, vegetation clearing, weed hygiene	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	At all times	General offset inspections (Section 7.1)
Access tracks (Section 6.2.2)	Maintenance/new tracks	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
Fencing (Section 6.2.3)	Construction of additional fencing to support strategic grazing and manage access	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
	Maintenance	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪		
Fire management (Section 6.2.4)	Fuel hazard reduction burns	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	Biomass monitoring (Section 7.2)
	Strategic grazing	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required based on the results of biomass monitoring, fuel load monitoring and weed monitoring	Biomass monitoring (Section 7.2) Fuel load monitoring (Section 7.4) Weed monitoring (Section 7.5)
Weed management (Section 6.2.5)	Cenchrus ciliaris, Parthenium hysterophorus and other weeds	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities in addition to strategic grazing to be undertaken as required	Weed monitoring (Section 7.5)
Pest animal management (Section 6.2.6)	Wild dog, feral cat, fox rabbit and pig control	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities to be undertaken as required	Pest animal monitoring (Section 7.6)
Reporting (Section 8)	Annual reporting	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Annual reports to be prepared each year OAMP will be reviewed, audited and updated every 5 years	Reporting (Section 8)
	Update OAMP					▪					▪					▪					▪		

Table 19 - Implementation of monitoring events

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Survey/monitoring guidelines	Reliability
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Offset area inspections (Section 7.1)	Twice yearly inspections of the offset area to enable a general assessment of the offset area and identify any potential issues that may require remedial action. See Section 7.1 for the criteria to be assessed as part of each inspection.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Inspections will be undertaken at least twice a year, usually at the end of the wet season and the end of the dry season, with one of the inspections occurring prior to the submission of the annual report.	See Section 7.1 for a list of potential issues to be inspected.	General assessment of the offset management areas to identify any potential issues that may require remedial action to be undertaken.
Biomass monitoring (Section 7.2)	Biomass monitoring for fire management and to inform strategic grazing regime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Twice every year at the end of the wet season (April) and end of the dry season (October).	Assessment against Future Beef photo standards (Section 7.3).	Methodology developed by the Queensland Government.
Fuel load monitoring (Section 7.4)	Assessment of the fuel hazard rating within the offset area to inform fire management strategies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually at the end of the wet season (April).	Overall Fuel Hazard Assessment Guide (Hines et al. 2010; Appendix E).	Method developed by the Victorian Government.
Weed monitoring (Section 7.5)	Ongoing weed surveys to assess the effectiveness of weed control	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		Every two years at the end of the wet season.	Monitoring techniques to be in accordance with published guidelines e.g. NSW Guidelines for Monitoring Weed Control and recovery of native vegetation (Auld 2009). Photo monitoring of selected sites to assess visual changes in weed species and infestations over time. The use of precision unmanned aerial vehicles (drone) technology, aerial imagery and/or remote sensing.	Assessment will be undertaken generally in accordance with published, reputable guidelines.
Pest animal monitoring (Section 7.6)	Ongoing pest animal surveys to assess the effectiveness of pest animal control	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		Every two years at the end of the wet season.	Monitoring method outlined in Section 7.6.	Assessment undertaken generally in accordance with published monitoring techniques developed by the NSW Government.

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required																			Timing	Survey/monitoring guidelines	Reliability
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Habitat quality assessment (baseline surveys completed in 2020) (Section 7.7)	Rapid monitoring events		✓		✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		Each year there is not full monitoring of habitat quality (BioCondition, Section 7.7.2).	See Section 7.7.1.	
	Assessment of vegetation condition and habitat quality	✓		✓		✓			✓			✓			✓			✓			✓	Year one, and then every two years for the first six years, and then every three years thereafter.	GTDTHQ (version 1.2; DEHP 2017).	Assessment undertaken in accordance with method developed by the Queensland Government and aligns with the EPBC Act *Environmental Offsets Policy* measure of 'habitat quality' and is intended to provide a consistent framework for environmental offsets in Queensland.
	Photo monitoring	✓		✓		✓			✓			✓			✓			✓			✓		Photos at each photo monitoring point will be taken in a north, east, south and westerly direction. A record of the photographs will be maintained, including GPS co-ordinates, date and time of each photograph and the direction in which the photograph was taken.	Based on best practice photo monitoring techniques, see Appendix 4 of BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Assessment Manual (version 2.2; Eyre et al. 2015).
	Targeted fauna surveys	✓		✓		✓			✓			✓			✓			✓			✓		See methods outlined in Section 7.7.4.	Techniques for fauna surveys area based on recommended survey guidelines published by the Queensland and Commonwealth governments.

10. References

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Appendix A

MNES habitat quality score method

Calculation of a habitat quality score for each MNES considers three attributes:

- site condition
- site context
- species stocking rate.

Site condition

The site condition score for each MNES is calculated generally in accordance with the site condition assessment method outlined in Section 5 of the GTDTHQ (version 1.2; DEHP 2017). Site condition is determined through a field-based assessment of 13 ecological attributes to describe the structure and function of the vegetation community, compared to the expected range for a relatively undisturbed community (i.e. RE benchmark).

The results of the field-based assessment are scored based on the scoring guide provided in the GTDTHQ to determine the site condition score for each MNES at each relevant monitoring site out of 80.

Site context

The method to calculate site context for a site is based on the site context assessment method provided in the GTDTHQ.

The following components were assessed through a GIS desktop analysis at each relevant monitoring site for each MNES:

- Patch size: the size of the patch/assessment unit being assessed and any directly connecting suitable/known habitat and remnant vegetation. To calculate the patch size score:
  - Measure the area of vegetation in which the assessment unit is contained and add on all other directly connecting areas of suitable or known habitat for the threatened species or community and remnant vegetation. Suitable or known habitat will be based on mapped vegetation comprising regional ecosystems known or likely to support the MNES value based on the conservation advice or other species-specific sources endorsed by Queensland and/or Commonwealth Governments. Where the connecting patch comprises an RE that is known or suitable habitat, then 100% of the area of that RE is attributed to the total patch size area. Where the connecting RE is not considered known or suitable habitat (i.e. non-compliant RE); however, is a remnant RE, only 10% of the area of that RE is attributed to the total patch size area sum. The reduced weighting for non-compliant REs acknowledges the importance of these REs in contributing to the overall patch size through its contribution to potential dispersal of species, and the supporting role of these REs for maintaining connectivity to potential source meta-populations.
  - Determine the score for this attribute by matching with the class ranges in Table B1.
- Connectedness: measure the proportion of the assessment unit's boundary which is connected to suitable/known habitat and remnant vegetation. To calculate the connectedness score:
  - Measure the percentage of suitable/known habitat and remnant vegetation along the boundary of the assessment unit.
  - Determine the score for this attribute by matching with the class ranges in Table B1.
- Context: measure the percentage of suitable/known habitat and remnant vegetation within a 1 km buffer around the site/assessment unit. To calculate the context score:
  - Create a 1 km buffer around the monitoring site.
  - Measure the percentage cover of remnant vegetation within the buffer area.
  - Determine the score for this attribute by matching with the thresholds Table B1.

- Ecological corridors: to calculate the ecological corridor score:
  - Determine the proximity of the site to state, bioregional, regional or sub-regional corridors (terrestrial or riparian).
  - Determine the score from Table B1. based on whether the site is located within (wholly or partly); shares a common boundary with; or is not within a corridor.

Table A1 - Site context scoring guide

Attribute	Scoring guide					
Size of Patch	Score	0	2	5	7	10
	Description	<5 ha	5-25 ha	26-100 ha	101-200 ha	>200 ha
Connectedness	Score	0	2		4	5
	Description	0-10%	>10%-<50%		50-75%	>75% or >500 ha
Context	Score	0	2		4	5
	Description	<10%	>10-30%		>30-75%	>75%
Ecological corridors	Score	0	4		6	
	Description	Not within	Sharing a common boundary		Within (whole or part)	

The total site context score for each MNES at each relevant monitoring site is calculated out of 26.

Species habitat index

A quantitative method is used to determine the species habitat index score for each fauna and flora MNES based on the species habitat index assessment method used as part of the GTDTHQ.

Table A2 to Table A5 summarise the method for calculating species habitat index score out of 50 for Collared Delma, Dunmall's Snake, Yakka Skink, Koala and South-eastern Long-eared Bat. Each sub-component of species habitat index scoring method is tailored for each MNES to consider species-specific habitat requirements and threats in accordance with conservation advices and other species-specific sources endorsed by Queensland and/or Commonwealth governments.

In the absence of the GTDTHQ including a species habitat index for flora species, the habitat condition scores for Brigalow TEC and SEVT TEC included a species presence index out of three, whereby: 0 = absent/not confirmed, 2 = single confirmed specimen, 3 = multiple confirmed specimens. The habitat condition score was then calculated as a combination of site condition and site context for the RE assessment unit (representing 60% of the score), with species stocking rate converted to a score out of 3 and contributing 40%.

Table A2 - Species habitat index scoring for Collared Delma

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Habitat is not protected through legislation and/or is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Removal of fallen timber.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural land use. • Strategic pulse livestock grazing resulting in irreversible damage to critical microhabitat including deep cracks in clay soils, fallen timber and logs. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No foxes and/or feral cats observed or known within the vicinity of the site and no known or observed evidence of predation. Successful active pest animal management implemented on site. • Habitat protected as part of a legally binding mechanism for an offset and/or National Park and/or Nature Refuge, with management aimed at maintaining or improving habitat. • Livestock grazing always excluded from habitat (except for need for fuel load control through strategic grazing, if required) • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND • <50% of the RE benchmark value for coarse woody debris OR leaf litter • Highly disturbed ground layer
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND • >50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. small skinks and geckos.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND • >70% of the RE benchmark for attributes coarse woody debris AND/OR leaf litter. • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. small skinks and geckos.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR • <50% of the RE benchmark value for coarse woody debris • Limited evidence of potential shelter habitat
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND • >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils)
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND • >70% of the RE benchmark for coarse woody debris.

Component	Level	Score	Description
			• No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils)
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat; OR • The site is likely to support only a small or relictual population of the species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat; OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site AND • The site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation

Table A3 - Species habitat index scoring for Dunmall's Snake

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Habitat is not protected through legislation and/or is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Removal of fallen timber.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural land use. • Strategic pulse livestock grazing resulting in irreversible damage to critical microhabitat including deep cracks in clay soils, fallen timber and logs. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No foxes and/or feral cats observed or known within the vicinity of the site and no known or observed evidence of predation. Successful active pest animal management implemented on site. • Habitat protected as part of a legally binding mechanism for an offset and/or National Park and/or Nature Refuge, with management aimed at maintaining or improving habitat. • Livestock grazing always excluded from habitat (except for need for fuel load control through strategic grazing, if required) • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND • <50% of the RE benchmark value for coarse woody debris OR leaf litter OR • <50% of the RE benchmark value for coarse woody debris AND leaf litter • Highly disturbed ground layer
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND • 50-90% of the RE benchmark for attributes coarse woody debris OR leaf litter OR • 50-90% of the RE benchmark for attributes coarse woody debris AND leaf litter • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. small skinks and geckos.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND • >90% of the RE benchmark for attributes coarse woody debris OR leaf litter OR • >90% of the RE benchmark for attributes coarse woody debris AND leaf litter • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. small skinks and geckos.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR • <50% of the RE benchmark value for coarse woody debris • Limited evidence of potential shelter habitat
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 OR • 50-90% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils)

Component	Level	Score	Description
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND • >90% of the RE benchmark for coarse woody debris • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils)
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat; OR • The site is likely to support only a small or relictual population of the species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat; OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover	5	• Evidence of one or more species records within the last 10 years within 15 km of the site AND • The site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation

Component	Level	Score	Description
	habitat for migratory species at the national or state scale.		

Table A4 - Species habitat index scoring for Yakka Skink

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Habitat is not protected through legislation and/or is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to microhabitat including logs, dense leaf litter and fallen bark. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Removal of fallen timber.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural development or subject to ongoing degradation. • Strategic pulse livestock grazing resulting in irreversible damage to critical microhabitat including logs, dense leaf litter and fallen bark. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No foxes and/or feral cats observed or known within the vicinity of the site and no known or observed evidence of predation. Successful active pest animal management implemented on site. • Habitat protected as part of a legally binding mechanism for an offset and/or National Park and/or Nature Refuge, with management aimed at maintaining or improving habitat. • Livestock grazing always excluded from habitat (except for need for fuel load control through strategic grazing, if required) • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND • <50% of the RE benchmark value for coarse woody debris OR leaf litter OR • <50% of the RE benchmark value for coarse woody debris AND leaf litter • Highly disturbed ground layer
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND • 50-90% of the RE benchmark for attributes coarse woody debris OR leaf litter OR • 50-90% of the RE benchmark for attributes coarse woody debris AND leaf litter • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. soft plant materials and fruits and a wide variety of invertebrates.

Component	Level	Score	Description
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND • >90% of the RE benchmark for attributes coarse woody debris OR leaf litter OR • >90% of the RE benchmark for attributes coarse woody debris AND leaf litter • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. soft plant materials and fruits and a wide variety of invertebrates.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR • <50% of the RE benchmark value for coarse woody debris • Limited evidence of potential shelter habitat
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 OR • 50-90% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs)
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND • >90% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs)
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat; OR • The site is likely to support only a small or relictual population of the species.
	Likely to be critical to species' survival Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat; OR • The site is likely to support only a small or relictual population of the species.

Component	Level	Score	Description
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site AND • The site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation

Table A5 - Species habitat index scoring for Koala

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Known presence of wild dogs on site and within adjacent properties and/or evidence of predation known or observed and. No active pest animal management on site. • Public vehicle access to site, with evidence of death through vehicle strike observed or likely. • Habitat is not protected through legislation and/or is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Wild dogs observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Restricted access to the site by authorised personnel only, with no public vehicle access. • Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural land use. • Active fire management and/or low risk of uncontrolled fire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No wild dogs observed or known within the vicinity of the site and no known or observed evidence of predation. Successful active pest animal management implemented on site. • Restricted access to the site for authorised personnel only, with no public vehicle access. Reduced speed limits in place and/or driver awareness and/or signs to identify species habitat and/or exclusion fencing to prevent Koalas accessing road. • Habitat protected as part of a legally binding mechanism for an offset and/or National Park and/or Nature Refuge, with management aimed at maintaining or improving habitat. • Active fire management, with controlled burns on site and low risk of uncontrolled fire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Minimum of one eucalypt species present (including species from the genera E*ucalyptus, Corymbia, Angophora* and *Lophostemon*) that is known from the RE, with limited foraging potential for the species.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Minimum of one eucalypt species present (including species from the genera *Eucalyptus, Corymbia, Angophora* and *Lophostemon*) that is known from the RE, and provides known foraging habitat for the species including Koala food trees known to support Koalas within the region AND

Component	Level	Score	Description
			• >50% of the RE benchmark for number of large trees attribute.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Minimum of two eucalypt species present (including species from the genera *Eucalyptus, Corymbia, Angophora* and *Lophostemon*) that is known from the RE, and provides known foraging habitat for the species including Koala food trees known to support Koalas within the region AND • >70% of the RE benchmark for attributes number of large trees OR • 1 Koala food tree species known to support Koalas within the region that alone accounts for >50% of the canopy.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Minimum of one eucalypt species present (including species from the genera *Eucalyptus, Corymbia, Angophora* and *Lophostemon*) that is known from the RE, with limited sheltering or dispersal habitat potential for the species.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Minimum of one eucalypt species present (including species from the genera *Eucalyptus, Corymbia, Angophora* and *Lophostemon*) that is known from the RE, and provides known habitat for the species including emergent trees likely to support shelter and/or dispersal habitat for Koalas, AND >50% of the RE benchmark for attributes number of large trees and/or canopy cover and/or canopy height.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Minimum of two eucalypt species present (including species from the genera *Eucalyptus, Corymbia, Angophora* and *Lophostemon*) that is known from the RE, and provides known habitat for the species including emergent trees known to support shelter and/or dispersal habitat for Koalas, AND >70% of the RE benchmark for at least two of the three following attributes: number of larger trees, canopy cover and canopy height
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat; OR • The site is likely to support only a small or relictual population of the species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat; OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and	4	• Evidence of one or more species records within the last 10 years within 15 km of the site AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.

Component	Level	Score	Description
	shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.		
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site AND • The site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation.

Table A6 - Species habitat index scoring for South-eastern Long-eared Bat

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development, timber production or agricultural land use and/or subject to ongoing degradation. No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Overgrazing resulting in a lack of understorey habitat that supports invertebrate prey.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. Active fire management and/or low risk of uncontrolled fire on site, including from adjacent properties. • Strategic livestock grazing resulting in some degradation to the understory habitat that supports invertebrate prey however, patches of habitat occur on site. • Active fire management and/or low risk of uncontrolled fire on site, including on adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. Active fire management, with controlled burns on site and low risk of uncontrolled fire on site, including from adjacent properties. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) allowing for recruitment of native saplings. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees. OR • <10% tree canopy cover.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark value for large trees, OR • >10% - <50% tree canopy cover.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark value for large trees, OR • >50% - <200% tree canopy cover.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees. • Limited evidence of dead trees and/or hollows for roosting.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark value for large trees. • Evidence of some dead trees and/or hollows for roosting.

Component	Level	Score	Description
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark value for large trees. • Evidence of dead trees and/or hollows for roosting.
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • The population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Appendix B

Baseline habitat quality score for Cobbadah offset area

Table B1 - Cobbadah offset habitat quality assessment based on May 2017 and August 2020 surveys (sites COB02 – COB11)

Site	Site COB02 RE 11.8.3			Site COB03 RE 11.9.5			Site COB04 RE 11.8.5			Site COB05 RE 11.9.2			Site COB06 RE 11.9.7			Site COB07 RE 11.9.2			Site COB08 RE 11.9.4			Site COB09 RE 11.9.4			Site COB10 RE 11.9.4 (regrowth)			Site COB11 RE 11.9.4		
Ecological condition indicators	Raw data	Benchmark (11.8.3)	Score	Raw data	Benchmark (11.9.5)	Score	Raw data	Benchmark (11.8.5)	Score	Raw data	Benchmark (11.3.6)[A]	Score	Raw data	Benchmark (11.9.7)	Score	Raw data	Benchmark (11.3.6)[A]	Score	Raw data	Benchmark (11.9.4a)	Score	Raw data	Benchmark (11.9.4a)	Score	Raw data	Benchmark (11.9.4a)	Score	Raw data	Benchmark (11.9.4a)	Score
Recruitment of woody perennial species	100	100	5	100	100	5	100	100	5	0	100	0	100	100	5	100	100	5	100	100	5	100	100	5	100	100	5	100	100	5
Native plant species richness - trees	5	15	3	6	4	5	5	2	5	5	3	5	5	3	5	5	3	5	15	16	5	12	16	3	10	16	3	11	16	3
Native plant species richness - shrubs	18	15	5	6	5	5	6	3	5	1	3	3	3	5	3	3	3	5	11	14	3	12	14	3	13	14	5	17	14	5
Native plant species richness - grasses	5	2	5	5	5	5	8	6	5	9	9	5	9	9	5	12	9	5	3	1	5	5	1	5	8	1	5	4	1	5
Native plant species richness - forbs	8	14	3	9	10	3	7	16	3	8	10	3	16	28	3	18	10	5	9	9	5	10	9	5	9	9	5	9	9	5
Tree canopy height	9.52	7	5	9.8	15	4	16.79	15	5	14.8	20	5	20.2	16	5	13	20	3	10.7	11	5	12.8	11	5	6.7	11	1.5	11.3	11	5
Tree sub canopy height	4.8	3		6.3	8		8.85	5		-	-		10.2	9		-	-		6.1	7		7	7		0	7		7	7	
Tree canopy cover	56.3	62	5	52	32	5	30.5	13	3	40.5	23	5	52.1	27	5	52.3	23	3	73.3	54	5	35	54	5	21.4	54	1	48.7	54	5
Tree sub canopy cover	27.3	17		23.9	30		24.5	3		-	-		14.7	12		-	-		22	23		32.8	23		0	23		25.4	23	
Shrub canopy cover	24.4	27	5	4.6	19	3	16.6	2	3	0	1	0	10	1	3	1.8	1	5	39.2	41	5	33.4	41	5	44.4	41	5	81.6	41	5
Native perennial grass cover	12.4	5	5	9	30	1	20	60	1	21	40	3	32	26	5	34	40	3	6	4	5	12	4	5	34	4	5	3	4	3
Organic litter	33.6	45	5	55	49	5	30	25	5	22	35	5	40.4	15	3	20	35	5	47	32	5	51	32	5	30	32	5	32	32	5
Large eucalypt trees	-	-	10	-	-	15	14	6	15	2	20	5	10	14	15	0	20	0	-	-	15	-	-	15	-	-	15	-	-	15
Large non-eucalypt trees	40	70		24	10		-	-		-	-		14	2		-	-		88	17		86	17		24	17		104	17	
Coarse woody debris	229	944	2	815	688	5	185	250	5	187	300	5	205	287	5	399	300	5	340	944	2	645	944	5	113	944	2	825	944	5
Non-native plant cover	0.6	0	10	0.45	0	10	1.1	0	10	37.75	0	3	9.25	0	5	16.25	0	5	0	0	10	0.35	0	10	29.5	0	3	2	0	10
Total			**68**			**71**			**70**			**47**			**67**			**54**			**75**			**76**			**60.5**			**76**
/10			**8.50**			**8.88**			**8.75**			**5.88**			**8.38**			**6.75**			**9.38**			**9.50**			**7.56**			**9.50**

[A] In the absence of benchmark for RE 11.9.2 at the time of assessment, RE 11.3.6 as it is a comparable RE from the same broad vegetation group (BVG 17b).

Table B2 - Cobbadah offset habitat quality assessment based on May 2017 and August 2020 surveys (sites COB12 – COB21)

Site	Site COB12 RE 11.9.7			Site COB13 RE 11.9.2			Site COB14 RE 11.9.7			Site COB15 RE 11.9.2			Site COB16 RE 11.9.7			Site COB17 RE 11.9.5			Site COB18 RE 11.8.5			Site COB19 RE 11.3.2			Site COB20 RE 11.3.2			Site COB21 RE 11.3.2		
Ecological condition indicators	Raw data	Benchmark (11.9.7)	Score	Raw data	Benchmark (11.3.6)[A]	Score	Raw data	Benchmark (11.9.7)	Score	Raw data	Benchmark (11.3.6)[A]	Score	Raw data	Benchmark (11.9.7)	Score	Raw data	Benchmark (11.9.5)	Score	Raw data	Benchmark (11.8.5)	Score	Raw data	Benchmark (11.3.2)	Score	Raw data	Benchmark (11.3.2)	Score	Raw data	Benchmark (11.3.2)	Score
Recruitment of woody perennial species	100	100	5	100	100	5	50	100	3	100	100	5	100	100	5	100	100	5	100	100	5	100	100	5	100	100	5	0	100	0
Native plant species richness - trees	10	3	5	3	3	5	8	3	5	4	3	5	6	3	5	5	4	5	4	2	5	4	2	5	5	2	5	5	2	5
Native plant species richness - shrubs	7	5	5	3	3	5	7	5	5	1	3	3	7	5	5	7	5	5	9	3	5	4	2	5	3	2	5	0	2	2.5
Native plant species richness - grasses	11	9	5	14	9	5	11	9	5	7	9	3	10	9	5	6	5	5	7	6	5	16	9	5	14	9	5	10	9	5
Native plant species richness - forbs	13	28	3	7	10	3	11	28	3	12	10	5	8	28	3	10	10	5	8	16	3	12	17	3	11	17	3	14	17	3
Tree canopy height	16.8	16	5	13	20	3	20	16	5	15	20	5	18.7	16	5	15.7	15	5	21.4	15	5	16.8	18	5	18.8	18	5	20	18	5
Tree sub canopy height	9.4	9		-	-		11	9		-	-		14.4	9		9.2	8		10.6	5		-	-		-	-		-	-	
Tree canopy cover	39	27	5	23	23	5	41	27	4	47.2	23	3	55.6	27	4	63	32	5	55	13	3	39.3	40	5	62.3	40	5	52.5	40	5
Tree sub canopy cover	17.6	12		-	-		41	12		-	-		11	12		51.3	30		16.3	3		-	-		-	-		-	-	
Shrub canopy cover	7	1	3	0.8	1	5	9.8	1	3		1	0	4.1	1	3	1	19	0	21.4	2	3	3.1	2	5	1.5	2	5	0	2	0
Native perennial grass cover	30	26	5	40	40	5	29	26	5	37	40	5	46	26	5	37	30	5	37	60	3	31	35	3	24	35	3	25	35	3
Organic litter	43	15	3	22	35	5	42.4	15	3	40	35	5	29	15	5	56	49	5	37	25	5	38	30	5	36	30	5	34	30	5
Large eucalypt trees	8	14	10	0	20	0	10	14	10	4	20	5	11	14	15	-	-	15	9	6	15	1	22	5	0	22	0	4	22	5
Large non-eucalypt trees	8	2		-	-		1	2		-	-		6	2		36	10		-	-		0	0		0	0		0	0	
Coarse woody debris	394	287	5	69	300	2	225	287	5	222	300	5	132	287	2	2016	688	2	413	250	5	146	307	2	117	307	2	413	307	5
Non-native plant cover	2.65	0	10	12.35	0	5	26	0	3	13.1	0	5	8.45	0	5	0.3	0	10	6.1	0	5	5	0	5	3	0	10	2.75	0	10
Total			**69**			**53**			**59**			**54**			**67**			**72**			**67**			**58**			**58**			**53.5**
/10			**8.63**			**6.63**			**7.38**			**6.75**			**8.38**			**9.00**			**8.38**			**7.25**			**7.25**			**6.69**

[A] In the absence of benchmark for RE 11.9.2 at the time of assessment, RE 11.3.6 as it is a comparable RE from the same broad vegetation group (BVG 17b).

Table B3 - Summary of the MNES habitat quality scores for each RE assessment unit on Cobbadah, Sites 2-11

Assessment unit habitat quality score /10	Site COB02 RE 11.8.3	Site COB03 RE 11.9.5	Site COB04 RE 11.8.5	Site COB05 RE 11.9.2	Site COB06 RE 11.9.7	Site COB07 RE 11.9.2	Site COB08 RE 11.9.4	Site COB09 RE 11.9.4	Site COB10 RE 11.9.4 regrowth	Site COB11 RE 11.9.4
Brigalow TEC										
Site condition score (/80) – 60% of final score	-	71	-	-	-	-	-	-	-	-
Site context score (/26) – 40% of final score	-	25	-	-	-	-	-	-	-	-
Habitat quality score (/10)	-	9.17	-	-	-	-	-	-	-	-
SEVT TEC										
Site condition score (/80) – 60% of final score	68	-	-	-	-	-	75	76	61	76
Site context score (/26) – 40% of final score	26	-	-	-	-	-	19	19	4	19
Habitat quality score (/10)	9.10	-	-	-	-	-	8.55	8.62	5.15	8.62
Collared Delma										
Site condition score (/80) – 30% of final score	68	71	70	47	67	54	-	-	-	-
Site context score (/26) – 30% of final score	26	25	26	23	22	25	-	-	-	-
Species habitat index score (/50) – 40% of final score	31	40	40	24	34	24	-	-	-	-
Habitat quality score (/10)	8.03	8.75	8.83	6.34	7.77	6.83	-	-	-	-
Dunmall's Snake										
Site condition score (/80) – 30% of final score	-	71	70	47	67	54	-	-	-	-
Site context score (/26) – 30% of final score	-	25	26	23	22	25	-	-	-	-
Species habitat index score (/50) – 40% of final score	-	40	40	24	34	24	-	-	-	-
Habitat quality score (/10)	-	8.75	8.83	6.34	7.77	6.83	-	-	-	-
Yakka Skink										
Site condition score (/80) – 30% of final score	-	71	70	47	67	54	-	-	-	-
Site context score (/26) – 30% of final score	-	25	26	23	22	25	-	-	-	-
Species habitat index score (/50) – 40% of final score	-	40	40	24	34	24	-	-	-	-
Habitat quality score (/10)	-	8.75	8.83	6.34	7.77	6.83	-	-	-	-
Koala										
Site condition score (/80) – 30% of final score	-	-	70	47	67	54	-	-	-	-
Site context score (/26) – 30% of final score	-	-	26	23	22	25	-	-	-	-
Species habitat index score (/50) – 40% of final score	-	-	34	30	35	25	-	-	-	-
Habitat quality score (/10)	-	-	8.35	6.82	7.85	6.91	-	-	-	-
South-eastern Long-eared Bat										
Site condition score (/80) – 30% of final score	68	71	70	47	67	54	75	76	61	76

Assessment unit habitat quality score /10	Site COB02 RE 11.8.3	Site COB03 RE 11.9.5	Site COB04 RE 11.8.5	Site COB05 RE 11.9.2	Site COB06 RE 11.9.7	Site COB07 RE 11.9.2	Site COB08 RE 11.9.4	Site COB09 RE 11.9.4	Site COB10 RE 11.9.4 regrowth	Site COB11 RE 11.9.4
Site context score (/26) – 30% of final score	26	25	26	23	22	25	19	19	4	19
Species habitat index score (/50) – 40% of final score	27	37	37	27	37	27	0	0	0	0
Habitat quality score (/10)	7.71	8.51	8.59	6.58	8.01	7.07	5.00	5.04	2.73	5.04

Note: Data is only provided for REs that the threatened community or species is associated with.

Table B4 - Summary of the MNES habitat quality scores for each RE assessment unit on Cobbadah, Sites 12-21

Assessment unit habitat quality score /10	Site COB12 RE 11.9.7	Site COB13 RE 11.9.2	Site COB14 RE 11.9.7	Site COB15 RE 11.9.2	Site COB16 RE 11.9.7	Site COB17 RE 11.9.5	Site COB18 RE 11.8.5	Site COB19 RE 11.3.2	Site COB20 RE 11.3.2	Site COB21 RE 11.3.2
Brigalow TEC										
Site condition score (/80) – 60% of final score	-	-	-	-	-	72	-	-	-	-
Site context score (/26) – 40% of final score	-	-	-	-	-	25	-	-	-	-
Habitat quality score (/10)	-	-	-	-	-	9.25	-	-	-	-
SEVT TEC										
Site condition score (/80) – 60% of final score	-	-	-	-	-	-	-	-	-	-
Site context score (/26) – 40% of final score	-	-	-	-	-	-	-	-	-	-
Habitat quality score (/10)	-	-	-	-	-	-	-	-	-	-
Collared Delma										
Site condition score (/80) – 30% of final score	69	53	59	54	67	72	67	58	58	54
Site context score (/26) – 30% of final score	22	19	22	19	22	25	25	18	16	18
Species habitat index score (/50) – 40% of final score	34	20	24	24	20	40	40	23	23	27
Habitat quality score (/10)	7.85	5.78	6.67	6.14	6.65	8.78	8.60	6.09	5.86	6.24
Dunmall's Snake										
Site condition score (/80) – 30% of final score	69	53	59	54	67	72	67	58	58	54
Site context score (/26) – 30% of final score	22	19	22	19	22	25	25	18	16	18
Species habitat index score (/50) – 40% of final score	34	20	24	24	20	40	40	23	23	27
Habitat quality score (/10)	7.85	5.78	6.67	6.14	6.65	8.78	8.60	6.09	5.86	6.24
Yakka Skink										
Site condition score (/80) – 30% of final score	69	53	59	54	67	72	67	58	58	54
Site context score (/26) – 30% of final score	22	19	22	19	22	25	25	18	16	18
Species habitat index score (/50) – 40% of final score	34	20	24	24	20	40	40	23	23	27
Habitat quality score (/10)	7.85	5.78	6.67	6.14	6.65	8.78	8.60	6.09	5.86	6.24
Koala										
Site condition score (/80) – 30% of final score	69	53	59	54	67	-	67	58	58	54

Assessment unit habitat quality score /10	Site COB12 RE 11.9.7	Site COB13 RE 11.9.2	Site COB14 RE 11.9.7	Site COB15 RE 11.9.2	Site COB16 RE 11.9.7	Site COB17 RE 11.9.5	Site COB18 RE 11.8.5	Site COB19 RE 11.3.2	Site COB20 RE 11.3.2	Site COB21 RE 11.3.2
Site context score (/26) – 30% of final score	22	19	22	19	22	-	25	18	16	18
Species habitat index score (/50) – 40% of final score	35	25	35	30	35	-	34	25	25	35
Habitat quality score (/10)	7.93	6.18	7.55	6.62	7.85	-	8.12	6.25	6.02	6.88
South-eastern Long-eared Bat										
Site condition score (/80) – 30% of final score	69	53	59	54	67	72	67	58	58	54
Site context score (/26) – 30% of final score	22	19	22	19	22	25	25	18	16	18
Species habitat index score (/50) – 40% of final score	37	32	27	27	37	37	37	27	27	27
Habitat quality score (/10)	8.09	6.74	6.91	6.38	8.01	8.54	8.36	6.41	6.18	6.24

Note: Data is only provided for REs that the threatened community or species is associated with.

Table B5 - Final area-weighted habitat quality score for each MNES across the Cobbadah offset area

RE	11.3.2	11.8.3	11.8.5	11.9.2	11.9.4	11.9.4 regrowth	11.9.5	11.9.7
Brigalow TEC								
Offset area (ha)	-	-	-	-	-	-	74.6	-
Average habitat quality score	-	-	-	-	-	-	9.21	-
Area-weighted contribution to habitat quality score	-	-	-	-	-	-	9.21	-
Final OAG habitat quality score	9 (9.21)							
SEVT TEC								
Offset area (ha)	-	208.4	-	-	168.6	109.3	-	-
Average habitat quality score	-	9.10	-	-	8.60	5.15	-	-
Area-weighted contribution to habitat quality score	-	3.90	-	-	2.98	1.16	-	-
Final OAG habitat quality score	8 (8.04)							
Collared Delma								
Offset area (ha)	174.0	208.4	101.3	110.7	-	-	74.6	105.2
Average habitat quality score	6.07	8.03	8.71	6.27	-	-	8.77	7.23
Area-weighted contribution to habitat quality score	1.36	2.16	1.14	0.90	-	-	0.84	0.98
Final OAG habitat quality score	7 (7.38)							

RE	11.3.2	11.8.3	11.8.5	11.9.2	11.9.4	11.9.4 regrowth	11.9.5	11.9.7
Dunmall's Snake								
Offset area (ha)	174.0	-	101.3	110.7	-	-	74.6	105.2
Average habitat quality score	6.07	-	8.71	6.27	-	-	8.77	7.23
Area-weighted contribution to habitat quality score	1.87	-	1.56	1.23	-	-	1.16	1.34
Final OAG habitat quality score	7 (7.16)							
Yakka Skink								
Offset area (ha)	174.0	-	101.3	110.7	-	-	74.6	105.2
Average habitat quality score	6.07	-	8.71	6.27	-	-	8.77	7.23
Area-weighted contribution to habitat quality score	1.87	-	1.56	1.23	-	-	1.16	1.34
Final OAG habitat quality score	7 (7.16)							
Koala								
Offset area (ha)	174.0	-	101.3	110.7	-	-	-	105.2
Average habitat quality score	6.39	-	8.23	6.63	-	-	-	7.79
Area-weighted contribution to habitat quality score	2.26	-	1.70	1.49	-	-	-	1.67
Final OAG habitat quality score	7 (7.12)							
South-eastern Long-eared Bat								
Offset area (ha)	174.0	208.4	101.3	110.7	168.6	109.3	74.6	105.2
Average habitat quality score	6.28	7.71	8.47	6.69	5.03	2.73	8.53	7.75

RE	11.3.2	11.8.3	11.8.5	11.9.2	11.9.4	11.9.4 regrowth	11.9.5	11.9.7
Area-weighted contribution to habitat quality score	1.04	1.53	0.82	0.70	0.81	0.28	0.60	0.78
Final OAG habitat quality score	7 (6.56)							

Note: Data is only provided for REs that the threatened community or species is associated with.

Appendix C

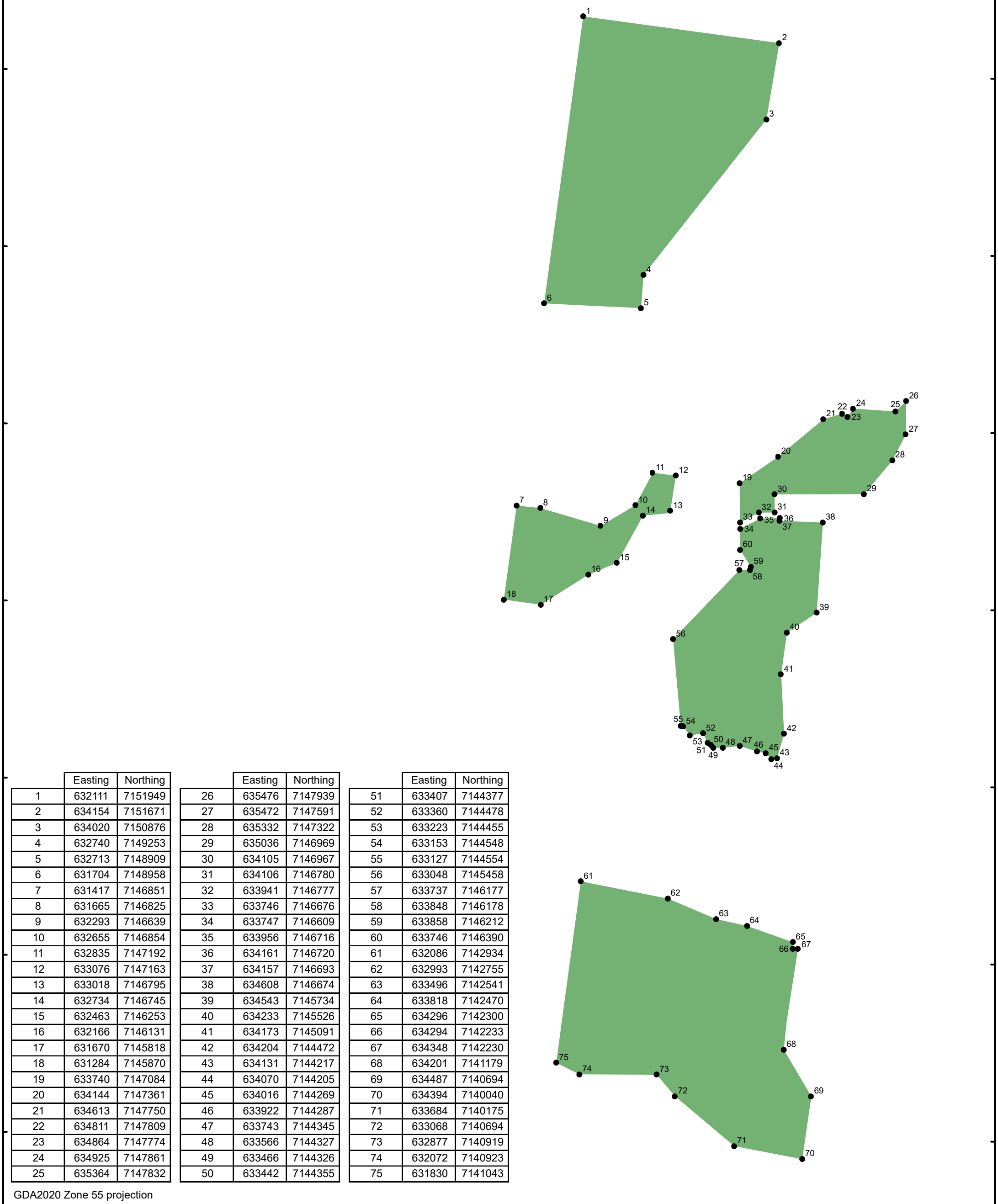
Offset area coordinates

Point	X coordinate	Y coordinate	Point	X coordinate	Y coordinate	Point	X coordinate	Y coordinate
1	632111	7151949	26	635476	7147939	51	633407	7144377
2	634154	7151671	27	635472	7147591	52	633360	7144478
3	634020	7150876	28	635332	7147322	53	633223	7144455
4	632740	7149253	29	635036	7146969	54	633153	7144548
5	632713	7148909	30	634105	7146967	55	633127	7144554
6	631704	7148958	31	634106	7146780	56	633048	7145458
7	631417	7146851	32	633941	7146777	57	633737	7146177
8	631665	7146825	33	633746	7146676	58	633848	7146178
9	632293	7146639	34	633747	7146609	59	633858	7146212
10	632655	7146854	35	633956	7146716	60	633746	7146390
11	632835	7147192	36	634161	7146720	61	632086	7142934
12	633076	7147163	37	634157	7146693	62	632993	7142755
13	633018	7146795	38	634608	7146674	63	633496	7142541
14	632734	7146745	39	634543	7145734	64	633818	7142470
15	632463	7146253	40	634233	7145526	65	634296	7142300
16	632166	7146131	41	634173	7145091	66	634294	7142233
17	631670	7145818	42	634204	7144472	67	634348	7142230
18	631284	7145870	43	634131	7144217	68	634201	7141179
19	633740	7147084	44	634070	7144205	69	634487	7140694
20	634144	7147361	45	634016	7144269	70	634394	7140040
21	634613	7147750	46	633922	7144287	71	633684	7140175
22	634811	7147809	47	633743	7144345	72	633068	7140694
23	634864	7147774	48	633566	7144327	73	632877	7140919
24	634925	7147861	49	633466	7144326	74	632072	7140923
25	635364	7147832	50	633442	7144355	75	631830	7141043

GDA2020 Zone 55 projection

148°16'0"E 148°17'0"E 148°18'0"E 148°19'0"E 148°20'0"E 148°21'0"E

25°45'0"S 25°46'0"S 25°47'0"S 25°48'0"S 25°49'0"S 25°50'0"S 25°51'0"S



	Easting	Northing
1	632111	7151949
2	634154	7151671
3	634020	7150876
4	632740	7149253
5	632713	7148909
6	631704	7148958
7	631417	7146851
8	631665	7146825
9	632293	7146639
10	632655	7146854
11	632835	7147192
12	633076	7147163
13	633018	7146795
14	632734	7146745
15	632463	7146253
16	632166	7146131
17	631670	7145818
18	631284	7145870
19	633740	7147084
20	634144	7147361
21	634613	7147750
22	634811	7147809
23	634864	7147774
24	634925	7147861
25	635364	7147832

	Easting	Northing
26	635476	7147939
27	635472	7147591
28	635332	7147322
29	635036	7146969
30	634105	7146967
31	634106	7146780
32	633941	7146777
33	633746	7146676
34	633747	7146609
35	633956	7146716
36	634161	7146720
37	634157	7146693
38	634608	7146674
39	634543	7145734
40	634233	7145526
41	634173	7145091
42	634204	7144472
43	634131	7144217
44	634070	7144205
45	634016	7144269
46	633922	7144287
47	633743	7144345
48	633566	7144327
49	633466	7144326
50	633442	7144355

	Easting	Northing
51	633407	7144377
52	633360	7144478
53	633223	7144455
54	633153	7144548
55	633127	7144554
56	633048	7145458
57	633737	7146177
58	633848	7146178
59	633858	7146212
60	633746	7146390
61	632086	7142934
62	632993	7142755
63	633496	7142541
64	633818	7142470
65	634296	7142300
66	634294	7142233
67	634348	7142230
68	634201	7141179
69	634487	7140694
70	634394	7140040
71	633684	7140175
72	633068	7140694
73	632877	7140919
74	632072	7140923
75	631830	7141043

GDA2020 Zone 55 projection

SANTOS

Location diagram

Figure C1
Offset area boundary

Cobbadah offset area

Offset area coordinates

CO2 AUSTRALIA

N

0 1 2

Kilometres

AUTHOR: J. Cousin

Date: 7/05/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:36,000@A3

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Cobbadah\Cobbadah_OAMP_mapping_20250416\Cobbadah_OAMP_mapping_20250416.aprx

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Appendix D

Risk Assessment

The following risk assessment assesses the potential risk of failing to achieve the management objectives, interim performance targets and completion criteria for the offset area as outlined in this OAMP.

For each risk identified, the potential consequence of the risk (rated from 1 (no impact) to 6 (irreversible impact; Table D1) was assessed against the likelihood of that risk occurring (Table D2) to determine a risk rating. The risk rating was evaluated by using the matrix in Table D2.

The consequence and likelihood of each risk was first considered without the management measures in place to provide an initial risk rating. The consequence and likelihood of each risk occurring was then reassessed following the implementation of the management measures to provide a residual risk rating.

Table D3 provides the risk register which was used to document the findings of the risk assessment process.

Table D1 - Consequence rating relative to offset value

	Consequence
I	No impact to MNES Value
II	Small-scale impact to MNES
III	Moderate-scale impact to MNES
IV	Large-scale impact to MNES
V	Extensive population or community scale impact to MNES
VI	Irreversible impact to MNES.

Table D2 - Likelihood classification and risk matrix

Santos Risk Matrix

Santos

Consequence							
Safety	**Negligible Harm** + No bodily damage or minimal harm or impairment (hours to days)	**Minor Harm** + Short term impairment (days to weeks)	**Moderate Harm** + Temporary disablement or medium term impairment (weeks to months)	**Severe Harm** + Long term/life altering disablement or impairment	**Single Fatality OR Critical Life Threatening Injuries**	**Multiple Fatalities**
Environment	+ No impact to Environmental Value (EV).	+ Small-scale impact to EV(s) of conservation significance + Potential surface or groundwater impact.	+ Moderate-scale impact to EV(s) of conservation significance + Localised surface or groundwater impact.	+ Large-scale impact to EV(s) of conservation significance + Moderate-scale surface water impact; + Localised impact to groundwater with potential or known beneficial use.	+ Extensive population or community scale impact to EV(s) of conservation significance + Extensive impact to other EV(s).	+ Irreversible impact to EV(s).
Community & Reputation	+ No actual or potential community criticism + Details remain within Santos sites and/or offices	+ Minor level local community criticism (< week) + No reputation impact	+ Local community criticism (> week) or one-day community protest + Local company reputation impacted	+ State-level community criticism or protest over multiple days/locations + State-based company reputation impacted + Very short-term share price impact (< week)	+ National community criticism or large scale protest + Company reputation and approvals impacted + Shareholder intervention or short-term share price impact (< month)	+ Sustained national community criticism or widespread protest + Industry reputation and approvals impacted + Changes at executive/board level or long-term share price impact (> month)
Financial (A$)	< $30k	$30k to $300k	$300k to $3m	$3m to $30m	$30m to $300m	> $300m
Workforce	+ Will require some staff attention over several days. + No actual or potential impact to culture	+ Will require several days local management time. + Minor impact to employee engagement and limited staff turnover	+ Will require head office staff and take several weeks of site management time. + Moderate impact to employee engagement and staff turnover above industry average with some key roles	+ Will require several weeks of senior management time + Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession	+ Will require several months of senior management time + Impact to employee engagement (< 18 months), high staff turnover and attraction issues	+ Will require more than a year of senior management involvement and operations severely disrupted + Impact to employee engagement (> 18 months), significant key role turnover and attraction issues
Compliance	+ Non-conformance with legislation, instruments (e.g. tenure licence) or contract + No regulatory or punitive action	+ Minor breach of legislation, instruments or contract + Notification/report to; request for information by; and/or administrative/ warning notice from the regulator + LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator	+ Limited number of minor breaches of legislation, instruments or contract + Statutory notice from the regulator + LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator	+ Systemic minor breaches (or one moderate breach) of legislation, instruments or contract + Company charged with an offence with minor penalty/fine + LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases	+ Systemic moderate breaches (OR single material breach) of legislation, instruments or contract + Company charged with an offence with moderate penalty/fine	+ Material breaches of legislation, instruments or contract + Company or officers charged with an offence with material penalty/fine, or loss of tenure/operatorship
	I	II	III	IV	V	VI

Likelihood							
ALMOST CERTAIN (< 4 monthly) Occurs in almost all circumstances OR could occur *within days to weeks*	f	Low	Medium	High	Very High	Very High	Very High
LIKELY (4 monthly - 1 yearly) Occurs in most circumstances OR could occur *within weeks to months*	e	Low	Medium	High	High	Very High	Very High
OCCASIONAL (1 - 3 yearly) Has occurred before in Santos OR could occur *within months to years*	d	Low	Low	Medium	High	High	Very High
POSSIBLE (3 - 10 yearly) Has occurred before in the industry OR could occur *within the next few years*	c	Very Low	Low	Low	Medium	High	Very High
UNLIKELY (10 - 30 yearly) Has occurred elsewhere OR could occur *within decades*	b	Very Low	Very Low	Low	Low	Medium	High
REMOTE (30 - 100 yearly) Requires exceptional circumstances and is unlikely even in the long term OR only occurs as a *"one in 100 year event"*	a	Very Low	Very Low	Very Low	Low	Medium	Medium

Table D3 - Risk assessment and management

Management objective	Risk	Event or circumstance	Initial risk rating			Mitigation measure	Timing, frequency or duration	Residual risk rating			Monitoring activity	Management trigger	Corrective action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
Achieve the completion criteria and habitat quality improvements for offset values, which include the habitat quality scores in this OAMP.	Completion criteria and habitat quality improvements are not achieved	Degradation of habitat	D	IV	H	Implementation of this OAMP, including the management actions and monitoring program outlined in Section 6 and Section 7. Implementation of the adaptive management process outlined in Section 5. Obtain advice with the aim of identifying appropriate additional management interventions if interim performance targets are not achieved for one or more offset values by year 5,10 or 15. If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance. The revised OAMP will be submitted to the Commonwealth Government.	Management actions to support the improvement of the offset area condition, and thereby achieve completion criteria, will be implemented as outlined in this OAMP for the lifetime of the OAMP. Habitat quality assessment will be undertaken in year 1 and then every two years for the first six years, and then every three years thereafter. Interim habitat quality score performance targets are defined for years 5, 10, and 15.	B	IV	L	Monitoring of offset value habitat quality scores and condition of habitat will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Rapid monitoring events (Section 7.7.1). • Habitat quality assessments to determine habitat quality scores (Section 7.7.2). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8.1).	Interim performance targets are not achieved for one or more offset values by year 5 or 10. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime to better support enhancement of offset values. • For offset values that have not achieved interim performance targets by year 5 or 10 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions.

Management objective	Risk	Event or circumstance	Initial risk rating			Mitigation measure	Timing, frequency or duration	Residual risk rating			Monitoring activity	Management trigger	Corrective action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
													• If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements. The revised OAMP will be submitted to the Commonwealth Government.
Maintain the extent of offset value habitat within the offset area.	Habitat or vegetation loss through land clearing.	A violation to the voluntary declaration and this OAMP, resulting in a loss of biodiversity and extent of threatened species habitat.	D	V	H	• Protection of the offset area via a Voluntary Declaration under section 19E and 19F of the VMA, as described in Section 2.7..	Conditions of the Voluntary Declaration under Section 19E and 19F of the VM Act will place for the life of EPBC 2012/6615. Restrictions outlined in Table 13 will therefore be implemented for the lifetime of the project and OAMP.	B	V	M	Reporting to the Commonwealth Government consistent with EPBC approval.	Any activities in contravention of the Voluntary Declaration and this OAMP.	**Step 1: Investigate cause of trigger** • Investigate reasons why unapproved clearing occurred e.g. unauthorised access. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Addition fencing, signage and/or security for the offset area. Restoration of the impacted area.
						Comply with the restrictions outlined in Table 13. Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in accordance with Sections 6.2.2, 6.2.3 and 6.2.4. Restoration of impacted areas subject to any unauthorised clearing	At all times	B	V	M	Compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks will also be assessed as part of offset area inspections (Section 7.1).	Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with the restrictions outlined in Section 6.2.2, 6.2.3 and 6.2.4.	Step 1: Investigate cause of trigger • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately. • Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to

Management objective	Risk	Event or circumstance	Initial risk rating			Mitigation measure	Timing, frequency or duration	Residual risk rating			Monitoring activity	Management trigger	Corrective action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
													determine the total clearing extent of offset value habitat. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.
Ensure that the livestock grazing restrictions for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Degradation of offset value habitat quality as a result of livestock grazing	Over grazing induced suppression and displacement of native flora and fauna species, reflected in environmental monitoring results and annual reports.	E	III	H	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses and promote the establishment of native perennial grass species in accordance with Section 6.2.4. Annual biomass monitoring (Section 7.2) to inform strategic grazing regimes. Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.7.1 and 7.7.2 including an assessment of % cover of native perennial grasses.	Biomass monitoring (Section 7.2) will be undertaken twice a year, at the end of the wet season and end of the dry season. Offset area inspections and rapid monitoring events will be undertaken once and twice per year, respectively, for the duration of the management period and will report on any major or noticeable changes to livestock grazing regimes.	B	III	L	Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.7.1 and 7.7.2. These will include assessment of % cover of native perennial grasses and incidental flora surveys.	Decrease in the richness and average % cover of native perennial grasses at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. • Constructing additional fencing should the current fencing be considered

Management objective	Risk	Event or circumstance	Initial risk rating			Mitigation measure	Timing, frequency or duration	Residual risk rating			Monitoring activity	Management trigger	Corrective action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
													insufficient to manage livestock in accordance with the grazing regime. • Installing additional watering points for livestock to manage livestock in accordance with the grazing regime.
Minimise predation risk by wild dogs to threatened fauna species.	Predation of threatened fauna by wild dogs.		D	III	M	Regular monitoring for pest animals will be undertaken in accordance with the methods detailed in Section 7.6 and pest animal control will be implemented following the results of monitoring in accordance with Section 6.2.6.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results. Frequency and duration of management will be appropriate to the target species biology, and extent of occurrence.	C	III	L	Monitoring will assess the relative abundance of foxes, dogs and feral cats within the offset area. Camera monitoring will be undertaken every two years, post wet season, to provide a measure of the Catling index for each species. See Section 7.5.	An increase in Catling* Index for either wild dog, feral cat, or fox from year 1 and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in the: • Catling* index for wild dogs, feral cats and/or foxes. • relative abundance of feral pigs and horses. • Review adherence to pest management control measures as outlined in Section 6.2.6. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Increasing the frequency and intensity of pest animal control. • Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the
Minimise predation risk by foxes to threatened fauna species.	Predation of threatened fauna by foxes.		D	III	M			C	III	L			
Minimise predation risk by feral cats to threatened fauna species.	Predation of threatened fauna by cats.		D	III	M			C	III	L			
Minimise degradation of offset value habitat by feral pigs.	Degradation of habitat by feral pigs.		D	III	M	Regular monitoring for pest animals will be undertaken in accordance with the methods detailed in Section 7.6 and pest animal control will be implemented following the results of monitoring in accordance with Section 6.2.6.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results. Frequency and duration of management will be appropriate to the target species biology, and extent of occurrence.	C	III	L	Pest monitoring activities will be undertaken every two years, post wet season. Assessment for the presence or absence of feral pig signs as a measure of abundance will be undertaken at permanent monitoring transects which have been randomly stratified across the offset area in environments that are more regularly impacted. See Section 7.6.	An increase in mean feral pig abundance score from year 1 and subsequent monitoring events.	
Minimise degradation of offset value habitat by rabbits.	Degradation of habitat by rabbits.		D	III	M			C	III	L	Pest monitoring activities will be undertaken every two years, post wet season. Assessment for the presence or absence of rabbit abundance, seedling abundance and rabbit damage will be undertaken at permanent monitoring transects which have been	Rabbit impact category measured as ‘monitor closely’, or ‘unacceptable’.	

Management objective	Risk	Event or circumstance	Initial risk rating			Mitigation measure	Timing, frequency or duration	Residual risk rating			Monitoring activity	Management trigger	Corrective action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
											randomly stratified across the offset area. See Section 7.6.		OAMP and targeted pest animal control programs.
Manage invasive weed species to reduce degradation of offset value habitat.	Invasion of habitat by weed species, including exotic grasses.	An increase in either the abundance or diversity of weed species.	D	III	M	Adhere to weed hygiene restrictions in accordance with Section 6.2.1. Based on the results of monitoring events (Section 7.5), weeds will be managed using biological, chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets, for the relevant weed species (see Section 6.2.5).	Weed treatment and control will be undertaken at optimal timing according to the lifecycle of the target species, i.e. before seeding. Frequency and duration of management will be appropriate to the target species biology, severity and extent of infestation.	C	III	L	Undertake weed monitoring in accordance with Section 7.4.	An increase in species richness and relative abundance of weed species at more than 20% of monitoring sites from year 1 and subsequent monitoring events. A new weed species is identified at one or more monitoring sites.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds. • Investigate potential sources or reasons for the occurrence of the new weed species. • Review adherence to weed management control measures as outlined in Section 6.2.5. • Review adherence to weed hygiene restrictions as outlined in Section 6.2.1. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Amending weed hygiene restrictions. • Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to. • Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld). • Increasing the frequency and intensity of weed control.

Management objective	Risk	Event or circumstance	Initial risk rating			Mitigation measure	Timing, frequency or duration	Residual risk rating			Monitoring activity	Management trigger	Corrective action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
													Updating weed control methods in the OAMP and targeted weed control programs.
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	Inappropriate fire regimes.	Decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events as a result of fire management measures, or an unplanned fire.	D	IV	H	Fuel loads within the offset area will be managed through strategic livestock grazing and fuel hazard reduction burns as outlined in Section 6.2.4. Firebreaks will be established and maintained around the boundary of the offset area, with green firebreaks established where the offset area joins native vegetation. Firebreaks will be maintained at least annually in mid / late autumn and, or early spring to remove overhanging trees or fallen debris and dense vegetation.	If deemed necessary, fuel load management will be carried out when required during suitable climatic conditions, as outlined in Section 6.2.4.	B	IV	L	Habitat quality assessments to determine habitat quality scores will be undertaken in accordance with Section 7.7.2. Rapid monitoring events will be undertaken to assess the general condition of vegetation in accordance with Section 7.7.1. Fuel load monitoring in accordance with Section 7.4.	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores. • Review adherence to the fire management measures as outlined in Section 6.2.4. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass and fuel load monitoring. • Increasing the frequency of weed control measures. • Amending the strategic grazing regime. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks. • Review timing and intensity of fuel hazard reduction burns in accordance with the Regional Ecosystem Description Database (REDD) fire management guidelines and conservation advice for the particular offset value.
Achieve the interim performance targets and completion criteria for	Interim performance targets are not	Offset fails to achieve the interim performance targets and completion	E	III	H	All management actions outlined in Section 6 will be implemented to ensure that the interim	Management methods and actions will occur during seasonally suitable timing,	B	III	L	Monitoring of the offset area will be undertaken in	Interim performance targets are not achieved for one or more offset	**Step 1: Investigate cause of trigger**

Management objective	Risk	Event or circumstance	Initial risk rating			Mitigation measure	Timing, frequency or duration	Residual risk rating			Monitoring activity	Management trigger	Corrective action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
each offset value within 5, 10, 15 and 20 years, respectively.	achieved for offset values by year 5, 10 or 15. Completion criteria are not achieved for offset values by year 20.	criteria within the anticipated 5-, 10-, 15- and 20-year timeframes, respectively.				performance targets and completion criteria are achieved. Monitoring of the offset area will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Offset value assessments (Section 7.7). • The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	in collaboration with the landholder and contractor undertaking the scope of work. Monitoring will occur in accordance with the implementation schedule, see Section 9.				accordance with Section 7 including: • Offset area inspections (Section 7.1). • Offset value assessments (Section 7.7). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	values by years 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** • The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values.

Appendix E

Interim performance targets and completion criteria for the Cobbadah offset area

MNES	Baseline habitat quality score	Interim performance target			Completion criteria
		Year 5	Year 10	Year 15	Year 20
Threatened ecological communities					
Brigalow TEC	9 (9.2)	No decrease in overall habitat quality score from previous monitoring event			9
SEVT TEC	8 (8.0)	(8.2)	(8.4)	(8.6)	9
Threatened fauna species					
Collared Delma (*Delma torquata)*	7 (7.4)	7.6	7.8	7.9	8
Dunmall's Snake (*Furina dunmalli)*	7 (7.2)	7.4	7.6	7.8	8
Yakka Skink (*Egernia rugosa*)	7 (7.2)	7.4	7.6	7.8	8
Koala (Phascolarctos cinereus)	7 (7.1)	7.3	7.6	7.8	8
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	7 (6.6)	6.9	7.3	7.7	8

Appendix F

Overall Fuel Hazard Assessment Guide

Department of Sustainability and Environment

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management

report no. 82

State Government Victoria

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management, report no. 82

By Francis Hines, Kevin G Tolhurst, Andrew AG Wilson and Gregory J McCarthy

This publication was produced with the support of the Attorney-General's Department of the Australian Government, who part funded this project through the Natural Disaster Resilience Grants Program.

Images have been provided by Department of Sustainability and Environment – Victoria, Department of Environment and Heritage – South Australia, Country Fire Service – South Australia, Department of Conservation and Environment – Western Australia and Christian Pearson – Misheye. Katy Friend drew the illustrations.

Cover image: Elaine – Atchison Rd Fire, Victoria, January 2008. Bark Hazard – Extreme, Elevated Fuel Hazard – Moderate, Near-surface Fuel Hazard – Low, Surface Fuel Hazard – Very High. Overall Fuel Hazard – Extreme. Fire burning under FFDI 17 – High.

Published by the Victorian Government Department of Sustainability and Environment
Melbourne, July 2010

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Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

Printed by Stream Solutions
Printed on 100% Recycled paper

ISBN 978-1-74242-676-1 (print)
ISBN 978-1-74242-677-8 (online)

For more information contact the DSE Customer Service Centre 136 186

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1. About this guide

1.1 Purpose

The main purpose of this guide is to allow people to:

- make a rapid, visual assessment of fuel arrangement, and
- gain an understanding of how this will affect the chances of controlling a bushfire.

1.2 Audience

This guide has been principally designed to provide information on fuel arrangement to be used by:

- firefighters to assess the difficulty of controlling a bushfire.

Information on fuel arrangement may also be used by:

- asset owners and managers to assess potential bushfire risks to assets
- land and fire managers to provide a measurable objective and trigger for fuel management in fire management plans
- personnel to identify which key attributes and fuel layers are contributing the most to the hazard
- personnel to plan and conduct planned burns
- personnel to assess the effectiveness of planned burning or mechanical hazard reduction
- fire behaviour analysts to produce fire-spread predictions and community warnings.

Those who use the guide for these other purposes need to be mindful of its limitations and how the results are applied and interpreted.

1.3 What fuel is assessed

This guide is for assessing fine fuels that burn in bushfires. Fine fuels are the fuels that burn in the continuous flaming zone at the fire's edge. They contribute the most to the fire's rate of spread and flame height. Typically, they are dead plant material, such as leaves, grass, bark and twigs thinner than 6mm thick, and live plant material thinner than 3mm thick. Once ignited, these fine fuels generally burn out within two minutes.

This guide focuses on assessing the key structural layers of the fine fuel complex, in particular those of bark, elevated, near-surface and surface fuels.

1.4 How the fuel is assessed

Each fuel layer is assessed simply and visually. Assessing the fuel takes only a few minutes and is based on the premise that the eye is better able to integrate local variations in fuel than systematic measurement. Each fuel layer is assessed in turn and given a hazard rating. Particular emphasis is placed on how the fuel is arranged within each of these layers. The hazard ratings are then combined to produce an Overall Fuel Hazard Rating that ranges from Low to Extreme.

1.5 Why fuel arrangement is more important than fuel load

The image below highlights the effect that changing the arrangement of the fuel can have on fire behaviour. Both fires were ignited at the same time in the same way. Both fires are burning in the same fuel load, approximately two broadsheets of newspaper over a 20cm diameter area. The fuel on the right was laid flat and has little vertical orientation. The fuel on the left was crumpled up, which gave it more vertical orientation and exposed more of the surface to the air. As a result, the fire on the left shows significantly greater flame height and the fuel is consumed much faster.

The simple difference in the arrangement of the fuel significantly affects the resulting fire behaviour. The effect would not be discerned if the fuel assessment was based purely on fuel load. An assessment of fuel hazard takes into account the fuel arrangement. It gives a better indication of potential fire behaviour and suppression difficulty.

1.6 Suppression difficulty is not just about fire behaviour

This guide has been mainly developed to allow people to assess the impact of fuel arrangement on suppression difficulty. An assessment of suppression difficulty (how hard it is to control a bushfire) is not based solely on the anticipated fire behaviour. Many other factors affect the chances of a firefighting operation succeeding, including resources, fire size and terrain.

In order to consider the impact of fuels, the other factors need to be treated as if they are constant. The factors that have been held constant are referred to as the Reference Extended First Attack Conditions. Further detail on these conditions is contained in Appendix 1.

1.7 Basis of the Overall Fuel Hazard classification

A comprehensive explanation of this guide is contained in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep.).

This assessment guide updates and builds on work previously published by Wilson (1992a, 1992b, 1993), McCarthy *et al*. (1998a, 1998b, 1998c, 1999, 2001), the Department of Environment and Heritage (2006) and Gould *et al*. (2007a, 2007b).

Classifying Overall Fuel Hazard is complex, with few available measurements. Therefore, we have relied on the perceptions of experienced fire personnel (e.g. fire behaviour specialists, fire managers and firefighters). The collective experience of these personnel is vast, with a broad geographic base across Australia.

1.8 Need for continual learning and development

Although our knowledge about fuels has many gaps, this guide is based on the best available information and experience. The authors acknowledge that this guide will need to change and improve as more information is obtained.

Observers of firefighting operations can improve future editions of this guide by carefully recording what they see. Observations, comments and feedback can be emailed to fire.monitoring@dse.vic.gov.au.

2. How to use the guide

This guide has been kept concise and should not be considered as a standalone document. To produce reliable and consistent results requires extra knowledge which may be gained through local hands-on training in fuel assessment.

2.1 Application

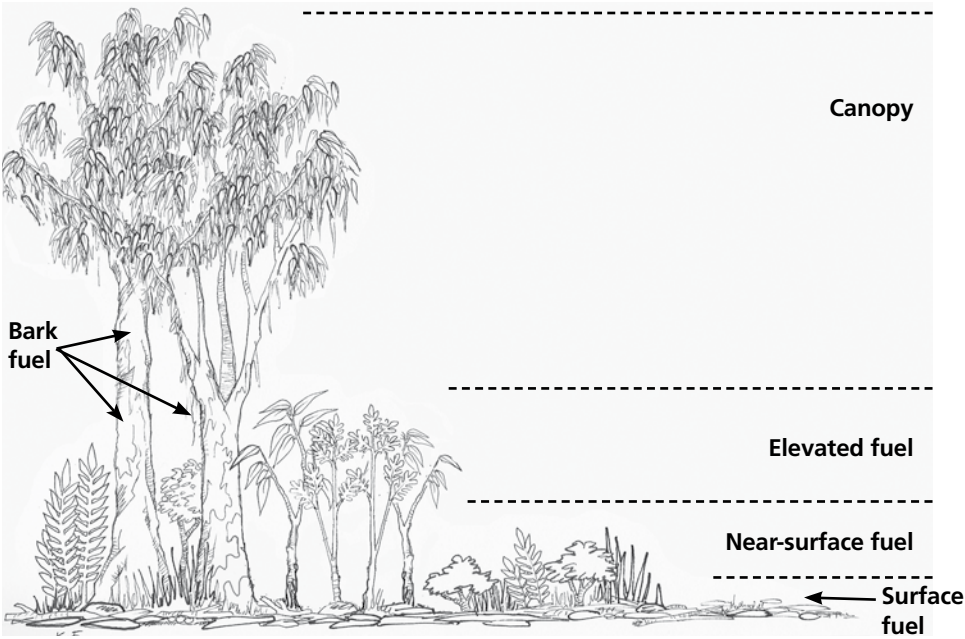
This guide is a tool for rapidly assessing fuel arrangement and its effect on the chances of controlling a bushfire. It may also be used for a range of other fire management purposes, as shown in the table below. Users of this guide should understand the underlying assumptions and limitations before applying it, particularly if applying it for purposes other than the assessment of suppression difficulty.

Application	Methodology
Assess suppression difficulty	Assess the fuels in which the fire may occur or is actually occurring.
Assess fuels for predicting potential risk to assets	Assess the fuels immediately adjacent to the asset as part of an assessment of possible radiant heat loads and defendable space. Assess the fuels further away from the asset; paying particular attention to areas that may generate spotting, such as ridges. Assessments should be focused, particularly in the direction of likely fire attack.
Assess the need for, or success of, fuel management activities	Assess the average fuels across the nominated area by sampling within major vegetation types, slopes and aspects.
Plan and conduct planned burns	Assess the variability in fuels across the nominated area by sampling within major vegetation types, slopes and aspects. Pay particular attention to areas where the burn may escape, such as the tops of gullies, ridge tops and areas adjacent to planned burn boundaries.
Assess fuels for predicting fire behaviour	Assess the fuel values needed as inputs for the appropriate fire behaviour model.

2.2 Fuel layers

Fuel in forests, woodlands and shrublands can be divided into four layers, each based on its position in the vegetation profile (Fig 2.1). This guide focuses on assessing the key structural layers of the fine fuel complex, those of bark, elevated, near-surface and surface fuels.

Figure 2.1 Fuel layers and bark



Use the following descriptions to determine how to separate vegetation into fuel layers.

Layer	Description	Contribution to suppression difficulty
Canopy	• Crowns of the tallest layer of trees. • Under some conditions canopy fuels can play a significant role in fire behaviour and suppression difficulty. Currently, however, these fuels are not assessed as part of Overall Fuel Hazard.	
Bark fuel	• Bark on tree trunks and branches, from ground level to canopy.	Spotting
Elevated fuel	• Fuels are mainly upright in orientation. • Generally most of the plant material is closer to the top of this fuel layer. • Sometimes contains suspended leaves, bark or twigs. • Fuels that have a clear gap between them and the surface fuels. • Can be highly variable in ground coverage. • Low-intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.	Influences the flame height and rate of spread of a fire.
Near-surface fuel	• Live and dead fuels, effectively in touch with the ground, but not lying on it. • Fuel has a mixture of vertical and horizontal orientation. • Bulk of the fuels are closer to the ground than to the top of this layer, or are distributed fairly evenly from the ground up. • Sometimes contains suspended leaves, bark or twigs. • Coverage may range from continuous to having gaps many times the size of the fuel patch. • Low-intensity fire (flame height of less than 0.5m) will consume most or all of this fuel. • Fuel in this layer will always burn when the surface fuel layer burns.	Influences the rate of spread and flame height of a fire.
Surface fuel (litter)	• Leaves, twigs, bark and other fine fuel lying on the ground. • Predominantly horizontal in orientation.	Influences the rate of spread of a fire.

This guide is for assessing fine fuels only. Coarse fuels including logs are not considered. See Section 1.3 for further details.

The descriptions of the fuel layers exclude references to species' names or common vegetation forms, such as shrubs. During a plant's life it may transition back and forth between different layers. For example, juvenile bracken fern can be classified as near-surface fuel before becoming elevated fuel as it matures. Once it dies and collapses it may become near-surface fuel again.

2.3 Assessment based on key attributes of fuel hazard

A fuel hazard rating of Low, Moderate, High, Very High or Extreme is assigned to each fuel layer by assessing it against the key attributes listed below.

Key attribute	
Horizontal continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel beside it. Identifies which of surface, near-surface or elevated fuels will determine the average flame height.
Vertical continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel above it.
Amount of dead material in the layer	Determines how much dead material is present to burn and thus help with igniting the live (green) fuels.
Thickness of the fuel pieces	Determines whether the fuel pieces will burn in the flaming front of the fire.
Total weight of fine fuel	Determines the weight of fine fuel contributing to the flaming front of the fire.

The descriptions in the hazard assessment tables do not cover all possible combinations of the key attributes. Users will need to exercise judgement and make an assessment using all key attributes when actual conditions fit between the descriptions.

2.4 Using the descriptions and photographs

This is **not** a photographic guide for assessing fuels. The **descriptions** for each of the key attributes should be used as the basis for determining the fuel hazard rating. Photographs cannot adequately show all of the key attributes that are important in determining fuel hazard. The photographs are provided to illustrate **some** of the key attributes for each fuel hazard rating. They do not represent all possible variations of that particular hazard rating.

2.5 Area of assessment

Within an area of interest fuels are assessed in small patches or plots. The size and number of plots depends on the reason for assessing the fuels. Some applications (such as for input into fire behaviour models) may require a more rigorous and systematic approach to sampling. Other applications (such as assessing fuel hazard during firefighting operations) will necessitate a more rapid informal approach. For whatever purpose the guide is being used it is recommended that the following principles be applied:

- Any assessment of fuels should try to assess the variability in fuels across an area by assessing the fuels at multiple plots.
- The size and number of plots should reflect the level of reliability required of the results.
- For surface, near-surface and elevated fuel layers the result of assessing the plot should reflect the average state of that fuel layer.
- For bark hazard the result of assessing the plot should be based on the trees with the highest rating.
- Always record with the result the name and the version of the guide used.

2.6 Tips for assessing fuel hazard

The process of assessing fuel hazard using this guide is largely subjective. Implementing the following techniques will help to improve accuracy and reliability:

- Identify and agree on examples of the highest rating of fuel hazard for each layer that occur locally. These examples should be used as benchmarks.
- Conduct assessments in pairs of observers and regularly change assessment pairs.
- Assessors should be no more than one hazard rating apart when assessing each layer (e.g. Low or Medium, not Low or High).
- Use different assessors to re-assess completed work and provide feedback.

2.7 Vesta fire behaviour predictions

In dry eucalypt forest with a litter and shrub understorey the *Field guide – fuel assessment and fire behaviour prediction in dry eucalypt forest* (Gould *et al.* 2007b) provides a systematic method for assessing fuel and predicting fire behaviour (rate of spread, flame height, and spotting). The Project Vesta fuel hazard scoring system is similar to the Victorian system developed by Wilson (1992a, 1992b, 1993) and revised by McCarthy *et al*. (1999). The scale that underlies the Vesta fuel hazard scores is directly related to fire behaviour. These scores, along with height measurements of various fuel layers, are needed as inputs into the fire behaviour prediction tables in Gould *et al*. (2007b). Section 9.3 contains a table for translating the fuel hazard rating for each fuel layer into Vesta fuel hazard scores.

2.8 Effect on fire behaviour

Each table for assessing fuel hazard contains information on the effect that the fuel arrangement is likely to have on fire behaviour. This effect is for weather conditions equivalent to a Forest Fire Danger Index (FFDI) of 25 (McArthur 1973). An FFDI of 25 can be achieved in many ways. For the purposes of this guide the specific conditions required to achieve this are:

Temperature: 33°C	Relative Humidity: 25%	Wind Speed: 20km/h
Drought Factor: 10	Slope: 0°	

If weather conditions vary from those listed above the effect on fire behaviour will also vary.

2.9 Fuel assessment data sheet

Appendix 2 contains a sample field data sheet that can be used when assessing fuels.

3. Bark fine fuel

3.1 Identification

Bark fuel is the bark on tree trunks and branches. Bark lying on or near the ground or draped over understorey plants is considered to be surface, near-surface or elevated fuel.

3.2 Identifying bark types

The key attributes for assessing the effect of bark on suppression difficulty are shown below:

Key attribute	Determines	How it is assessed
Ease of ignition	• How readily the bark will ignite. • Whether the fire will burn up the trunk and into the branches of the tree.	Thickness, size and shape of bark pieces.
How bark is attached	• How likely the bark is to break off the tree.	How easily the bark breaks off the tree.
Quantity of combustible bark	• Volume of potential embers that a fire may generate.	Relative quantity of combustible bark.
Size-to-weight ratio of the bark pieces	• How far the wind is likely to carry bark pieces once they break off the tree.	Thickness, size and shape of bark pieces.
Burn out time	• Length of time a piece of bark will stay ignited once it breaks off the tree.	Thickness, size and shape of bark pieces.

Descriptions of trees have been separated into three broad bark types using three of these key attributes – ease of ignition, burn out time and size-to-weight ratio:

1. Fine fibrous barks, including stringybarks
2. Ribbon or candle barks
3. Other bark types, including smooth, platy, papery and coarsely fibrous. The reason for describing these types in some detail is to help observers distinguish them from the above two types.

3.3 Identifying Stringybark and other fine fibrous bark types

Contribution to suppression difficulty	• Bark types that can produce massive quantities of embers and short distance spotting.
Physical description	• Bark is fine fibrous material with easily visible fibres less than 1mm thick covering the whole trunk. • Bark fibres resemble the fine fibres that are twisted together to form natural string. • Old bark is retained on the trunk of the tree for decades, forming a relatively spongy fibrous mass with deep vertical fissures. • Outer bark may weather to a greyish colour, while underlying bark retains its original colour. • Bark may form large strands when peeled off. • Fine, hairlike pieces also break off from the tree when it is rubbed.
Ease of ignition	• Bark is very flammable (can be easily lit with a match when dry). • Fires will readily climb the tree and branches.
How bark is attached	• Young or new bark is held tightly to the trunk. • As bark ages it becomes less tightly held. • Old, long-unburnt bark is held very loosely.
Quantity of combustible bark	• Bark on old, long-unburnt stringybarks can be more than 10cm in depth. During fires it can produce massive quantities of embers.
Size-to-weight ratio	Burning pieces of bark tend to be either: • Very fine lightweight fibres that will be carried for less than 100m. • Small lightweight wads (about the size of a thumb) that will be carried for less than 300m. • Very large wads (bigger than a fist) that fall close to the tree.
Burn out time	• Very fine fibres of bark that will burn out within one minute. • Small wads of bark that will burn out within 2–3 minutes. • Very large wads of bark that will burn for up to 10 minutes.
Hazard accumulation	• Bark hazard can reach Extreme. • Bark hazard increases over time as the thickness and looseness of the old bark increases. • Repeated low intensity fires (<0.5m flame height) may produce a 'black sock' effect on the base of the trunk, but this may have limited effect in reducing the overall quantity of bark and the hazard.

Examples

Table 3.1 Assessing the hazard of fine fibrous bark types including stringybarks

Only use this table if at least 10% of the trees in a forest have fine fibrous bark. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[1]
How bark is attached	**Quantity of combustible bark**		
This hazard rating cannot occur when only this bark type is present.		Low	
Bark tightly held. Requires substantial effort to break off bark by hand.	Very little combustible bark. Entire trunk almost completely black or charred.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Bark is mostly tightly held with a few pieces loosely attached.	Limited amount of combustible bark. 50–90% of trunk charred. Most of the bark is charred, especially on the lower part of the trunk.	High	Infrequent spotting. Fires will climb some of these trees.
Many pieces of bark loosely held. Deep fissures present in bark.	Large amounts of combustible bark. 10–50% of trunk charred. Upper parts of the tree may not be charred at all.	Very High	Substantial spotting. Fires will climb most of these trees.
Outer bark on trees is weakly attached. Light hand pressure will break off large wads of bark. Deep fissures present in bark.	Huge amounts of combustible bark. <10% of trunk charred. Minimal evidence of charring.	Extreme	Quantity of spotting generated makes fire control very difficult or impossible. Fires will climb virtually all these trees.

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as being the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

1 FFDI 25 is a Forest Fire Danger Index of 25 (McArthur 1973). Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.2 Examples of Stringybarks and other fine fibrous bark hazard

Low	This hazard rating cannot occur when only this bark type is present.
Moderate	
High	
Very High	
Extreme	

The photos above show some of the variation possible within each bark hazard rating.

3

3.4 Identifying ribbon or candle bark types

Effect on suppression difficulty	• Bark types that can produce substantial quantities of spotting at distances greater than 2km. Will also produce short distance spotting.
Physical description	• Trees characterised by the annual shedding of old bark layers, exposing the smooth new bark underneath. • Bark is shed in the form of long strips or ribbons of bark. • Long strips of bark curl tightly inwards to form a candle-like shape (see image lower right). • Bark strips 50cm or more in length fall off and often drape around the trunk and over branches and surrounding shrubs. • Strips of bark are usually less than 2mm thick. • Bark is shed at various times of the year so that the trunk may have a mottled appearance.
Ease of ignition	• Bark is moderately flammable (can be lit with a cigarette lighter when dry). • Fires will climb up ribbons of bark.
How bark is attached	• Bark strips may drape over, or be weakly attached to, the trunk and branches.
Quantity of combustible bark	• Large quantities of bark can be retained in upper trunk and head of the tree.
Size-to-weight ratio	• Bark pieces are relatively light for their large size. • Easily transported by strong updrafts – may travel up to 30km downwind.
Burn out time	• Bark can burn and smoulder within the curled up ribbons for longer than 10 minutes.
Hazard accumulation	• Bark hazard never exceeds Very High. • Bark hazard tends to increase over the long term as ribbons accumulate on the tree. • A low intensity fire (flame height of less than 0.5m) may not reduce the hazard in this bark type.

Example

Note: Loose ribbon or candle-like bark that is retained on the trunk near ground level is not included in the assessment of ribbon or candle bark types. It is usually:
- firmly attached to the trunk of the tree
- consumed in place by a surface fire.

This bark is considered in 'Other bark types' and can also be considered as near-surface fuel.

Smooth-bark trees also shed bark as slabs or flakes. These bark types are considered in 'Other bark types'.

Table 3.3 Assessing the hazard of ribbon or candle bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site.

Key attribute Amount of combustible bark	Hazard rating	Effect on fire behaviour (at FFDI 25)[2]
This hazard rating cannot occur when only this bark type is present.	Low	
No long ribbons of bark present. Trunk and branches of trees almost entirely smooth.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Long ribbons of bark present on upper trunk (>4m above ground) and in head of trees. Lower trunk mainly smooth.	High	Infrequent spotting. Fires will climb some of these trees.
Long ribbons of bark in the head and upper trunk with: • ribbons hanging down to ground level or, • flammable bark covers trunk.	Very High	Substantial spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.	Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

2 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.4 Examples of ribbon or candle bark hazard

Low	This hazard rating cannot occur when only this bark type is present.
Moderate	
High	
Very High	
Extreme	This hazard rating cannot occur when only this bark type is present.

3.5 Identifying other bark types

This bark type includes all other bark types not included in the previous two types. As a result, many different tree species are grouped together. This grouping is based on the ease of ignition, burn out time and size-to-weight ratio of the bark, rather than on botanical values. These other bark types can produce limited quantities of short distance spotting.

This bark type group has been divided into several subgroups. These subgroups are described in some detail to help observers distinguish them from the other two main bark types.

3.5.1 Ironbarks and Platy barks

Physical description	• Trees characterised by layers of old, coarse bark retained on the trunk and branches. • Bark becomes rough, compacted and furrowed with age • Bark feels very abrasive when rubbed by hand. • Bark pieces tend to be more than 2mm thick when they break off. • There may be little or no evidence of charring on the bark following planned burns.
Hazard accumulation	• Bark hazard never exceeds Moderate.

Example

3.5.2 Coarsely fibrous barks

Physical description	• Trees characterised by short strand fibrous bark. • Layers of old dead bark are retained on the trunk and branches. • Unlike stringybark trees, the bark on these trees forms only short strands or chunks when peeled off. • Evidence of charring on the bark may last for up to 10 years.
Hazard accumulation	• Bark hazard never exceeds High. • Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.3 Papery barks

Physical description

- Shrubs and trees growing from 2m to 30m tall, often with flaky shedding bark.
- Old bark is retained on the trunk and branches and builds up into a thick spongy mass.
- Bark layers tend to split allowing sheets of bark to become loose and eventually peel off.
- Evidence of charring on the bark may last for up to 10 years.

Hazard accumulation

- Bark hazard never exceeds High.
- Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.4 Slab bark, smooth bark and small flakes

Physical description

- Trees characterised by the annual shedding of old bark layers, exposing the smooth living bark underneath.
- Bark shed is often seasonal and often annual.
- Species where the old bark tends to peel into large slabs (<50cm in length) or small flakes when shed.
- Most of the bark falls off the tree soon after it is shed.
- Some small amounts of bark may be retained on the stem or branches for several months before falling off, leading to a mottled effect.
- The mottled effect leads to discontinuous bark fuel up the tree.

Hazard accumulation

- Bark hazard never exceeds Moderate.
- Bark hazard tends to be seasonal.

Example

Table 3.5 Assessing the hazard of other bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[3]
How bark is attached	**Quantity of combustible bark**		
No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.		Low	No bark present that could contribute to fire behaviour.
Bark rubs off by hand with firm pressure.	Limited amount of combustible bark.	Moderate	Spotting generally does not hinder fire control. Fires will climb some of these trees.
Light hand pressure will break bark off.	Large amounts of combustible bark.	High	Infrequent spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.		Very High	
This hazard rating cannot occur when only this bark type is present.		Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

3 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

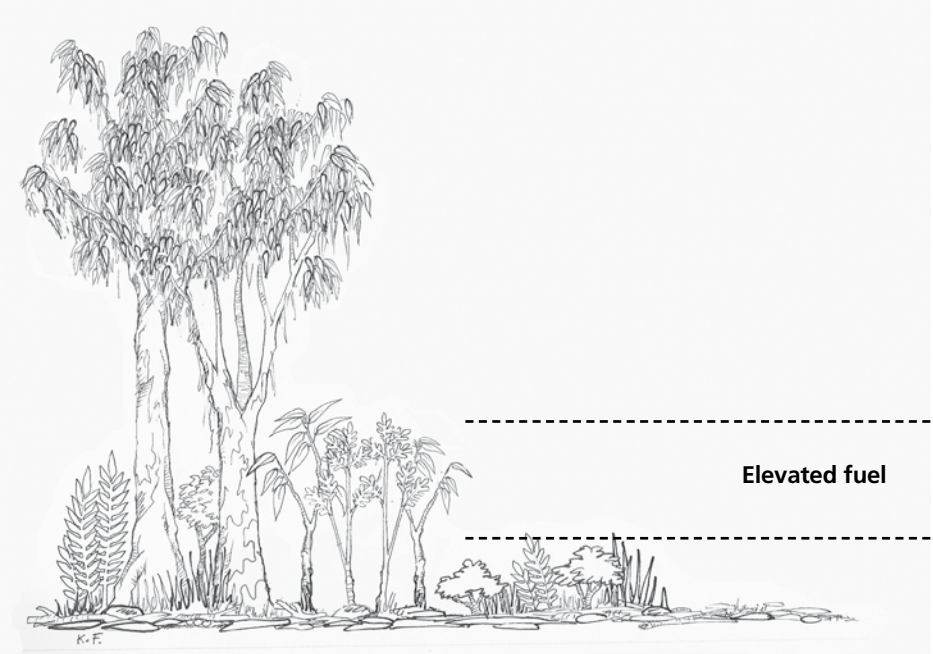
Table 3.6 Examples of other bark types

Low	No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.	
Moderate		
High		
Very High	Does not occur when this is the only bark type present on a site.	
Extreme	Does not occur when this is the only bark type present on a site.	

4. Elevated fine fuel

4.1 Identification

- Fuels are mainly upright in orientation
- Generally most of the plant material is closer to the top of this layer
- Sometimes contains suspended leaves, bark or twigs
- Fuels that have a clear gap between them and the surface fuels
- Elevated fuel can be highly variable in ground coverage
- A low intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.



4.2 Assessment

The elevated fuel hazard is highest when the:

- foliage, twigs and other fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and/or horizontal and vertical continuity that promotes the spread of flames
- live foliage has low fuel moisture content.

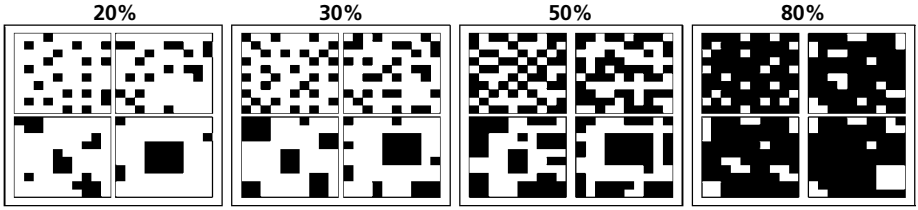
Table 4.1 Assessing elevated fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes					Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[4]
Plant Cover	% dead	Vertical continuity	Vegetation density	Thickness of fuel pieces		
<20% or low flammability species	<20%		Easy to walk in any direction without needing to choose a path between shrubs.		Low	Little or no effect.
20–30%	<20%	Most of the fine fuel is at the top of the layer.	Easy to choose a path through but brush against vegetation occasionally.		Moderate	Does not sustain flames readily.
30–50%	<20%	Most of the fine fuel is at the top of the layer.	Moderately easy to choose a path through, but brush against vegetation most of the time.		High	Causes some patchy increases in the flame height and/or rate of spread of a fire.
50–80%	20–30%	Continuous fine fuel from the bottom to the top of the layer.	Need to carefully select path through.	Mostly less than 1–2mm thick.	Very High	Elevated fuels mostly dictate flame height and rate of spread of a fire.
>70%	>30%	Continuous fine fuel from the bottom to the top of the layer.	Very difficult to select a path through. Need to push through vegetation.	Large amounts of fuel <2mm thick.	Extreme	Elevated fuels almost entirely determine the flame height and rate of spread of a fire.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



4 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 4.2 Examples of elevated fine fuel hazard

Low	Elevated fuel absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

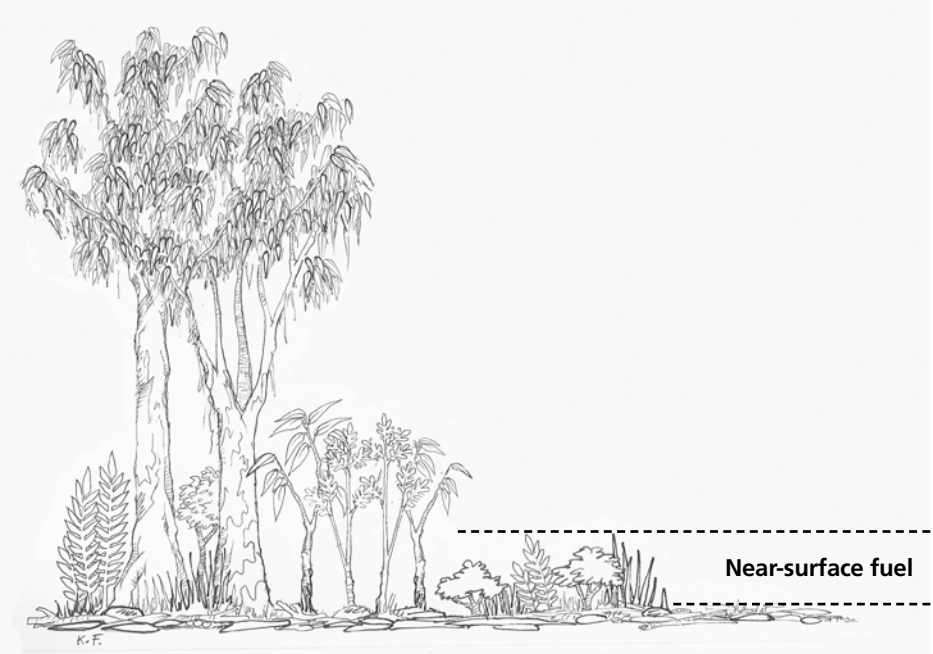
Assess elevated hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of elevated fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the elevated fuel height (m) should be the average of 10 measurements taken along a 300m walk-through. Measure the typical height from ground level.

5. Near-surface fine fuel

5.1 Identification

- Live and dead fuels effectively in touch with the ground but not lying on it
- Fuel has a mixture of vertical and horizontal orientation
- Either the bulk of the fuels is closer to the ground than the top of this layer, or is distributed fairly evenly from the ground up
- Sometimes contains suspended leaves, bark or twigs
- Coverage may range from continuous to having gaps many times the size of the fuel patch
- A low intensity fire (flame height of less than 0.5m) will consume most or all of this fuel
- Fuel in this layer will always burn when the surface fuel layer burns.



5.2 Assessment

The near-surface fuel hazard is highest when the:

- foliage, twigs and other fine fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and /or horizontal and vertical continuity, that promotes the spread of flames
- live foliage has low fuel-moisture content.

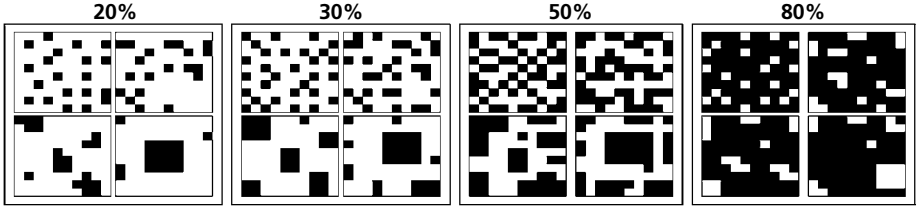
Table 5.1 Assessing near-surface fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[5]
Plant cover	% dead	Horizontal connectivity		
<10%	<10%	Near-surface fuel is absent or virtually absent.	Low	Little or no effect.
10–20%	<20%	Gaps many times the size of fuel patches.	Moderate	Occasionally increases flame height.
20–40%	>20%	Gaps between fuel patches are greater than the size of fuel patches. Starting to obscure logs and rocks.	High	Contributes to surface fire spread and causes patchy increase to flame height.
40–60%	>30%	Fuel patches are equal to or larger than the gaps between the fuel patches.	Very High	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.
>60%	>50%	Very small gaps between fuel patches. Logs and rocks obscured.	Extreme	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



5 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 5.2 Examples of near-surface fine fuel hazard

Low	Near-surface fuel is absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

Assess near-surface hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of near-surface fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the near-surface fuel height (cm) should be the average of 10 measurements taken over a 300m walk through. Measure the typical height from ground level.

6. Surface fine fuel

6.1 Identification

- Leaves, twigs, bark and other fine fuel lying on the ground
- Predominantly horizontal in orientation
- Usually contributes the most to fuel load or quantity
- Includes the partly decomposed fuel (duff) on the soil surface.

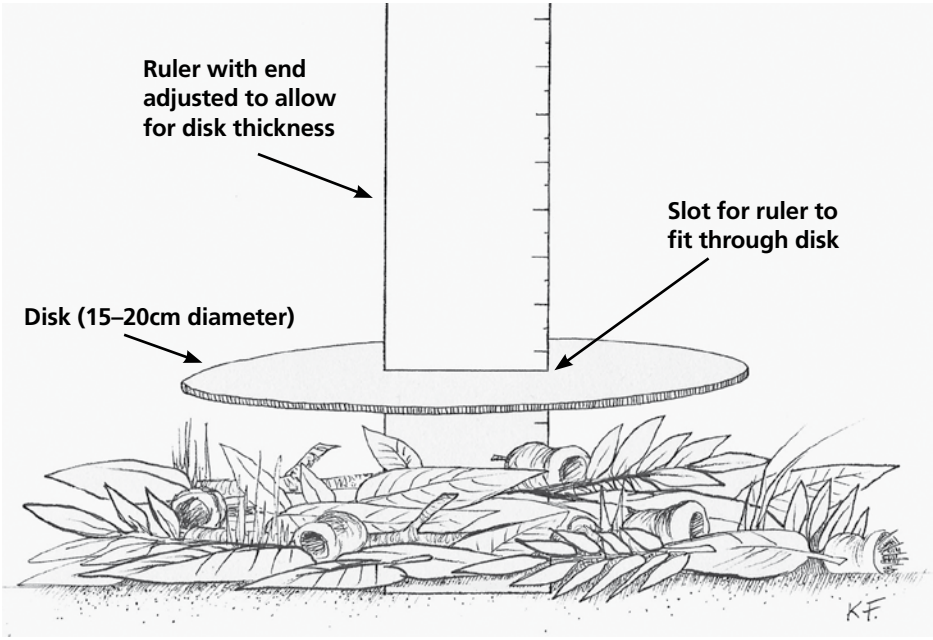
6.2 Assessment

The surface fine fuel hazard is highest when the:

- litter pieces are well connected
- surface litter cover is high, with minimal interruption from rocks, logs or patches of bare soil
- surface litter has substantial depth (greater than 30mm).

6.3 Measurement

Surface litter-bed depth should be measured using a simple depth gauge, as pictured below. This follows the methodology described in McCarthy (2004) and McCarthy *et al*. (1999).



Litter depth should be measured in areas where near-surface fuels do not obscure the litter. Fuel depth is measured using a 15cm circular disk with a ruler through a slot in its centre. To use this gauge, a small gap is made in the litter bed down to mineral soil, then the end of the ruler is placed resting on the mineral soil surface. The disk is pushed down with light pressure until its whole perimeter is in contact with the fuel. Light pressure can be described as 'enough pressure to hold a tennis ball under water'. The ruler is read off level with the top of the disk. Note that the end of the ruler needs to be adjusted to match the thickness of the disk.

Five measurements of litter bed depth should be made at each site. The average of these measurements is one of the attributes that can be used to determine the surface fine fuel hazard.

Table 6.1 Assessing surface fine fuel hazard

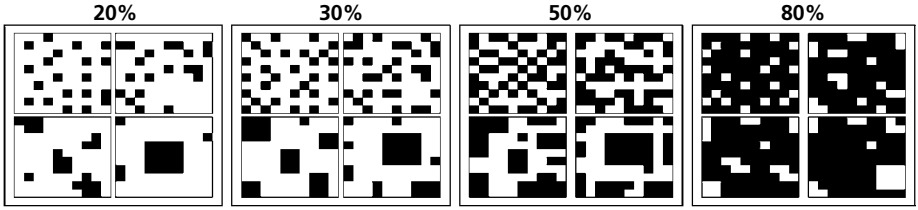
To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[6]
Horizontal connectivity	Surface litter cover	Litter-bed depth		
Litter poorly interconnected. Large areas of bare soil or rock. More soil than litter. Soil surface readily visible through litter bed.	<60%	Very thin litter layer <10mm	Low	Surface fires will not spread.
Litter well connected. Some areas of bare soil or rock. Soil surface occasionally visible through litter bed.	60–80%	Thin litter layer 10–25mm	Moderate	Litter connected well enough to allow fire spread to overcome bare patches.
Litter well connected. Little bare soil.	80–90%	Established litter with layers of leaves ranging from freshly fallen to decomposing. 20–30mm	High	Surface fires spread easily with a continuous fire edge.
Litter completely connected.	>90%	Thick litter layer 25–45mm	Very High	Surface fires spread easily. Increasing flame depth and residence time.
Litter completely connected.	>95%	Very thick layer of litter >35mm	Extreme	Surface fires spread easily. Increasing flame depth and residence time.

Assess surface hazard over a plot 10m in radius. Assessing multiple plots will give better results. For each plot litter bed depth should be an average of five measurements (McCarthy 2004) or more.

See Section 9.3 for application of surface fuel hazard ratings for the Vesta fire behaviour tables.

The following visual guide can be used to assist in assessing surface litter cover. Each quarter of any one square has the same percent cover.



6 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 6.2 Examples of surface fine fuel hazard

Low		
Moderate		
High		
Very High		
Extreme		

7. Determining the combined surface and near-surface fine fuel hazard rating

Assessments of surface and near-surface fuels must be combined together before an Overall Fuel Hazard rating can be determined. The near-surface fuel rating is used to adjust the surface fine fuel hazard rating, according to Table 7.1.

To determine the effect of near-surface fine fuel hazard:

1. Select the **surface fuel hazard rating** from column 1
2. Select the **near-surface fuel hazard rating** from column 2
3. Select the resulting **combined rating** value 3
4. Use this value to determine the Overall Fuel Hazard rating using the Table 8.1.

Table 7.1 Determining the combined surface and near-surface fine fuel hazard rating

1 Surface fine fuel hazard rating	2 Near-surface fine fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
	3 Combined surface and near-surface fine fuel hazard rating				
Low	L	L	M	H	VH
Moderate	M	M	H	VH	E
High	H	VH	VH	VH	E
Very High	VH	VH	E	E	E
Extreme	E	E	E	E	E

8. Determining Overall Fuel Hazard

Overall Fuel Hazard = (sum of the influences of) Bark Hazard + Elevated Fine Fuel Hazard + Combined Surface and Near-surface Fine Fuel Hazard.

The following table is used to combine the assessed levels of Bark, Elevated and Combined Surface and Near-surface Fuel Hazard to give an Overall Fuel Hazard rating.

To determine the Overall Fuel Hazard rating:

1. Select the row that corresponds to the **Bark Hazard** ❶
2. Select the row that corresponds to the **Elevated Fine Fuel Hazard** ❷
3. Select the column that corresponds to the assessed level of **Combined Surface and Near-surface Fine Fuel Hazard** ❸
4. Identify where these two intersect and this will provide you with the corresponding Overall Fuel Hazard rating.

Table 8.1 Determining the Overall Fuel Hazard rating

❶ Bark Hazard	❷ Elevated Fine Fuel Hazard	❸ Combined Surface and Near-surface Fine Fuel Hazard *				
		L	M	H	VH	E
Low or Moderate	L	L	M	M	H	H
	M	L	M	M	H	H
	H	L	M	H	VH	VH
	VH	VH	VH	VH	VH	VH
	E	E	E	E	E	E
High	L	L	M	H	H	H
	M	L	M	H	H	H
	H	L	H	H	VH	VH
	VH	VH	VH	VH	VH	E
	E	E	E	E	E	E
Very High or Extreme	L	L	VH	VH	VH	E
	M	M	VH	VH	E	E
	H	M	VH	E	E	E
	VH	E	E	E	E	E
	E	E	E	E	E	E

* Combined Surface and Near-surface Fine Fuel Hazard is a measure of the Surface Fine Fuel Hazard adjusted to account for the level of near-surface fine fuel (see Table 7.1).

9. Interpreting and applying Overall Fuel Hazard

9.1 Chances of extended first attack success

The chances of extended first attack being successful[1] for a fire ignited in these fuels under the reference extended first attack conditions (Appendix 1) is approximately as follows:

Table 9.1 Chances of extended first attack success

GFDI[2]	FFDI[3]	Overall Fuel Hazard rating[4]				
		Low	Moderate	High	Very High	Extreme
0–2	0–5					
3–7	6–11					
8–20	12–24					
20–49	25–49					
50–74	50–74					
75–99	75–99					
100+	100+					

Chance of extended first attack success is greater than 95% (almost always succeeds)

Chance of extended first attack success is between 95% and 50% (succeeds most of the time)

Chance of extended first attack success is between 49% and 10% (fails most of the time)

Chance of extended first attack success is less than 10% (almost always fails)

Notes:

1. Extended first attack is deemed successful when a fire is controlled by 0800hrs the day after ignition and at less than 400 hectares.
2. GFDI is the Grass Fire Danger Index at the time of ignition and is assumed to be the highest GFDI expected before 0800hrs the next day.
3. FFDI is the Forest Fire Danger Index at the time of ignition and is assumed to be the highest FFDI expected before 0800hrs the next day.
4. Chance of success is for a fire ignited in fuels with this Overall Fuel Hazard rating.
5. Predicted outcomes will differ if the conditions vary from those listed in the reference extended first attack conditions.
6. Predicted outcomes based on expert opinion and informed by work carried out by Wilson (1992b, 1993), McCarthy *et al*. (1998a, 2001) and Plucinski *et al*. (2007).

9.2 Indicative fuel loads (t/ha)

In the absence of local data obtained by sampling fuel loads destructively the following table of indicative fuel load data from Project Vesta and Victorian studies may be useful. These tonnes per hectare figures may be applied to the Forest Fire Danger Meter Mark V (McArthur 1973) for predicting forward rate of spread and flame height for forest fires.

Table 9.2 Indicative fuel loads (t/ha)

Fuel	Fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
Bark	0	1	2	5	7
Elevated	0–1	1–2	2–3	3–5	5–8
Near-surface	1–2	2–3	3–4	4–6	6–8
Surface	2–4	4–10	8–14	12–20	16–20+

9.3 Determining Vesta fuel hazard scores

The following table translates fuel hazard ratings for each fuel layer into Project Vesta fuel hazard scores. These scores can be used with the fire behaviour prediction tables in publications such as Gould *et al*. (2007b).

To determine the Vesta fuel hazard score:

1. Select the row that corresponds to the fuel hazard rating for required fuel layer (1)
2. Select the Vesta fuel hazard score column that corresponds to the same layer (2)
3. Identify where these two intersect and this will provide you with the corresponding Vesta fuel hazard score.

Table 9.3 Determining Vesta fuel hazard scores

	Vesta fuel hazard score (2)			
Fuel hazard rating (1)	**Surface**	**Near-surface**	**Elevated**	**Bark**
Low	1	1	1	0
Moderate	2	2	2	1
High	3	3	3	2
Very High	3.5	3.5	3.5	3
Extreme	4	4	4	4

Notes:

- Surface and near-surface hazard score and near-surface height (cm) is required for fire spread prediction.
- Rate of spread and elevated fuel height (m) is required for flame height prediction.
- Rate of spread, surface and bark fuel hazard scores are required for prediction of spotting distance.

Acknowledgements

This Fuel Hazard Assessment Guide updates and continues to develop work previously conducted by a number of authors. Andrew Wilson laid the foundations for this guide, with the conceptual framework presented in Research Report No. 31; and the visual guides for assessing the influence of bark and elevated fuels on suppression difficulty in the *Eucalypt Bark Hazard Guide and Elevated Fuel Guide* (Reports 32 and 35, respectively). Greg McCarthy (2004) detailed a method for rapidly assessing surface fine fuels in Research Report No. 44.

These three techniques were brought together in the first three editions of the *Overall Fuel Hazard Guide* (McCarthy, Tolhurst and Chatto, 1998b, 1998c, 1999). A subsequent unpublished edition of the guide, produced by Kevin Tolhurst (2005), provided greater detail on the assessment of near-surface fuels. In 2006, Mike Wouters adapted the guide for South Australian conditions, and incorporated the preliminary results from Project Vesta (CSIRO and Department of Conservation and Environment, Western Australia). Further information and results from the final Project Vesta report (Gould *et al.* 2007a) have also been incorporated.

Thanks to Lachie McCaw (Department of Environment and Conservation, Western Australia), Mike Wouters (Department of Environment and Heritage, South Australia), Jim Gould and Miguel Cruz (CSIRO) for their advice and comments during the production of this guide. Thanks must also go to the many other people across Australia who have provided comments and feedback during the production of the guide.

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Wilson, AAG 1993, *Elevated fuel guide*, research report no. 35, Fire Management Branch, Department of Conservation and Environment, Victoria.

Appendix 1. Reference extended first attack conditions

This guide assesses the impact of fuels in suppressing a fire during extended first attack, using local resources. Several factors affect the success of an extended first attack. Therefore, to consider the impact of fuels alone, the other factors must be treated as if they were constant. Table A1 below adapted from Wilson (1993) summarises reference extended first attack conditions for four fuel types.

Table A1. Revised reference extended first attack conditions

Fuel type	Forest fuels	Grass fuels	Mallee and scrub fuels	Heath fuels
Examples of typical resources (on scene within the designated arrival time)	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters	5 x 4WD heavy tankers (4000l) each with 5 firefighters	Small dozer (D4) or tractor with scrub roller 1 to 2 small 4WD tankers (400l) 6 firefighters	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters
Extended attack resources	Potential additional resources deployed to the fire during extended first attack may include heavy tankers, large plant (dozers, graders or tractors) and fire bombing aircraft.			
Arrival time	Within 60 minutes of detection			
Suppression workload	A single fire			
Topography and terrain	Burning on level ground with good access			
Fuel availability[1]	MDF is 10 or AFF is 1.0	100% grass curing	MDF is 10 or AFF is 1.0	
Wind speed[2]	20km/h	30km/h		20km/h
Fire danger rating system[3]	McArthur FFDI	McArthur GFDI	McArthur FFDI	

Notes:

1. MDF (McArthur Drought Factor) is calculated using the Forest Fire Danger Meter (McArthur 1973) and is a measure of the short-term availability of forest fuels. AFF (Available Fuel Factor) is used in Western Australia to define the proportion of litter fuel available for burning (Sneeuwjagt & Peet 1998).
2. Wind speed is measured at 10m height in the open above ground level.
3. FFDI is the McArthur Forest Fire Danger Index, GFDI is the McArthur Grass Fire Danger Index.

The rationale for the reference first attack conditions is documented in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep).

Appendix 2. Sample fuel assessment field work form v3

Date Assessed:	Assessors:
Sampling Location:	Veg Type:

Plot Information			
Plot No.			
Zone:			
Easting (GDA94 MGA UTM):			
Northing (GDA94 MGA UTM):			

Canopy height (Assess over a 20m radius)			
Average Height to Top of Canopy:	m	m	m
Average Height to Base of Canopy:	m	m	m

Bark fuel (Assess over a 20m radius)															
Stringybark Fuel Hazard:	NP	M	H	VH	E	NP	M	H	VH	E	NP	M	H	VH	E
Ribbon Bark Fuel Hazard:	NP	M	H	VH		NP	M	H	VH		NP	M	H	VH	
Other Bark Fuel Hazard:	L	M	H			L	M	H			L	M	H		

Select the Bark Hazard rating from above that will be used to determine Overall Fuel Hazard. (Only use the Stringybark hazard rating if more than 10% of the trees are Stringybark **AND** it has the highest rating. Otherwise use the bark with next highest rating.)

Bark Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Elevated fuel layer (Assess over a 10m radius)															
Elevated % Cover:	%					%					%				
Elevated % Dead	%					%					%				
Elevated Fuel Ave Height (m)	m					m					m				
Elevated Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Near-surface fuel layer (Assess over a 10m radius)															
Near-surface % Cover:	%					%					%				
Near-surface % Dead	%					%					%				
NS Average Height (cm):	cm					cm					cm				
NS Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

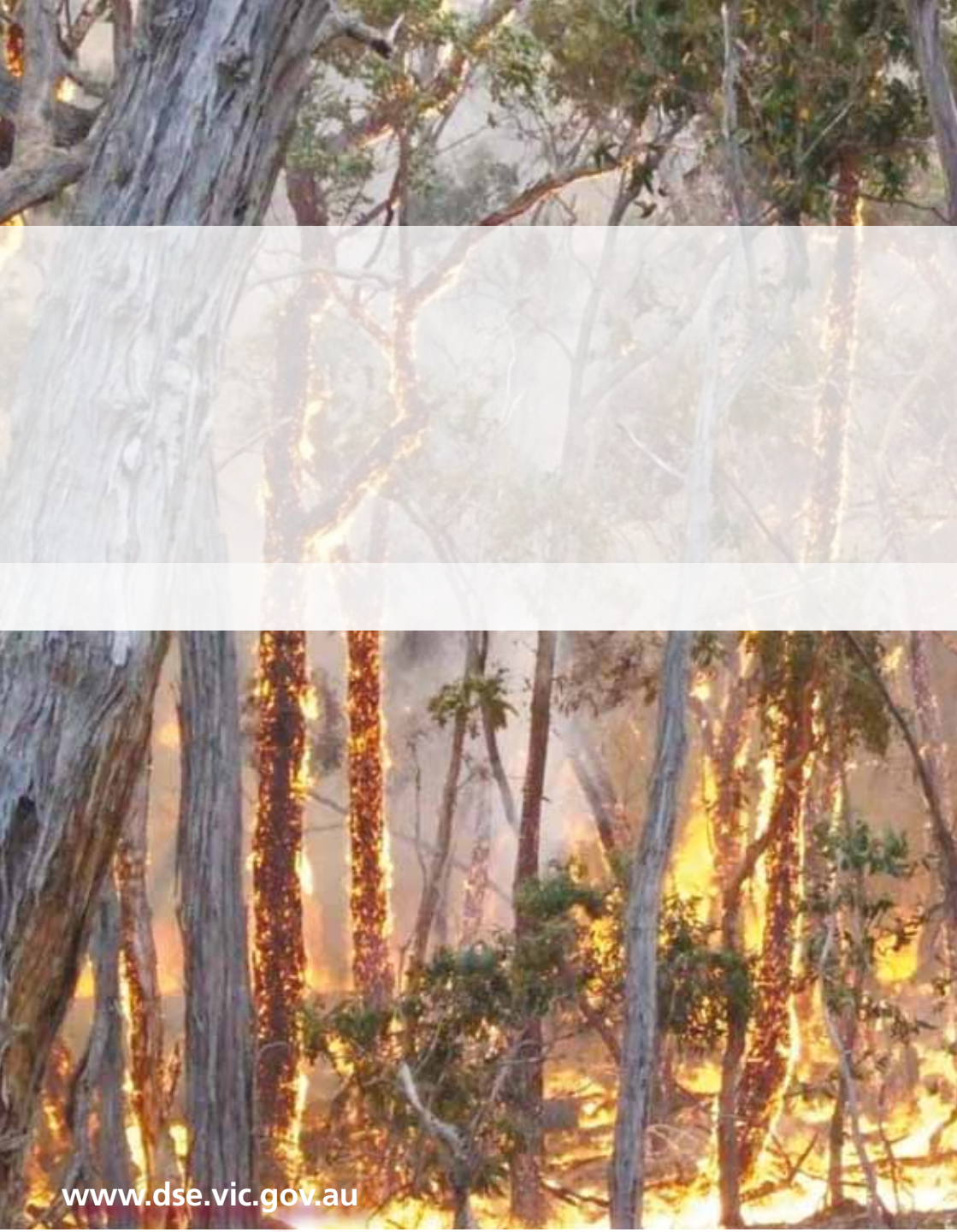
Surface fuel layer (Assess over a 10m radius)															
Surface Litter % Cover:	%					%					%				
Average Litter Depth (mm):	mm					mm					mm				
Surface Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Combined Surface and Near-surface Fine Fuel Hazard calculation (refer Section 7)															
Combined Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Overall Fuel Hazard calculation (refer Section 8)															
Overall Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Are the plots representative of the average fuels across the sampling location?	Yes	No

If no, explain any significant difference between plots. For example, wet gully runs through the sampling area, no plots were located in this gully.



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Appendix D

Mt Tabor Offset Area Management Plan

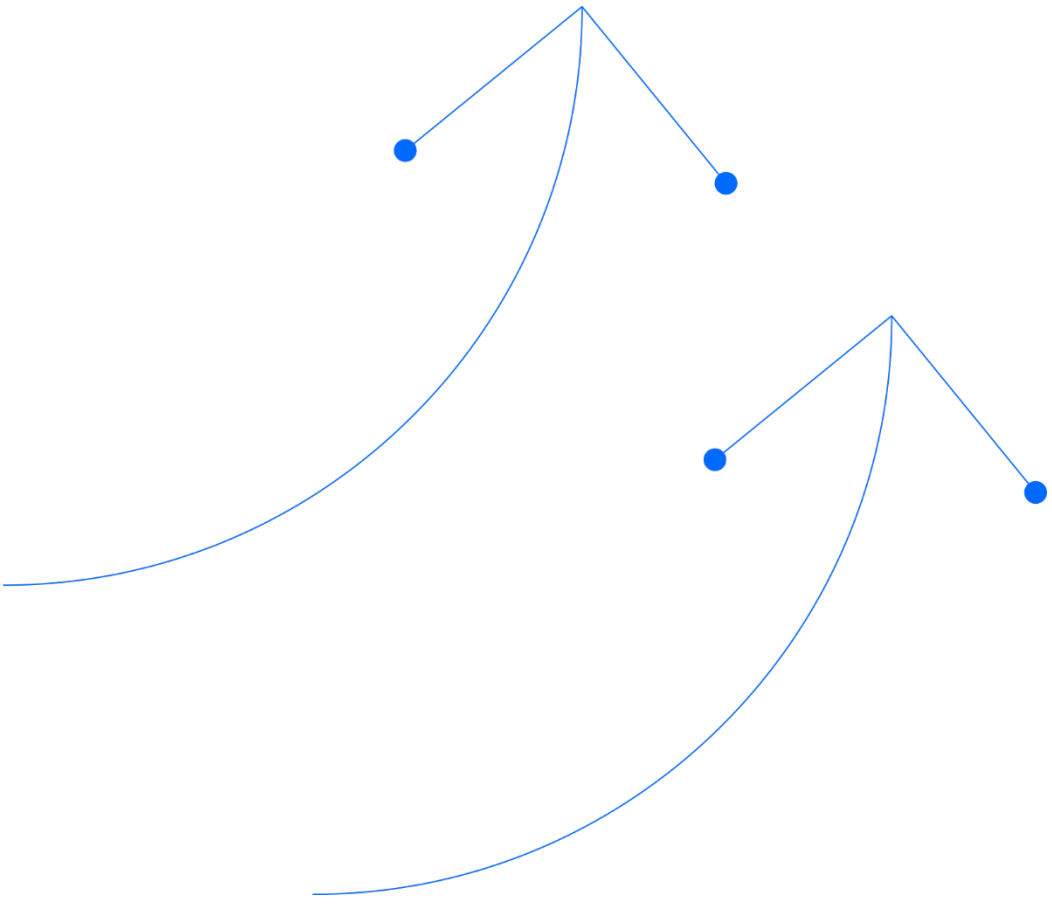
Santos

SANTOS GLNG MT TABOR OFFSET AREA MANAGEMENT PLAN

EPBC Act Approval 2012/6615 (Stage 8)

Document Number: 0007-650-EMP-0047

31 October 2025



Date	Rev	Reason For Issue	Reviewed	Endorsed	Approved
9 May 2025	0	For DCCEEW submission	AB	AB	DG
31 October 2025	1	Updated based on DCCEEW review	JK	AB	DG

Declaration of Accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or document to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulation 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed [redacted]

Full Name (please print) [redacted]

Organisation (please print) Santos Ltd

Date 31 / 10 / 2025

Santos

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Abbreviations

Acronym	Description
BPA	Biodiversity Planning Assessment
DAF	Department of Agriculture and Fisheries (Qld)
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DESI	Department of Environment, Science and Innovation (formerly the Department of Environment and Science [DES])
EMP	Environmental Management Plan Guidelines (DCCEEW 2024)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
GFD	Gas Field Development
GLNG	Gladstone Liquefied Natural Gas
GTDTHQ	*Guide to Determining Terrestrial Habitat Quality* (version 1.3; DES 2020)
MNES	Matters of National Environmental Significance
OAMP	Offset Area Management Plan
PMAV	Property Map of Assessable Vegetation
RE	Regional Ecosystem
REDD	Regional Ecosystem Description Database
spp	species
TEC	Threatened Ecological Community
VM Act	*Vegetation Management Act 1999* (Qld)

Executive summary

This offset area management plan (OAMP) has been prepared to address the offset requirements for matters of national environmental significance (MNES) associated with Stage 8 of the Gas Fields Development Project (GFD Project) in accordance with EPBC 2012/6615. Original approval for the OAMP was received from the Department of Agriculture, Water and the Environment (now the Department of Climate Change, Energy, the Environment and Water) in November 2022. It was then updated to include an additional offset area on the Mt Tabor property, expanding on the original offset area approved in November 2022, as well as address offset requirements associated with Stage 7 of the GFD Project under EPBC 2012/6615. This document has been updated to address predicted MNES offset requirements associated with Stage 8 of the GFD Project in accordance with the staged approach to offsets under EPBC 2012/6615.

A consolidated offset area of 7,468 ha will be secured, managed and monitored on the Mt Tabor property (Lot 6 CHS25) in accordance with this OAMP. While the consolidated offset will be managed as one area, for the purposes of reconciling offset requirements for Stage 8 of the GFD Project and assigning appropriate completion criteria based on the EPBC *Offsets Assessment Guide* (OAG), throughout this OAMP the offset area will be referred to as the following:

- Offset area 1 (5,124.5 ha) – this offset area was originally approved in November 2022 to acquit MNES offset requirements associated with Stage 4 of the GFD Project. The original approved offset area also included areas of surplus MNES habitat, to be drawn down on by Santos to acquit future offset requirements. Santos has been actively managing and monitoring offset area 1 following original approval of the OAMP in November 2022. Offset area 1 partially acquits offset requirements for Stages 4 and 7 of the GFD Project.
- Offset area 2 (2,343.9 ha) – this additional offset area has been included, as part of the previous updated version of the OAMP, to expand on the original approved offset area in November 2022. Offset area 2 is located adjacent to offset area 1 and partially acquits offset requirements for Stages 7 and 8 of the GFD Project (Table ES1). Santos now includes offset area 2 as part of the current management and monitoring regime implemented across the property, considering any additional requirements of the updated OAMP.

Desktop and field surveys of the Mt Tabor property were completed from December 2020 to January 2021 and in October 2023 and April 2024 to confirm the presence of offset values and suitability to satisfy the GFD Project's offset obligations as follows:

- Preliminary desktop assessment of biodiversity offset values (Boobook 2021a)
- Detailed field assessment to confirm presence of environmental values within the offset area including:
  - Ground-truthing of vegetation mapping
  - BioCondition assessments in accordance with the BioCondition methodology (Eyre *et al*. 2015)
  - Targeted fauna surveys
  - Incidental flora surveys.

The outcome of this OAMP will partially acquit the Stage 8 offset obligations for the GFD Project under EPBC 2012/6615 in accordance with the EPBC Act *Environmental Offsets Policy*. The Mt Tabor offset area will be managed and monitored as a consolidated area, based on an adaptive management framework, to achieve the interim performance targets and completion criteria presented in Table ES2. The performance target and completion criteria have been assigned for offset areas 1 and 2 separately, to effectively monitor the time until ecological benefit and achieving these scores, since management of offset area 1 began in 2022.

The key management actions to be implemented include:

- restricting access to the offset area
- maintenance and upgrades of existing access tracks, fencing and firebreaks
- fire management through strategic grazing and fuel hazard reduction burns
- weed management
- pest animal management.

Ongoing monitoring events will be undertaken to assess the effectiveness of the management actions and progress of the offset area in achieving the interim performance targets and completion criteria, including:

- biannual offset area inspections
- biomass monitoring
- fuel load monitoring
- weed monitoring
- pest animal monitoring
- rapid monitoring events
- habitat quality assessments
- photo monitoring.

Annual reports will be prepared to detail progress of the offset area in achieving the interim performance targets and completion criteria for each management year including the results of management and monitoring activities completed.

Offset area 1 was legally secured via a Voluntary Declaration under Section 19E and 19F of the *Vegetation Management Act 1999* (Qld; VM Act) on 4 January 2023. In March 2025, Santos applied for an amendment to the existing Voluntary Declaration to legally secure the updated offset area 1 and offset area 2 under Section 19E and 19F of the VM Act. The Voluntary Declaration will remain in place for the life of EPBC 2012/6615.

Table ES1 – Summary of the Mt Tabor offset area and acquittal for Stage 8 of EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Habitat within the Mt Tabor offset area (ha)	Offset area (ha)			% acquittal of Stage 8[2]	Surplus area (ha)[3]
				Approved for Stage 4 under EPBC 2012/6615	Approved for Stage 7 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615		
Threatened fauna species								
Collared delma (*Delma torquata*)	V	49.49	7,468.4	4,172.9	2,988.0	307.42	95.50	0
Yakka skink (*Egernia rugosa*)	V	39.99	6,151.8	4,172.9	1,973.4	5.38	1.72	0
Dunmall's snake (*Furina dunmalli*)	V	49.98	7,468.4	4,172.9	2,988.0	307.42	94.57	0
Red goshawk (*Erythrotriorchis radiatus*)	E	25.61	7,468.4	4,172.9	2,988.0	307.42	126.10	0
Squatter pigeon (southern) (*Geophaps scripta scripta*)	V	32.11	7,468.4	4,172.9	2,988.0	307.42	122.67	0
Northern quoll (*Dasyurus hallucatus*)	E	26.11	7,468.4	4,172.9	2,988.0	307.42	148.42	0
Koala (*Phascolarctos cinereus*)	E	36.56	7,468.4	4,172.9	2,988.0	307.42	88.32	0
South-eastern long-eared bat (*Nyctophilus corbeni*)	V	50.48	7,468.4	4,172.9	2,988.0	307.42	78.02	0
Large-eared pied bat (*Chalinolobus dwyeri*)	E	32.61	7,468.4	4,172.9	2,988.0	307.42	99.03	0

[1] Status: E = Endangered and V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties for MNES with less than 100% acquittal.
[3] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 5 of this OAMP to understand how areas are accounted for in each stage.

Table ES2 – Interim performance targets and completion criteria for the Mt Tabor offset area 2, including Stage 8 acquittal under EPBC 2012/6615

MNES	Offset area 2		
	Baseline	Interim performance targets (year 5, 10 and 15)	Completion criteria (year 20)
Threatened fauna species			
Collared delma (*Delma torquata)*	8	No decrease in overall habitat quality score from previous monitoring event	9
Yakka skink (*Egernia rugosa*)	8	No decrease in overall habitat quality score from previous monitoring event	9
Dunmall's snake (*Furina dunmalli)*	8	No decrease in overall habitat quality score from previous monitoring event	9
Red goshawk (*Erythrotriorchis radiatus*)	7	No decrease in overall habitat quality score from previous monitoring event	8
Squatter pigeon (southern) (*Geophaps scripta scripta*)	7	No decrease in overall habitat quality score from previous monitoring event	8
Northern quoll (*Dasyurus hallucatus)*	7	No decrease in overall habitat quality score from previous monitoring event	8
Koala (*Phascolarctos cinereus*)	7	No decrease in overall habitat quality score from previous monitoring event	8
South-eastern long-eared bat (*Nyctophilus corbeni*)	8	No decrease in overall habitat quality score from previous monitoring event	9
Large-eared pied bat (*Chalinolobus dwyeri)*	8	No decrease in overall habitat quality score from previous monitoring event	9

1. Introduction

The Santos Gladstone Liquefied Natural Gas (GLNG) Project involves the development of Coal Seam Gas resources in the Surat and Bowen Basins in Queensland, to supply gas via a 430 kilometre (km) gas transmission pipeline to the liquified natural gas facility located on Curtis Island. Throughout the development of the Santos GLNG Project and in accordance with Santos GLNG Project approvals, potentially impacted environmental values are systematically identified and assessed and in order of preference are avoided, minimised or mitigated.

The Santos GLNG Project is required to provide environmental offsets for significant residual impacts on matters of national environmental significance (MNES) in accordance with approvals granted under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth; EPBC Act).

This offset area management plan (OAMP) was originally prepared and approved to address the offset requirements for MNES associated with Stage 4 of the Gas Fields Development Project (GFD Project) under EPBC 2012/6615, and later updated to address offset requirements for Stage 7 of the GFD Project. Approval for the Stage 7 OAMP was received from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in January 2025.

This version of the OAMP has been updated from the January 2025 approved version, in accordance with the staged approach to offsets under EPBC 2012/6615, to address partial acquittal of the MNES significant residual impacts associated with Stage 8 of the Gas Fields Development (GFD) Project under the GLNG Project approval EPBC 2012/6615 (herein referred to as Stage 8), outlined in Table 1, on the Mt Tabor offset area (Figure 1).

Table 1 – Impacted MNES required to be offset for Stage 8 of the GFD Project under EPBC 2012/6615

MNES	Status under EPBC Act	Disturbance area (ha)
Threatened ecological communities		
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC)[1]	Endangered	0.51
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community (SEVT TEC)[1]	Endangered	0.50
Threatened fauna species		
Collared Delma (*Delma torquata*)	Vulnerable	49.49
Yakka Skink (*Egernia rugosa*)	Vulnerable	39.99
Dunmall's Snake (*Furina dunmalli*)	Vulnerable	49.98
Red Goshawk (*Erythrotriorchis radiatus*)	Endangered	25.61
Black-breasted Button-quail (*Turnix melanogaster*)[1]	Vulnerable	0.50
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	Vulnerable	32.11
Northern Quoll (*Dasyurus hallucatus*)	Endangered	26.11
Koala (*Phascolarctos cinereus*)	Endangered	36.56
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	Vulnerable	50.48
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Endangered	32.61

[1] Offset requirements for these MNES are acquitted on other properties for Stage 8.

A consolidated offset area of 7,468.4 ha will be secured, managed and monitored on the Mt Tabor property (Lot 6 CHS25; Figure 1) in accordance with approved OAMPs. While the consolidated offset will be managed as one area, for the purposes of reconciling offset requirements for Stage 8 of the GFD Project and assigning appropriate completion criteria based on the EPBC *Offsets Assessment Guide* (OAG), the offset area comprises the following:

- Offset area 1 (5,124.5 ha):
  - A 5,329.4 ha area was originally approved in November 2022 to partially acquit MNES offset requirements associated with Stage 4 of the GFD Project. The original approved offset area also included areas of surplus MNES habitat, to be drawn down on by Santos to acquit future offset requirements. Santos has been actively managing and monitoring offset area 1 following original approval of the OAMP in November 2022,
  - As part of management, Santos established a fence around the boundary of offset area 1 to assist with management of livestock control for weed and fuel load management in accordance with the OAMP. The fence line location was scouted with the Traditional Owners as part of on-ground cultural heritage surveys considering topographical aspects of the landscape and existing access tracks (see Section 6.2.3). This resulted in a variation to the extent of offset area 1 managed as part of the approved OAMP, now totalling 5,124.5 ha.
  - Offset area 1 partially acquits offset requirements for Stages 4 and 7 of the GFD Project.
- Offset area 2 (2,343.9 ha):
  - This additional offset area, located adjacent to offset area 1, was included as part of the Stage 7 OAMP, to expand on the original approved offset area in November 2022 and increase the extent of protected MNES habitat on the Mt Tabor property.
  - Offset area 2 will partially acquit offset requirements for Stages 7 and 8 of the GFD Project (Section 2.7).
  - Following approval of the Stage 7 OAMP, Santos now includes offset area 2 as part of the current management and monitoring regime implemented across the property considering any additional requirements of the updated OAMP.

1.1. Purpose

This OAMP is written consistent with the Environmental Management Plan (EMP) Guidelines (DCCEEW 2024) and provides a detailed management and monitoring framework for the Mt Tabor offset area in accordance with the requirements of EPBC 2012/6615 as presented in Table 2 below. The following table (Table 3) details how this OAMP satisfies the requirements of a comprehensive EMP, and how the following information in this OAMP aligns with the EMP Guidelines set by DCCEEW (2024).

Table 2 – Approval conditions satisfied through this OAMP

Condition number	Condition	How the conditions are met
EPBC Act approval 2012/6615		
11	The approval holder must ensure that environmental offsets comply with the principles of the EPBC Act *Environmental Offsets Policy*.	Offsets to compensate for significant residual impacts associated with Stage 8 of the GFD Project will be delivered in accordance with the principles of the EPBC Act *Environmental Offsets Policy*. An offset area will be secured on Mt Tabor to partially acquit offset obligations for the MNES matters outlined in Table 1. The Mt Tabor offset area has been identified to comply with the requirements for an offset under the EPBC Act *Environmental Offsets Policy* as detailed in Section 2.9 of this OAMP.
12	The approval holder may carry out the action in project stages. The approval holder must deliver environmental offsets for residual significant impacts to matters of national environmental significance for each project stage.	The action will be carried out in stages. An offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with Stage 8 of the GFD Project.
13	The approval holder must submit an Offset Management Plan for the Minister's written approval. The Offset Management Plan may be prepared and submitted to the Minister for written approval in stages. If the approval holder submits the Offset Management Plan in stages, each version of the Offset Management Plan must address the known and predicted impacts of the completed, current, and next proposed project phases.	An offset plan has been prepared to address offset requirements for residual significant impacts on MNES associated with Stage 8 of the GFD Project. This OAMP for the Mt Tabor offset area is submitted as part of the offset plan to address Stage 8 of the GFD Project. A reconciliation of impacts for Stage 1-7 of the GFD Project is included in the Stage 8 offset plan.
14	The Offset Management Plan must include: a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities; b. results from pre-disturbance surveys and/or an alternative approved methodology (if used) for the project phase as required under conditions 4 and 5; c. details of the offset areas required to address predicted residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities for the project phase; d. a survey and description of the current condition (prior to any management activities) of each offset area proposed, including existing vegetation (the baseline condition). This must include a shapefile of each offset property boundary; e. information about how the offset areas provide connectivity with other relevant habitats and biodiversity corridors, including a map depicting the offset areas in relation to other habitats and biodiversity corridors; f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary); g. a description of the management measures that will be implemented for the protection of EPBC threatened species, EPBC migratory species and EPBC communities, including a discussion of how measures outlined take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans; h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria; i. a description of potential risks to the successful implementation of the plan, and a description of the contingency measures that would be implemented to mitigate against these risks; j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and k. the proposed legal mechanism for securing the offset.	The Mt Tabor offset area is proposed to be secured to partially acquit offset requirements for Stage 8 of the GFD Project. An OAMP for the Mt Tabor offset area has been developed in accordance with the requirements outlined in condition 14. A summary of how each requirement has been addressed is provided below. a. The method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities is discussed in the offset plan, submitted in conjunction with this OAMP. b. Details of the relevant field assessments within the Stage 8 GFD Project development areas are provided in the offset plan, submitted in conjunction with this OAMP. c. Summaries of the significant residual impacts associated with Stage 8 of the GFD Project are provided in Table 1 of this OAMP and the offset plan. Summaries of the offset area required to acquit the Stage 8 offset requirements are provided in the offset plan, with a summary of the proposed offset area on Mt Tabor and how it partially acquits the Stage 8 offset requirements provided in Section 2.7 of this OAMP. In accordance with the EPBC Act *Environmental Offsets Policy*, the proposed offset areas required to be secured for each MNES were determined using the OAG as described in Section 2.7. d. A summary of the ecological field surveys undertaken on the Mt Tabor offset area is described in Section 2.5. Details of the baseline ecological condition are provided in Section 2.6 and Appendix A of this OAMP. e. Details on the connectivity and the landscape context are provided in Section 2.3. f. Individual completion criteria have been developed for each MNES as part of the environmental outcomes to be achieved for the Mt Tabor offset area (Section 4). In addition, specific management objectives and performance criteria have been developed which will provide the basis for achieving the MNES completion criteria. The complete adaptive management process for this OAMP is encapsulated in Table 12 and includes management actions, monitoring events, adaptive management triggers and corrective actions that have been assigned to each management objective and performance criteria. g. Management measures to be implemented as part of this OAMP have been developed to address key threats known or with the potential to occur within the Mt Tabor offset area identified as part of detailed field surveys and take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans. A summary of the known and potential threats is detailed and proposed management measures are detailed in Table 11. h. The monitoring program to measure the effectiveness of the management measures and progress against the performance and completion criteria is detailed in Section 7. i. Risks to the successful implementation of this plan are included in the risk assessment presented in Appendix C. j. The timing for implementation of the management and monitoring program are provided in Section 9. k. Details on how the Mt Tabor offset area for Stage 8 of the GFD Project will be legally secured are provided in Section 2.8 of this OAMP.
15	The currently approved Offset Management Plan must be implemented by the approval holder.	Once approved, this OAMP will be implemented.

Condition number	Condition	How the conditions are met
16	The approval holder must register and legally secure offsets for the first project phase identified in the Offset Management Plan within two years of commencement of the first project phase.	The offset area for Stage 4 was legally secured via Voluntary Declaration on 04 January 2023. Details on how the Mt Tabor offset area for Stage 8 of the GFD Project will be legally secured are provided in Section 2.8.
17	The approval holder must register and legally secure offsets for a project phase which are sufficient to acquit the residual significant impacts of that project phase.	Details on how the Mt Tabor offset area for Stage 8 of the GFD Project will be legally secured are provided in Section 2.8.
18	If the approval holder submits the Offset Management Plan in stages, the approval holder must prepare and submit an updated Offset Management Plan for each subsequent project phase, for written approval by the Minister. The updated Offset Management Plan must: a. include the information required for the Offset Management Plan at condition 14 for the next project phase; b. include a reconciliation of actual and predicted but yet to be actualised residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities against offsets secured for the commenced project phases. Secured offsets in excess of requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases may be subtracted from the obligations required for subsequent project phases. Any shortfall in secured offsets relative to the requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases must be added to the obligations required for the next project phase; and c. demonstrate how the offset builds on offsets already secured for previous project phases and will contribute to a larger strategic offset for cumulative project impacts.	An updated version of this OAMP will be submitted for any subsequent stages of the GFD project.
19	The approval holder must not commence the project phase until the Offset Management Plan, updated for that project phase has been approved by the Minister in writing.	This OAMP is submitted for the approval of the Minister.

Table 3 – Alignment of OAMP with EMP Guidelines

Key content	Reference within OAMP	Reference to EMP guideline
Conditions of approval	Section 1.1, Table 2 details the approval conditions satisfied through this OAMP.	Section 3, page 8
Property information and baseline data	Section 2 describes the Mt Tabor property, sub-Section 2.5 lists the history of ecological surveys undertaken at the Mt Tabor property, including baseline surveys, and sub-Section 2.6 describes the ground-truthed environmental values of the property.	Section 3
Offset values	Section 3 describes and details the offset values of this OAMP, and Section 4 lists the associated environmental outcomes.	Section 3
Adaptive management framework and program	Section 5 describes the adaptive management framework to be applied through this OAMP, and Section 4 details the environmental outcomes to be achieved. Section 6, Table 10 describes the management program.	Section 3, page 11-12
Management program entailing objectives, triggers, and actions	Section 6.1, Table 12 details the management objectives, performance targets, method of management actions, and measurable milestones of progression in terms of monitoring actions, monitoring timing and frequency, management triggers, and corrective actions.	Section 3, page 11-12
A detailed monitoring program	Section 7 breaks down the monitoring program, and details the program timing, frequency, methods.	Section 3, page 11-12
A detailed monitoring and implementation schedule	Section 9 summarises the overall schedule of the monitoring program inclusive of timing, activity, location of activity, method, and reliability of method.	Section 3, page 11-12
Risk assessment and management actions to avoid, mitigate and manage risks	Section 6 and Appendix C identifies risks which have been identified as potentially impeding to the outcomes of environmental management objectives.	Section 4, pages 13-14
Risk matrix	Table C3 in Appendix C applies a risk matrix including residual risk rating following mitigation measures, management triggers, and corrective actions.	Section 4, pages 13-14
Maintenance of monitoring records	Section 8 details the reporting obligations of this OAMP and how information will be stored for the lifetime of the approval.	Section 3, page 9

147°0'0"E 148°0'0"E 149°0'0"E

24°0'0"S 25°0'0"S 26°0'0"S

Theresa Hut Nature Refuge
Withersfield State Forest
Keilambete State Forest
Capricorn Highway
Anakie
Belmah Conservation Park
Emerald
Rifle Range Nature Refuge
Fairbairn State Forest
Zamia State Forest
Bogantungan
Alpha
Willows Gemfields
Gregory Highway
Comet
Blackwater Conservation Park
Blackwater
Wallaby Bluff Lane Nature Refuge
Arthurs Bluff State Forest
Amaroo State Forest
Blackdown Tableland National Park
Avocet Nature Refuge
Fernlees
Goonderoo Nature Refuge
Kenmare Nature Refuge
Shotover State Forest
Snake Range National Park
Minerva Hills National Park
Springsure
Vandyke Creek Conservation Park
Cairdbeign State Forest
PL 1083
PL 1082
Humboldt State Forest
Humboldt National Park
Rainmore Nature Refuge
Yarrai Nature Refuge
Nandowrie State Forest
Squire State Forest
Dawson Highway
Albinia Resources Reserve
Albinia Conservation Park
Rolleston
Expedition State Forest
Castlevale Nature Refuge
Mount Hope State Forest
Mount Pleasant State Forest
Rainbow Nature Refuge
Phiara Downs Nature Refuge
Cometside Nature Refuge
Mount Nicholson State Forest
Carnarvon Station Nature Refuge
Carnarvon Highway
Serocold State Forest
Pluto Timber Reserve
Carnarvon National Park
Nuga Nuga National Park
Expedition Resources Reserve
Expedition National Park
PL 451
PL 236
PL 450
PL 235
PPL 166
Bandana State Forest
PL 440
Presho State Forest
PL 1062
Cunno State Forest
6CHS25
McLeay State Forest
Eden State Forest
Forfar State Forest
Boxvale State Forest
PL 420
PL 1059
PL 1017
Chesterton State Forest
Attica State Forest
PL 421
Belington Hut State Forest
PL 234
PL 233
Howe State Forest
Forrest State Forest
Expedition (Limited Depth) National Park
PL 90
Koolbellup State Forest
Hillside State Forest
Oakvale State Forest
PL 457
Doonkuna State Forest
PL 91
Beilba State Forest
PL 232
PL 92
PL 1012
Sunnyside State Forest
Hallett State Forest
PL 100
PL 99
Augathella
Mitchell Highway
Injune
Landsborough Highway
Orkadilla State Forest
Orkadilla Nature Refuge
Chesterton Range National Park
Mount Armour Nature Refuge
Waroonga State Forest
Walhallow State Forest
Taboonbay State Forest
Gubberamunda State Forest 1
Gubberamunda State Forest 2
Gubberamunda State Forest 3
Barabanbel State Forest 3
Barabanbel State Forest 1
Barabanbel State Forest 2
Morven Conservation Park
Morven
Tregole National Park
Tokatakiya Nature Refuge
Mungallala
Womalilla
Mitchell
Amby
Hodgson
Roma
Blythdale
Muckadilla
Warrego Highway
PL 1019
PL 322
PL 314
PL 1020
PL 313
PL 315
PL 316
PL 317
PL 318
PL 320
Eversfield Station Nature Refuge

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Location diagram

Figure 1
Project Context

Mt Tabor
Santos PLs
Santos Petroleum Pipeline Licences

Statewide Corridors
Regional
State

Protected areas
National Park
State Forest
Conservation Park
Resources Reserve
Timber Reserve
Nature Refuge

CO2 AUSTRALIA

N

0 20 40 60
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 Scale: 1:1,000,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Statewide Corridors v1.6
- Protected areas
- Resource authorities
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Mt Tabor\MtTabor_OAMP_mapping_20250429.aprx

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2. Mt Tabor Property

2.1. Property overview

'Mt Tabor', also known as 'Goorathuntha' is a 71,200 ha property located approximately 120 km north-east of Augathella, in south central Queensland (Figure 2). The property is owned by Goorathuntha Traditional Owners Ltd and is currently used for cattle grazing.

Mt Tabor is situated within Subregion 24 (Carnarvon Ranges) of the Brigalow Belt Bioregion (Sattler and Williams 1999) and straddles the boundary between Murweh Shire Council and Maranoa Regional Council. Access to the property is via Mt Tabor Road from Augathella, or Killarney and Mt Tabor Roads from Morven.

The property is located in the north-eastern portion of the Warrego catchment of the Murray-Darling basin. Numerous watercourses, a branched upper tributary catchment of Tickerabang Creek, and several peripheral gullies are present on the site, allowing temporary pools to occur throughout the site. Several farm dams are also present, although no permanent streams, springs or wetlands are known to occur on the site.

The Mt Tabor property is currently on a rolling term lease, in which the Department of Agriculture and Fisheries (DAF) have a right to the forestry products and quarry material under the *Forestry Act 1959*. It is a requirement of the lease that the lessee must allow any authorised person access under the *Forestry Act*. From the initial stages of offset conception on Mt Tabor, Santos has maintained communication lines with between the landholder and DAF to negotiate and obtain consent from DAF for the proposed Mt Tabor offset areas. Whilst the offset area has been located to exclude some areas comprising commercial cypress pine, as requested by DAF, security of the Mt Tabor offset area will result in the long-term protection of MNES habitat that may have otherwise been degraded and lost through future logging.

Table 4 summarises Mt Tabor landholder and property details.

Table 4 – Mt Tabor landholder and property details

Landholder and Property Details	
Registered Owner/s on Title:	Goorathuntha Traditional Owners Ltd
Postal Address:	PO BOX 187, Charleville QLD 4470
Lot on plan(s):	Lot 6 CHS25
Address:	13499 Mount Tabor Rd, Mount Moffatt, QLD
Tenure:	Leasehold
Area:	71,200 ha
Primary Local Government Area:	Maranoa Regional Council
Permits	
Coal Exploration Permit:	EPC 27222 Diversified Asset Holdings Pty Ltd, expired 7 Nov 2024 (renewal lodged)

2.2. Offset area boundary realignment

Following approval of the original *Santos GLNG Mt Tabor Offset Area Management Plan* (Santos 2022) for Stage 4 of EPBC 2012/6615 in November 2022, Santos established a fence around the boundary of offset area 1 to assist with management of livestock control for weed and fuel load management in accordance with the OAMP. The fence line location was scouted with the Traditional Owners as part of on-ground cultural heritage surveys considering topographical aspects of the landscape and existing access tracks. As a result of the final fence line location, the size of the original offset area 1 presented in the approved OAMP decreased from 5,329.4 ha to 5,124.5 ha.

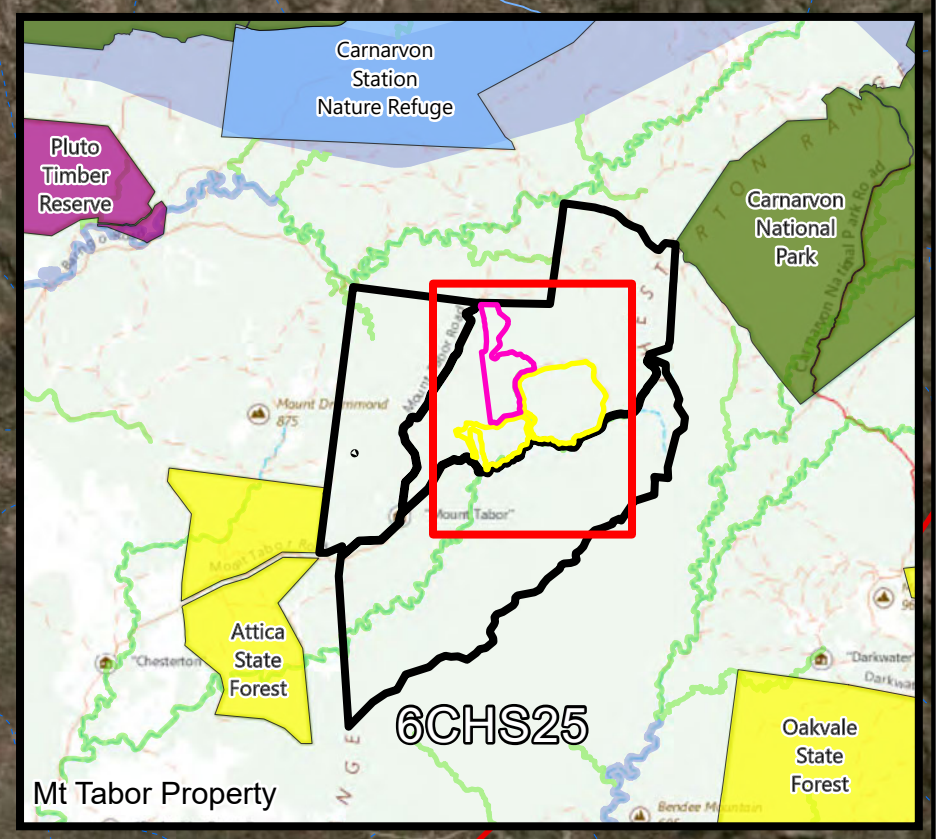
147°34'0"E 147°36'0"E 147°38'0"E 147°40'0"E 147°42'0"E

25°4'0"S 25°6'0"S 25°8'0"S 25°10'0"S 25°12'0"S 25°14'0"S

6CHS25

Tickerabang Creek

Sandy Creek



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Location diagram

Figure 2
Property overview

Mt Tabor

Watercourse
- Major watercourse
- Creekline
- Minor drainage line
- Drainage contour

Offset area
- Area 1
- Area 2

Offset area stage
- GLNG GFD 2012/6615 Stage 4
- GLNG GFD 2012/6615 Stage 7
- GLNG GFD 2012/6615 Stage 8

Protected areas
- National Park
- State Forest
- Timber Reserve
- Nature Refuge

Statewide Corridors
- Regional
- State

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0 1 2 3
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 Scale: 1:55,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Statewide Corridors v1.6
- Protected areas
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Mt Tabor\MTabor_OAMP_mapping_20250429.aprx

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This change was incorporated into a revised *Santos GLNG Mt Tabor Offset Area Management Plan* (Santos 2024) for Stage 7 of EPBC 2012/6615, approved in January 2025. Following this approval, Santos established a fence around the boundary of offset area 2, again considering consultation with Traditional Owners as part of on-ground cultural heritage surveys. As a result of the final fence line alignment, the size of the original offset area 2 presented in the approved Stage 7 OAMP has decreased from 2,348.8 ha to 2,343.9 ha.

This version of the OAMP has been updated to present the actual on-ground extent of MNES habitat within offset area 1 and 2, not only addressing offset requirements for Stage 8 of EPBC 2012/6615, but reconciling the changes in offset area 2 to the previously approved OAMP for Stage 7 of EPBC 2012/6615.

2.3. Connectivity

The Mt Tabor property is part of a vast area of remnant vegetation covering the Carnarvon and Chesterton Ranges. This is an area considered of national significance on account of the extent of remnant vegetation, one which includes the headwaters of all major rivers of inland central Queensland (Boobook 2021a). The Attica State Forest is located adjacent to the south-west boundary of the property and the Mount Moffatt section of Carnarvon National Park adjoins the north-east corner of the property (Figure 1).

Conservation corridors mapped as part of the Queensland Government's Biodiversity Planning Assessments (BPA) assess the biodiversity significance of land in a bioregion. The mapping of state and regional corridors within the Brigalow Belt Bioregion has focussed on those corridors that link adjacent bioregions or connect wildlife refugia (Department of Environment and Science [DES] 2021). Regional riparian corridors mapped as part of the BPA extend through the offset area with mapped state conservation corridors located within proximity to the property corresponding with nearby Carnarvon National Park (Figure 1).

2.4. Climate

The Mt Tabor property is characterised by a hotter wet season (typically November to March) and a cooler dry season (typically April to October) (Figure 3). Temperature records from the Injune weather station (#43015), approximately 117 km south-east of Mt Tabor, show mean monthly maximum temperatures range from ~21°C (July) to ~34°C (January) and mean monthly minimum temperatures range from ~3°C (July) to ~20°C (January) (Bureau of Meteorology [BoM] 2024a, b). Rainfall records from the Injune Post Office weather station (#43015), also show the mean monthly rainfall for the period 2000-2023 ranges from ~20 mm (May) to ~89 mm (February) (BoM 2024c).

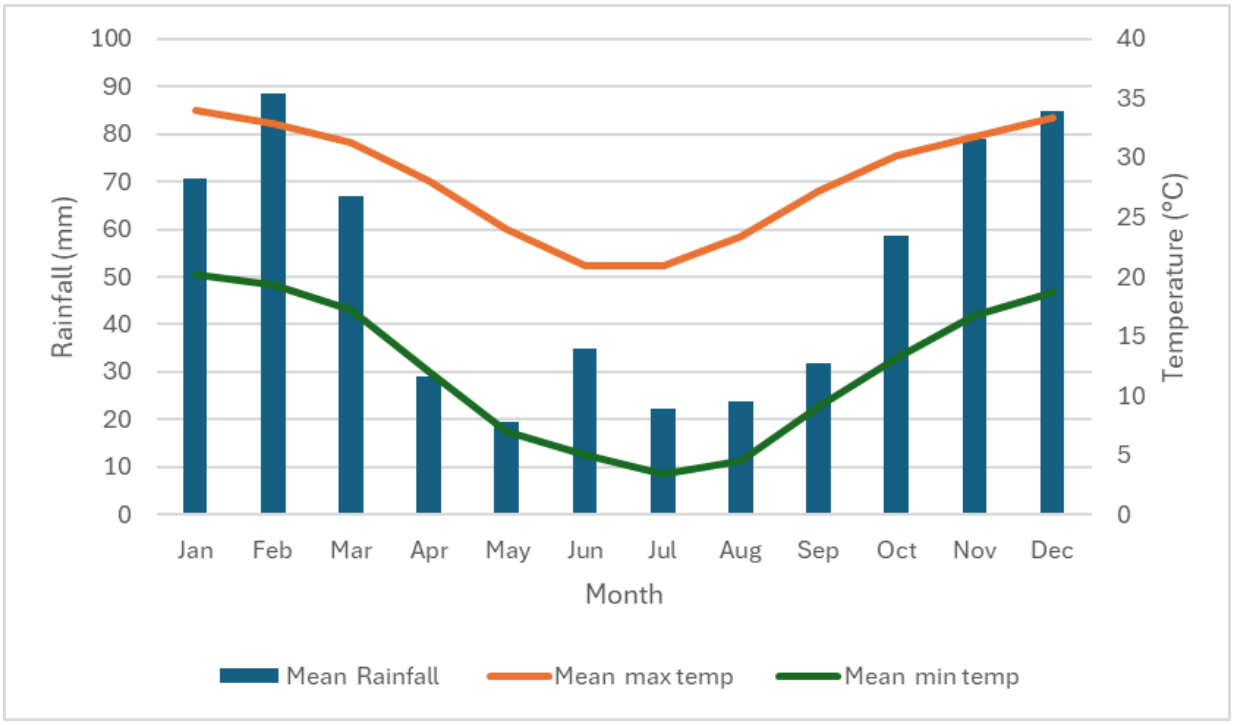

Figure 3 – Mean monthly temperature and rainfall records

2.5. On-ground property assessments

Within the Mt Tabor property, Santos has identified a 7,468.4 ha area for environmental offsets, comprising offset area 1 (5,124.5 ha) and offset area 2 (2,343.9 ha). A combination of desktop and detailed on-ground assessments of the offset area have been undertaken within the offset areas and broader property to confirm the suitability of the area to satisfy the project's offset obligations. The key desktop and field surveys of the offset area completed to date are summarised below:

- Preliminary desktop assessment of biodiversity offset values (Boobook 2021a).
- Detailed field assessments were undertaken to ground-truth vegetation and confirm presence of environmental values by Boobook from December 2020 to January 2021 within offset area 1 (Boobook 2021a) and by CO2 Australia within offset area 2 in April 2024 (CO2 Australia 2024).
- BioCondition assessments were undertaken, during the above-mentioned surveys, in accordance with the BioCondition methodology (Eyre *et al*. 2015). The condition of each site was compared to the benchmark data provided for each RE. Photo monitoring sites were established at all BioCondition assessment sites.
- Targeted fauna surveys using the following methods to assess the presence of fauna for the endangered and vulnerable species also listed below within the Mt Tabor offset area:
  - Collared delma
  - Yakka skink
  - Dunmall's snake
  - Red goshawk
  - Squatter pigeon (southern)
  - Northern quoll
  - Koala
  - South-eastern long-eared bat
  - Large-eared pied bat.
- Survey methods:
  - Camera traps
  - Harp trapping
  - Ultrasonic bat call detection
  - Active daytime habitat searching
  - Driven and on foot spotlighting searches
  - Active koala searches and scat analysis.
- Incidental searches for threatened flora species listed under the EPBC Act and/or *Nature Conservation Act 1992* (Qld) were carried out at vegetation assessment sites and during meanders in targeted habitat types.

2.6. Ground-truthed vegetation and habitat mapping

Based on the results of detailed ecological field assessments, ground-truthed vegetation (Figure 4) within the offset area has been classified as remnant vegetation. Remnant woody dominated vegetation is defined as vegetation that has not been cleared or that has been cleared but where the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy (Neldner *et al*. 2023).

The results of detailed field assessments were subsequently used to confirm the suitability of the mapped ground-truthed regional ecosystems (RE) on the offset to support habitat for the project's MNES offset requirements. Known habitat requirements for each conservation significant species were assessed against on-ground microhabitat observations within each vegetation type of the offset area. These assessments, combined with ecologist knowledge, was used to develop RE-based predictive habitat mapping for EPBC Act-listed threatened fauna species confirmed likely or potentially present in the offset area (Boobook 2021a).

147°34'0"E
147°36'0"E
147°38'0"E
147°40'0"E
147°42'0"E
25°4'0"S
25°6'0"S
25°8'0"S
25°10'0"S
25°12'0"S

Tickerabang Creek
Sandy Creek

SANTOS

Location diagram

Figure 4
Ground-truthed vegetation

Mt Tabor
Property access track
Fence

Watercourse
Major watercourse
Creekline
Minor drainage line
Drainage contour

Offset area
Area 1
Area 2

Ground truthed RE
11.3.2
11.3.39
11.10.4
11.10.6
11.10.7
11.10.11
11.10.13

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0 1 2 3
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:50,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Mt Tabor\MtTabor_OAMP_mapping_20250429.aprx

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2.6.1. Vegetation description

Table 5 provides a summary of the ground-truthed REs mapped on the Mt Tabor offset areas.

The offset areas are located within a vast area of remnant vegetation dominated by Myrtaceae species, particularly on hills, slopes, shelves and plateaus (Boobook 2021a). *Eucalyptus decorticans* covers a significant proportion of the property, although *E. crebra, E. melanophloia, E. fibrosa subsp. fibrosa* and *Corymbia* spp. are dominant in some sections (Boobook 2021a; CO2 Australia 2024).

Lysicarpus angustifolius, Allocasuarina inophloia and *Allocasuarina luehmannii* are characteristic of areas on and around rocky plateaus (Boobook 2021a). However, *E. macrocarpa* was also noted in shallow soils on the sandstone plateau, around the basalt hills, and in gravely areas below scarps (Boobook 2021a). *E. conica* and *E. melanophloia* dominate the broad valley areas with varying amounts of *E. melanophloia,* while *E. chloroclada* is dominant along streams (Boobook 2021a). Stands of *E. grisea* and *E. major* are present along the floor and lower slopes of narrow gorges, as well as the areas below scarps (Boobook 2021a). On gentler lower slopes, with areas of deep sand, a community of *Angophora leiocarpa* and *Callitris glaucophylla* is supported (Boobook 2021a). Areas of basalt, although limited, are vegetated with grassy woodland dominated by *E. orgadophila* and/or *E. melanophloia* and abundant, tall *Macrozamia moorei* in some areas (Boobook 2021a; CO2 Australia 2024).

Table 5 – Ground-truthed RE mapped within the Mt Tabor offset area

RE	Description	Mt Tabor offset area (ha)					
		Total area	EPBC 2012/6615 Stage 4 approved offset area	EPBC 2012/6615 Stage 7 approved offset area		EPBC 2012/6615 Stage 8 proposed offset area	Surplus
			Offset area 1	Offset area 1	Offset area 2	Offset area 2	
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	54.5	33.5	1.3	19.7	0	0
11.3.39	*Eucalyptus melanophloia* +/- *E. chloroclada* open woodland on undulating plains and valleys with sandy soils.	1,282.9	805.7	22.2	449.6	5.4	0
11.10.4	*Eucalyptus decorticans, Lysicarpus angustifolius* +/- *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp. woodland on coarse-grained sedimentary rocks	3,070.5	2,109.1	0	961.4	0	0
11.10.6	*Angophora leiocarpa*, *Callitris glaucophylla* open woodland on coarse-grained sedimentary rocks. Broad valleys.	1,316.7	0	885.6	129.0	302.0	0
11.10.7	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	43.2	38.8	4.4	0	0	0
11.10.11	*Eucalyptus populnea, E. melanophloia* +/- *Callitris glaucophylla* woodland on coarse-grained sedimentary rocks	146.8	48.2	0	98.6	0	0
11.10.13	*Eucalyptus* spp. and/or *Corymbia* spp. open forest on scarps and sandstone tablelands.	1,553.9	1,137.6	38.1	378.2	0	0
Total		**7,468.4**	**4,172.9**	**951.5**	**2,036.5**	**307.4**	**0**

2.6.2. Habitat description

Following the results of detailed field assessments, known habitat requirements for targeted fauna species were assessed against on-ground microhabitat observations within each habitat type to categorise the quality of habitat present into essential or general habitat (Boobook 2021a). The habitat definitions, 'essential' and 'general', used by Boobook were provided in the Santos Fauna Habitat model (Aurecon 2014) and are defined as follows:

- Essential habitat is defined as an area containing essential resources for the maintenance of species populations (e.g. habitat for breeding, roosting, foraging and shelter), for either migratory or non-migratory species, from known records and/or expert advice.
- General habitat is defined as areas or locations that are used by transient individuals or where species have been recorded but there is insufficient information to assess the area as 'essential habitat'. It may be defined from known records and expert knowledge of habitat relationships, despite the absence of records. Areas classified as 'general' may include areas of sub optimal habitat.

Table 6 provides a summary of the extent of predicted suitable habitat mapped on the Mt Tabor offset area for the project's MNES offset requirements based on the results of detailed field assessments (Boobook 2021a; CO2 Australia 2024). An additional description of the offset area for each MNES is provided in Section 3.

Table 6 – Extent of suitable habitat mapped for MNES across the Mt Tabor offset area

MNES	Suitable REs	Habitat Mapping Rules	Offset area 1		Offset area 2	
			Essential Habitat (ha)	General Habitat (ha)	Essential habitat (ha)	General Habitat (ha)
Threatened fauna species						
Collared delma	11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.13	*General habitat* includes all areas of remnant and regrowth vegetation of the nominated RE.	-	5,124.5	-	2,343.9
Yakka skink	Essential Habitat: 11.3.2, 11.3.39, 11.10.7, 11.10.11 General Habitat: 11.10.4, 11.10.13	*Essential habitat* is based on known records within the nominated RE and includes all remnant and regrowth vegetation of the nominated RE. *General habitat* includes all remnant and regrowth vegetation of the nominated RE. This may include sub-optimal habitat.	954.1	3,284.8	573.2	1,339.6
Dunmall's snake	11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.13	*General habitat* includes all remnant and regrowth vegetation of the nominated RE.	-	5,124.5	-	2,343.9
Red goshawk	11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.13	*General habitat* includes all areas of remnant and regrowth vegetation of the nominated RE. This species requires tall trees close to permanent water for nest sites but may forage at a distance from this habitat.	-	5,124.5	-	2,343.9
Squatter pigeon (southern)	11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.13	*General habitat* includes all areas of remnant and regrowth vegetation of the nominated RE.	-	5,124.5	-	2,343.9
Northern quoll	11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.13	*Essential habitat* includes all nominated RE within 1 km of potentially suitable shelter habitat (extensive areas of dissected sandstone with deep crevices and caves). *General Habitat* includes all remnant and regrowth vegetation of the nominated RE within 1 to 5 km of potential shelter habitat.	4,261.7	862.8	1,885.0	458.9
Koala	11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.13	*Essential habitat* includes all remnant and regrowth vegetation of RE dominated by Myrtaceae species.	5,124.5	-	-	2,343.9
South-eastern long-eared bat	11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.13	*General habitat* includes all areas of remnant and regrowth vegetation that may be suitable for foraging or shelter.	-	5,124.5	-	2,343.9
Large-eared pied bat	11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.13	*Essential habitat* includes all areas of remnant and regrowth vegetation of the nominated RE within 5 km of potentially suitable shelter habitat (extensive areas of dissected sandstone with deep crevices and caves).	-	5,124.5	-	2,343.9

2.7. Offset area

The total consolidated offset area to be secured on Mt Tabor is 7,468.4 ha, which includes 5,124.5 ha in offset area 1 and 2,343.9 ha in offset area 2 as illustrated in Figure 4. The Mt Tabor offset area includes:

- 4,172.9 ha to acquit offset requirements associated with Stage 4 of the GFD Project under EPBC 2012/6615, all located within offset area 1.
- 2,988.0 ha to acquit offset requirements associated with Stage 7 of the GFD Project under EPBC 2012/6615, located across offset area 1 (951.6 ha) and offset area 2 (2,036.5 ha).
- 307.4 ha to acquit offset requirements associated with Stage 8 of the GFD Project under EPBC 2012/6615, located within offset area 2.
- With the approval of this OAMP for Stage 8 of EPBC 2012/6615, there will be no surplus areas available for future drawdown, subject to any future reconciliation of previous stages' impacts.

Table 7 provides a summary of the Mt Tabor offset area to be secured under Stage 8 of EPBC 2012/6615. Figure 4 spatially presents the Mt Tabor offset areas and the ground-truthed vegetation communities.

The results of the detailed field assessments including the ground-truthed RE mapping and fauna habitat associations discussed in Section 2.6 were used to inform the suitability to acquit the MNES offset requirements. The minimum offset area required to be secured for the MNES was determined in accordance with the EPBC Act OAG, presented as part of *Santos GLNG Offset Plan and Acquittal Summary: EPBC Act Approval 2012/6615, Stage 8* (Santos 2025).

Baseline habitat quality scores for the MNES offset values were determined generally in accordance with the *Guide to Determining Terrestrial Habitat Quality* (GTDTHQ; version 1.3; DES 2020) based on the results of the detailed field assessments (Section 2.5). The baseline habitat quality score was used to inform the OAG for the MNES under EPBC 2012/6615. The habitat quality scores will be used as a measure to assess the success of the OAMP through the interim performance targets and completion criteria outlined in Section 4. A detailed summary of the baseline habitat quality scores for the MNES is provided in Appendix A.

Santos is committed to providing the required area of suitable habitat to acquit MNES offset requirements for Stage 8 of the GFD Project in accordance with the EPBC Act *Environmental Offsets Policy* and OAG; however, the final boundary of the Mt Tabor offset area is subject to change following consultation with Traditional Owners and in consideration of cultural heritage values present on site.

Table 7 – Summary of the Mt Tabor offset area and acquittal for Stage 8 of EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Offset area (ha)				% acquittal of Stage 8[2]	Surplus area (ha)[3]
			Approved for Stage 4 under EPBC 2012/6615	Approved for Stage 7 under EPBC 2012/6615		To be secured for Stage 8 under EPBC 2012/6615		
				Offset area 1	Offset area 2			
Threatened fauna species								
Collared delma (*Delma torquata*)	V	49.49	4,172.9	951.5	2,036.5	307.42	95.50	0
Yakka skink (*Egernia rugosa*)	V	39.99	4,172.9	66.0	1,908.2	5.38	1.72	0
Dunmall's snake (*Furina dunmalli*)	V	49.98	4,172.9	951.5	2,036.5	307.42	94.57	0
Red goshawk (*Erythrotriorchis radiatus*)	E	25.61	4,172.9	951.5	2,036.5	307.42	126.10	0
Squatter pigeon (southern) (*Geophaps scripta scripta*)	V	32.11	4,172.9	951.5	2,036.5	307.42	122.67	0
Northern quoll (*Dasyurus hallucatus*)	E	26.11	4,172.9	951.5	2,036.5	307.42	148.42	0
Koala (*Phascolarctos cinereus*)	E	36.56	4,172.9	951.5	2,036.5	307.42	88.32	0
South-eastern long-eared bat (*Nyctophilus corbeni*)	V	50.48	4,172.9	951.5	2,036.5	307.42	78.02	0
Large-eared pied bat (*Chalinolobus dwyeri*)	E	32.61	4,172.9	951.5	2,036.5	307.42	99.03	0

[1] Status: E = Endangered and V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties for MNES with less than 100% acquittal.
[3] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 5 of this OAMP to understand how areas are accounted for in each stage.

2.8. Offset protection

Following approval of the Mt Tabor OAMP in November 2022, Santos successfully secured the original offset area (5,329.4 ha) via a Voluntary Declaration under Section 19E and 19F of the Queensland *Vegetation Management Act 1999* (VM Act). Santos will apply to have the Voluntary Declaration amended to reflect the updated offset area 2 boundary within 12 months following the approval of this OAMP. The Voluntary Declaration will be registered on the property title and will be binding on current and future landowners.

A Voluntary Declaration under the VM Act is an authorised legally binding mechanism and is considered appropriate to legally secure MNES values and protect the area from vegetation clearing. The offset areas will be mapped as a Category A area on the Property Map of Assessable Vegetation (PMAV). A Category A area on a PMAV is described as an “Area subject to compliance notices, offsets and voluntary declarations”.

The Voluntary Declaration will remain in place for the life of EPBC 2012/6615. The Voluntary Declaration may only be removed in accordance with the provisions of the VM Act or if the chief executive the Queensland Department of Natural Resources and Mines, Manufacturing, and Regional and Rural Development considers it necessary.

The offset area coordinates for the combined boundaries of offset area 1 and 2 are provided in Appendix B.

2.9. EPBC Act Environmental Offsets Policy

Table 8 outlines how the Stage 8 GFD Project offset obligations partially acquitted on the Mt Tabor offset area meet the requirements of the EPBC Act *Environmental Offsets Policy*.

Table 8 – Assessment against Principles of the Offset Policy

Principle	How the principle is met in this offset proposal
1. deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The Mt Tabor offset areas partially acquit MNES offset requirements for Stage 8 of the GFD Project under EPBC 2012/6615 as outlined in Table 7. The remaining will be acquitted elsewhere. The Mt Tabor offset areas will be managed and monitored to improve the quality and viability of habitat for threatened fauna species. This OAMP sets out specific management objectives with interim performance targets and completion criteria. Management actions are outlined with accompanying adaptive management triggers and corrective actions in the event that monitoring identifies that interim performance targets are not attained, or completion criteria are not attained and/or maintained. The offset areas will be managed and monitored from approval of the OAMP for a minimum of 20 years. It is anticipated that the completion criteria will be achieved within a 20-year period.
2. be built around direct offsets but may include other compensatory measures	MNES offset obligations for Stage 8 of the GFD Project under EPBC 2012/6615 will be acquitted through the delivery of direct land-based offsets on the Mt Tabor offset area and additional land based offset areas to be secured by Santos.
3. be in proportion to the level of statutory protection that applies to the protected matter	The threatened status of the impacted protected matters is considered in the OAG in calculating the area of the offset to be provided.
4. be of a size and scale proportionate to the residual impacts on the protected matter	The size of the offset areas to be secured for offset obligations has been calculated in accordance with the OAG (see *Santos GLNG Offset Plan and Acquittal Summary: EPBC Act Approval 2012/6615, Stage 8 [Santos 2025]*)
5. effectively account for and manage the risks of the offset not succeeding	This OAMP has been developed in consideration of known and identified threats to the offset values to manage the risk of failing to the achieve the completion criteria and overall environmental outcomes for the offset areas.

Principle	How the principle is met in this offset proposal
	Threats to the offset site are managed through the implementation of the management measures discussed in Section 6, including: • fire prevention and management • weed and pest animal monitoring and control • clearing protection • management of grazing • restricted access. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans etc) and identification of potential site-specific risks based on the results of field surveys and discussions with the landholder. The results of the risk assessment, presented in Appendix C, have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions. If the offset cannot attain and maintain the completion criteria then additional offsets will be provided to compensate for the impact and the failed offset (see Section 5.2.4).
6. be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	The environmental outcomes proposed to be achieved through the implementation of this OAMP are based on additional management and monitoring measures conducted as part of business as usual on the Mt Tabor property. For example, under the *Biosecurity Act 2014* (Qld) a person has a general biosecurity obligation to take all reasonable and practical steps to prevent or minimise each biosecurity risk. The steps proposed in this OAMP are above reasonable and practical steps required to control feral animals and weeds in central Queensland. With a Voluntary Declaration secured over the offset areas, environmental laws prevent other land uses inconsistent with this OAMP being approved over this part of the property.
7. be efficient, effective, timely, transparent, scientifically robust and reasonable	The Mt Tabor offset areas have been identified to be suitable using an evidence based and scientifically robust approach. The environmental outcomes to be achieved through this OAMP will be delivered progressively over 20 years. The offset areas are or will be legally secured through a Voluntary Declaration under the VM Act, therefore any vegetation clearing contravention of this OAMP is not permissible without specific Queensland Government approval. The preparation and implementation of this OAMP supports the efficient, effective, timely, transparent and scientifically robust approach to providing offsets.
8. have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced	This OAMP includes a detailed monitoring program which will assess the effectiveness of the management actions undertaken and the progress of the offset areas in achieving the environmental outcomes. The results of all management and monitoring programs will be included in annual reports (Section 8). An implementation schedule for monitoring and management is provided in Section 9 which will be reviewed at least annually to ensure the timely implementation of this OAMP.
9. be efficient, effective, timely, transparent, scientifically robust and reasonable	The Mt Tabor offset area have been identified to be suitable using an evidence based and scientifically robust approach. The environmental outcomes to be achieved through this OAMP will be delivered progressively over 20 years. The offset areas are or will be legally secured through a Voluntary Declaration under the VM Act, therefore any

Principle	How the principle is met in this offset proposal
	vegetation clearing contravention of this OAMP is not permissible without specific Queensland government approval. The preparation and implementation of this OAMP supports the efficient, effective, timely, transparent and scientifically robust approach to providing offsets.
10. have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced	This OAMP includes a detailed monitoring program which will assess the effectiveness of the management actions undertaken and the progress of the offset areas in achieving the environmental outcomes. The results of all management and monitoring programs will be included in annual reports (Section 8). An implementation schedule for monitoring and management is provided in Section 9 which will be reviewed at least annually to ensure the timely implementation of this OAMP.

3. Offset Values

The following sections provide a description of the offset area that will be managed as part of this OAMP for each MNES offset value. Figure 5 presents the MNES habitat areas in the Mt Tabor offset area.

3.1. Collared delma

Habitat for collared delma within the offset areas comprises areas of RE 11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11 and 11.10.13.

Collared delma is known to occur in REs on land zones 3, 9 and 10 (DCCEEW 2025b), with all REs in the offset area comprising of these land zones (Boobook 2021a; CO2 Australia 2024). The species occupies a range of eucalypt woodlands and open forests; and requires rocks, timber bark and other large woody debris for shelter (Wilson 2015; DCCEEW 2025b). General habitat for the collared delma was identified through the entirety of the offset area, including eucalypt woodland supporting potentially suitable shelter sites (e.g. small rocks, woody debris). There are scattered occurrences of this species from inland southern Queensland, with the closest record being from Carnarvon Station around 40 km north-northeast (Boobook 2021a).

3.2. Yakka skink

Habitat for yakka skink within the Mt Tabor offset areas comprises areas of RE 11.3.2, 11.3.39, 11.10.4, 11.10.7, 11.10.11 and 11.10.13.

Yakka skink is known to occur in open dry sclerophyll forest, woodland and scrub and a within a wide variety of vegetation types within land zones 3, 4, 5, 7, 9 and 10 (DCCEEW 2025d). The species is commonly found under partly buried rocks, logs, root cavities or in abandoned animal burrows (DCCEEW 2025d). Suitable habitat for the species was identified across the offset area comprising of eucalypt-dominant woodlands with occasional shelter sites (e.g. large logs) (Boobook 2021a; CO2 Australia 2024).

3.3. Dunmall's snake

Habitat for Dunmall's snake within the offset areas comprises areas of RE 11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11 and 11.10.13.

Dunmall's snake occurs in a variety of habitats including forests and woodlands (including those dominated by brigalow, bull-oak and other *Acacia, Eucalyptus* and *Callitris* species) on clay loam, cracking clay soils and sandstone derived soil (DCCEEW 2025f). Rare observations have been made on the edge of dry vine scrub and in hard ironstone country (DCCEEW 2025f). The offset area is comprised of eucalypt and *Callitris*-dominated REs providing suitable general habitat for the species (Boobook 2021a; CO2 Australia 2024).

3.4. Red goshawk

Habitat for red goshawk within the offset areas comprises areas of RE 11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11 and 11.10.13.

Breeding habitat is intact tall forest associated with major drainage lines; however, the species may often forage much further away from these areas (DCCEEW 2025e). The offset area is considered to comprise of suitable foraging habitat for the species with open areas near water, forests and woodlands of the mentioned REs likely supporting a diversity of prey (Boobook 2021a; CO2 Australia 2024).

3.5. Squatter pigeon (southern)

Habitat for squatter pigeon within the offset areas comprises areas of RE 11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11 and 11.10.13.

Squatter pigeon (southern) favours open-forests to sparse, open-woodlands and scrub that are mostly dominated by *Eucalyptus, Corymbia, Acacia* or *Callitris* species and are close to water bodies or watercourses (DCCEEW 2025g). Although there are no known permanent streams, springs or wetlands within the offset, it does encompass numerous watercourses and farm dams (Boobook 2021a; CO2 Australia 2024). The above REs, which are distributed across the offset area, are dominated by *Eucalyptus, Corymbia, Acacia* and *Callitris* species.

As such, general habitat for the squatter pigeon (southern) was identified across the entirety of the offset. This species was observed across the offset area during Boobook's assessment, with 11 locations recorded, and subsequently during CO2 Australia's assessments in 2024 (Figure 5).

3.6. Northern quoll

Habitat for northern quoll within the offset areas comprises areas of RE 11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11 and 11.10.13.

This species is dependent on the presence of suitable shelter habitat in the form of caves and deep crevices in extensive rock formations (commonly sandstone) and forages in associated woodland and forest habitat (DCCEEW 2025c). The offset area is characterised by rugged topography from remnant eroded sandstone, bounded by scarps and cliffs with numerous narrow gorges, with the above REs found across the offset area (Boobook 2021a; CO2 Australia 2024). Primarily essential habitat for the species, defined by all of the mentioned REs within 1 km of potentially suitable shelter habitat, covers a majority of the offset area (Boobook 2021a; CO2 Australia 2024). A small area of general habitat, defined as >1 km from potentially suitable shelter habitat, is also present (Boobook 2021a; CO2 Australia 2024). The offset area is located within the species historical range, with recent records for the species from the nearby Carnarvon Range (Boobook 2021a).

3.7. Koala

Habitat for koala within the offset area comprises areas of RE 11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11 and 11.10.13.

Koala habitat can be broadly defined as any forest or woodland containing known koala food trees, which are naturally abundant on fertile clay soils (DCCEEW 2025i). Koalas predominantly feed on *Eucalyptus* spp.; however, they are also known to consume other Myrtaceae species (DCCEEW 2025i). Suitable habitat (eucalypt-dominated woodlands and open forests) was identified across the offset area with potential food trees, including *Eucalyptus populnea, E. chloroclada, E. major, E. grisea, E. microcarpa, E. melanophloia, E. fibrosa* and *E. crebra,* present (Boobook 2021a; CO2 Australia 2024). Several koala observations were made during assessment in the southern section of the site, including scratch marks on trees, with the largest cluster around the centre of the southern border (Figure 5; Boobook 2021a; CO2 Australia 2024).

3.8. South-eastern long-eared bat

Habitat on the Mt Tabor offset areas for south-eastern long-eared bat comprises areas of RE 11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11 and 11.10.13.

The species is known to occur in a variety of dry forest habitats including those dominated by river red gum, open woodland, mallee, brigalow and other arid and semi-arid habitats, although the preferred habitat is mallee and *Callitris* woodlands, and habitats that have a distinct canopy with a dense, cluttered understorey (DCCEEW 2025h). The species roosts in tree hollows or under bark. Surveys suggest the species requires large tracts of forest to occur (DCCEEW 2025h).

The entirety of the offset area was identified as suitable general habitat for foraging and roosting (CO2 Australia 2024). One observation of this species was made during assessment, close to the south-west border (Figure 5; Boobook 2021a).

3.9. Large-eared pied bat

Habitat for large-eared pied bat within the offset areas comprises areas of RE 11.3.2, 11.3.39, 11.10.4, 11.10.6, 11.10.7, 11.10.11 and 11.10.13.

This species requires a combination of sandstone cliffs/escarpments to provide roosting habitat that is adjacent to fertile woodlands, preferably box gum or river/rainforest corridors for foraging (DCCEEW 2025a). The offset is characterised by eroded sandstone plateaus, bounded by scraps and cliffs and is within the known range of the species (Boobook 2021a; CO2 Australia 2024). The large-eared pied bat is known to occur from nearby Mount Moffatt within Carnarvon National Park (Boobook 2021a). Essential habitat was identified throughout the entirety of the offset area defined as all areas of remnant vegetation within 5 km of potentially suitable shelter habitat (extensive areas of dissected sandstone with deep crevices and caves) (Boobook 2021a; CO2 Australia 2024).

147°34'0"E
147°36'0"E
147°38'0"E
147°40'0"E
147°42'0"E
25°4'0"S
25°6'0"S
25°8'0"S
25°10'0"S
25°12'0"S

6CHS25

Tickerabang Creek

Sandy Creek

SANTOS

Location diagram

Figure 5
MNES habitat

Mt Tabor
Property access track
Fence

Offset area

Area 1
Area 2

Watercourse

Major watercourse
Creekline
Minor drainage line
Drainage contour

MNES Habitat

All MNES habitat
All MNES habitat (excl. Yakka skink)

MNES fauna observation

Glossy black cockatoo
Greater glider
Koala
Squatter pigeon

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:50,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Mt Tabor\MtTabor_OAMP_mapping_20250429.aprx

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4. Environmental Outcomes to be Achieved

The outcome of this OAMP is to partially acquit the offset obligations for Stage 8 under EPBC 2012/6615 (conditions 11-19) in accordance with the EPBC Act *Environmental Offsets Policy*. Progress towards achieving these outcomes will be measured against the interim performance targets and criteria defined in Table 9.

The specific environmental outcomes to be achieved for the offset on Mt Tabor are defined as interim performance targets and completion criteria, detailed in Table 9, based on the proposed habitat quality score to be achieved for each MNES in the OAGs in the Offset Acquittal report (Santos 2025).

Table 9 – Interim performance targets and completion criteria for the Mt Tabor offset area

MNES	Baseline		Interim performance targets (year 5, 10 and 15)	Completion criteria (year 20)	
	Offset area 1	Offset area 2		Offset area 1	Offset area 2
Threatened fauna species					
Collared delma (*Delma torquata)*	7	8	No decrease in overall habitat quality score from previous monitoring event	8	9
Yakka skink (*Egernia rugosa*)	7	8	No decrease in overall habitat quality score from previous monitoring event	8	9
Dunmall's snake (*Furina dunmalli)*	7	8	No decrease in overall habitat quality score from previous monitoring event	8	9
Red goshawk (*Erythrotriorchis radiatus*)	8	7	No decrease in overall habitat quality score from previous monitoring event	9	8
Squatter pigeon (southern) (*Geophaps scripta scripta*)	8	7	No decrease in overall habitat quality score from previous monitoring event	9	8
Northern quoll (*Dasyurus hallucatus)*	7	7	No decrease in overall habitat quality score from previous monitoring event	8	8
Koala (*Phascolarctos cinereus*)	8	7	No decrease in overall habitat quality score from previous monitoring event	9	8
South-eastern long-eared bat (*Nyctophilus corbeni*)	8	8	No decrease in overall habitat quality score from previous monitoring event	9	9
Large-eared pied bat (*Chalinolobus dwyeri)*	8	8	No decrease in overall habitat quality score from previous monitoring event	9	9

5. Adaptive Management

This OAMP is based on an adaptive management approach which involves 'flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood' (National Research Council 2004).

5.1. Adaptive management

Adaptive management includes two key phases:

- Establishment of the key components of a management framework including engaging stakeholders, developing clear and measurable objectives and performance criteria, identification and selection of potential management actions and the development of monitoring protocols which enable the evaluation of progress towards achieving objectives, and which will effectively contribute to the adaptive management decision making process.
- An iterative learning phase which involves utilisation of the management framework to learn about the natural resource system and iteratively adapt management strategies and approaches based on what is learned (Williams 2011).

The management of natural systems involves uncertainty which can affect the success of the management measures in achieving the objectives and performance criteria. Williams (2011) and Williams and Brown (2016) identify four kinds of uncertainty, outlined as follows, with how they have been addressed through the development of this OAMP:

- environmental variation:
  - caused by external factors that act upon natural systems, but which are not influenced by the resource conditions and dynamics, for example variation in rainfall or temperature,
  - largely outside of the control of the manager (Williams 2011), and
  - influence is considered in the analysis of the effectiveness of the adaptive management approach, the analysis of the ability to achieve and maintain performance criteria and when considering the need for corrective actions.
- partial observability:
  - includes potential uncertainty arising from variation in the collection of data during monitoring events, and from being unable to completely observe the natural system in its entirety (Williams and Brown 2016), and
  - addressed in this OAMP through the development of a monitoring program based on scientifically tested and repeatable methods.
- partial controllability:
  - relates to the difference between the intended effect of the management measures to be implemented through this OAMP and the actual effect of their implementation on the ground (Williams and Brown 2016), and
  - address through adherence to an adaptive management approach including regular monitoring of conformance with performance criteria, assessment of adaptive management triggers, the implementation of corrective actions, review and amendments to the OAMP, and reporting to ensure that management measures are being effectively implemented on the ground.
- structural and process uncertainty:
  - concerns a lack of knowledge or understanding regarding biological and ecological processes and relationships, and differing views regarding how natural systems respond to management (Williams and Brown 2016), and
  - addressed through the adaptive management approach. Following the results of ongoing management, monitoring and reporting, the OAMP will be reviewed and updated as required to incorporate learnings, updated conservation advice and best practice management techniques.

5.2. OAMP adaptive management framework

5.2.1. Risk assessment

The adaptive management process for this OAMP is supported by a risk assessment through which the known and potential risks for each offset value have been evaluated. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans etc) and identification of potential site-specific risks. As presented in Appendix C, the risk assessment included an assessment of the likelihood and consequence for each identified risk, both with and without the implementation of control strategies. The results of the risk assessment have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions.

Implementation of the adaptive management process aims to reduce the risk of the identified threats occurring to ensure that the overall outcome sought by this OAMP are achieved.

5.2.2. Adaptive management process

The adaptive management process for this OAMP includes the following key components:

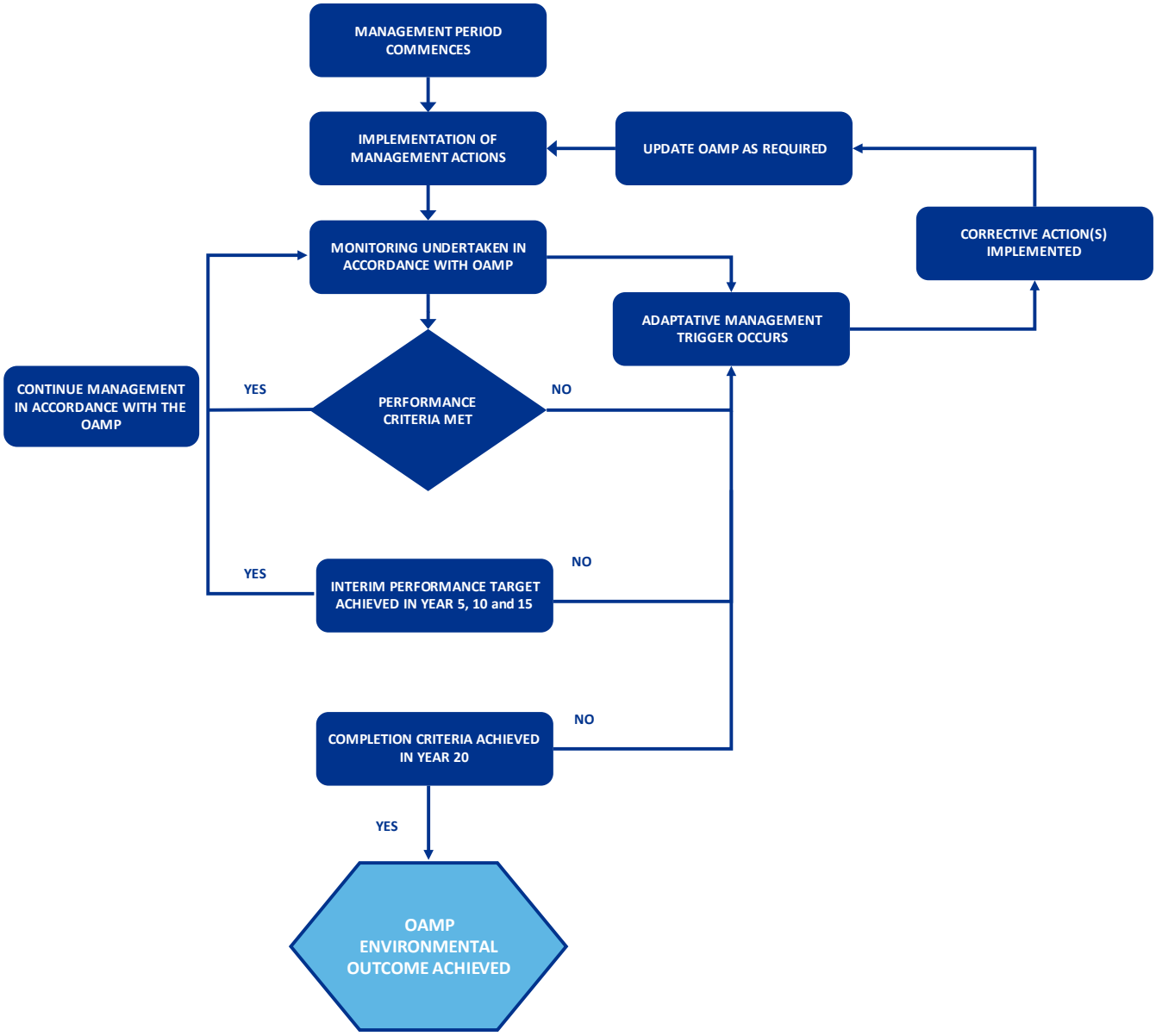
- **identified threats to offset values** – known and potential threats to the offset values have been identified as part of the risk assessment process
- **relevant offset values** – MNES or other offset matter for which the identified threat is relevant have been indicated
- **management objectives** – management objectives have been developed to address each identified threat to the offset values, and to ensure that the interim performance targets and completion criteria are attained
- **performance criteria** – assessable criteria have been defined to measure adherence to the management objectives
- **management actio**n – specific management actions have been identified to ensure that the performance criteria and management objectives are satisfied, and which will ultimately result in attainment of the interim performance targets and completion criteria
- **monitoring** – a combination of qualitative and quantitative methodologies has been included to assess whether management actions are meeting the performance criteria and management objectives, and ultimately, whether the OAMP is supporting the delivery of the interim performance targets and completion criteria
- **adaptive management trigger** – measurable events or parameters have been identified which, when triggered, indicate that a performance criterion has not been satisfied, instigating the implementation of contingency plans and corrective actions
- **corrective actions** – a two-step process has been established to identify the likely cause of the non-compliance with the performance criteria and allow for identification of suitable corrective actions. Corrective actions include the implementation of a feasible, appropriate and effective action to address the identified issue and ensure the performance criteria is satisfied.

Figure 6 illustrates the ongoing adaptive management cycle of implementation, learning and review, with the aim of achieving the interim performance targets and completion criteria. Through the implementation of this adaptive management process, it is anticipated that the interim performance targets and completion criteria will be attained and maintained for the life of the approval.

5.2.3. Timing for implementation of the OAMP

The offset area will be managed and monitored until the interim performance targets and completion criteria are achieved. It is anticipated that through the adaptive management approach, interim performance targets and completion criteria will be achieved within the proposed 20-year management period. However, if the interim performance targets and/or completion criteria for offset values have not been achieved within the anticipated timeframes, management and monitoring will continue beyond the 20-year management period in accordance with this OAMP until the completion criteria have been achieved. Once attained, completion criteria will be maintained for at least the life of the EPBC Act approval relevant to this OAMP.

Figure 6 – Process for implementation of the OAMP



5.2.4. Risk of offset failure

Based on the adaptive approach to management and the proposed management and monitoring program, it is considered that the management objectives, interim performance targets and completion criteria will be successfully achieved.

In the unlikely event that the interim performance targets are not achieved for one or more offset values by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions.

It should be noted that unavoidable temporary perturbations such as severe drought, or insect/fungal pest invasion that may cause a temporary decrease in metrics such as canopy or shrub cover from which the community still may recover within the next 5-year period should not preclude assessment of a satisfactory increase in ecological condition by the completion date.

If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements. The revised OAMP will be submitted to the Commonwealth Government.

6. Management Program

6.1. Management objectives

A summary of the management objectives and performance criteria for the offset area is presented in Table 10, and the complete adaptive management process for this OAMP is encapsulated in Table 12. The management measures provided in this section take into account the information in the relevant conservation advices, recovery plans and threat abatement plans for each MNES, as demonstrated in Table 11 below. Management actions, monitoring events, adaptive management triggers and corrective actions have been assigned to each management objective and performance criteria.

Table 10 – Summary of the management objectives and performance criteria

Management objectives	Performance criteria
Achieve the completion criteria including habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events so as to achieve the scores in the completion criteria.
Maintain the extent of offset value habitat within the offset area.	No unapproved and/or intentional clearing of habitat within the offset area, with the exception of clearing that is required for fencing, access, firebreaks and public safety as outlined in Table 11.
Ensure that the livestock grazing restrictions outlined in Section 6.2.4 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events.
	Biomass levels of 2,500 kg/ha are retained at each of the monitoring sites at the end of the dry season.
	Livestock are only observed to be grazing in the offset area during strategic grazing event/s.
Minimise predation risk by wild dogs to threatened fauna species.	Reduction in Catling* Index for wild dogs from year 1 and subsequent monitoring events.
Minimise predation risk by feral cats to threatened fauna species.	Reduction in Catling* Index for feral cats from year 1 and subsequent monitoring events.
Minimise predation risk by foxes to threatened fauna species.	Reduction in Catling* Index for foxes from year 1 and subsequent monitoring events.
Minimise degradation of offset value habitat by feral horses.	Reduction in Catling* Index for feral horses from year 1 and subsequent monitoring events.
Minimise degradation of offset value habitat by rabbits.	Maintain rabbit impact category as ‘acceptable’.
Minimise degradation of offset value habitat by feral pigs.	Reduction in mean feral pig abundance score from year 1 and subsequent monitoring events.
Minimise risk of poisoning by ingestion of cane toads by the northern quoll.	Manage to reduce relative abundance of cane toads to the greatest extent possible.
Manage invasive weed species to reduce degradation of offset value habitat.	A decrease in species richness and relative abundance of weed species at 80% of monitoring sites from year 1 and subsequent monitoring events.

Management objectives	Performance criteria
	No new weed species are identified at any monitoring site (based on year 1 and subsequent monitoring data).
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	No unplanned fire within the offset area. Increase in habitat quality scores as a result of implementation of any fire management measures.
Achieve the interim performance targets and completion criteria for each offset value within 5, 10 and 20 years, respectively.	The interim performance targets are achieved for all offset values by year 5, 10 or 15. The completion criteria are achieved for all offset values by year 20.

* Catling index provides a measure of relative abundance of wild dogs, foxes, horse and feral cats within the offset area. The Catling index will be measured as the percentage of camera nights in which the pest species was observed as part of fauna camera monitoring for the species, as outlined in Section 6.2.6.

Table 11 – Recovery actions for each MNES and their associated threats

MNES	Threats	Recovery/management actions
Threatened fauna species		
Collared Delma (*Delma torquata)*	Threats to the species have been determined based on conservation advice (DCCEEW 2025b): • Alteration of ground cover as a consequence of unsuitable fire regime. • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Predation by feral predators (e.g., cats, foxes, wild dogs). • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025b): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Pest animal management and monitoring (see Sections 6.2.6 and 7.5). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.4).
Yakka Skink (*Egernia rugosa*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025d): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Destruction of potential shelter habitat associated with rabbit warren ripping. • Predation by feral predators (e.g., cats, foxes, pigs). • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025d): • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.6 and 7.5). • Weed management and monitoring (see Sections 6.2.5 and 7.4). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3). • Biomass monitoring (see Section 7.2).
Dunmall's snake (*Furina dunmalli)*	Threats to the species have been determined based on conservation advice (DCCEEW 2025f): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025f): • Pest animal management and monitoring (see Sections 6.2.6 and 7.5).

MNES	Threats	Recovery/management actions
	• Predation by feral predators (e.g., cats, foxes, pigs). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	• Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.4). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).
Red Goshawk (*Erythrotriorchis radiatus*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025e): • Loss of suitable foraging habitat through land clearing and effects associated with fragmentation of large contiguous patches of forest and woodland, particularly large trees in alluvial valleys. • Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity. • Potential of reduced prey (e.g., medium sized birds) as a consequence of unsuitable fire regime.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025e): • Exclusion of cattle from the offset area (see Section 6.2.3). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2).
Squatter pigeon (*Geophaps scripta scripta*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025g): • Change in ground layer composition as a consequence of grazing and ecosystem engineering actions by rabbits (e.g. burrowing, soil turnover) • Change in ground layer composition and trampling ground nests as a consequence of livestock grazing and feral horse browsing, especially in grassy, alluvial areas • Change in ground layer composition, including thickening of understorey structure, as a consequence of unsuitable fire regime • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat • Predation by feral predators (e.g., cats, foxes)	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025g): • Pest animal management and monitoring (see Sections 6.2.6 and 7.5). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.4).

MNES	Threats	Recovery/management actions
Northern Quoll (*Dasyurus hallucatus)*	Threats to the species have been determined based on conservation advice (DCCEEW 2025c): • Poisoning through ingestion of cane toads (Rhinella marina). • Loss of ground cover as a consequence of unsuitable fire, resulting in risk of increased predation and/or reduced food. • Loss of ground cover as a consequence of livestock grazing. • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Predation by feral predators (e.g., cats, foxes, wild dogs). • Poisoning through 1080 baiting.	The following recovery actions for the species will be implemented based on conservation advice and recovery objectives (DCCEEW 2025c): • Pest animal management and monitoring (see Sections 6.2.6 and 7.5). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.5 and 7.4).
Koala (*Phascolarctos cinereus*)	Threats to the species have been determined based on conservation advice and the Recovery Plan (DCCEEW 2025i): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Mortality due to vehicle collision. • Predation by feral predators, particularly wild or domesticated dogs. • Alteration of the structure of suitable habitat, including loss of primary feed trees, as well as direct mortality as a consequence of unsuitable fire regime. • Evidence for the presence of disease within the population (i.e., Chlamydia *pecorum*).	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025i): • Exclusion of cattle within offset areas (see Section 6.2.3). • Management of unauthorised access and vehicles within the offset area (see Sections 6.2.1 and 6.2.2). • Pest animal management and monitoring (see Sections 6.2.6 and 7.5). • Weed management and monitoring (see Sections 6.2.5 and 7.4). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3). • Biomass monitoring (see Section 7.2).
South-eastern long-eared bat (*Nyctophilus corbeni*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025h): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat • Alteration of the structure of suitable habitat (e.g. mix of shrubby and open structure habitat) including loss of hollow-bearing trees as a consequence of unsuitable fire regime	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025h): • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.6 and 7.5). • Weed management and monitoring (see Sections 6.2.5 and 7.4). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).

MNES	Threats	Recovery/management actions
	• Impacts on understorey habitat as a consequence of livestock grazing, impacting habitat for understorey invertebrate prey • Competition for hollows from native fauna species (e.g., parrots and cockatoos) and non-native fauna species (e.g., European honeybees, common myna), especially where hollows are limited	• Biomass monitoring (see Section 7.2).
Large-eared pied bat (*Chalinolobus dwyeri)*	Threats to the species have been determined based on conservation advice and the Recovery Plan (DCCEEW 2025a): • Potential of reduced foraging opportunities and flying invertebrate productivity as a consequence of unsuitable fire regime • Predation by feral predators (e.g., foxes) • Loss of sandstone roosting/maternity sites, whether through occupation by pest animal species (e.g., goats) or impacts to structural integrity from uncontrolled wildfire.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025a): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Pest animal management and monitoring (see Sections 6.2.6 and 7.5).

Table 12 – Management objectives, performance criteria, adaptive management triggers and corrective actions

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
Achieve the completion criteria including habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events to achieve the scores in the completion criteria. Achieve structural and floristic components for a vegetation community to be reclassified as remnant.	Implementation of the management actions and adaptive management framework as outlined in this OAMP.	Repeatable, measurable BioCondition monitoring at fixed monitoring locations to calculate comparable Habitat Quality scores in accordance with the GTDTHQ over the lifetime of the OAMP.	Fixed transects were established and assessed as part of the baseline in 2020 (see Figure 8). Transect locations were randomly stratified and are representative of offset values across vegetation communities and condition.	BioCondition assessments will be undertaken at each of the transects in year 1 and then every two years for the first six years, and then every three years thereafter.	Monitoring of offset value habitat quality scores and condition of habitat will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Rapid monitoring events (Section 7.6.1). • Habitat quality assessments to determine habitat quality scores (Section 7.6.2). • Targeted fauna surveys (Section 7.6.4). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime to better support enhancement of offset values. • For offset values that have not achieved interim performance targets by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions. • If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the OAG. The revised OAMP will be submitted to the Commonwealth Government.
Maintain the extent of offset value habitat within the offset area.	No unapproved and/or intentional clearing of habitat within the offset area, with the exception of clearing that is required for fencing, access, firebreaks and public safety as	Protection of the offset area via a Voluntary Declaration under Section 19E and 19F of the VM Act, as described in Section 2.8.	The offset area will be legally protected from unapproved vegetation clearing activities through compliance with the Voluntary Declaration under Section 19E and 19F of the VM Act, and declared an area of high nature conservation value. See Section 2.8.	The entirety of the offset area is subject to the conditions of the Voluntary Declaration under the VM Act.	Restrictions outlined in Table 13 will be implemented for the lifetime of the project and OAMP.	Offset area inspections will be undertaken twice per year for the duration of the management period and will report on any major or noticeable changes to the extent of offset value habitat. Reporting to the Commonwealth	Any activities in contravention of the Voluntary Declaration and this OAMP.	**Step 1: Investigate cause of trigger** • Investigate reasons why unapproved clearing occurred e.g. unauthorised access. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Addition fencing, signage and/or security for the offset area.

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
	outlined in Table 13.					Government consistent with EPBC approval.		• Restoration of the impacted area.
		Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in accordance with Sections 6.2.2, 6.2.3, and 6.2.4. If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be planned, recorded and monitored.	Compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks will also be assessed as part of offset area inspections (Table 13, Section 6.2.1).				Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with the restrictions outlined in Section 6.2.1.	**Step 1: Investigate cause of trigger** • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately. • Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.
Ensure that the livestock grazing restrictions outlined in Section 6.2.4 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events.	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses and promote the establishment of native perennial grass species in accordance with Section 6.2.4.	Best practice management for strategic livestock grazing within the offset area will be undertaken as follows: • livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover • within the offset area a minimum of 2,500 kg/ha of biomass will be retained at the end of the dry season	The precise location of strategic livestock grazing will occur at the discretion of the landholder and/or property manager of whom is responsible for cattle management. Environmentally sensitive areas such as SEVT will be avoided.	Strategic livestock grazing effort (i.e. the number of cattle and their exposed time to an area) will be managed at the discretion of the landholder and/or property manager of whom is responsible for cattle management.	Rapid monitoring events and habitat quality assessments will be undertaken in accordance with 7.6.1 and 7.6.2. These will include assessment of % cover of native perennial grasses and incidental flora surveys. Monitoring will report on locations where strategic grazing effort is being either under or over utilised.	Decrease in the richness and average % cover of native perennial grasses at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime. • Installing additional watering points for livestock to manage livestock in accordance with the grazing regime.

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
	Biomass levels of 2,500 kg/ha are retained at each of the monitoring sites at the end of the dry season.	Implementation of a strategic grazing regime to protect and maintain environmental values in accordance with Section 6.2.4.	See Section 6.2.4. for more detail.			Biomass monitoring will be undertaken in accordance with Section 7.2.	Biomass monitoring results indicate less than 2,500 kg/ha of biomass is present at any of the monitoring sites at the end of the dry season.	**Step 1: Investigate cause of trigger** • Investigate the reason for biomass being less than 2,500 kg/ha. • Re-evaluate the strategic grazing regime to assess the suitability of grazing to ensure no less than an average of 2,500 kg/ha of biomass is retained at the end of the dry season. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Removal of stock or spelling grazing from the area of the offset in which less than 2,500 kg/ha of biomass was identified. • Review adherence to livestock grazing restrictions in Section 6.2.5.1. • Where relevant, amending livestock management practices in the OAMP, including amending stocking rates, and/or duration and/or frequency of strategic grazing events.
Minimise predation risk by feral animals to threatened fauna species.	Reduction in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	Implement control actions for wild dogs in accordance with Section 6.2.6.	• Ground baiting • Foot hold traps • Shooting	The requirement for and location of pest animal management will be strategically and safely designed, informed by pest animal monitoring results.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results.	Pest monitoring activities will be undertaken every two years, post wet season. Motion sensor cameras will be placed within the offset area along tracks and will be left in place for a minimum of three consecutive nights. Analysis of the camera footage will be undertaken to determine the percentage of camera nights with animal captures for each species observed. This percentage represents the Catling index (Mitchell and Balogh 2007b, 2007c). Monitoring methods are detailed in Section 7.5.	An increase in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in the: – Catling* index for wild dogs, feral cats and/or foxes. – relative abundance of feral pigs and horses. • Review adherence to pest management control measures as outlined in Section 6.2.6. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency and intensity of pest animal control.
	Reduction in Catling* Index for feral cats from year 1 and subsequent monitoring events.	Implement control actions for feral cats in accordance with Section 6.2.6.	• Ground baiting • Trapping • Shooting				An increase in Catling* Index for feral cats from year 1 and subsequent monitoring events.	

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
	Reduction in Catling* Index for foxes from year 1 and subsequent monitoring events.	Implement control actions for foxes in accordance with Section 6.2.6.	• Night shooting • Poisoning • Trapping				An increase in Catling* Index for foxes from year 1 and subsequent monitoring events.	• Revising methods of pest animal control in accordance with DAF guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the OAMP and targeted pest animal control programs.
Minimise degradation of offset value habitat by feral horse and feral pigs	Reduction in the observed presence of feral horse on the property.	Implement control actions for feral horses in accordance with Section 6.2.6.	Relocation through mustering or trapping	The requirement for and location of pest animal management will be strategically and safely designed, informed by pest animal monitoring results.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results.	The presence of or signs of horses will be documented during offset area inspections, twice yearly.	An increase in the observed presence of feral horses across monitoring events.	
	Reduction in mean feral pig abundance score from year 1 and subsequent monitoring events.	Implement control actions for feral pigs in accordance with Section 6.2.6.	• Trapping • Shooting • Poisoning			Pest monitoring activities will be undertaken every two years, post wet season. Assessment for the presence or absence of feral pig signs as a measure of abundance will be undertaken at permanent monitoring transects which have been randomly stratified across the offset area in environments that are more regularly impacted.	An increase in mean feral pig abundance score from year 1 and subsequent monitoring events.	
Manage invasive weed species to reduce degradation of offset value habitat.	A decrease in species richness and relative abundance of weed species at 80% of monitoring sites from year 1 and subsequent monitoring events. No new weed species are identified at any monitoring site (based on year 1 and subsequent monitoring data).	Implement weed control actions in accordance with Section 6.2.5. Adhere to weed hygiene restrictions in accordance with Table 13.	Weed treatment methods will be suitable to the target weed species and may include biological, chemical, or mechanical control. See Section 6.2.5 for more detail.	The results of weed monitoring activities will inform the location for weed treatment and control.	Weed treatment and control will be undertaken at optimal timing according to the lifecycle of the target species, i.e. before seeding.	The offset area will be monitored for weeds every two years (post wet season) to determine the species richness and abundance, for the duration of the management period. See Section 7.4 for more detail.	An increase in species richness and relative abundance of weed species at more than 20% of monitoring sites from year 1 and subsequent monitoring events. A new weed species is identified at one or more monitoring sites.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds. • Investigate potential sources or reasons for the occurrence of the new weed species. • Review adherence to weed management control measures as outlined in Section 6.2.5. • Review adherence to weed hygiene restrictions as outlined in Section 6.2.1. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Amending weed hygiene restrictions.

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
								• Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to. • Revising weed control methods in accordance with the Biosecurity Act 2014 (Qld). • Increasing the frequency and intensity of weed control. • Updating weed control methods in the OAMP and targeted weed control programs.
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	No unplanned fire within the offset area. Increase in habitat quality scores as a result of implementation of any fire management measures.	All fire management measures to be implemented in accordance with the program outlined in Section 6.2.4.	Monitor and control fuel loads, where required. Fuel loads will be managed through implementation of the following: • maintained fire breaks, • controlled grazing regimes; and, • fuel hazard reduction burns. All management methods will be undertaken in compliance with Section 6.2.4.	Fuel load management will be carried out where safe and practicable. Precise location will be determined in collaboration with the landholder and a suitability qualified ecologist to assist the avoidance of sensitive habitats such as SEVT.	If deemed necessary, fuel load management will be carried out when required during suitable climatic conditions.	Fuel loads will be monitored as a result of habitat quality assessments to determine habitat quality scores, in accordance with Section 7.6.2. Rapid monitoring events will be undertaken to assess the general condition of vegetation in accordance with Section 7.6.1.	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores. • Review adherence to the fire management measures as outlined in Section 6.2.4. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass monitoring. • Increasing the frequency of weed control measures. • Amending the strategic grazing regime. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks. • Review timing and intensity of fuel hazard reduction burns in accordance with the Regional Ecosystem Description Database (REDD) fire management guidelines and conservation advice for the particular offset value.
Achieve the interim performance targets and completion criteria for each offset value within 5, 10, 15 and 20 years, respectively.	The interim performance targets are achieved for all offset values by year 5, 10 or 15. The completion criteria are achieved for all offset values by year 20.	All management actions outlined in Section 6 will be implemented to ensure that the interim performance targets and completion criteria are achieved.	All management control actions detailed in Section 6 will be implemented where necessary and practicable.	Management methods and actions will take place where required within the Offset area.	Management methods and actions will occur during seasonally suitable timing, in collaboration with the landholder and contractor undertaking the scope of work.	All monitoring activities detailed in Section 7 will be implemented and completed as per the implementation schedule in Section 9.	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s**

Objective	Performance Target	Management Measure	Methodology	Location	Timing or Frequency	Monitoring Activity	Management Trigger	Corrective Action
								The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values.

6.2. Management actions

6.2.1. General restrictions

Table 13 details the restrictions to be implemented for the offset area to ensure the completion criteria and management objectives are met.

Table 13 – Offset area restrictions

Restrictions	Details
Weed hygiene	• Weed hygiene measures will be implemented to prevent the movement of weed material into the offset area. • All persons entering the offset area will be required to ensure vehicles and equipment are weed free. • All contractors entering the offset area must hold a current weed hygiene certificate or equivalent for all vehicles and equipment. • Evidence is to be provided on request to the landowner and Santos environmental advisors that vehicles, slashers or any machinery implementing management actions are clean prior to entry to minimise potential weed spread.
Vehicles	• Vehicle movement will be limited to designated access tracks in the offset area and access will be restricted to authorised personnel only. • Vehicles will travel to track conditions to minimise the risk of vehicle strike to fauna.
Vegetation clearing	• Clearing will be excluded from the offset area through demarcation and protection by means of Voluntary Declaration under the VM Act. Clearing for timber gathering and development will also be excluded. • Clearing of native vegetation will not be permitted within the offset area as part of any management and monitoring activities associated with this OAMP, except for clearing that is required for: – maintenance of access tracks and/or fire breaks, – fence construction and maintenance, and – ensuring public safety or as directed by emergency management response personnel in the event of unplanned fire or other emergency or associated procedure. • If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be appropriately planned, recorded and monitored. • Machinery will not be allowed on site after heavy or prolonged rainfall events until after the site has dried to allow for safe movement of traffic.
Unauthorised access or use	• Access into the offset area will be restricted to authorised personnel only. • Signs will be installed in prominent locations (i.e. at access points into the offset area) which recognise that the areas are protected for conservation purposes. The signs will advise that access into the offset area is restricted to authorised personnel only • The property will be suitably fenced to restrict access by unauthorised persons. • At no time can persons access the site without first approaching the Land Advisor of the Mt Tabor property and informing them of their intent. • When entering and leaving the property, the Land Advisor must be advised. • Contractors will only be permitted to access the property following the direct engagement by Santos.

6.2.2. Access tracks

Existing access tracks will be utilised to facilitate necessary management, maintenance and monitoring activities as part of this OAMP. If existing access tracks become impassable (through erosion or vegetation regrowth), maintenance activities of these tracks (e.g. grading) will be prioritised over alternative track alignments. Gully crossings are likely to be subject to periodic, ongoing maintenance because of erosion following rain events.

Existing and new access tracks will be no wider than 5 metres (m) and vegetation disturbance will be minimised.

6.2.3. Fencing

Fencing has been installed around the boundary of offset area 1 and offset area 2, in consultation with Traditional Owners, and will assist with livestock and feral animal control, as well as weed and fuel load management (Figure 7).

Fencing comprises of a 4-wire fence consisting of 3 strand 1.57HT barb with a plain high tensile wire at the top, wood and/or steel posts at 7 m spacing, a strainer post every 100 m and 1 gate located every kilometre. This type of fencing is also considered appropriate to facilitate the fauna movement across the property. Importantly, the movement of the species being offset will not be impeded by the fencing design.

Any vegetation disturbance associated with new fence construction will be minimised in accordance with Table 13.

Regular inspections of all fencing will be undertaken in accordance with Section 7.1, and repairs to the fences will be made as required.

6.2.4. Fire management

The Mt Tabor property has previously been subject to severe fire, particularly within the last five years (Boobook 2021a). A planned and co-ordinated fire management strategy will be implemented to

- improve habitat quality through:
  - controlling weeds, biomass levels and fuel loads,
  - supporting development of structural components of habitat for offset values (e.g. recruitment of native plants, establishment of fire sensitive native herbs and groundcover, important microhabitat including fallen logs and leaf litter, and increased understorey), and
  - promoting germination and recruitment of eucalypt species and other species characteristic of the specific RE.

Unplanned fire risk will be managed through:

- establishment and regular maintenance of firebreaks (Figure 7),
- monitoring and managing fuel loads primarily through the implementation of a controlled grazing regime (Section 6.2.4), and
- fuel hazard reduction burns (if required; Section 6.2.4).

Firebreaks will be established and maintained around the boundary of the offset area, with green firebreaks established where the offset area joins native vegetation. Firebreaks will be maintained at least annually to remove overhanging trees or fallen debris and dense vegetation. Firebreak maintenance will be undertaken to a width of up to 10 m.

147°32'0"E 147°34'0"E 147°36'0"E 147°38'0"E 147°40'0"E 147°42'0"E

25°4'0"S 25°6'0"S 25°8'0"S 25°10'0"S 25°12'0"S 25°14'0"S 25°16'0"S

Doolooggarah Creek
Murphy Creek
Murphy Creek
Murphy Creek
Stallion Pdk Dam
Binalong Spring
Brumby Dam
6CHS25
Scrubby Doboy Dam
White Bank Dam
Stockwhip Dam
Boyce's Dam
Kelly Gully
Mt King Dam
Entire Dam
Binalong Shortcut Dam
6 Mile Dam
Foal Gully Bore
Bull Holes Dam
Green Hills Dam
7 Mile Waterhole
Tickerabang Creek
Dave's Dam
The Caves Dam
Post Office Dam
Airstrip Dam
White Flat Creek
Surgarbag Dam
House Dam
Sawmill Dam
Sandy Creek

SANTOS

Location diagram

Figure 7
Property Infrastructure

- Mt Tabor
- Property access track
- Fence
- Homestead
- Property dam

Watercourse
- Major watercourse
- Creekline
- Minor drainage line
- Drainage contour

Offset area
- Area 1
- Area 2

CO2 AUSTRALIA

N

0 1 2 3
Kilometres

Date: 4/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:70,000@A3

Queensland
Brisbane

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Mt Tabor\MtTabor_OAMP_mapping_20250429.aprx

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Strategic grazing

The current and historic land use of the Mt Tabor property includes cattle grazing supported by tracks, fencing and dams, with limited clearing around this infrastructure. Strategic grazing within the offset area will be used to manage fuel loads and control exotic weeds and pasture grasses. As increasing grazing intensity is correlated with an increase in weedy cover (Franks 2002), and a decrease in native grass species richness, grazing will be permitted in the offset area on a managed and limited basis to control weeds and reduce fuel loads.

Best practice management for strategic livestock grazing within the Mt Tabor offset area will be undertaken as follows:

- livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover, and
- within the offset area a minimum of 2,500 kg/ha of biomass will be retained at the end of the dry season.

To minimise erosion and subsequent impacts on water quality, strategic grazing will be excluded where rainfall causes inundated or waterlogged soils. The location and extent of grazing exclusion areas will be reviewed annually based on the results of management and monitoring events.

The suitability of conditions for undertaking a grazing event will be informed by biomass monitoring events as described in Section 7.2.

Fuel hazard reduction burns

The aim of fuel hazard reduction burns is to manage excess fuel loads, to initiate regeneration of eucalypt communities and to create habitat with a mosaic of different fire frequencies and times since fire.

Fire management, through fuel hazard reductions burns will be guided by conservation advice documentation (e.g. for MNES) and the REDD (Queensland Herbarium 2024), which provides recommendations for fire management for each of the component RE (Table 14), guidelines published in the *Fire and Biodiversity Monitoring Manual* published by Southeast Queensland Fire & Biodiversity Consortium (2002), local regional fire plans, regional fire authorities and local knowledge of fire behaviour.

Hazard reduction burns will be considered if fuel hazard ratings within the offset area are unable to be maintained below extreme in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines *et al.* 2010; Appendix D) through the implementation of strategic grazing and weed control. However, the location and timing for fuel hazard reduction burns will be informed by the results of biomass monitoring (Section 7.2) and fuel load monitoring (Section 7.3) in conjunction with the results of habitat quality assessments and considering the REDD fire management guidelines for the vegetation community and MNES conservation advices.

In addition to the above conservation and ecological advice, fire management through fuel hazard reductions burns will also be undertaken in consultation with the Traditional Owners taking into account any cultural burning practices.

In general, fire management will be undertaken in a mosaic pattern at the appropriate time of year when there is:

- high soil and fuel moisture levels, ideally following minimum of 40 mm of rainfall,
- low ambient temperature and wind speed,
- high atmospheric humidity,
- the risk of long-term impacts/high intensity fire is low, and/or
- a more active growing phase for plants.

Table 14 – Fire management guidelines for each component RE

RE	Fire Management Guidelines
11.3.2	• Conduct a low to moderate burn every 6-10 years. • Timing for burning should be late wet to early dry season when there is good soil moisture, early storm season or after good spring rains. • Burn less than 30% of the area in any year. • Burn under conditions of good soil moisture and when plants are actively growing. Sometimes a small amount of wind may move the fire front quickly so that burn intensity is not too severe to destroy habitat trees. • Management of this vegetation type will be based on maintaining vegetation composition, structural diversity, fauna habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfire by: – maintaining a fire mosaic, – control invasive shrubs, – low to moderate intensity burns with good soil moisture to minimise loss of hollow trees, and – avoiding riparian communities where appropriate.
11.3.39	• Conduct a low to moderate burn every 6-10 years. • Timing for burning should be late wet to early dry season when there is good soil moisture, early storm season or after good spring rains. • Burn less than 30% in any year. • Burn under conditions of good soil moisture and when plants are actively growing. Sometimes a small amount of wind may move the fire front quickly so that burn intensity is not too severe to destroy habitat trees. • Management of this vegetation type will be based on maintaining vegetation composition, structural diversity, fauna habitats (in particular hollow-bearing trees and logs) and preventing extensive wildfire by: – maintaining a fire mosaic, – control invasive shrubs, – low to moderate intensity burns with good soil moisture are necessary to minimise loss of hollow trees, and – avoid riparian communities where appropriate.
11.10.4	• Maintain fire management of surrounding country. • Burn surrounding country only under conditions of good soil moisture and when plants are actively growing. • This RE is likely to be difficult to burn owing to a lack of ground fuel that normally occurs in this RE.
11.10.6	• Conduct a low to moderate burn every 6-10 years. • Timing for burning should be late wet to early dry season when there is good soil moisture, early storm season or after good spring rains. • Burn less than 10-30% in any year to achieve a mosaic. • Burn under conditions of good soil moisture and when plants are actively growing.

RE	Fire Management Guidelines
	• Protection relies on broad-scale management of surrounding country with numerous small fires throughout the year so that wildfires will be very limited in extent.
11.10.7	• Conduct a moderate to high burn every 6-10 years. • Timing for burning should be during late wet to early dry season when there is good soil moisture, early storm season or after good spring rains. • Burn less than 10-30% of the area in any year. • Burn surrounding vegetation under conditions of good soil moisture and when plants are actively growing throughout the year so that fires will be very limited in extent. • Best protection from fire is through the creation of a multi-aged mosaic in surrounding vegetation and perimeter burning.
11.10.11	• Conduct a moderate burn every 3-5 years. • Timing for burning should be during late wet to early dry season when there is good soil moisture, early storm season or after good spring rains. • Burn less than 30% in any year. • Burn under conditions of good soil moisture and when plants are actively growing.
11.10.13	• Manage surrounding country. • Burn surrounding country only under conditions of good soil moisture and when plants are actively growing. • Will be difficult to burn owing to a lack of ground fuel that normally occurs in this RE.

6.2.5. Weed management

Weed management in the offset area will aim to minimise the introduction, establishment and spread of restricted and prohibited pest plants under the *Biosecurity Act 2014* (Qld) and other invasive species that present a threat to vegetation communities and species habitat in the offset area. Weed management will focus on reducing the extent of the existing weeds as well as minimising the risk of introduction of additional weed species to the offset area.

Historically several different invasive grasses and broadleaf weeds have been recorded within the offset area. As such, weeds will be managed using biological, chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets for the relevant weed species, as necessary.

6.2.6. Pest animal management

Pest animals present or have the potential to occur on or within the immediate vicinity of the Mt Tabor property, pose the following threats:

- Predation of native fauna by foxes, feral cats and wild dogs.
- Erosion and degradation of habitat and competition by rabbits, pigs and feral horses.
- Risk of lethal ingestion of cane toads by the northern quoll.

Pest animal control activities will be undertaken to minimise the introduction of pest animals and control existing pest animal populations in accordance with the *Biosecurity Act*. Table 15 provides examples of approved species-specific pest animal control measures recommended by the Queensland and Commonwealth governments. Results of pest animal assessments will be reviewed following each reporting event to inform the need for, location and timing of species-specific control measures in subsequent years.

Table 15 – Examples of species-specific control methods for pest animal species

Species	Status under *Biosecurity Act 2014* (Qld)	Example control method	Reference
Wild dog (*Canis familiaris*)	Category 3,4,6	• Exclusion fencing • Trapping (e.g. foot hold traps) • Baiting • Shooting	DAF 2024a
Fox (*Vulpes vulpes*)	Category 3,4,5,6	• Exclusion fencing • Trapping • Shooting • Poisoning	DAF 2024b
Feral cat (*Felis catus*)	Category 3,4,6	• Exclusion fencing • Night shooting • Poisoning • Trapping	DAF 2023b
Pig (*Sus scrofa*)	Category 3,4,6	• Exclusion fencing • Trapping • Shooting • Poisoning	DAF 2023c

Species	Status under *Biosecurity Act 2014* (Qld)	Example control method	Reference
Rabbits (*Oryctolagus cuniculus*)	Category 3, 4, 5, 6	• Manual control (i.e. harbour destruction) • Mechanical control (i.e. warren ripping) • Trapping • Exclusion fencing • Biological control • Poison baiting • Fumigation • Shooting	DAF 2023d
Cane toad (*Rhinella marina*)	-	Currently there are no effective broad scale control methods (e.g. baiting). Should cane toads be identified to be present within the northern quoll offset management area and the relative abundance has been observed to be increasing from the monitoring event undertaken in year 1 of management, potential sources or reasons that may have attributed to the increase will be investigated. Appropriate control strategies relevant to the offset management area and the reason for the increase in the relative abundance of cane toads will be identified and implemented.	DAF 2023a
Feral horse (*Equus caballus*)	-	Relocation, and/or culling through mustering or trapping	DAF 2022

7. Monitoring

The results of the monitoring program outlined in the following sections will be used to inform operational management decisions, including adaptive implementation of this OAMP to ensure the performance criteria and management objectives, and ultimately interim performance targets and completion criteria are met.

The monitoring results will also be used to assess adherence to performance criteria, and to determine when corrective actions are required to be implemented. The results will also be compared to those from previous monitoring events to assess change over time and to inform the ongoing implementation of the OAMP.

7.1. Offset area inspections

The aim of offset area inspections is to enable a general assessment of the offset area to identify any potential issues that may require remedial action to be undertaken. Inspections will be undertaken twice per year for the duration of the management period to assess the following:

- condition of fencing, gates and signs
- condition of access tracks
- condition of firebreaks
- compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks
- incidence of erosion within offset area, particularly around permanent and semi-permanent water bodies or areas subject to inundation or waterlogging
- damage/degradation resulting from pest animal activity within the offset area
- signs of land degradation and over-grazing
- presence of weed/invasive species
- exclusion of livestock
- incidental fauna observations and any additional risks to offset values (i.e. evidence of vehicle strike).

7.2. Biomass monitoring

Biomass monitoring for fire management will be undertaken twice a year, at the end of the wet season and end of the dry season, to:

- determine the risk of fire to the offset site
- inform fire management strategies to control fuel loads.

Biomass is at its greatest at the end of the wet season (April) with fire risk greatest towards the end of the dry season (October). Biomass will be monitored within the offset areas using appropriate photo standards which will be used to determine dry matter yields and subsequently fuel loads. Biomass monitoring will be undertaken at the same permanent weed monitoring sites established as part of the year 1 monitoring.

Fuel loads will be managed through strategic grazing events (see Section 6.2.4) if the biomass assessment at the end of the wet season shows that biomass is greater than 2,500 kg/ha within the offset area.

The stocking rate of these strategic grazing events will be determined through a feed budgeting assessment (see Section 7.2.1) undertaken prior to a grazing event in the offset area. A feed budgeting assessment is a recognised method of determining the stocking rate based on the amount of feed available and the amount of feed desired at the end of the grazing event (i.e. >2,500 kg/ha).

7.2.1. Feed budgeting assessment

The process for undertaking a feed budget assessment will include the following sequence of activities:

- Determine the current amount of feed present (kg/ha) using appropriate photo standards available on the Future Beef website [1].
- Determine the amount of feed desired (kg/ha) at the end of the grazing event.
- Calculate the total useable feed (kg/ha) by subtracting the feed desired from the feed present.
- Determine utilisation (i.e. the proportion of useable feed that livestock can use).
- Determine the feed available for the grazing animal (kg/ha) by multiplying the total useable feed by the utilisation rate.
- Calculate the safe stocking rate by:
  - determining the feed consumption per day (kg/day),
  - determining the number of days feed is required (days),
  - calculating the feed requirement per head (kg/hd) by multiplying the feed consumption per day by the number of days,
  - calculating the stocking rate (ha/hd) by dividing the feed requirement per head by feed available, and
  - calculate the number of stock (head) by dividing the area of the paddock by the stocking rate.

The amount of feed available prior to the grazing event will be estimated using the appropriate photo standards available on the Future Beef website. The “Dry Season Feed Budget” worksheet will then be used to calculate the required stocking rate for the grazing event.

At the completion of the grazing event, photo standards will be used to assess ground cover and ecosystem biomass. Should the grazing event be required to be extended (e.g. as a result of additional rainfall and resultant grass growth and potential weed flowering), the feed budget assessment will be recalculated using the “Dry Season Feed Budget” worksheet.

7.3. Fuel load monitoring

Fuel load monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix D). Fuel load assessment monitoring will include a baseline survey in year 1 (post-wet season; April), with ongoing fuel load assessment monitoring conducted every year at the same time and location as biomass monitoring post wet season. Monitoring will focus on assessing the key structural layers of the fine fuels that burn in bushfires, specifically bark, elevated fuels, near-surface fuels and surface fuels. This will allow for a rapid assessment of each fuel layer, which in in turn is given a hazard rating and are then combined to provide an overall fuel hazard rating of low, moderate, high, very high or extreme.

The fuel hazard rating will be monitored to compare any changes from previous assessments. In conjunction with results of habitat quality assessments, the results of the fuel load assessments will be used to determine if fuel hazard reduction burns are required within the offset area. Weed management and strategic grazing within the offset area will also be undertaken to maintain fuel hazard rating below extreme.

7.4. Weed monitoring

Weed monitoring sites will be randomly stratified, fixed monitoring sites representative of offset values and incorporating natural variability such as aspect (e.g. a mix of north-, east-, south- and west-facing monitoring sites), community type – (e.g. woodland, riparian). There will also be fixed monitoring sites at strategic trafficable areas (e.g. entry gates, creek crossings, stock watering points) to monitor potential introduction and/or irruptions of prohibited and restricted weed species.

The offset area will be monitored for weeds every two years (post-wet season) to determine the species richness and abundance, for the duration of the management period. The results of this monitoring will inform the methods for weed treatment and control (see Section 6.2.5).

Non-native plant cover is also assessed as part of the habitat quality assessments detailed in Section 7.6.2, and the presence of weed species will also be recorded as part of the general offset area inspections (see Section 7.1), where noted.

[1] See https://futurebeef.com.au/knowledge-centre/pastures-forage-crops/pasture-photo-standards/.

7.5. Pest animal monitoring

The offset area will be monitored for evidence of pest animals every two years (post wet season), including a baseline survey in year 1 of the distribution and abundance of pest animals.

Based on the results of year 1 surveys, pest animal monitoring sites will be established in year 1. Monitoring of pest animals will target areas of known impacts/movements (e.g. along topographic features, including creeks, pads, paths, ridge-tops and roads) to not only maximise the success of encountering pest animals, but target monitoring in environments that are more regularly impacted (e.g. drainage lines, moist gullies and around swamps and lagoons favoured by feral pigs; Hone 1995). The location of pest animal monitoring sites will be assessed prior to each monitoring event.

Pest animal monitoring will also be undertaken in association with and immediately prior to the pest animal control activities (Section 6.2.6). Initial monitoring results will determine the degree of effort required to control the pest population and post control monitoring will determine the degree of success of control operations.

Monitoring of pest animals will involve the deployment of motion sensing infra-red cameras as well as other techniques such as transect assessments as appropriate to determine pest animal species present in the offset area and indicative population numbers.

Methods for determining the presence and relative abundance for foxes, feral cats, wild dogs, feral pigs and rabbits are presented in Table 16. Evidence of pest animals, including feral horses, will be documented during the offset area inspections (see Section 7.1).

Table 16 – Pest animal monitoring methodology

Pest animal	Methodology to be implemented
Fox, wild dog, feral cat, horse	To assess the relative abundance of foxes and feral cats within the offset area, camera monitoring will be undertaken as follows to provide a measure of the Catling index for each species. The Catling index will be measured as the percentage of camera nights in which the pest species was observed. An increase or decrease in the Catling index value between subsequent monitoring events will represent an increase or a decrease in the relative abundance of pest species and a measure of the success of pest animal control. • fauna monitoring cameras will be placed in the offset area, • cameras will be placed along tracks and left in place for a minimum of three consecutive nights, and • an analysis of the camera footage will be undertaken to determine the percentage of camera nights with animal captures for each species observed. This percentage represents the Catling index (Mitchell and Balogh 2007b,c).
Feral pig	An assessment of the presence or absence of feral pig signs[a] as a measure of the relative abundance of feral pigs within the offset area in accordance with Mitchell and Balogh (2007a) and Hone (1988), will be undertaken as follows: • nominate randomly stratified sites across the offset area in environments that are more regularly impacted (e.g. drainage lines, moist gullies, around swamps etc), • calculate an abundance score for each transect as the percentage of 'present' feral pig signs, and • calculate the mean abundance score (and variance) across all transects in the offset area. The average frequency of occurrence across the offset area will be used as an index of abundance and compared between subsequent monitoring events to assess the effectiveness of feral pig control. Furthermore, changes to scores for individual sites/transects can point to areas to target control activities. [a] Feral pig signs can include rooting, wallows, dung, footprints, travel pads, plant damage and tree rubs, as well as the physical presence of feral pigs.

Pest animal	Methodology to be implemented
Rabbit	An assessment of rabbit impact in accordance with Cooke *et al.* (2014) will be undertaken as follows. Randomly stratified, permanent monitoring points, a 2-ha patch of habitat is traversed over 15-20 minutes assessing: • Rabbit abundance – a measure of the presence and number of rabbit warrens and the abundance of any faecal pellets (including 'buck-heaps' or latrines) – measured on a scale of 0 – 5. • Seedling abundance – a measure of the presence and abundance of native vegetation seedlings encountered during the 15-20-minute traverse – measured on a scale of 0 – 5. • Rabbit damage – a measure of seedlings (< 0.5 m height) with evidence of rabbit damage, identified as 45˚ 'secateurs-like' cuts through smaller stems, defoliation and gnawing of bark – measured on a scale of 0 – 5. From this assessment, a 'corrected regeneration score' is calculated from the seedling abundance and rabbit damage score. This measure corrects for seedling regeneration as a function of observed rabbit damage and is subsequently used to calculate overall rabbit impact with the rabbit abundance score (refer to Cooke *et al.* [2014]). Overall rabbit impact is assigned as one of three categories – 'acceptable', 'monitor closely' or 'unacceptable', as determined from a combination of the score for rabbit abundance and the corrected regeneration score.
Cane toad	An assessment of the relative abundance of cane toads within the offset area will be undertaken as follows based on survey methods outlined in the best practice guideline (Office of Environment and Heritage, Department of Premier and Cabinet 2013): • nominate three randomly stratified, permanent 200 m x 200 m sites across the Mt Tabor offset area, near areas of standing perennial freshwater water bodies, • at each site, randomly select the start location of two 200 m transects (100 m apart) to run in an east-west direction and record the start locations via GPS, • traversing in an east-west direction, survey for the presence or absence of any cane toads or signs of 1 m either side of the transects in every 20 m section, • calculate an abundance score for transects at each site as the percentage of 'present' cane toads from the 20 sections along the two 200 m transects, and • calculate the mean abundance score (and variance) across all transects in the offset site. If the variance exceeds 20% of the mean, more sites/transects are required. Targeted searches for cane toads will be during warmer months (September to March) after dark when the species is most active, on a suitably warm and wet night. However, targeted searches of water bodies will also be undertaken during day light when tadpoles are most active, and eggs can be easily identified.

7.6. Offset value assessments

7.6.1. Rapid monitoring event

Rapid monitoring events will be carried out each year monitoring events are not completed for habitat quality assessments (Section 7.6.2) and targeted fauna survey (Section 7.6.4).

These will be aligned with the offset area inspections (see Section 7.1) and carried out by suitably qualified ecologists during spring and early summer (October to January) to coincide with the optimal time of year for fauna in the Brigalow Belt Bioregion (Eyre *et al*. 2018).

During each rapid monitoring field assessment, the following will be conducted:

- Incidental fauna surveys including early morning and late evening bird surveys and other MNES species will be conducted throughout the day by the ecologists.
- Photos will be taken at designated and fixed photo monitoring points as outlined in Section 7.6.3. The locations of the fixed photo monitoring points are shown in Figure 8.

7.6.2. Habitat quality assessment

Vegetation condition and habitat quality for each MNES will be assessed generally in accordance with the GTDTHQ and the methods outlined in Appendix E. In order to be consistent with the requirements under the EPBC Act guideline for the OAG, the species habitat index component of the habitat quality score will be calculated based on the results of the targeted fauna surveys detailed in Section 7.6.4.

A detailed baseline assessment of habitat quality was completed between December 2020 and January 2021 for offset area 1, including establishment of BioCondition sites in all major vegetation communities. Fixed transect sites have been established within offset area 1 as part of baseline assessments and ongoing monitoring events (Figure 8).

Fixed transects were established and assessed as part of the baseline in 2024 for Offset area 2, with additional transects proposed to be established as part of the year one habitat quality assessments to meet the minimum requirement for sites in accordance with the GTDTHQ (see Figure 8).

BioCondition assessments will be undertaken at each of the transects in year one and then every two years for the first six years, and then every three years thereafter. As part of year one monitoring activities, monitoring points will be marked with a capped stake and a GPS location will be recorded.

The results of habitat quality assessments for subsequent years will include summary data from previous reporting years, presented to allow trend analysis of each of the measured attributes and assess progress towards achieving the interim performance targets and completion criteria.

7.6.3. Photo monitoring

Photo monitoring is a qualitative analysis technique that provides the opportunity for visual time series analysis of changes in vegetation composition, structure and integrity. In areas where active management is being undertaken, photo monitoring offers a simple and effective visual means by which to capture the response of the vegetation to management actions. Photo monitoring will be conducted at all habitat quality assessment sites presented in Figure 8, based on best practice photo monitoring techniques, see Appendix 4 of *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2.* (Eyre *et al*. 2015).

Photo monitoring will be undertaken as part of habitat quality assessments (Section 7.6.2) and rapid monitoring events (Section 7.6.1).

147°34'0"E 147°36'0"E 147°38'0"E 147°40'0"E 147°42'0"E

25°4'0"S 25°6'0"S 25°8'0"S 25°10'0"S 25°12'0"S

Murphy Creek

MTBA10 MTBA14 MTBA15 MTBA03 MTBA08 MTBA11 MTBA12b MTBA12 MTBA07 MTBA13 MTBA01 MTBA18 MTBA02 MTBA06 MTBA04 MTBA17 MTBA09 MTBA16 MTBA05

MTB21 MTB37 MTB39 MTB42 MTB16 MTB41 MTB34 MTB26 MTB30 MTB20 MTB36 MTB44 MTB29 MTB40 MTB02 MTB35 MTB32 MTB25 MTB33 MTB27 MTB31 MTB45 MTB43 MTB01 MTB28 MTB46 MTB38

Tickerabang Creek

Sandy Creek

SANTOS

Figure 8
Monitoring sites

Mt Tabor
Property access track
Fence

Offset area
Area 1
Area 2

Watercourse
Major watercourse
Creekline
Minor drainage line
Drainage contour

Ground-truthed RE
11.3.2
11.3.39
11.8.4
11.8.5
11.10.4
11.10.6
11.10.7
11.10.9
11.10.11
11.10.13

Habitat quality monitoring site
Offset area 1
Offset area 2
Outside offset area

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 6/05/2025 Coordinate System: GDA2020 MGA zone 55 Scale: 1:55,000@A3

Location diagram

Queensland
Brisbane

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Mt Tabor\MtTabor_OAMP_mapping_20250429.aprx

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7.6.4. Targeted fauna surveys

Targeted fauna surveys will be conducted to assess the distribution and richness of the fauna offset values within the offset area. The targeted fauna survey methods focus on the MNES species that are unlikely to be detected effectively during the rapid assessment surveys due to cryptic behaviour or localised habitat requirements. Targeted surveys will be undertaken generally in accordance with recommended surveys guidelines from the Queensland and Commonwealth governments and/or other reputable published guidelines. Table 17 provides a summary of the proposed methodology, search effort and timing for targeted surveys. It is important to note that the proposed survey methodology will be reviewed prior to each survey event and if considered necessary will be modified to ensure they are based on the ecology, habitat requirements and behavioural aspects of the species of interest.

Targeted fauna surveys will be carried out in conjunction with habitat quality assessments in year 1 and then every two years for the first six years, and then every three years thereafter.

Table 17 – Fauna species survey methods

Technique	Regime	Target and method
Elliot B (box trap) or cage trap	Four per site over four consecutive nights, checked early morning, reopened late afternoon.	Baited with a mixture of oats, peanut butter, vegetable oil and sardines. Placed within suitable micro-habitat for northern quoll.
Funnel trap	Six at each of five trap sites over four consecutive nights, checked early morning and afternoon.	Placed in pairs either side along a 30m drift-fence. Targeting Dunmall's snake and collared delma.
Anabat	Three units overnight for four consecutive nights	Left overnight on site near entrances to possible roost sites for large-eared pied bat, if considered present, and/or along flyways and near waterbodies.
Harp trap	Two per night for four consecutive nights, locations chosen based on presence of suitable flyways	Targeting south-eastern long-eared bat, which is not identifiable by ultrasonic calls, and the large-eared pied bat. Targeting large-eared pied bat
Camera trap	10 over at least 14 consecutive nights	Focused on stations baited with a mixture of oats, peanut butter, vegetable oil and sardines. Targeting northern quoll and possibly yakka skink. (Meek *et al.* 2014).
Spotlighting	On foot	Targeting koala and Dunmall's snake.
Spotlighting	Rocky areas.	Targeting northern quoll and collared delma.
Spotlighting	By vehicle along tracks.	Targeting Dunmall's snake and koala.
Scat search	Conducted in habitat considered suitable for target species.	Targeting koala and northern quoll. The Spot Assessment Technique (SAT), or a variation, were used to survey for koalas within suitable habitat within the site.
Bird survey	At waterbodies.	Targeting squatter pigeon (southern).
Bird survey	Meander along watercourses during the day.	Targeting nest sites for red goshawk. Includes diurnal koala search.
Track traverse	By vehicle and on foot.	Targeting squatter pigeon (southern).
Diurnal herpetofauna search	Late morning/early afternoon.	Conducted by two searchers, duration is determined by site-specific habitat quality and presence of suitable micro-habitat. Targeting collared delma, Dunmall's snake and yakka skink.

8. Reporting

8.1. Reporting

A report detailing the progress of the offset area in achieving the interim performance targets and completion criteria will be prepared for each management year. The report will be prepared by the suitably qualified ecologists who are awarded the scope of works for that monitoring year, and delivered to the approval holder, Santos, within three months of every 12-month anniversary of the commencement of the action (22/03/2016). In compliance with clause 34 and 41 of the approval, Santos will publicly publish all monitoring reports on their website, and they will remain published for the lifetime of the approval (expiry 21/03/2066).

The report will contain, at a minimum:

- a description of the monitoring conducted, when it was conducted, and by whom
- a discussion of the weather in the lead up to and during the monitoring
- results of monitoring events conducted
- an overview of the management actions implemented since the last report
- a description of the performance criteria not met any triggers that have been exceeded and the corrective actions that were implemented
- an indication of any risks or potential threats that have become apparent to the management area since the development of this management plan, and activities to be undertaken to manage these threats and/or risks
- progress towards achieving the interim performance targets and completion criteria.

Monitoring and progress reports will be stored electronically by each the approval holder and the contractor undertaking and completing the scope of work. Field data will be stored as spatial data files (e.g. shapefile) by the contractor who is responsible for collecting the raw data, as well as detailed in the contents of the results or appendices section of the report. All data and reports pertaining to this OAMP will be stored for the lifetime of the approval.

8.2. Update of OAMP

The OAMP will be reviewed, audited and updated every 5 years. In addition, the OAMP will be updated in accordance with the principles of adaptive management, if required, to incorporate any changes identified through management activities, site visits and monitoring activities. This may include the revision of current management actions, identification of additional activities (including monitoring activities) and responses to adaptive management triggers, other environmental threats to the offset area, information obtained through research programs.

9. Implementation Schedule

Table 18 and Table 19 summarise the implementation schedule for the management, monitoring and reporting activities presented in this OAMP. Santos will be wholly responsible for the implementation of this OAMP and reporting on the performance of the offset area in meeting the offset obligations under EPBC Approval 2012/6615 and Section 4 of this OAMP.

Table 18 – Implementation of management actions

Activity		Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Related monitoring
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
General restrictions (Section 6.2.1)	Access, vehicles, vegetation clearing, weed hygiene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	At all times	General offset inspections (Section 7.1)
Access tracks (Section 6.2.2)	Maintenance/new tracks	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
Fencing (Section 6.2.3)	Construction of additional fencing to support livestock exclusion and strategic grazing	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
	Maintenance	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪		
Fire management (Section 6.2.4)	Fuel hazard reduction burns	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	Biomass monitoring (Section 7.2)
Grazing (Section 6.2.4)	Strategic grazing	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required based on the results of biomass monitoring, and informed by weed monitoring	Biomass monitoring (Section 7.2) Weed monitoring (Section 7.4)
Weed management (Section 6.2.5)	Invasive grasses and broadleaf weeds	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities in addition to strategic grazing to be undertaken as required	Weed monitoring (Section 7.4)
Pest animal management (Section 6.2.6)	Wild dog, feral cat, fox, pig, rabbit, cane toad and feral horse	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities to be undertaken as required	Pest animal monitoring (Section 7.5)
Reporting (Section 8)	Annual reporting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annual reports to be prepared each year. The OAMP will be reviewed, audited and updated every 5 years.	Reporting (Section 8)
	Update OAMP					▪					▪					▪					▪		

Table 19 – Implementation of monitoring events

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Location	Survey/monitoring guidelines	Reliability
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				
Offset area inspections (Section 7.1)	Twice yearly inspections of to enable a general assessment of the offset area and identify any potential issues that may require remedial action. See Section 7.1 for the criteria to be assessed as part of each inspection.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Inspections will be undertaken at least twice a year. Usually at the end of the wet season and the end of the dry season, with one of the inspections occurring prior to the submission of the annual report.	Inspections will encompass the entirety of the offset area as reasonably as practicable. Inspections will occur concurrently and opportunistically whilst completing other monitoring obligations.	See Section 7.1 for a list of potential issues to be inspected.	General assessment of the offset management areas to identify any potential issues that may require remedial action to be undertaken.
Biomass monitoring (Section 7.2)	Biomass monitoring for fire management and to inform strategic grazing regime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Twice every year at the end of the wet season (April) and towards the end of the dry season (October).	Biomass monitoring will be undertaken at the same permanent weed monitoring sites established as part of the year 1 monitoring.	Assessment against Future Beef photo standards (Section 7.2).	Methodology developed by the Queensland Government.
Fuel load monitoring (Section 7.3)	Assessment of the fuel hazard rating within the offset area to inform fire management strategies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually at the end of the wet season (April).	Fuel load assessment monitoring will be undertaken at the same time and location as biomass monitoring.	*Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix D).	Method developed by the Victorian Government.
Weed monitoring (Section 7.4)	Ongoing weed surveys to assess the effectiveness of weed control	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		Every two years post wet season.	Fixed weed monitoring sites will be randomly stratified throughout the offset area. Sites will represent the different offset values, incorporate natural variability, vegetation community type, as well as more trafficable areas which often aid in weed spread such as gates, tracks, and creeks.	NSW Guidelines for monitoring weed control and recovery of native vegetation (Auld 2009). Photo monitoring of selected sites to assess visual changes in weed species and infestations over time. The use of precision unmanned aerial vehicles (drone) technology, aerial imagery and/or remote sensing.	Assessment will be undertaken generally in accordance with published, reputable guidelines.
Pest animal monitoring (Section 7.5)	Ongoing pest animal surveys to assess the effectiveness of pest animal control	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		Every two years post wet season.	Pest animal monitoring plots will be randomly stratified across the offset area. Monitoring sites will be collocated with BioCondition transects, where possible. Pest animal monitoring motion-sensor cameras will be placed in the same locations each consecutive monitoring period. Camera locations will be strategically chosen along tracks and drainage lines which are favoured by pest species.	Monitoring method outlined in Section 7.5.	Assessment undertaken generally in accordance with published monitoring techniques developed by the NSW Government.

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required																			Timing	Location	Survey/monitoring guidelines	Reliability
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				
Offset value assessments (Section 7.6)	Rapid monitoring events		✓		✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		Each year monitoring events are not completed for habitat quality assessments (Section 7.6.2), targeted fauna survey (Section 7.6.4).	Rapid monitoring will encompass the entirety of the offset area as reasonably as practicable. Incidental flora and fauna observations will be recorded opportunistically whilst completing other monitoring obligations and traversing the site.	See Section 7.6.1.	
	Assessment of vegetation condition and habitat quality	✓		✓		✓			✓			✓			✓			✓			✓	Year one, and then every two years for the first six years, and then every three years thereafter.	Fixed BioCondition transects were established during the December 2019 and January 2020 baseline surveys for offset area 1 and in 2024 for Offset area 2. Transect locations were randomly stratified to be representative of each RE and condition class, as well as allow for natural variability and be wholistically indicative of the offset area and offset values.	GTDTHQ and the methods outlined in Appendix E.	Assessment undertaken in accordance with method developed by the Queensland Government and aligns with the EPBC Act *Environmental Offsets Policy* measure of 'habitat quality' and is intended to provide a consistent framework for environmental offsets in Queensland.
	Photo monitoring	✓		✓		✓			✓			✓			✓			✓			✓		Photo monitoring will be undertaken at each the 0 m and 50 m point of each BioCondition transect line.	Photos at each photo monitoring point will be taken in a north, east, south and westerly direction. A record of the photographs will be maintained, including GPS co-ordinates, date and time of each photograph and the direction in which the photograph was taken.	Based on best practice photo monitoring techniques, see Appendix 4 of *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2*. (Eyre *et al.* 2015).
	Targeted fauna surveys	✓		✓		✓			✓			✓			✓			✓			✓		Targeted fauna surveys will be strategically designed and located to improve the probability of encountering MNES target species, as well as be representative of the diversity of habitat type and condition within the offset area. Survey sites will be carefully selected at the discretion of the ecological team undertaking the survey.	See methods outlined in Section 7.6.4.	Techniques for fauna surveys are based on recommended survey guidelines published by the Queensland and Commonwealth governments.

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Appendix A

Baseline habitat quality score for the Mt Tabor offset areas

Table A1 – Baseline habitat quality score for Mt Tabor offset area 1 (sites MTB01 to MTB24)

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		**Max. score**	**Weighting**	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***	**rem***
Site condition	Total number of large trees	15	19%	15	15	15	15	10	15	15	5	5	10	10	10	15	15	10	5	15	15	5	5	15	15	15	15
	Canopy height	5	6%	5	5	3	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	2.5	1.5	5	4	4	5
	Recruitment of canopy sp.	5	6%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	5	5	5	5	5
	Canopy cover	5	6%	4	5	2	3.5	3.5	5	4	4	4	5	5	4	2.5	5	5	2	2.5	3.5	2.5	2.5	2.5	5	5	4
	Shrub canopy cover	5	6%	0	0	0	5	5	3	0	3	3	3	3	5	3	3	3	5	5	3	5	5	5	5	3	3
	Woody debris length	5	6%	3	2	5	2	5	2	3	2	5	5	5	5	5	5	2	5	0	0	2	2	2	3	0	2
	Native sp. richness	20	25%	10	15	10	17.5	12.5	17.5	15	17.5	20	15	20	17.5	15	20	15	12.5	12.5	15	15	10	17.5	17.5	20	15
	Non-native plant cover	10	13%	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5	10	10	10	10	10	10	10
	Native perennial grass cover	5	6%	1	5	3	5	5	3	5	1	3	1	5	5	3	1	1	3	5	3	3	5	1	5	1	5
	Litter cover	5	6%	3	5	3	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	5	5
	Total/80	**80**	**100%**	**51**	**67**	**56**	**73**	**66**	**70.5**	**67**	**57.5**	**64**	**64**	**73**	**71.5**	**68.5**	**72**	**61**	**57.5**	**60**	**64.5**	**50**	**51**	**68**	**74.5**	**68**	**69**

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		Max. score	Weighting	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*
Northern quoll																											
Site context	Patch size	10	25%	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Absence of threats	25	50%	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
	Total/45	45	100%	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9
Species habitat index	Quality as foraging habitat	5	17%	4	4	3	4	4	4	3	4	3	3	3	3	4	5	4	4	4	4	4	3	3	4	3	4
	Quality as shelter, breeding habitat	5	17%	3	3	3	3	3	3	3	3	3	3	3	4	2	4	3	3	3	3	2	2	3	3	3	3
	Quality as mobility habitat	5	17%	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4
	Role of the site population in regards to the overall species population	5	50%	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total/20	20	100%	13.3	13.3	12.7	13.3	13.3	13.3	12.7	13.3	12.7	12.7	12.7	13.3	12.7	15.3	13.3	13.3	13.3	13.3	12.7	12.0	12.7	13.3	12.7	13.3
Habitat quality score	Site condition	80	30%	51	67	56	73	66	70.5	67	57.5	64	64	73	71.5	68.5	72	61	57.5	60	64.5	50	51	68	74.5	68	69
	Site context	45	30%	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9
	Species habitat index	20	40%	13.3	13.3	12.7	13.3	13.3	13.3	12.7	13.3	12.7	12.7	12.7	13.3	12.7	15.3	13.3	13.3	13.3	13.3	12.7	12.0	12.7	13.3	12.7	13.3
	Total /10	145	100%	6.8	7.4	6.9	7.7	7.4	7.6	7.3	7.1	7.2	7.2	7.5	7.6	7.4	8.0	7.2	7.1	7.2	7.3	6.7	6.6	7.3	7.7	7.3	7.5
Total /10 (rounded)				**7**	**7**	**7**	**8**	**7**	**8**	**7**	**7**	**7**	**7**	**8**	**8**	**7**	**8**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**8**	**7**	**8**

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		Max. score	Weighting	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*
Koala																											
Site context	Patch size	10	25%	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Absence of threats	25	50%	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
	Total/45	45	100%	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7
Species habitat index	Quality as foraging habitat	5	17%	4	4	4	5	4	4	4	4	4	4	4	4	5	3	4	4	4	4	4	3	4	4	3	4
	Quality as shelter, breeding habitat	5	17%	4	4	4	5	4	4	4	4	4	4	4	4	5	4	4	3	4	3	4	3	4	4	4	4
	Quality as mobility habitat	5	17%	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	4	5
	Role of the site population to the overall species population	5	50%	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Total/20	20	100%	16.0	16.0	16.0	17.3	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	17.3	15.3	16.0	15.3	16.0	15.3	16.0	14.7	16.7	16.7	15.3	16.7
Habitat quality score	Site condition	80	30%	51	67	56	73	66	70.5	67	57.5	64	64	73	71.5	68.5	72	61	57.5	60	64.5	50	51	68	74.5	68	69
	Site context	45	30%	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7
	Species habitat index	20	40%	16.0	16.0	16.0	17.3	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	17.3	15.3	16.0	15.3	16.0	15.3	16.0	14.7	16.7	16.7	15.3	16.7
	Total /10	145	100%	7.7	8.3	7.9	8.8	8.3	8.4	8.3	7.9	8.2	8.2	8.5	8.5	8.6	8.3	8.1	7.8	8.0	8.1	7.7	7.4	8.5	8.7	8.2	8.5
Total /10 (rounded)				**8**	**8**	**8**	**9**	**8**	**8**	**8**	**8**	**8**	**8**	**9**	**8**	**9**	**8**	**8**	**8**	**8**	**8**	**8**	**7**	**8**	**9**	**8**	**9**

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		Max. score	Weighting	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*
Large-eared pied bat																											
Site context	Patch size	10	25%	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Absence of threats	25	50%	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
	Total/45	45	100%	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5
Species habitat index	Quality as foraging habitat	5	17%	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Quality as shelter, breeding habitat	5	17%	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Quality as mobility habitat	5	17%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Role of the site population to the overall species population	5	50%	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total/20	20	100%	14.0	14.0	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Habitat quality score	Site condition	80	30%	51	67	56	73	66	70.5	67	57.5	64	64	73	71.5	68.5	72	61	57.5	60	64.5	50	51	68	74.5	68	69
	Site context	45	30%	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5
	Species habitat index	20	40%	14.0	14.0	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
	Total /10	145	100%	7.4	8.0	7.7	8.4	8.1	8.3	8.1	7.8	8.0	8.0	8.4	8.3	8.2	8.3	7.9	7.8	7.9	8.1	7.5	7.5	8.2	8.4	8.2	8.2
Total /10 (rounded)				**7**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		Max. score	Weighting	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*
South-eastern long-eared bat																											
Site context	Patch size	10	25%	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Absence of threats	25	50%	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
	Total/45	45	100%	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8
Species habitat index	Quality as foraging habitat	5	17%	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Quality as shelter, breeding habitat	5	17%	5	3	4	4	4	3	4	4	2	4	3	4	4	4	3	3	2	2	1	1	3	3	1	4
	Quality as mobility habitat	5	17%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	4	5
	Role of the site population to the overall species population	5	50%	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Total/20	20	100%	16.7	15.3	16.7	16.7	16.7	16.0	16.7	16.7	15.3	16.7	16.0	16.7	16.7	16.7	16.0	16.0	15.3	15.3	14.0	14.0	16.0	16.0	14.0	16.7
Habitat quality score	Site condition	80	30%	51	67	56	73	66	70.5	67	57.5	64	64	73	71.5	68.5	72	61	57.5	60	64.5	50	51	68	74.5	68	69
	Site context	45	30%	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8	42.8
	Species habitat index	20	40%	16.7	15.3	16.7	16.7	16.7	16.0	16.7	16.7	15.3	16.7	16.0	16.7	16.7	16.7	16.0	16.0	15.3	15.3	14.0	14.0	16.0	16.0	14.0	16.7
	Total /10	145	100%	8.1	8.4	8.3	8.9	8.7	8.7	8.7	8.3	8.3	8.6	8.8	8.9	8.8	8.9	8.3	8.2	8.2	8.3	7.5	7.6	8.6	8.8	8.2	8.8
Total /10 (rounded)				**8**	**8**	**8**	**9**	**9**	**9**	**9**	**8**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	**8**	**8**	**8**	**8**	**8**	**9**	**9**	**8**	**9**

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		Max. score	Weighting	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*
Red goshawk																											
Site context	Patch size	10	25%	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Absence of threats	25	50%	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	Total/45	45	100%	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6
Species habitat index	Quality as foraging habitat	5	17%	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Quality as shelter, breeding habitat	5	17%	3	3	1	3	3	3	3	3	3	3	3	3	3	2	2	1	2	3	3	1	3	4	2	2
	Quality as mobility habitat	5	17%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Role of the site population to the overall species population	5	50%	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total/20	20	100%	13.3	13.3	12.0	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	12.7	12.7	12.0	12.7	13.3	13.3	12.0	13.3	14.0	12.7	12.7
Habitat quality score	Site condition	80	30%	51	67	56	73	66	70.5	67	57.5	64	64	73	71.5	68.5	72	61	57.5	60	64.5	50	51	68	74.5	68	69
	Site context	45	30%	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6
	Species habitat index	20	40%	13.3	13.3	12.0	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	12.7	12.7	12.0	12.7	13.3	13.3	12.0	13.3	14.0	12.7	12.7
	Total /10	145	100%	7.0	7.6	6.9	7.8	7.6	7.8	7.6	7.3	7.5	7.5	7.8	7.8	7.7	7.7	7.3	7.0	7.2	7.5	7.0	6.8	7.7	8.0	7.5	7.6
	Total /10 (rounded)			**7**	**8**	**7**	**8**	**8**	**8**	**8**	**7**	**8**	**8**	**8**	**8**	**8**	**8**	**7**	**7**	**7**	**8**	**7**	**7**	**8**	**8**	**8**	**8**

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		Max. score	Weighting	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*
Squatter pigeon (southern)																											
Site context	Patch size	10	25%	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Absence of threats	25	50%	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
	Total/45	45	100%	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3
Species habitat index	Quality as foraging habitat	5	17%	4	5	4	4	4	5	4	4	5	3	4	3	4	3	4	4	4	4	4	3	4	4	4	4
	Quality as shelter, breeding habitat	5	17%	5	5	5	4	5	5	5	5	5	4	4	5	4	5	4	4	4	4	4	4	4	4	4	4
	Quality as mobility habitat	5	17%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Role of the site population in regards to the overall species population	5	50%	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Total/20	20	100%	17.3	18.0	17.3	16.7	17.3	18.0	17.3	17.3	18.0	16.0	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.0	16.7	16.7	16.7	16.7
Habitat quality score	Site condition	80	30%	51	67	56	73	66	70.5	67	57.5	64	64	73	71.5	68.5	72	61	57.5	60	64.5	50	51	68	74.5	68	69
	Site context	45	30%	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3
	Species habitat index	20	40%	17.3	18.0	17.3	16.7	17.3	18.0	17.3	17.3	18.0	16.0	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.0	16.7	16.7	16.7	16.7
	Total /10	145	100%	7.9	8.7	8.1	8.6	8.5	8.8	8.5	8.2	8.6	8.2	8.6	8.6	8.5	8.6	8.2	8.0	8.1	8.3	7.8	7.7	8.4	8.7	8.4	8.5
Total /10 (rounded)				**8**	**9**	**8**	**9**	**8**	**9**	**9**	**8**	**9**	**8**	**9**	**9**	**8**	**9**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**9**	**8**	**8**

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		Max. score	Weighting	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*
Collared delma																											
Site context	Patch size	10	25%	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Absence of threats	25	50%	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	Total/45	45	100%	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
Species habitat index	Quality as foraging habitat	5	17%	4	4	3	4	4	4	4	4	3	3	4	4	3	4	3	3	4	4	4	3	3	4	4	3
	Quality as shelter, breeding habitat	5	17%	4	4	4	4	4	4	4	4	3	4	3	3	3	5	3	3	2	3	3	3	3	4	2	3
	Quality as mobility habitat	5	17%	4	4	3	4	4	4	4	4	4	4	4	4	4	5	4	4	3	4	4	3	4	5	4	4
	Role of the site population to the overall species population	5	50%	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total/20	20	100%	14.0	14.0	12.7	14.0	14.0	14.0	14.0	14.0	12.7	13.3	13.3	13.3	12.7	15.3	12.7	12.7	12.0	13.3	13.3	12.0	12.7	14.7	12.7	12.7
Habitat quality score	Site condition	80	30%	51	67	56	73	66	70.5	67	57.5	64	64	73	71.5	68.5	72	61	57.5	60	64.5	50	51	68	74.5	68	69
	Site context	45	30%	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
	Species habitat index	20	40%	14.0	14.0	12.7	14.0	14.0	14.0	14.0	14.0	12.7	13.3	13.3	13.3	12.7	15.3	12.7	12.7	12.0	13.3	13.3	12.0	12.7	14.7	12.7	12.7
	Total /10	145	100%	7.2	7.8	7.1	8.0	7.7	7.9	7.8	7.4	7.4	7.5	7.9	7.8	7.6	8.2	7.3	7.1	7.1	7.5	7.0	6.8	7.5	8.2	7.5	7.6
Total /10 (rounded)				**7**	**8**	**7**	**8**	**8**	**8**	**8**	**7**	**7**	**8**	**8**	**8**	**8**	**8**	**7**	**7**	**7**	**8**	**7**	**7**	**8**	**8**	**8**	**8**

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		Max. score	Weighting	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*
Yakka skink																											
Site context	Patch size	10	25%	10	10	-	10	-	10	10	10	10	10	-	10	10	10	10	10	10	10	10	10	10	-	10	10
	Connectivity	5	13%	5	5	-	5	-	5	5	5	5	5	-	5	5	5	5	5	5	5	5	5	5	-	5	5
	Context	5	13%	5	5	-	5	-	5	5	5	5	5	-	5	5	5	5	5	5	5	5	5	5	-	5	5
	Absence of threats	25	50%	9	9	-	9	-	9	9	9	9	9	-	9	9	9	9	9	9	9	9	9	9	-	9	9
	Total/45	45	100%	30.6	30.6	-	30.6	-	30.6	30.6	30.6	30.6	30.6	-	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	-	30.6	30.6
Species habitat index	Quality as foraging habitat	5	17%	3	4	-	3	-	4	3	3	3	3	-	4	3	3	3	3	3	3	4	3	3	-	3	3
	Quality as shelter, breeding habitat	5	17%	4	3	-	3	-	3	2	2	3	3	-	3	3	3	2	2	1	3	3	1	2	-	2	2
	Quality as mobility habitat	5	17%	4	4	-	4	-	4	4	4	4	4	-	4	4	4	3	3	3	4	4	3	4	-	4	4
	Role of the site population to the overall species population	5	50%	3	3	-	3	-	3	3	3	3	3	-	3	3	3	3	3	3	3	3	3	3	-	3	3
	Total/20	20	100%	13.3	13.3	-	12.7	-	13.3	12.0	12.0	12.7	12.7	-	13.3	12.7	12.7	11.3	11.3	10.7	12.7	13.3	10.7	12.0	-	12.0	12.0
Habitat quality score	Site condition	80	30%	51	67	-	73	-	70.5	67	57.5	64	64	-	71.5	68.5	72	61	57.5	60	64.5	50	51	68	-	68	69
	Site context	45	30%	30.6	30.6	-	30.6	-	30.6	30.6	30.6	30.6	30.6	-	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	-	30.6	30.6
	Species habitat index	20	40%	13.3	13.3	-	12.7	-	13.3	12.0	12.0	12.7	12.7	-	13.3	12.7	12.7	11.3	11.3	10.7	12.7	13.3	10.7	12.0	-	12.0	12.0
	Total /10	145	100%	6.6	7.2	-	7.3	-	7.4	7.0	6.6	7.0	7.0	-	7.4	7.1	7.3	6.6	6.5	6.4	7.0	6.6	6.1	7.0	-	7.0	7.0
	Total /10 (rounded)			**7**	**7**	**-**	**7**	**-**	**7**	**7**	**7**	**7**	**7**	**-**	**7**	**7**	**7**	**7**	**6**	**6**	**7**	**7**	**6**	**7**	**-**	**7**	**7**

Site ID				MTB01	MTB02	MTB03	MTB04	MTB05	MTB06	MTB07	MTB08	MTB09	MTB10	MTB11	MTB12	MTB13	MTB14	MTB15	MTB16	MTB17	MTB18	MTB19	MTB20	MTB21	MTB22	MTB23	MTB24
RE				11.3.39	11.3.2	11.10.6	11.10.4	11.10.6	11.3.2	11.3.39	11.10.4	11.10.4	11.10.11	11.10.6	11.10.11	11.10.7	11.10.13	11.3.2	11.10.13	11.3.39	11.3.39	11.10.13	11.10.13	11.10.7	11.10.6	11.10.7	11.10.11
Attributes		Max. score	Weighting	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*	rem*
Dunmall's snake																											
Site context	Patch size	10	25%	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context	5	13%	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Absence of threats	25	50%	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	Total/45	45	100%	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
Species habitat index	Quality as foraging habitat	5	17%	4	3	3	4	4	4	4	4	3	3	3	4	4	3	3	3	4	4	4	3	3	4	3	3
	Quality as shelter, breeding habitat	5	17%	5	3	3	4	3	4	3	3	3	4	3	4	3	3	3	3	2	3	3	1	2	3	2	2
	Quality as mobility habitat	5	17%	5	4	4	5	5	5	5	5	4	4	4	4	5	4	4	4	3	4	4	4	4	4	4	4
	Role of the site population to the overall species population	5	50%	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total/20	20	100%	15.3	12.7	12.7	14.7	14.0	14.7	14.0	14.0	12.7	13.3	12.7	14.0	14.0	12.7	12.7	12.7	12.0	13.3	13.3	11.3	12.0	13.3	12.0	12.0
Habitat quality score	Site condition	80	30%	51	67	56	73	66	70.5	67	57.5	64	64	73	71.5	68.5	72	61	57.5	60	64.5	50	51	68	74.5	68	69
	Site context	45	30%	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
	Species habitat index	20	40%	15.3	12.7	12.7	14.7	14.0	14.7	14.0	14.0	12.7	13.3	12.7	14.0	14.0	12.7	12.7	12.7	12.0	13.3	13.3	11.3	12.0	13.3	12.0	12.0
	Total /10	145	100%	7.4	7.5	7.1	8.1	7.7	8.0	7.8	7.4	7.4	7.5	7.7	7.9	7.8	7.7	7.3	7.1	7.1	7.5	7.0	6.6	7.4	7.9	7.4	7.4
	Total /10 (rounded)			**7**	**8**	**7**	**8**	**8**	**8**	**8**	**7**	**7**	**8**	**8**	**8**	**8**	**8**	**7**	**7**	**7**	**8**	**7**	**7**	**7**	**8**	**7**	**7**

Note: Data is only provided for REs that the threatened community or species is associated with.
*rem = remnant vegetation.

Table A2 – Baseline habitat quality score for Mt Tabor offset area 2 (sites MTBA01 to MTBA18)

	Site ID			MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
	RE			11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
	Attributes	**Maximum score**	**Weighting**	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
Ecological condition indicators																						
Site condition	Native plant species richness - trees/5			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.5	5.0	5.0	5.0	2.5	5.0	5.0	2.5	5.0	2.5
	Native plant species richness - shrubs/5			5.0	2.5	5.0	5.0	5.0	5.0	5.0	5.0	2.5	5.0	5.0	5.0	5.0	2.5	5.0	5.0	5.0	2.5	5.0
	Native plant species richness - grasses/5			2.5	5.0	2.5	5.0	2.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.5	5.0	5.0	0.0	5.0	2.5
	Native plant species richness - forbs/5			2.5	2.5	2.5	5.0	5.0	5.0	5.0	5.0	5.0	2.5	2.5	2.5	5.0	2.5	2.5	2.5	2.5	5.0	2.5
	Tree canopy height /5			5.0	5.0	2.5	4.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	5.0	3.0	5.0	5.0	3.0	5.0	4.0	1.5
	Tree canopy cover /5			5.0	2.5	3.5	4.0	3.0	5.0	5.0	2.0	4.0	3.5	4.0	5.0	3.5	5.0	4.0	1.0	2.0	4.0	5.0
	Shrub canopy cover/5			3.0	5.0	0.0	3.0	3.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	5.0	5.0	3.0
	Recruitment of woody perennial species/5			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Native perennial grass cover /5			5.0	3.0	5.0	1.0	3.0	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0
	Organic litter/5			3.0	5.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.0	5.0	5.0
	Large trees/10			10.0	10.0	10.0	15.0	5.0	15.0	15.0	5.0	5.0	10.0	10.0	15.0	5.0	15.0	0.0	5.0	10.0	15.0	5.0
	Coarse woody debris /5			5.0	5.0	5.0	2.0	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
	Non-native plant cover/10			3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Total score			59	66	61	67	59	78	78	65	66	66	69	78	67	65	60	60	60	74	57
	MAX ecological condition score			80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
	Score /10			**7.4**	**8.2**	**7.6**	**8.4**	**7.3**	**9.8**	**9.8**	**8.1**	**8.2**	**8.2**	**8.6**	**9.7**	**8.3**	**8.1**	**7.4**	**7.4**	**7.5**	**9.2**	**7.1**

Site ID				MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
RE				11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
Attributes		Maximum score	Weighting	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
Northern quoll																						
Site context	Size of patch (fragmented bioregions)	10.0	0.3	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	Connectivity (fragmented bioregions)	5.0	0.1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Context (fragmented bioregions)	5.0	0.1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Threats to species (site context)	25.0	0.5	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4
	Site context score	45.0	1.0	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7
Species habitat index	Quality and availability of food and habitat required for foraging	5.0	0.2	3.0	3.0	3.0	3.0	1.0	3.0	3.0	4.0	3.0	5.0	5.0	1.0	5.0	2.0	3.0	4.0	3.0	3.0	4.0
	Quality and availability of habitat required for shelter and breeding	5.0	0.2	3.0	3.0	1.0	1.0	2.0	2.0	2.0	3.0	3.0	5.0	4.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0
	Quality and availability of habitat required for mobility	5.0	0.2	4.0	4.0	3.0	2.0	3.0	4.0	4.0	4.0	3.0	5.0	4.0	5.0	5.0	3.0	4.0	4.0	5.0	4.0	4.0
	Role of site location to species overall population in the state	5.0	0.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	Total species habitat index score	20.0	1.0	12.7	12.7	10.7	10.0	10.0	12.0	12.0	13.3	12.0	16.0	14.7	12.0	14.7	11.3	12.7	13.3	14.0	13.3	14.0
Habitat quality score	Site condition score	80.0	0.3	59.0	65.5	61.0	67.0	58.5	78.0	78.0	65.0	65.5	65.5	68.5	77.5	66.5	65.0	59.5	59.5	60.0	73.5	57.0
	Site context score	45.0	0.3	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7
	Species habitat index score	20.0	0.4	12.7	12.7	10.7	10.0	10.0	12.0	12.0	13.3	12.0	16.0	14.7	12.0	14.7	11.3	12.7	13.3	14.0	13.3	14.0
	Total/10	-	1.0	7.0	7.2	6.7	6.8	6.4	7.6	7.6	7.3	7.1	7.9	7.7	7.6	7.7	6.9	7.0	7.1	7.3	7.7	7.2
	Total/10 (rounded)			**7.0**	**7.0**	**7.0**	**7.0**	**6.0**	**8.0**	**8.0**	**7.0**	**7.0**	**8.0**	**8.0**	**8.0**	**8.0**	**7.0**	**7.0**	**7.0**	**7.0**	**8.0**	**7.0**

Site ID				MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
RE				11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
Attributes		Maximum score	Weighting	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
Collared delma																						
Site context	Size of patch (fragmented bioregions)	10	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity (fragmented bioregions)	5	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context (fragmented bioregions)	5	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Threats to species (site context)	25.0	0.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
	Site context score	45.0	1.0	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7
Species habitat index	Quality and availability of food and habitat required for foraging	5	0	3	5	3	5	5	5	5	5	5	5	5	5	5	5	3	3	3	5	3
	Quality and availability of habitat required for shelter and breeding	5	0	3	5	3	3	3	5	5	5	3	3	5	5	3	3	3	3	3	5	3
	Quality and availability of habitat required for mobility	5	0	3	5	3	4	4	5	5	5	4	4	5	5	4	4	3	3	3	5	3
	Role of site location to species overall population in the state	5	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total species habitat index score	20	1.0	12.0	16.0	12.0	14.0	14.0	16.0	16.0	16.0	14.0	14.0	16.0	16.0	14.0	14.0	12.0	12.0	12.0	16.0	12.0
Habitat quality score	Site condition score	80	0.3	59.0	65.5	61.0	67.0	58.5	78.0	78.0	65.0	65.5	65.5	68.5	77.5	66.5	65.0	59.5	59.5	60.0	73.5	57.0
	Site context score	45	0.3	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7
	Species habitat index score	20	0.4	12.0	16.0	12.0	14.0	14.0	16.0	16.0	16.0	14.0	14.0	16.0	16.0	14.0	14.0	12.0	12.0	12.0	16.0	12.0
	Total/10	-	1.0	6.9	8.0	7.0	7.6	7.3	8.4	8.4	7.9	7.6	7.6	8.1	8.4	7.6	7.5	6.9	6.9	7.0	8.3	6.8
	Total/10 (rounded)			**7**	**8**	**7**	**8**	**7**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**7**	**7**	**7**	**8**	**7**

Site ID				MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
RE				11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
Attributes		Maximum score	Weighting	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
Dunmall's snake																						
Site context	Size of patch (fragmented bioregions)	10	0.3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity (fragmented bioregions)	5	0.1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context (fragmented bioregions)	5	0.1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Threats to species (site context)	25	0.5	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7
	Site context score	45	1.0	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Species habitat index	Quality and availability of food and habitat required for foraging	5	0.2	3	5	3	3	3	5	5	5	3	3	5	5	3	3	5	3	3	5	5
	Quality and availability of habitat required for shelter and breeding	5	0.2	3	5	3	3	3	5	5	5	3	3	5	5	3	3	3	3	3	5	3
	Quality and availability of habitat required for mobility	5	0.2	4	5	4	4	4	5	5	5	4	4	5	5	4	4	4	4	4	5	4
	Role of site location to species overall population in the state	5	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total species habitat index score	20	1.0	12.7	16.0	12.7	12.7	12.7	16.0	16.0	16.0	12.7	12.7	16.0	16.0	12.7	12.7	14.0	12.7	12.7	16.0	14.0
Habitat quality score	Site condition score	80	0.3	59	66	61	67	59	78	78	65	66	66	69	78	67	65	60	60	60	74	57
	Site context score	45	0.3	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
	Species habitat index score	20	0.4	12.7	16.0	12.7	12.7	12.7	16.0	16.0	16.0	12.7	12.7	16.0	16.0	12.7	12.7	14.0	12.7	12.7	16.0	14.0
	Total/10	-	1.0	7.2	8.2	7.3	7.5	7.2	8.6	8.6	8.1	7.5	7.5	8.3	8.6	7.5	7.5	7.5	7.3	7.3	8.5	7.4
	Total/10 (rounded)			**7**	**8**	**7**	**8**	**7**	**9**	**9**	**8**	**7**	**7**	**8**	**9**	**8**	**7**	**8**	**7**	**7**	**8**	**7**

Site ID				MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
RE				11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
Attributes		Maximum score	Weighting	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
Large-eared pied bat																						
Site context	Size of patch (fragmented bioregions)	10	0.3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity (fragmented bioregions)	5	0.1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context (fragmented bioregions)	5	0.1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Threats to species (site context)	25	0.5	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
	Site context score	45	1.0	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
Species habitat index	Quality and availability of food and habitat required for foraging	5	0.2	3	5	3	5	3	5	5	3	5	5	5	5	5	5	5	3	3	5	3
	Quality and availability of habitat required for shelter and breeding	5	0.2	3	5	5	3	3	3	1	5	5	5	5	5	5	1	5	5	5	5	5
	Quality and availability of habitat required for mobility	5	0.2	4	5	4	4	3	4	4	4	5	5	5	5	5	4	5	4	4	5	4
	Role of site location to species overall population in the state	5	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total species habitat index score	20	1.0	12.7	16.0	14.0	14.0	12.0	14.0	12.7	14.0	16.0	16.0	16.0	16.0	16.0	12.7	16.0	14.0	14.0	16.0	14.0
Habitat quality score	Site condition score	80	0.3	59.0	65.5	61.0	67.0	58.5	78.0	78.0	65.0	65.5	65.5	68.5	77.5	66.5	65.0	59.5	59.5	60.0	73.5	57.0
	Site context score	45	0.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
	Species habitat index score	20	0.4	12.7	16.0	14.0	14.0	12.0	14.0	12.7	14.0	16.0	16.0	16.0	16.0	16.0	12.7	16.0	14.0	14.0	16.0	14.0
	Total/10	-	1.0	7.0	7.9	7.3	7.5	6.8	7.9	7.7	7.5	7.9	7.9	8.0	8.3	7.9	7.2	7.7	7.3	7.3	8.2	7.2
	Total/10 (rounded)			**7**	**8**	**7**	**8**	**7**	**8**	**8**	**7**	**8**	**8**	**8**	**8**	**8**	**7**	**8**	**7**	**7**	**8**	**7**

Site ID				MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
RE				11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
Attributes		Maximum score	Weighting	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
Red goshawk																						
Site context	Size of patch (fragmented bioregions)	10	0.25	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity (fragmented bioregions)	5	0.125	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context (fragmented bioregions)	5	0.125	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Threats to species (site context)	25	0.5	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	Site context score	45	1	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
Species habitat index	Quality and availability of food and habitat required for foraging	5	0.2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Quality and availability of habitat required for shelter and breeding	5	0.2	3	3	3	3	3	3	3	1	1	3	3	3	3	3	1	3	3	3	1
	Quality and availability of habitat required for mobility	5	0.2	4	4	4	4	4	4	4	3	3	4	4	4	4	4	3	4	4	4	3
	Role of site location to species overall population in the state	5	0.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Total species habitat index score	20	1.0	12.7	12.7	12.7	12.7	12.7	12.7	12.7	10.7	10.7	12.7	12.7	12.7	12.7	12.7	10.7	12.7	12.7	12.7	10.7
Habitat quality score	Site condition score	80	0.3	59.0	65.5	61.0	67.0	58.5	78.0	78.0	65.0	65.5	65.5	68.5	77.5	66.5	65.0	59.5	59.5	60.0	73.5	57.0
	Site context score	45	0.3	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
	Species habitat index score	20	0.4	12.7	12.7	12.7	12.7	12.7	12.7	12.7	10.7	10.7	12.7	12.7	12.7	12.7	12.7	10.7	12.7	12.7	12.7	10.7
	Total/10	-	1.0	7.2	7.4	7.3	7.5	7.2	7.9	7.9	7.0	7.0	7.4	7.6	7.9	7.5	7.4	6.8	7.2	7.2	7.7	6.7
	Total/10 (rounded)			**7**	**7**	**7**	**8**	**7**	**8**	**8**	**7**	**7**	**7**	**8**	**8**	**7**	**7**	**7**	**7**	**7**	**8**	**7**

Site ID				MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
RE				11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
Attributes		Maximum score	Weighting	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
Squatter pigeon (southern)																						
Site context	Size of patch (fragmented bioregions)	10	0.25	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity (fragmented bioregions)	5	0.125	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context (fragmented bioregions)	5	0.125	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Threats to species (site context)	25	0.5	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
	Site context score	45	1	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
Species habitat index	Quality and availability of food and habitat required for foraging	5	0.2	3	5	3	5	1	5	5	5	5	5	5	5	5	5	3	3	1	1	1
	Quality and availability of habitat required for shelter and breeding	5	0.2	3	5	3	5	1	3	3	3	3	3	3	3	5	3	3	3	1	1	1
	Quality and availability of habitat required for mobility	5	0.2	4	5	4	5	3	4	4	4	4	4	4	4	5	4	4	4	3	3	3
	Role of site location to species overall population in the state	5	0.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Total species habitat index score	20	1.0	14.7	18.0	14.7	18.0	11.3	16.0	16.0	16.0	16.0	16.0	16.0	16.0	18.0	16.0	14.7	14.7	11.3	11.3	11.3
Habitat quality score	Site condition score	80	0.3	59.0	65.5	61.0	67.0	58.5	78.0	78.0	65.0	65.5	65.5	68.5	77.5	66.5	65.0	59.5	59.5	60.0	73.5	57.0
	Site context score	45	0.3	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9
	Species habitat index score	20	0.4	14.7	18.0	14.7	18.0	11.3	16.0	16.0	16.0	16.0	16.0	16.0	16.0	18.0	16.0	14.7	14.7	11.3	11.3	11.3
	Total/10	-	1.0	7.1	8.1	7.2	8.1	6.5	8.1	8.1	7.6	7.7	7.7	7.8	8.1	8.1	7.6	7.2	7.2	6.5	7.0	6.4
	Total/10 (rounded)			**7**	**8**	**7**	**8**	**6**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**7**	**7**	**7**	**7**	**6**

Site ID				MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
RE				11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
Attributes		Maximum score	Weighting	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
Yakka skink																						
Site context	Size of patch (fragmented bioregions)	10	0	10	10	10	10	10	10	10	10	-	-	-	10	10	10	10	10	10	10	10
	Connectivity (fragmented bioregions)	5	0	5	5	5	5	5	5	5	5	-	-	-	5	5	5	5	5	5	5	5
	Context (fragmented bioregions)	5	0	5	5	5	5	5	5	5	5	-	-	-	5	5	5	5	5	5	5	5
	Threats to species (site context)	25	0.5	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	-	-	-	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
	Site context score	45	1.0	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	-	-	-	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8
Species habitat index	Quality and availability of food and habitat required for foraging	5	0.2	3	5	3	3	3	5	5	5	-	-	-	5	3	3	5	3	3	5	5
	Quality and availability of habitat required for shelter and breeding	5	0.17	3	5	3	3	3	5	5	5	-	-	-	5	3	3	3	3	3	5	3
	Quality and availability of habitat required for mobility	5	0.17	3	5	3	3	3	5	5	5	-	-	-	5	3	3	4	3	3	5	4
	Role of site location to species overall population in the state	5	0.50	3	3	3	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3	3
	Total species habitat index score	20	1.0	12.0	16.0	12.0	12.0	12.0	16.0	16.0	16.0	-	-	-	16.0	12.0	12.0	14.0	12.0	12.0	16.0	14.0
Habitat quality score	Site condition score	80	0.3	59.0	65.5	61.0	67.0	58.5	78.0	78.0	65.0	-	-	-	77.5	66.5	65.0	59.5	59.5	60.0	73.5	57.0
	Site context score	45	0.3	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	-	-	-	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8
	Species habitat index score	20	0.4	12.0	16.0	12.0	12.0	12.0	16.0	16.0	16.0	-	-	-	16.0	12.0	12.0	14.0	12.0	12.0	16.0	14.0
	Total/10	-	1.0	6.9	8.0	7.0	7.2	6.9	8.4	8.4	8.0	-	-	-	8.4	7.2	7.2	7.4	7.0	7.0	8.3	7.3
	Total/10 (rounded)			**7**	**8**	**7**	**7**	**7**	**8**	**8**	**8**	**-**	**-**	**-**	**8**	**7**	**7**	**7**	**7**	**7**	**8**	**7**

Site ID				MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
RE				11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
Attributes		Maximum score	Weighting	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
South-eastern long-eared bat																						
Site context	Size of patch (fragmented bioregions)	10	0.25	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity (fragmented bioregions)	5	0.13	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context (fragmented bioregions)	5	0.13	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Threats to species (site context)	25	0.50	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	Site context score	45	1.00	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Species habitat index	Quality and availability of food and habitat required for foraging	5	0.2	3	5	3	5	3	5	5	5	5	5	5	5	5	5	3	3	3	5	3
	Quality and availability of habitat required for shelter and breeding	5	0.2	3	5	3	5	3	5	5	3	3	5	5	5	3	5	3	3	3	5	3
	Quality and availability of habitat required for mobility	5	0.2	3	5	3	5	3	5	5	4	4	5	5	5	4	5	3	3	3	5	3
	Role of site location to species overall population in the state	5	0.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Total species habitat index score	20	1.0	14.0	18.0	14.0	18.0	14.0	18.0	18.0	16.0	16.0	18.0	18.0	18.0	16.0	18.0	14.0	14.0	14.0	18.0	14.0
Habitat quality score	Site condition score	80	0.3	59.0	65.5	61.0	67.0	58.5	78.0	78.0	65.0	65.5	65.5	68.5	77.5	66.5	65.0	59.5	59.5	60.0	73.5	57.0
	Site context score	45	0.3	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
	Species habitat index score	20	0.4	14.0	18.0	14.0	18.0	14.0	18.0	18.0	16.0	16.0	18.0	18.0	18.0	16.0	18.0	14.0	14.0	14.0	18.0	14.0
	Total/10	-	1.0	7.1	8.2	7.2	8.2	7.1	8.7	8.7	7.8	7.8	8.2	8.3	8.6	7.8	8.2	7.2	7.2	7.2	8.5	7.1
	Total/10 (rounded)			**7**	**8**	**7**	**8**	**7**	**9**	**9**	**8**	**8**	**8**	**8**	**9**	**8**	**8**	**7**	**7**	**7**	**8**	**7**

Site ID				MTBA01	MTBA02	MTBA03	MTBA04	MTBA05	MTBA06	MTBA07	MTBA08	MTBA09	MTBA10	MTBA11	MTBA12	MTBA12b	MTBA13	Mtba14a	MTBA15	MTBA16	MTBA17	MTBA18
RE				11.3.2	11.3.39	11.3.39	11.3.39	11.10.4	11.10.4	11.10.4	11.10.4	11.10.6	11.10.6	11.10.6	11.10.7	11.10.7	11.10.9	11.10.11	11.10.11	11.10.13	11.10.13	11.10.13
Attributes		Maximum score	Weighting	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem	*rem
Koala																						
Site context	Size of patch (fragmented bioregions)	10	0.3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Connectivity (fragmented bioregions)	5	0.1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Context (fragmented bioregions)	5	0.1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Threats to species (site context)	25	0.5	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
	Site context score	45	1.0	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7
Species habitat index	Quality and availability of food and habitat required for foraging	5	0.2	3	3	3	3	1	1	5	1	3	1	1	1	1	3	1	1	1	1	1
	Quality and availability of habitat required for shelter and breeding	5	0.2	5	5	5	5	1	3	5	3	5	3	5	5	5	5	3	3	3	3	3
	Quality and availability of habitat required for mobility	5	0.2	5	5	5	5	3	3	5	3	4	3	4	4	4	5	3	3	3	3	3
	Role of site location to species overall population in the state	5	0.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Total species habitat index score	20	1.0	16.7	16.7	16.7	16.7	11.3	12.7	18.0	12.7	16.0	12.7	14.7	14.7	14.7	16.7	12.7	12.7	12.7	12.7	12.7
Habitat quality score	Site condition score	80	0.3	59.0	65.5	61.0	67.0	58.5	78.0	78.0	65.0	65.5	65.5	68.5	77.5	66.5	65.0	59.5	59.5	60.0	73.5	57.0
	Site context score	45	0.3	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7
	Species habitat index score	20	0.4	16.7	16.7	16.7	16.7	11.3	12.7	18.0	12.7	16.0	12.7	14.7	14.7	14.7	16.7	12.7	12.7	12.7	12.7	12.7
	Total/10	-	1.0	7.7	8.0	7.8	8.0	6.6	7.6	8.7	7.2	7.8	7.2	7.7	8.0	7.6	8.0	6.9	6.9	7.0	7.5	6.9
	Total/10 (rounded)			**8**	**8**	**8**	**8**	**7**	**8**	**9**	**7**	**8**	**7**	**8**	**8**	**8**	**8**	**7**	**7**	**7**	**7**	**7**

Note: Data is only provided for REs that the threatened community or species is associated with.
*rem = remnant vegetation.

Table A3 – Scoring for known or potential threats to threatened fauna species on Mt Tabor contributing to habitat quality score

Potential or known threats to species occurring on Mt Tabor to be addressed in OAMP	Scope	Severity	Score	Contributing to habitat quality score*
Collared delma (*Delma torquata*)				
Alteration of ground cover as a consequence of unsuitable fire regime	4	4	16	Yes
Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat	5	5	25	-
Predation by feral predators (e.g., cats, foxes, wild dogs)	5	5	25	-
Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter)	5	5	25	-
Change in ground layer composition as a consequence of livestock grazing and feral horse browsing	5	5	25	-
Alteration of habitat suitability through the presence and extent of non-native, invasive weeds	5	5	25	-
Total/25 (contributing to habitat quality score)			**16**	
Yakka skink (*Egernia rugosa*)				
Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat	5	5	25	-
Predation by feral predators (e.g., cats, foxes, pigs)	5	5	25	-
Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter)	5	5	25	-
Destruction of potential shelter habitat associated with rabbit warren ripping	5	5	25	-
Alteration of habitat suitability through the presence and extent of non-native, invasive weeds	5	5	25	-
Alteration of ground cover as a consequence of unsuitable fire regime	3	3	9	Yes
Total/25 (contributing to habitat quality score)			**9**	
Dunmall's snake (*Furina dunmalli*)				
Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat	5	5	25	-

Potential or known threats to species occurring on Mt Tabor to be addressed in OAMP	Scope	Severity	Score	Contributing to habitat quality score*
Predation by feral predators (e.g., cats, foxes, pigs)	5	5	25	-
Change in ground layer composition as a consequence of livestock grazing and feral horse browsing	5	5	25	-
Alteration of habitat suitability through the presence and extent of non-native, invasive weeds	5	5	25	-
Alteration of ground cover as a consequence of unsuitable fire regime	4	4	16	Yes
Total/25 (contributing to habitat quality score)			**16**	
Red goshawk (*Erythrotriorchis radiatus*)				
Loss of suitable foraging habitat through land clearing and effects associated with fragmentation of large contiguous patches of forest and woodland, particularly large trees in alluvial valleys	4	4	16	Yes
Potential of reduced prey (e.g., medium sized birds) as a consequence of unsuitable fire regime	4	4	16	Yes
Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity	3	5	15	Yes
Total/25 (contributing to habitat quality score)			**16**	
Squatter pigeon (southern) (*Geophaps scripta scripta*)				
Change in ground layer composition as a consequence of grazing and ecosystem engineering actions by rabbits (e.g. burrowing, soil turnover)	5	5	25	-
Change in ground layer composition and trampling ground nests as a consequence of livestock grazing and feral horse browsing, especially in grassy, alluvial areas	3	5	15	Yes
Change in ground layer composition, including thickening of understorey structure, as a consequence of unsuitable fire regime	4	5	20	Yes
Alteration of habitat suitability through the presence and extent of non-native, invasive weeds	5	5	25	-
Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat	5	5	25	-
Predation by feral predators (e.g., cats, foxes)	5	5	25	-
Total/25 (contributing to habitat quality score)			**18**	

Potential or known threats to species occurring on Mt Tabor to be addressed in OAMP	Scope	Severity	Score	Contributing to habitat quality score*
Northern quoll (*Dasyurus hallucatus*)				
Poisoning through ingestion of cane toads (*Rhinella marina*)	1	2	2	Yes
Loss of ground cover as a consequence of unsuitable fire, resulting in risk of increased predation and/or reduced food	4	4	16	Yes
Loss of ground cover as a consequence of livestock grazing	5	4	20	Yes
Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat	5	5	25	-
Alteration of habitat suitability through the presence and extent of non-native, invasive weeds	5	5	25	-
Predation by feral predators (e.g., cats, foxes, wild dogs)	5	5	25	-
Poisoning through 1080 baiting	5	5	25	-
Total/25 (contributing to habitat quality score)			**13**	
Koala (*Phascolarctos cinereus*)				
Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat	5	5	25	-
Mortality due to vehicle collision	5	5	25	-
Predation by feral predators, particularly wild or domesticated dogs	5	4	20	Yes
Alteration of the structure of suitable habitat, including loss of primary feed trees, as well as direct mortality as a consequence of unsuitable fire regime	4	4	16	Yes
Evidence for the presence of disease within the population (i.e., *Chlamydia pecorum*)				-
Total/25 (contributing to habitat quality score)			**18**	
South-eastern long-eared bat (*Nyctophilus corbeni*)				
Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat	5	5	25	-

Potential or known threats to species occurring on Mt Tabor to be addressed in OAMP	Scope	Severity	Score	Contributing to habitat quality score*
Alteration of the structure of suitable habitat (e.g. mix of shrubby and open structure habitat) including loss of hollow-bearing trees as a consequence of unsuitable fire regime	4	5	20	Yes
Impacts on understorey habitat as a consequence of livestock grazing, impacting habitat for understorey invertebrate prey	5	5	25	Yes
Competition for hollows from native fauna species (e.g., parrots and cockatoos) and non-native fauna species (e.g., European honeybees, common myna), especially where hollows are limited	5	5	25	-
Total/25 (contributing to habitat quality score)			**23**	
Large-eared pied bat (*Chalinolobus dwyeri*)				
Potential of reduced foraging opportunities and flying invertebrate productivity as a consequence of unsuitable fire regime	4	5	20	Yes
Predation by feral predators (e.g., foxes)	5	5	25	-
Loss of sandstone roosting/maternity sites, whether through occupation by pest animal species (e.g., goats) or impacts to structural integrity from uncontrolled wildfire	5	5	25	-
Total/25 (contributing to habitat quality score)			**20**	

*Based on habitat quality scoring method described in Appendix E.

Table A4 – Habitat quality scores for REs contributing to the offset area 1 for each MNES

RE	Area (ha)	Average habitat quality score /10								
		Collared delma	Yakka skink	Dunmall's snake	Red goshawk	Squatter pigeon (southern)	Northern quoll	Koala	South-eastern long-eared bat	Large-eared pied bat
11.3.2	34.8	7.7	7.0	7.7 k	7.7	8.7	7.3	8.0	8.3	8.0
11.3.39	828.0	7.5	6.8	7.5	7.5	8.3	7.0	8.0	8.3	7.8
11.10.4	2,109.2	7.3	7.0	7.3	7.7	8.7	7.3	8.3	8.3	8.0
11.10.6	885.6	7.8	-	7.8	7.8	8.5	7.5	8.5	8.8	8.0
11.10.7	43.2	8.0	7.0	7.3	8.0	8.0	7.0	8.3	8.7	8.0
11.10.11	48.2	8.0	7.0	7.7	8.0	8.3	7.7	8.3	9.0	8.0
11.10.13	1,175.6	7.3	6.5	7.7	7.3	8.3	7.3	7.8	8.3	8.0

Note: Data is only provided for REs that the threatened community or species is associated with.

Table A5 – Final area-weighted habitat quality score contribution per RE in offset area 1 for each MNES

RE	Area (ha)	Contribution to final habitat quality score /10								
		Collared delma	Yakka skink	Dunmall's snake	Red goshawk	Squatter pigeon (southern)	Northern quoll	Koala	South-eastern long-eared bat	Large-eared pied bat
11.3.2	34.8	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
11.3.39	828.0	1.2	1.3	1.2	1.2	1.4	1.2	1.3	1.4	1.3
11.10.4	2,109.2	2.9	3.4	2.9	3.1	3.5	2.9	3.3	3.3	3.2
11.10.6	885.6	1.3	-	1.3	1.3	1.4	1.3	1.4	1.5	1.3
11.10.7	43.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

RE	Area (ha)	Contribution to final habitat quality score /10								
		Collared delma	Yakka skink	Dunmall's snake	Red goshawk	Squatter pigeon (southern)	Northern quoll	Koala	South-eastern long-eared bat	Large-eared pied bat
11.10.11	48.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
11.10.13	1,175.6	1.7	1.9	1.7	1.7	2.0	1.7	1.8	2.0	1.9
Final habitat quality score		7	7	7	7	8	7	8	8	7

Note: Data is only provided for REs that the threatened community or species is associated with.

Table A6 – Habitat quality scores for REs contributing to the offset area 2 for each MNES

RE	Area (ha)	Average habitat quality score /10								
		Collared delma	Yakka skink	Dunmall's snake	Red goshawk	Squatter pigeon (southern)	Northern quoll	Koala	South-eastern long-eared bat	Large-eared pied bat
11.3.2	19.7	6.9	6.9	7.2	7.2	7.1	7.0	7.7	7.1	7.0
11.3.39	454.9	7.5	7.4	7.7	7.4	7.8	6.9	6.6	7.9	7.6
11.10.4	961.4	8.0	7.9	8.2	7.5	7.6	7.2	7.5	8.1	7.5
11.10.6	431.1	7.7	-	7.7	7.4	7.7	7.6	7.6	8.1	7.9
11.10.7	0.0	8.0	7.8	8.1	7.7	8.1	7.6	7.8	8.2	8.1
11.10.9	0.0	7.5	7.2	7.5	7.4	7.6	6.9	8.0	8.2	7.2
11.10.11	98.6	6.9	7.2	7.4	7.0	7.2	7.1	6.9	7.2	7.5
11.10.13	378.0	7.4	7.5	7.7	7.2	6.6	7.4	7.1	7.6	7.5

Note: Data is only provided for REs that the threatened community or species is associated with.

Table A7 – Final area-weighted habitat quality score contribution per RE in offset area 2 for each MNES

RE	Area (ha)	Contribution to final habitat quality score /10								
		Collared delma	Yakka skink	Dunmall's snake	Red goshawk	Squatter pigeon (southern)	Northern quoll	Koala	South-eastern long-eared bat	Large-eared pied bat
11.3.2	19.7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
11.3.39	454.9	1.5	1.8	1.5	1.4	1.5	1.3	1.3	1.5	1.5
11.10.4	961.4	3.3	4.0	3.3	3.1	3.1	3.0	3.1	3.3	3.1
11.10.6	431.1	1.4	-	1.4	1.4	1.4	1.4	1.4	1.5	1.5
11.10.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.10.11	98.6	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3
11.10.13	378.0	1.2	1.5	1.2	1.2	1.1	1.2	1.1	1.2	1.2
Final habitat quality score		**8**	**8**	**8**	**7**	**7**	**7**	**7**	**8**	**8**

Note: Data is only provided for REs that the threatened community or species is associated with.

Appendix B

Mt Tabor Voluntary Declaration and offset area boundary coordinates

Declaration notice – approval

Vegetation Management Act 1999 Sections 19E to 19G

1. Details of request

1.1. Owner's name: Gooranthuntha Traditional Owners Limited

1.2. Applicant name: Santos Limited – Mr Mitch Bird

1.3. Date request received: 8 November 2022

1.4. Request: Request for a declared area.

1.5. Property description: Lots 6 CHS25 - Maranoa Regional Council, Murweh Shire Council

1.6. Land tenure: Leasehold

1.7. Decision reference: 2022/003111

2. Declaration information

2.1. Declaration made:

The Chief Executive of the Department of Resources declares the area identified on Declared Area Map DAM 2022/003111 as an area of high nature conservation value in accordance with section 19F of the *Vegetation Management Act 1999*.

The chief executive considers the declared area to meet the following criteria under section 19G of the *Vegetation Management Act 1999*—

The declared area is an area of high nature conservation value under section 19G(1)(b), as the area is one or more of the following:

- an area containing a vegetation clump or corridor that contributes to the maintenance of biodiversity;
- another area that contributes to the conservation of the environment.

The documents outlined in **2.2** form part of this declaration.

2.2. Declaration documents:

The following documents are part of this declaration, and must be read in conjunction with this notice:

- Declared area map (DAM 2022/003111)
- Declared area management plan (DAMP 2022/003111)

2.3. Property Map of Assessable Vegetation

In accordance with s20B of the *Vegetation Management Act 1999*, the following Property Map of Assessable Vegetation has been prepared for the declared area.

- Declared area PMAV 2022/003112

2.4. Date of declaration: 4 January 2023

3. Delegated officer's signature

Jason Countryman

Natural Resource Management Officer (VM2)

4 January 2023

DECLARATION NOTICE

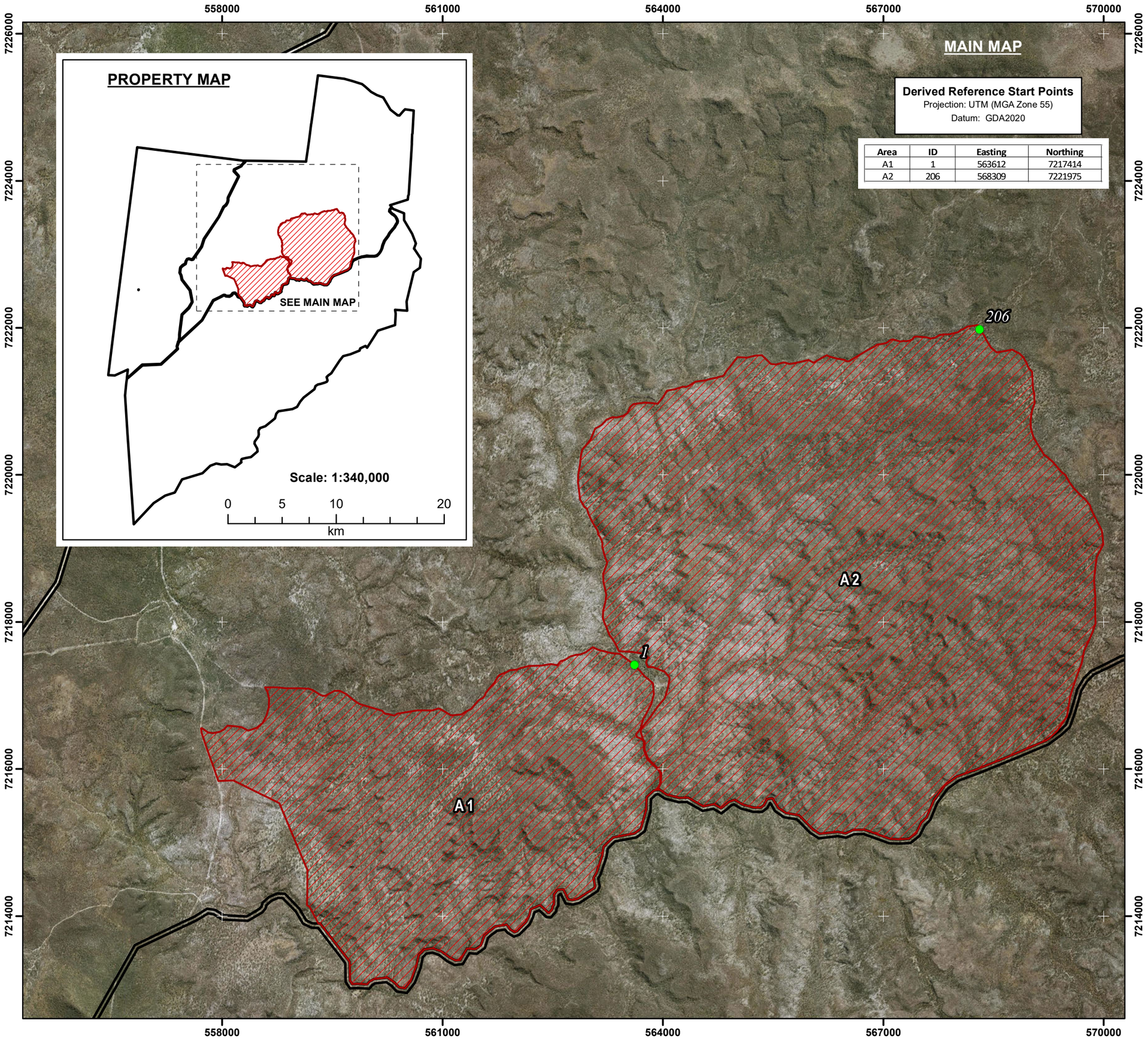
Declaration Notice issued pursuant to section 19F of the *Vegetation Management Act 1999*

Introduction

This notice is to inform you of the decision of the Department of Resources for a declaration 2022/003111 over lot 6 CHS25 - Maranoa Regional Council, Murweh Shire Council under sections 19E to 19L of the *Vegetation Management Act 1999* (VMA). These sections allow the Department of Resources to make a declaration over an area that is an area of high nature conservation value.

Reasons for the decision

The Mount Tabor Offset Area Management Plan (Mt Tabor OAMP) was developed to satisfy the conditions under the EPBC approval 2012/6615 and to satisfy the conditions under EPBC approval 2012/6615 Santos is seeking legal security of the designated offset through a Declaration under the *Vegetation Management Act 1999* (VMA).



Declaration Area Map

Sheet 1 of 1

Queensland Government

DAM 2022/003111

LOT on PLAN
6CHS25

0 1 2 3 4
km

MAIN MAP
Scale: 1:50000
(original size A3)

N

LEGEND

- Derived Reference Points
- Subject Lot(s)
- Declared A area (A1, A2)

This plan must be read in conjunction with Declaration Notice 2022/003111

Notes:

Property boundaries provided by Department of Resources.
The property boundaries on this map are a spatial representation of the property boundaries.
They are not the legal property boundaries and are subject to change as more accurate information becomes available.

classification as a result of detailed assessment.

Map Information:
Horizontal Datum: GDA 2020
Projection: Universal Transverse Mercator - Zone 55

Digital Imagery: Surat_Basin_North_20cm_SISP
Imagery Date: 08/07/2020 - 29/10/2020
Imagery Type: Digital Ortho- rectified Satellite

While every care is taken to ensure the accuracy of this product, the Department of Resource makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability, including without limitation, liability in negligence for all expenses, losses, damages (including indirect or consequential damage) and costs which might incur as a result of the product being inaccurate or incomplete in any way and for any reason. Data must not be used for direct marketing or be used in breach of the privacy laws.

This is a colour map and must be reproduced in colour

Map Prepared by: KJJ
Department of Resources,
PO Box 15216
CITY EAST QLD 4002

Map Preparation Date:03/01/2023

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147°34'0"E 147°36'0"E 147°38'0"E 147°40'0"E

25°4'0"S 25°6'0"S 25°8'0"S 25°10'0"S 25°12'0"S

OffsetArea	ID	Easting	Northing
Area 1	1	568902	7221606
Area 1	2	569098	7220385
Area 1	3	569996	7219000
Area 1	4	569730	7218482
Area 1	5	569418	7216638
Area 1	6	567561	7215796
Area 1	7	567390	7215215
Area 1	8	566135	7215119
Area 1	9	565488	7215604
Area 1	10	564977	7215582
Area 1	11	563935	7215719
Area 1	12	563984	7215971
Area 1	13	563686	7216515
Area 1	14	564056	7217081
Area 1	15	564096	7217232
Area 1	16	563814	7217358
Area 1	17	563593	7217631
Area 1	18	563370	7217571
Area 1	19	563161	7218642
Area 1	20	562829	7219860
Area 1	21	562852	7220290
Area 1	22	563240	7220803
Area 1	23	564430	7221175
Area 1	24	566556	7221547
Area 1	25	568269	7222014
Area 1	26	559234	7217066
Area 1	27	559558	7217079
Area 1	28	560314	7216736

OffsetArea	ID	Easting	Northing
Area 1	29	560979	7216826
Area 1	30	561207	7216727
Area 1	31	561850	7217317
Area 1	32	563400	7217549
Area 1	33	563852	7217181
Area 1	34	563660	7216518
Area 1	35	563964	7215955
Area 1	36	563701	7215189
Area 1	37	563066	7214537
Area 1	38	562326	7214151
Area 1	39	561239	7213402
Area 1	40	560753	7213545
Area 1	41	560199	7213157
Area 1	42	559906	7214525
Area 1	43	559758	7215632
Area 1	44	559742	7216099
Area 1	45	559209	7216316
Area 1	46	559666	7214691
Area 1	47	559706	7213967
Area 1	48	559129	7214184
Area 1	49	559130	7214644
Area 1	50	558756	7215532
Area 1	51	558136	7215857
Area 1	52	558145	7215660
Area 1	53	558004	7215669
Area 1	54	557723	7216554
Area 1	55	558354	7216523
Area 1	56	558582	7217117

OffsetArea	ID	Easting	Northing
Area 2	1	562482	7222749
Area 2	2	563131	7222563
Area 2	3	564263	7221722
Area 2	4	564348	7221193
Area 2	5	563218	7220848
Area 2	6	562806	7220309
Area 2	7	562779	7219853
Area 2	8	563111	7218644
Area 2	9	563307	7217620
Area 2	10	561827	7217362
Area 2	11	561203	7216783
Area 2	12	560986	7216876
Area 2	13	560568	7216821
Area 2	14	560568	7216821
Area 2	15	559812	7222711
Area 2	16	560158	7222744
Area 2	17	560100	7224588
Area 2	18	559863	7225954
Area 2	19	559733	7226192
Area 2	20	559838	7226493
Area 2	21	561354	7226469
Area 2	22	561546	7225761
Area 2	23	562234	7225216
Area 2	24	562229	7224762
Area 2	25	561475	7223645
Area 2	26	561608	7223307
Area 2	27	560925	7222346
Area 2	28	561056	7222178
Area 2	28	561160	7222435

GDA2020 Zone 55 projection

SANTOS

Figure B1
Offset area boundary

Offset area

Offset area coordinate

Area 1

Area 2

Location diagram

N

0 1 2 3

Kilometres

Date: 6/05/2025 Coordinate System: GDA2020 Scale: 1:52,000@A3

AUTHOR: S.Worrall

Path: P:\GIS\Data\Projects\Santos\20250416_Roma_Stage8_OAMPs\Mt Tabor\MtTabor_OAMP_mapping_20250429.aprx

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Appendix C

Risk assessment

Risk assessment summary

The following risk assessment assess the potential risk of failing to achieve the management objectives, interim performance targets and completion criteria for the offset area as outlined in this OAMP.

For each risk identified, the potential consequence of the risk (rated from 1 (no impact) to 6 (irreversible impact; Table C1) was assessed against the likelihood of that risk occurring (Table C2) to determine a risk rating. The risk rating was evaluated by using the matrix in Table C2.

The consequence and likelihood of each risk was first considered without the management measures in place to provide an initial risk rating. The consequence and likelihood of each risk occurring was then reassessed following the implementation of the management measures to provide a residual risk rating.

Table C3 provides the risk register which was used to document the findings of the risk assessment process.

Table C1 – Consequence rating relative to offset value

	Consequence
I	No impact to MNES Value
II	Small-scale impact to MNES
III	Moderate-scale impact to MNES
IV	Large-scale impact to MNES
V	Extensive population or community scale impact to MNES
VI	Irreversible impact to MNES.

Table C2 – Likelihood classification and risk matrix

Santos Risk Matrix

Santos

Consequence							
	Safety	**Negligible Harm** + No bodily damage or minimal harm or impairment (hours to days)	**Minor Harm** + Short term impairment (days to weeks)	**Moderate Harm** + Temporary disablement or medium term impairment (weeks to months)	**Severe Harm** + Long term/life altering disablement or impairment	**Single Fatality OR Critical Life Threatening Injuries**	**Multiple Fatalities**
	Environment	+ No impact to Environmental Value (EV).	+ Small-scale impact to EV(s) of conservation significance + Potential surface or groundwater impact.	+ Moderate-scale impact to EV(s) of conservation significance + Localised surface or groundwater impact.	+ Large-scale impact to EV(s) of conservation significance + Moderate-scale surface water impact; + Localised impact to groundwater with potential or known beneficial use.	+ Extensive population or community scale impact to EV(s) of conservation significance + Extensive impact to other EV(s).	+ Irreversible impact to EV(s).
	Community & Reputation	+ No actual or potential community criticism + Details remain within Santos sites and/or offices	+ Minor level local community criticism (< week) + No reputation impact	+ Local community criticism (> week) or one-day community protest + Local company reputation impacted	+ State-level community criticism or protest over multiple days/locations + State-based company reputation impacted + Very short-term share price impact (< week)	+ National community criticism or large scale protest + Company reputation and approvals impacted + Shareholder intervention or short-term share price impact (< month)	+ Sustained national community criticism or widespread protest + Industry reputation and approvals impacted + Changes at executive/board level or long-term share price impact (> month)
	Financial (A$)	< $30k	$30k to $300k	$300k to $3m	$3m to $30m	$30m to $300m	> $300m
	Workforce	+ Will require some staff attention over several days. + No actual or potential impact to culture	+ Will require several days local management time. + Minor impact to employee engagement and limited staff turnover	+ Will require head office staff and take several weeks of site management time. + Moderate impact to employee engagement and staff turnover above industry average with some key roles	+ Will require several weeks of senior management time + Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession	+ Will require several months of senior management time + Impact to employee engagement (< 18 months), high staff turnover and attraction issues	+ Will require more than a year of senior management involvement and operations severely disrupted + Impact to employee engagement (> 18 months), significant key role turnover and attraction issues
	Compliance	+ Non-conformance with legislation, instruments (e.g. tenure licence) or contract + No regulatory or punitive action	+ Minor breach of legislation, instruments or contract + Notification/report to; request for information by; and/or administrative/ warning notice from the regulator + LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator	+ Limited number of minor breaches of legislation, instruments or contract + Statutory notice from the regulator + LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator	+ Systemic minor breaches (or one moderate breach) of legislation, instruments or contract + Company charged with an offence with minor penalty/fine + LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases	+ Systemic moderate breaches (OR single material breach) of legislation, instruments or contract + Company charged with an offence with moderate penalty/fine	+ Material breaches of legislation, instruments or contract + Company or officers charged with an offence with material penalty/fine, or loss of tenure/operatorship

Likelihood			I	II	III	IV	V	VI
	ALMOST CERTAIN (< 4 monthly) Occurs in almost all circumstances OR could occur *within days to weeks*	f	Low	Medium	High	Very High	Very High	Very High
	LIKELY (4 monthly - 1 yearly) Occurs in most circumstances OR could occur *within weeks to months*	e	Low	Medium	High	High	Very High	Very High
	OCCASIONAL (1 - 3 yearly) Has occurred before in Santos OR could occur *within months to years*	d	Low	Low	Medium	High	High	Very High
	POSSIBLE (3 - 10 yearly) Has occurred before in the industry OR could occur *within the next few years*	c	Very Low	Low	Low	Medium	High	Very High
	UNLIKELY (10 - 30 yearly) Has occurred elsewhere OR could occur *within decades*	b	Very Low	Very Low	Low	Low	Medium	High
	REMOTE (30 - 100 yearly) Requires exceptional circumstances and is unlikely even in the long term OR only occurs as a *"one in 100 year event"*	a	Very Low	Very Low	Very Low	Low	Medium	Medium

Table C3 – Risk assessment and management

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
Achieve the completion criteria including habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Completion criteria and habitat quality improvements are not achieved	Degradation of habitat.	D	IV	H	Implementation of this OAMP, including the management actions and monitoring program outlined in Section 6 and Section 7. Implementation of the adaptive management process outlined in Section 5. Obtain advice with the aim of identifying appropriate additional management interventions if interim performance targets are not achieved for one or more offset values by year 5,10 or 15. If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the OAG. The revised OAMP will be submitted to the Commonwealth Government.	Management actions to support the improvement of the offset area condition, and thereby achieve completion criteria, will be implemented as outlined in this OAMP for the lifetime of the OAMP. Habitat quality assessment will be undertaken in year 1 and then every two years for the first six years, and then every three years thereafter. Interim habitat quality score performance targets are defined for years 5, 10, and 15.	B	IV	L	Monitoring of offset value habitat quality scores and condition of habitat will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Rapid monitoring events (Section 7.6.1). • Habitat quality assessments to determine habitat quality scores (Section 7.6.2). • Targeted fauna surveys (Section 7.6.4). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures or revising the type of measures to be implemented. • Modifying the strategic grazing regime to better support enhancement of offset values. • For offset values that have not achieved interim performance targets by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions. • If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the OAG. The revised OAMP will be submitted to the Commonwealth Government.

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
Maintain the extent of offset value habitat within the offset area.	Habitat or vegetation loss through land clearing.	A violation to the voluntary declaration and this OAMP, resulting in a loss of biodiversity and extent of threatened species habitat.	D	V	H	Protection of the offset area via a Voluntary Declaration under Section 19E and 19F of the VM Act, as described in Section 2.8.	Conditions of the Voluntary Declaration under Section 19E and 19F of the VM Act will place for the life of EPBC 2012/6615. Restrictions outlined in Table 13 will therefore be implemented for the lifetime of the project and OAMP.	B	V	M	Reporting to the Commonwealth Government consistent with EPBC approval.	Any activities in contravention of the Voluntary Declaration and this OAMP.	**Step 1: Investigate cause of trigger** • Investigate reasons why unapproved clearing occurred e.g. unauthorised access. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Addition fencing, signage and/or security for the offset area. • Restoration of the impacted area.
						Comply with the restrictions outlined in Table 13. Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in accordance with Sections 6.2.2, 6.2.3 and 6.2.4. Restoration of impacted areas subject to any unauthorised clearing.	At all times	B	V		Compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks will also be assessed as part of offset area inspections (Section 7.1).	Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with the restrictions outlined in Section 6.2.2, 6.2.3, and 6.2.4.	Step 1: Investigate cause of trigger • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately. • Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
													out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.
Ensure that the livestock grazing restrictions outlined in Section 6.2.4 for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Degradation of habitat by livestock overgrazing.	Over grazing induced suppression and displacement of native flora and fauna species, reflected in environmental monitoring results and annual reports.	E	III	H	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses and promote the establishment of native perennial grass species in accordance with Section 6.2.4. Annual biomass monitoring (Section 7.2) to inform strategic grazing regimes. Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 6.2.4 including an assessment of % cover of native perennial grasses.	Biomass monitoring (Section 7.2) will be undertaken twice a year, at the end of the wet season and end of the dry season. Offset area inspections and rapid monitoring events will be undertaken once and twice per year, respectively, for the duration of the management period and will report on any major or noticeable changes to livestock grazing regimes.	B	III	L	Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.6.1 and 7.6.2. These will include assessment of % cover of native perennial grasses and incidental flora surveys.	Decrease in the richness and average % cover of native perennial grasses at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime. • Installing additional watering points for livestock to manage livestock in accordance with the grazing regime.
Minimise predation risk by feral animals to threatened fauna species.	Predation by wild dogs. Predation by feral cats. Predation by foxes.	Reduction in the abundance and diversity of native fauna species within the offset area, as well as possible reduction in the population density and growth of threatened species.	D	III	M	Regular monitoring for pest animals will be undertaken in accordance with the methods detailed in Section 7.5 and pest animal control will be implemented following the results of monitoring in accordance with Section 6.2.6.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results. Frequency and duration of management will be appropriate to the target species biology, and extent of occurrence.	C	III	L	Monitoring will assess the relative abundance of foxes, dogs and feral cats within the offset area. Camera monitoring will be undertaken every two years, post wet season, to provide a measure of the Catling index for each species. See Section 7.5.	An increase in Catling* Index for either wild dog, feral cat, or fox from year 1 and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in the: – Catling* index for wild dogs, feral cats and/or foxes. – relative abundance of feral pigs and horses. • Review adherence to pest management control measures as outlined in Section 6.2.6. • Identify appropriate corrective actions.
Minimise degradation of offset value habitat by feral horse and feral pig.	Degradation of habitat by feral horses.	Reduction in the species cover and diversity of native	D	III	M	Regular monitoring for pest animals will be undertaken in accordance with the	The requirement for and timing of pest animal management will be	C	III	L	The presence of, or signs of horses will be documented during offset	An increase in the observed presence of feral horses	

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
		vegetation ground cover, as a result of impacts including but not limited to horse/pig trampling, grazing, and uprooting.				methods detailed in Section 7.5 and pest animal control will be implemented following the results of monitoring in accordance with Section 6.2.6.	informed by annual pest animal monitoring results. Frequency and duration of management will be appropriate to the target species biology, and extent of occurrence.				area inspections, twice yearly.	across monitoring events.	**Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency and intensity of pest animal control. • Revising methods of pest animal control in accordance with DAF guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the OAMP and targeted pest animal control programs.
	Degradation of habitat by feral pigs.										Pest monitoring activities will be undertaken every two years, post wet season. Assessment for the presence or absence of feral pig signs as a measure of abundance will be undertaken at permanent monitoring transects which have been randomly stratified across the offset area in environments that are more regularly impacted. See Section 7.5.	An increase in mean feral pig abundance score from year 1 and subsequent monitoring events.	
Manage invasive weed species to reduce degradation of offset value habitat.	Invasion of habitat by weed species, including exotic grasses.	An increase in either the abundance or diversity of weed species.	D	III	M	Implement weed control actions in accordance with Section 6.2.5. Adhere to weed hygiene restrictions in accordance with Table 13. Regular weed monitoring will be undertaken in accordance with Section 7.4. Based on the results of monitoring events, weeds will be managed using biological, chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets, for the relevant weed species (see Section 6.2.5).	Weed treatment and control will be undertaken at optimal timing according to the lifecycle of the target species, i.e. before seeding. Frequency and duration of management will be appropriate to the target species biology, severity and extent of infestation.	C	III	L	The offset area will be monitored for weeds every two years (post-wet season) to determine the species richness and abundance, for the duration of the management period. See Section 7.4 for more detail.	An increase in species richness and relative abundance of weed species at more than 20% of monitoring sites from year 1 and subsequent monitoring events. A new weed species is identified at one or more monitoring sites.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds. • Investigate potential sources or reasons for the occurrence of the new weed species. • Review adherence to weed management control measures as outlined in Section 6.2.5. • Review adherence to weed hygiene restrictions as outlined in Section 6.2.1. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Amending weed hygiene restrictions. • Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to.

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
													• Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld). • Increasing the frequency and intensity of weed control. • Updating weed control methods in the OAMP and targeted weed control programs.
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	Inappropriate fire regimes.	Decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events as a result of fire management measures, or an unplanned fire.	D	IV	H	Fuel loads within the offset area will be managed through strategic livestock grazing and fuel hazard reduction burns as outlined in Section 6.2.4. Firebreaks will be established and maintained around the boundary of the offset area, with green firebreaks established where the offset area joins native vegetation. Firebreaks will be maintained at least annually in mid / late autumn and, or early spring to remove overhanging trees or fallen debris and dense vegetation.	If deemed necessary, fuel load management will be carried out when required during suitable climatic conditions, as outlined in Section 6.2.4.	B	IV	L	Fuel loads will be monitored as a result of habitat quality assessments to determine habitat quality scores, in accordance with Section 7.6.2. Rapid monitoring events will be undertaken to assess the general condition of vegetation in accordance with Section 7.6.1.	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores. • Review adherence to the fire management measures as outlined in Section 6.2.4. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass monitoring. • Increasing the frequency of weed control measures. • Amending the strategic grazing regime. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks. • Review timing and intensity of fuel hazard reduction burns in accordance with the REDD fire management guidelines and conservation advice for the particular offset value.

Management Objective	Risk	Event or Circumstance	Risk Rating			Mitigation Measure	Timing, Frequency or Duration	Residual Risk Rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk Level			Likelihood	Consequence	Risk Level			
Achieve the interim performance targets and completion criteria for each offset value within 5, 10, 15 and 20 years, respectively.	Interim performance targets are not achieved for offset values by year 5, 10 or 15.	Offset fails to achieve the interim performance targets and completion criteria within the anticipated 5-, 10-, 15- and 20-year timeframes, respectively.	E	III	H	All management actions outlined in Section 6 will be implemented to ensure that the interim performance targets and completion criteria are achieved. Monitoring of the offset area will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Offset value assessments (Section 7.6). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	Management methods and actions will occur during seasonally suitable timing, in collaboration with the landholder and contractor undertaking the scope of work. Monitoring will occur in accordance with the implementation schedule, see Section 9.	B	III	L	Monitoring of the offset area will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Offset value assessments (Section 7.6). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values.

Santos

Appendix D

Overall Fuel Hazard Assessment Guide

Department of Sustainability and Environment

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management

report no. 82

State Government Victoria

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management, report no. 82

By Francis Hines, Kevin G Tolhurst, Andrew AG Wilson and Gregory J McCarthy

This publication was produced with the support of the Attorney-General's Department of the Australian Government, who part funded this project through the Natural Disaster Resilience Grants Program.

Images have been provided by Department of Sustainability and Environment – Victoria, Department of Environment and Heritage – South Australia, Country Fire Service – South Australia, Department of Conservation and Environment – Western Australia and Christian Pearson – Misheye. Katy Friend drew the illustrations.

Cover image: Elaine – Atchison Rd Fire, Victoria, January 2008. Bark Hazard – Extreme, Elevated Fuel Hazard – Moderate, Near-surface Fuel Hazard – Low, Surface Fuel Hazard – Very High. Overall Fuel Hazard – Extreme. Fire burning under FFDI 17 – High.

Published by the Victorian Government Department of Sustainability and Environment
Melbourne, July 2010

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Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

Printed by Stream Solutions
Printed on 100% Recycled paper

ISBN 978-1-74242-676-1 (print)
ISBN 978-1-74242-677-8 (online)

For more information contact the DSE Customer Service Centre 136 186

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1. About this guide

1.1 Purpose

The main purpose of this guide is to allow people to:

- make a rapid, visual assessment of fuel arrangement, and
- gain an understanding of how this will affect the chances of controlling a bushfire.

1.2 Audience

This guide has been principally designed to provide information on fuel arrangement to be used by:

- firefighters to assess the difficulty of controlling a bushfire.

Information on fuel arrangement may also be used by:

- asset owners and managers to assess potential bushfire risks to assets
- land and fire managers to provide a measurable objective and trigger for fuel management in fire management plans
- personnel to identify which key attributes and fuel layers are contributing the most to the hazard
- personnel to plan and conduct planned burns
- personnel to assess the effectiveness of planned burning or mechanical hazard reduction
- fire behaviour analysts to produce fire-spread predictions and community warnings.

Those who use the guide for these other purposes need to be mindful of its limitations and how the results are applied and interpreted.

1.3 What fuel is assessed

This guide is for assessing fine fuels that burn in bushfires. Fine fuels are the fuels that burn in the continuous flaming zone at the fire's edge. They contribute the most to the fire's rate of spread and flame height. Typically, they are dead plant material, such as leaves, grass, bark and twigs thinner than 6mm thick, and live plant material thinner than 3mm thick. Once ignited, these fine fuels generally burn out within two minutes.

This guide focuses on assessing the key structural layers of the fine fuel complex, in particular those of bark, elevated, near-surface and surface fuels.

1.4 How the fuel is assessed

Each fuel layer is assessed simply and visually. Assessing the fuel takes only a few minutes and is based on the premise that the eye is better able to integrate local variations in fuel than systematic measurement. Each fuel layer is assessed in turn and given a hazard rating. Particular emphasis is placed on how the fuel is arranged within each of these layers. The hazard ratings are then combined to produce an Overall Fuel Hazard Rating that ranges from Low to Extreme.

1.5 Why fuel arrangement is more important than fuel load

The image below highlights the effect that changing the arrangement of the fuel can have on fire behaviour. Both fires were ignited at the same time in the same way. Both fires are burning in the same fuel load, approximately two broadsheets of newspaper over a 20cm diameter area. The fuel on the right was laid flat and has little vertical orientation. The fuel on the left was crumpled up, which gave it more vertical orientation and exposed more of the surface to the air. As a result, the fire on the left shows significantly greater flame height and the fuel is consumed much faster.

The simple difference in the arrangement of the fuel significantly affects the resulting fire behaviour. The effect would not be discerned if the fuel assessment was based purely on fuel load. An assessment of fuel hazard takes into account the fuel arrangement. It gives a better indication of potential fire behaviour and suppression difficulty.

1.6 Suppression difficulty is not just about fire behaviour

This guide has been mainly developed to allow people to assess the impact of fuel arrangement on suppression difficulty. An assessment of suppression difficulty (how hard it is to control a bushfire) is not based solely on the anticipated fire behaviour. Many other factors affect the chances of a firefighting operation succeeding, including resources, fire size and terrain.

In order to consider the impact of fuels, the other factors need to be treated as if they are constant. The factors that have been held constant are referred to as the Reference Extended First Attack Conditions. Further detail on these conditions is contained in Appendix 1.

1.7 Basis of the Overall Fuel Hazard classification

A comprehensive explanation of this guide is contained in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep.).

This assessment guide updates and builds on work previously published by Wilson (1992a, 1992b, 1993), McCarthy *et al*. (1998a, 1998b, 1998c, 1999, 2001), the Department of Environment and Heritage (2006) and Gould *et al*. (2007a, 2007b).

Classifying Overall Fuel Hazard is complex, with few available measurements. Therefore, we have relied on the perceptions of experienced fire personnel (e.g. fire behaviour specialists, fire managers and firefighters). The collective experience of these personnel is vast, with a broad geographic base across Australia.

1.8 Need for continual learning and development

Although our knowledge about fuels has many gaps, this guide is based on the best available information and experience. The authors acknowledge that this guide will need to change and improve as more information is obtained.

Observers of firefighting operations can improve future editions of this guide by carefully recording what they see. Observations, comments and feedback can be emailed to fire.monitoring@dse.vic.gov.au.

2. How to use the guide

This guide has been kept concise and should not be considered as a standalone document. To produce reliable and consistent results requires extra knowledge which may be gained through local hands-on training in fuel assessment.

2.1 Application

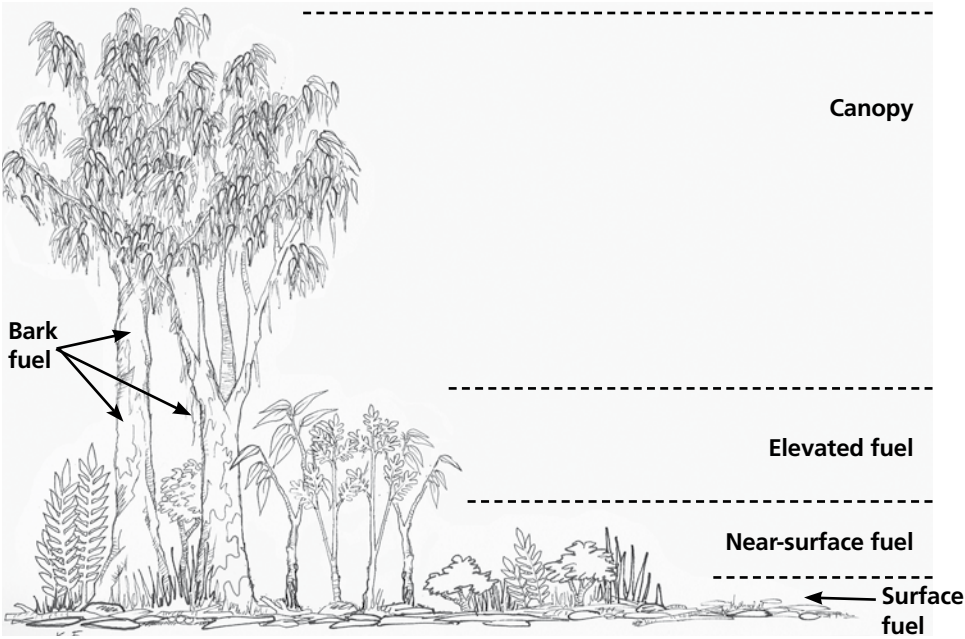
This guide is a tool for rapidly assessing fuel arrangement and its effect on the chances of controlling a bushfire. It may also be used for a range of other fire management purposes, as shown in the table below. Users of this guide should understand the underlying assumptions and limitations before applying it, particularly if applying it for purposes other than the assessment of suppression difficulty.

Application	Methodology
Assess suppression difficulty	Assess the fuels in which the fire may occur or is actually occurring.
Assess fuels for predicting potential risk to assets	Assess the fuels immediately adjacent to the asset as part of an assessment of possible radiant heat loads and defendable space. Assess the fuels further away from the asset; paying particular attention to areas that may generate spotting, such as ridges. Assessments should be focused, particularly in the direction of likely fire attack.
Assess the need for, or success of, fuel management activities	Assess the average fuels across the nominated area by sampling within major vegetation types, slopes and aspects.
Plan and conduct planned burns	Assess the variability in fuels across the nominated area by sampling within major vegetation types, slopes and aspects. Pay particular attention to areas where the burn may escape, such as the tops of gullies, ridge tops and areas adjacent to planned burn boundaries.
Assess fuels for predicting fire behaviour	Assess the fuel values needed as inputs for the appropriate fire behaviour model.

2.2 Fuel layers

Fuel in forests, woodlands and shrublands can be divided into four layers, each based on its position in the vegetation profile (Fig 2.1). This guide focuses on assessing the key structural layers of the fine fuel complex, those of bark, elevated, near-surface and surface fuels.

Figure 2.1 Fuel layers and bark



Use the following descriptions to determine how to separate vegetation into fuel layers.

Layer	Description	Contribution to suppression difficulty
Canopy	• Crowns of the tallest layer of trees. • Under some conditions canopy fuels can play a significant role in fire behaviour and suppression difficulty. Currently, however, these fuels are not assessed as part of Overall Fuel Hazard.	
Bark fuel	• Bark on tree trunks and branches, from ground level to canopy.	Spotting
Elevated fuel	• Fuels are mainly upright in orientation. • Generally most of the plant material is closer to the top of this fuel layer. • Sometimes contains suspended leaves, bark or twigs. • Fuels that have a clear gap between them and the surface fuels. • Can be highly variable in ground coverage. • Low-intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.	Influences the flame height and rate of spread of a fire.
Near-surface fuel	• Live and dead fuels, effectively in touch with the ground, but not lying on it. • Fuel has a mixture of vertical and horizontal orientation. • Bulk of the fuels are closer to the ground than to the top of this layer, or are distributed fairly evenly from the ground up. • Sometimes contains suspended leaves, bark or twigs. • Coverage may range from continuous to having gaps many times the size of the fuel patch. • Low-intensity fire (flame height of less than 0.5m) will consume most or all of this fuel. • Fuel in this layer will always burn when the surface fuel layer burns.	Influences the rate of spread and flame height of a fire.
Surface fuel (litter)	• Leaves, twigs, bark and other fine fuel lying on the ground. • Predominantly horizontal in orientation.	Influences the rate of spread of a fire.

This guide is for assessing fine fuels only. Coarse fuels including logs are not considered. See Section 1.3 for further details.

The descriptions of the fuel layers exclude references to species' names or common vegetation forms, such as shrubs. During a plant's life it may transition back and forth between different layers. For example, juvenile bracken fern can be classified as near-surface fuel before becoming elevated fuel as it matures. Once it dies and collapses it may become near-surface fuel again.

2.3 Assessment based on key attributes of fuel hazard

A fuel hazard rating of Low, Moderate, High, Very High or Extreme is assigned to each fuel layer by assessing it against the key attributes listed below.

Key attribute	
Horizontal continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel beside it. Identifies which of surface, near-surface or elevated fuels will determine the average flame height.
Vertical continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel above it.
Amount of dead material in the layer	Determines how much dead material is present to burn and thus help with igniting the live (green) fuels.
Thickness of the fuel pieces	Determines whether the fuel pieces will burn in the flaming front of the fire.
Total weight of fine fuel	Determines the weight of fine fuel contributing to the flaming front of the fire.

The descriptions in the hazard assessment tables do not cover all possible combinations of the key attributes. Users will need to exercise judgement and make an assessment using all key attributes when actual conditions fit between the descriptions.

2.4 Using the descriptions and photographs

This is **not** a photographic guide for assessing fuels. The **descriptions** for each of the key attributes should be used as the basis for determining the fuel hazard rating. Photographs cannot adequately show all of the key attributes that are important in determining fuel hazard. The photographs are provided to illustrate **some** of the key attributes for each fuel hazard rating. They do not represent all possible variations of that particular hazard rating.

2.5 Area of assessment

Within an area of interest fuels are assessed in small patches or plots. The size and number of plots depends on the reason for assessing the fuels. Some applications (such as for input into fire behaviour models) may require a more rigorous and systematic approach to sampling. Other applications (such as assessing fuel hazard during firefighting operations) will necessitate a more rapid informal approach. For whatever purpose the guide is being used it is recommended that the following principles be applied:

- Any assessment of fuels should try to assess the variability in fuels across an area by assessing the fuels at multiple plots.
- The size and number of plots should reflect the level of reliability required of the results.
- For surface, near-surface and elevated fuel layers the result of assessing the plot should reflect the average state of that fuel layer.
- For bark hazard the result of assessing the plot should be based on the trees with the highest rating.
- Always record with the result the name and the version of the guide used.

2.6 Tips for assessing fuel hazard

The process of assessing fuel hazard using this guide is largely subjective. Implementing the following techniques will help to improve accuracy and reliability:

- Identify and agree on examples of the highest rating of fuel hazard for each layer that occur locally. These examples should be used as benchmarks.
- Conduct assessments in pairs of observers and regularly change assessment pairs.
- Assessors should be no more than one hazard rating apart when assessing each layer (e.g. Low or Medium, not Low or High).
- Use different assessors to re-assess completed work and provide feedback.

2.7 Vesta fire behaviour predictions

In dry eucalypt forest with a litter and shrub understorey the *Field guide – fuel assessment and fire behaviour prediction in dry eucalypt forest* (Gould *et al.* 2007b) provides a systematic method for assessing fuel and predicting fire behaviour (rate of spread, flame height, and spotting). The Project Vesta fuel hazard scoring system is similar to the Victorian system developed by Wilson (1992a, 1992b, 1993) and revised by McCarthy *et al*. (1999). The scale that underlies the Vesta fuel hazard scores is directly related to fire behaviour. These scores, along with height measurements of various fuel layers, are needed as inputs into the fire behaviour prediction tables in Gould *et al*. (2007b). Section 9.3 contains a table for translating the fuel hazard rating for each fuel layer into Vesta fuel hazard scores.

2.8 Effect on fire behaviour

Each table for assessing fuel hazard contains information on the effect that the fuel arrangement is likely to have on fire behaviour. This effect is for weather conditions equivalent to a Forest Fire Danger Index (FFDI) of 25 (McArthur 1973). An FFDI of 25 can be achieved in many ways. For the purposes of this guide the specific conditions required to achieve this are:

Temperature: 33°C	Relative Humidity: 25%	Wind Speed: 20km/h
Drought Factor: 10	Slope: 0°	

If weather conditions vary from those listed above the effect on fire behaviour will also vary.

2.9 Fuel assessment data sheet

Appendix 2 contains a sample field data sheet that can be used when assessing fuels.

3. Bark fine fuel

3.1 Identification

Bark fuel is the bark on tree trunks and branches. Bark lying on or near the ground or draped over understorey plants is considered to be surface, near-surface or elevated fuel.

3.2 Identifying bark types

The key attributes for assessing the effect of bark on suppression difficulty are shown below:

Key attribute	Determines	How it is assessed
Ease of ignition	• How readily the bark will ignite. • Whether the fire will burn up the trunk and into the branches of the tree.	Thickness, size and shape of bark pieces.
How bark is attached	• How likely the bark is to break off the tree.	How easily the bark breaks off the tree.
Quantity of combustible bark	• Volume of potential embers that a fire may generate.	Relative quantity of combustible bark.
Size-to-weight ratio of the bark pieces	• How far the wind is likely to carry bark pieces once they break off the tree.	Thickness, size and shape of bark pieces.
Burn out time	• Length of time a piece of bark will stay ignited once it breaks off the tree.	Thickness, size and shape of bark pieces.

Descriptions of trees have been separated into three broad bark types using three of these key attributes – ease of ignition, burn out time and size-to-weight ratio:

1. Fine fibrous barks, including stringybarks
2. Ribbon or candle barks
3. Other bark types, including smooth, platy, papery and coarsely fibrous. The reason for describing these types in some detail is to help observers distinguish them from the above two types.

3.3 Identifying Stringybark and other fine fibrous bark types

Contribution to suppression difficulty	• Bark types that can produce massive quantities of embers and short distance spotting.
Physical description	• Bark is fine fibrous material with easily visible fibres less than 1mm thick covering the whole trunk. • Bark fibres resemble the fine fibres that are twisted together to form natural string. • Old bark is retained on the trunk of the tree for decades, forming a relatively spongy fibrous mass with deep vertical fissures. • Outer bark may weather to a greyish colour, while underlying bark retains its original colour. • Bark may form large strands when peeled off. • Fine, hairlike pieces also break off from the tree when it is rubbed.
Ease of ignition	• Bark is very flammable (can be easily lit with a match when dry). • Fires will readily climb the tree and branches.
How bark is attached	• Young or new bark is held tightly to the trunk. • As bark ages it becomes less tightly held. • Old, long-unburnt bark is held very loosely.
Quantity of combustible bark	• Bark on old, long-unburnt stringybarks can be more than 10cm in depth. During fires it can produce massive quantities of embers.
Size-to-weight ratio	Burning pieces of bark tend to be either: • Very fine lightweight fibres that will be carried for less than 100m. • Small lightweight wads (about the size of a thumb) that will be carried for less than 300m. • Very large wads (bigger than a fist) that fall close to the tree.
Burn out time	• Very fine fibres of bark that will burn out within one minute. • Small wads of bark that will burn out within 2–3 minutes. • Very large wads of bark that will burn for up to 10 minutes.
Hazard accumulation	• Bark hazard can reach Extreme. • Bark hazard increases over time as the thickness and looseness of the old bark increases. • Repeated low intensity fires (<0.5m flame height) may produce a 'black sock' effect on the base of the trunk, but this may have limited effect in reducing the overall quantity of bark and the hazard.

Examples

Table 3.1 Assessing the hazard of fine fibrous bark types including stringybarks

Only use this table if at least 10% of the trees in a forest have fine fibrous bark. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[1]
How bark is attached	**Quantity of combustible bark**		
This hazard rating cannot occur when only this bark type is present.		Low	
Bark tightly held. Requires substantial effort to break off bark by hand.	Very little combustible bark. Entire trunk almost completely black or charred.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Bark is mostly tightly held with a few pieces loosely attached.	Limited amount of combustible bark. 50–90% of trunk charred. Most of the bark is charred, especially on the lower part of the trunk.	High	Infrequent spotting. Fires will climb some of these trees.
Many pieces of bark loosely held. Deep fissures present in bark.	Large amounts of combustible bark. 10–50% of trunk charred. Upper parts of the tree may not be charred at all.	Very High	Substantial spotting. Fires will climb most of these trees.
Outer bark on trees is weakly attached. Light hand pressure will break off large wads of bark. Deep fissures present in bark.	Huge amounts of combustible bark. <10% of trunk charred. Minimal evidence of charring.	Extreme	Quantity of spotting generated makes fire control very difficult or impossible. Fires will climb virtually all these trees.

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as being the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

1 FFDI 25 is a Forest Fire Danger Index of 25 (McArthur 1973). Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.2 Examples of Stringybarks and other fine fibrous bark hazard

Low	This hazard rating cannot occur when only this bark type is present.
Moderate	
High	
Very High	
Extreme	

The photos above show some of the variation possible within each bark hazard rating.

3

3.4 Identifying ribbon or candle bark types

Effect on suppression difficulty	• Bark types that can produce substantial quantities of spotting at distances greater than 2km. Will also produce short distance spotting.
Physical description	• Trees characterised by the annual shedding of old bark layers, exposing the smooth new bark underneath. • Bark is shed in the form of long strips or ribbons of bark. • Long strips of bark curl tightly inwards to form a candle-like shape (see image lower right). • Bark strips 50cm or more in length fall off and often drape around the trunk and over branches and surrounding shrubs. • Strips of bark are usually less than 2mm thick. • Bark is shed at various times of the year so that the trunk may have a mottled appearance.
Ease of ignition	• Bark is moderately flammable (can be lit with a cigarette lighter when dry). • Fires will climb up ribbons of bark.
How bark is attached	• Bark strips may drape over, or be weakly attached to, the trunk and branches.
Quantity of combustible bark	• Large quantities of bark can be retained in upper trunk and head of the tree.
Size-to-weight ratio	• Bark pieces are relatively light for their large size. • Easily transported by strong updrafts – may travel up to 30km downwind.
Burn out time	• Bark can burn and smoulder within the curled up ribbons for longer than 10 minutes.
Hazard accumulation	• Bark hazard never exceeds Very High. • Bark hazard tends to increase over the long term as ribbons accumulate on the tree. • A low intensity fire (flame height of less than 0.5m) may not reduce the hazard in this bark type.

Example

Note: Loose ribbon or candle-like bark that is retained on the trunk near ground level is not included in the assessment of ribbon or candle bark types. It is usually:
- firmly attached to the trunk of the tree
- consumed in place by a surface fire.

This bark is considered in 'Other bark types' and can also be considered as near-surface fuel.

Smooth-bark trees also shed bark as slabs or flakes. These bark types are considered in 'Other bark types'.

Table 3.3 Assessing the hazard of ribbon or candle bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site.

Key attribute Amount of combustible bark	Hazard rating	Effect on fire behaviour (at FFDI 25)[2]
This hazard rating cannot occur when only this bark type is present.	Low	
No long ribbons of bark present. Trunk and branches of trees almost entirely smooth.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Long ribbons of bark present on upper trunk (>4m above ground) and in head of trees. Lower trunk mainly smooth.	High	Infrequent spotting. Fires will climb some of these trees.
Long ribbons of bark in the head and upper trunk with: • ribbons hanging down to ground level or, • flammable bark covers trunk.	Very High	Substantial spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.	Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

2 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.4 Examples of ribbon or candle bark hazard

Low	This hazard rating cannot occur when only this bark type is present.
Moderate	
High	
Very High	
Extreme	This hazard rating cannot occur when only this bark type is present.

3.5 Identifying other bark types

This bark type includes all other bark types not included in the previous two types. As a result, many different tree species are grouped together. This grouping is based on the ease of ignition, burn out time and size-to-weight ratio of the bark, rather than on botanical values. These other bark types can produce limited quantities of short distance spotting.

This bark type group has been divided into several subgroups. These subgroups are described in some detail to help observers distinguish them from the other two main bark types.

3.5.1 Ironbarks and Platy barks

Physical description	• Trees characterised by layers of old, coarse bark retained on the trunk and branches. • Bark becomes rough, compacted and furrowed with age • Bark feels very abrasive when rubbed by hand. • Bark pieces tend to be more than 2mm thick when they break off. • There may be little or no evidence of charring on the bark following planned burns.
Hazard accumulation	• Bark hazard never exceeds Moderate.

Example

3.5.2 Coarsely fibrous barks

Physical description	• Trees characterised by short strand fibrous bark. • Layers of old dead bark are retained on the trunk and branches. • Unlike stringybark trees, the bark on these trees forms only short strands or chunks when peeled off. • Evidence of charring on the bark may last for up to 10 years.
Hazard accumulation	• Bark hazard never exceeds High. • Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.3 Papery barks

Physical description

- Shrubs and trees growing from 2m to 30m tall, often with flaky shedding bark.
- Old bark is retained on the trunk and branches and builds up into a thick spongy mass.
- Bark layers tend to split allowing sheets of bark to become loose and eventually peel off.
- Evidence of charring on the bark may last for up to 10 years.

Hazard accumulation

- Bark hazard never exceeds High.
- Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.4 Slab bark, smooth bark and small flakes

Physical description

- Trees characterised by the annual shedding of old bark layers, exposing the smooth living bark underneath.
- Bark shed is often seasonal and often annual.
- Species where the old bark tends to peel into large slabs (<50cm in length) or small flakes when shed.
- Most of the bark falls off the tree soon after it is shed.
- Some small amounts of bark may be retained on the stem or branches for several months before falling off, leading to a mottled effect.
- The mottled effect leads to discontinuous bark fuel up the tree.

Hazard accumulation

- Bark hazard never exceeds Moderate.
- Bark hazard tends to be seasonal.

Example

Table 3.5 Assessing the hazard of other bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[3]
How bark is attached	**Quantity of combustible bark**		
No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.		Low	No bark present that could contribute to fire behaviour.
Bark rubs off by hand with firm pressure.	Limited amount of combustible bark.	Moderate	Spotting generally does not hinder fire control. Fires will climb some of these trees.
Light hand pressure will break bark off.	Large amounts of combustible bark.	High	Infrequent spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.		Very High	
This hazard rating cannot occur when only this bark type is present.		Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

3 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

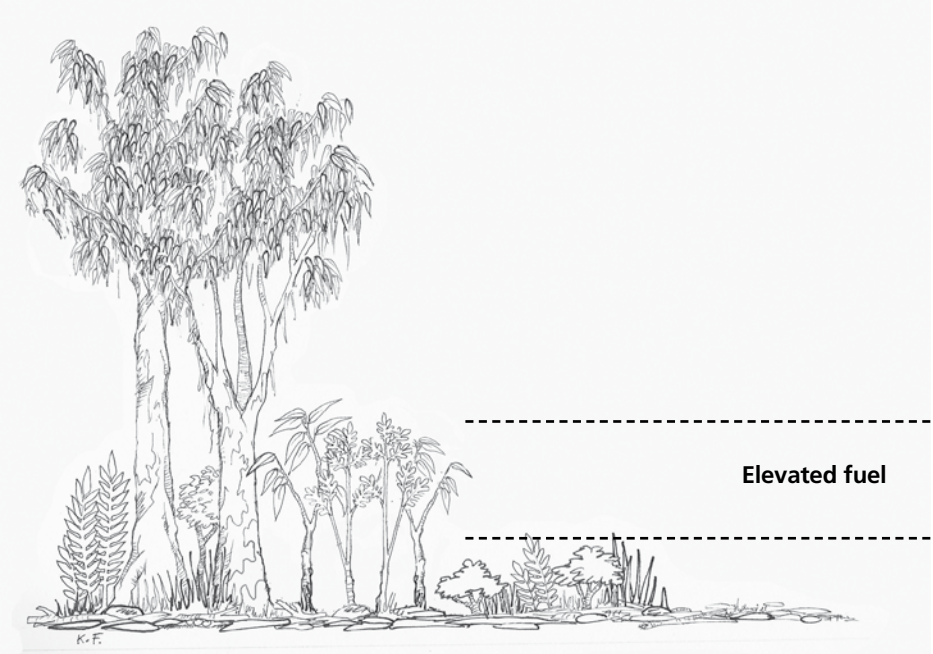
Table 3.6 Examples of other bark types

Low	No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.	
Moderate		
High		
Very High	Does not occur when this is the only bark type present on a site.	
Extreme	Does not occur when this is the only bark type present on a site.	

4. Elevated fine fuel

4.1 Identification

- Fuels are mainly upright in orientation
- Generally most of the plant material is closer to the top of this layer
- Sometimes contains suspended leaves, bark or twigs
- Fuels that have a clear gap between them and the surface fuels
- Elevated fuel can be highly variable in ground coverage
- A low intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.



4.2 Assessment

The elevated fuel hazard is highest when the:

- foliage, twigs and other fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and/or horizontal and vertical continuity that promotes the spread of flames
- live foliage has low fuel moisture content.

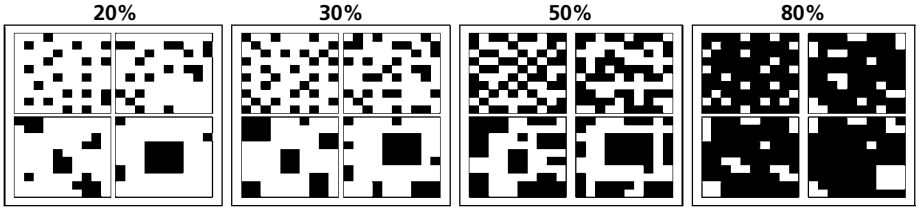
Table 4.1 Assessing elevated fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes					Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[4]
Plant Cover	% dead	Vertical continuity	Vegetation density	Thickness of fuel pieces		
<20% or low flammability species	<20%		Easy to walk in any direction without needing to choose a path between shrubs.		Low	Little or no effect.
20–30%	<20%	Most of the fine fuel is at the top of the layer.	Easy to choose a path through but brush against vegetation occasionally.		Moderate	Does not sustain flames readily.
30–50%	<20%	Most of the fine fuel is at the top of the layer.	Moderately easy to choose a path through, but brush against vegetation most of the time.		High	Causes some patchy increases in the flame height and/or rate of spread of a fire.
50–80%	20–30%	Continuous fine fuel from the bottom to the top of the layer.	Need to carefully select path through.	Mostly less than 1–2mm thick.	Very High	Elevated fuels mostly dictate flame height and rate of spread of a fire.
>70%	>30%	Continuous fine fuel from the bottom to the top of the layer.	Very difficult to select a path through. Need to push through vegetation.	Large amounts of fuel <2mm thick.	Extreme	Elevated fuels almost entirely determine the flame height and rate of spread of a fire.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



4 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 4.2 Examples of elevated fine fuel hazard

Low	Elevated fuel absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

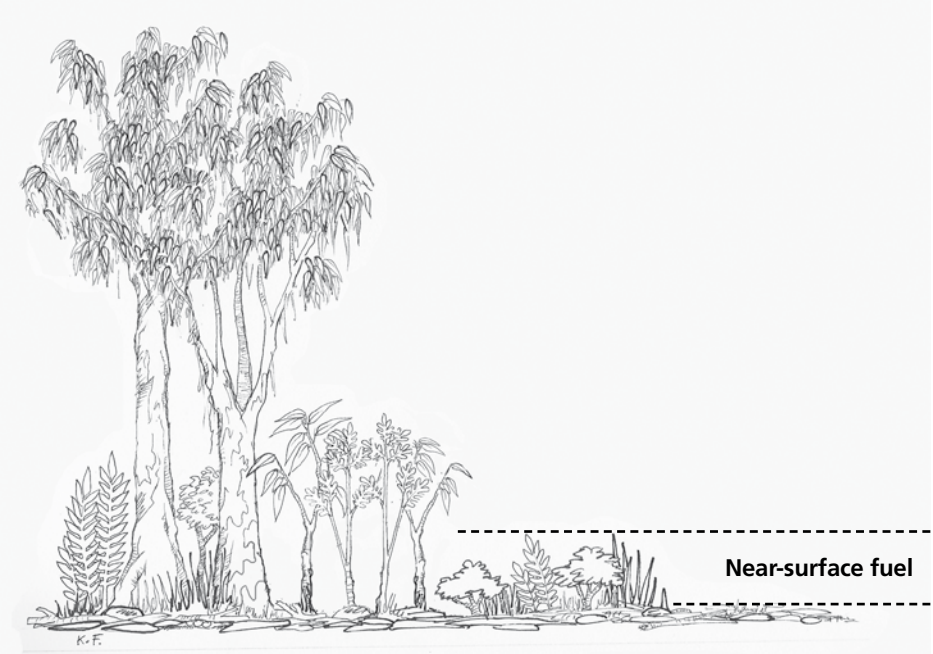
Assess elevated hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of elevated fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the elevated fuel height (m) should be the average of 10 measurements taken along a 300m walk-through. Measure the typical height from ground level.

5. Near-surface fine fuel

5.1 Identification

- Live and dead fuels effectively in touch with the ground but not lying on it
- Fuel has a mixture of vertical and horizontal orientation
- Either the bulk of the fuels is closer to the ground than the top of this layer, or is distributed fairly evenly from the ground up
- Sometimes contains suspended leaves, bark or twigs
- Coverage may range from continuous to having gaps many times the size of the fuel patch
- A low intensity fire (flame height of less than 0.5m) will consume most or all of this fuel
- Fuel in this layer will always burn when the surface fuel layer burns.



5.2 Assessment

The near-surface fuel hazard is highest when the:

- foliage, twigs and other fine fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and /or horizontal and vertical continuity, that promotes the spread of flames
- live foliage has low fuel-moisture content.

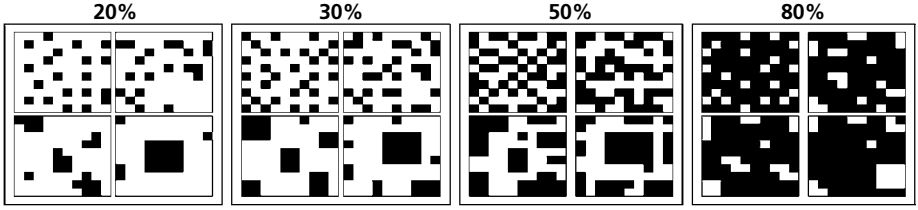
Table 5.1 Assessing near-surface fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[5]
Plant cover	% dead	Horizontal connectivity		
<10%	<10%	Near-surface fuel is absent or virtually absent.	Low	Little or no effect.
10–20%	<20%	Gaps many times the size of fuel patches.	Moderate	Occasionally increases flame height.
20–40%	>20%	Gaps between fuel patches are greater than the size of fuel patches. Starting to obscure logs and rocks.	High	Contributes to surface fire spread and causes patchy increase to flame height.
40–60%	>30%	Fuel patches are equal to or larger than the gaps between the fuel patches.	Very High	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.
>60%	>50%	Very small gaps between fuel patches. Logs and rocks obscured.	Extreme	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



5 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 5.2 Examples of near-surface fine fuel hazard

Low	Near-surface fuel is absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

Assess near-surface hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of near-surface fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the near-surface fuel height (cm) should be the average of 10 measurements taken over a 300m walk through. Measure the typical height from ground level.

6. Surface fine fuel

6.1 Identification

- Leaves, twigs, bark and other fine fuel lying on the ground
- Predominantly horizontal in orientation
- Usually contributes the most to fuel load or quantity
- Includes the partly decomposed fuel (duff) on the soil surface.

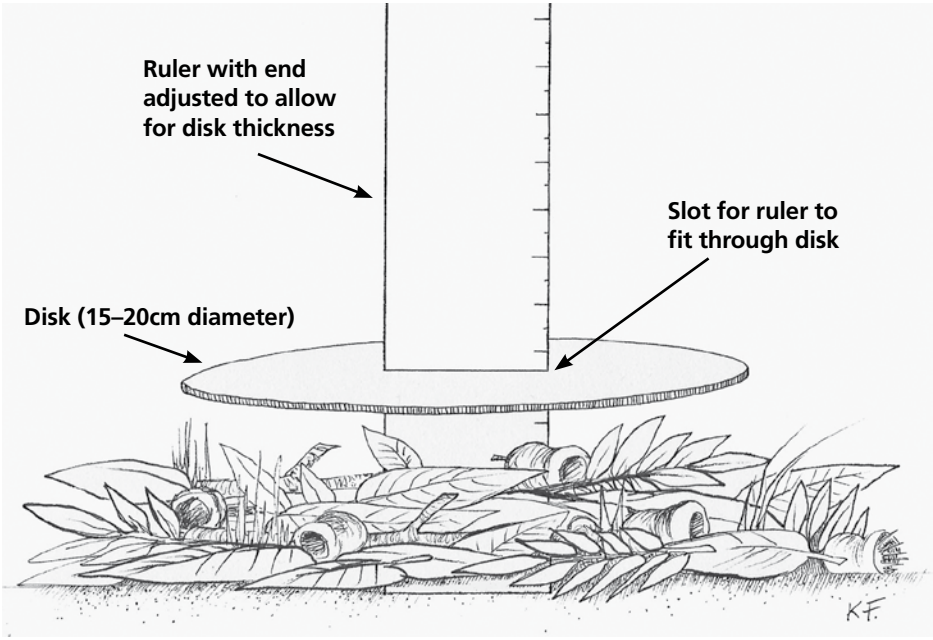
6.2 Assessment

The surface fine fuel hazard is highest when the:

- litter pieces are well connected
- surface litter cover is high, with minimal interruption from rocks, logs or patches of bare soil
- surface litter has substantial depth (greater than 30mm).

6.3 Measurement

Surface litter-bed depth should be measured using a simple depth gauge, as pictured below. This follows the methodology described in McCarthy (2004) and McCarthy *et al*. (1999).



Litter depth should be measured in areas where near-surface fuels do not obscure the litter. Fuel depth is measured using a 15cm circular disk with a ruler through a slot in its centre. To use this gauge, a small gap is made in the litter bed down to mineral soil, then the end of the ruler is placed resting on the mineral soil surface. The disk is pushed down with light pressure until its whole perimeter is in contact with the fuel. Light pressure can be described as 'enough pressure to hold a tennis ball under water'. The ruler is read off level with the top of the disk. Note that the end of the ruler needs to be adjusted to match the thickness of the disk.

Five measurements of litter bed depth should be made at each site. The average of these measurements is one of the attributes that can be used to determine the surface fine fuel hazard.

Table 6.1 Assessing surface fine fuel hazard

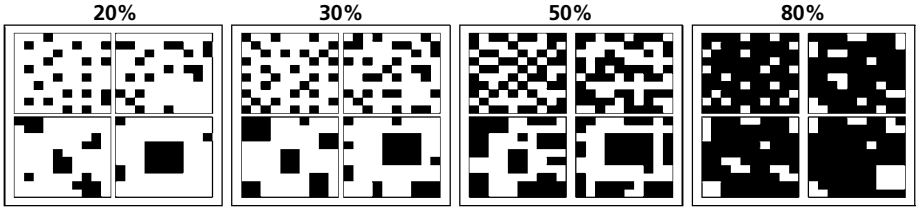
To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[6]
Horizontal connectivity	Surface litter cover	Litter-bed depth		
Litter poorly interconnected. Large areas of bare soil or rock. More soil than litter. Soil surface readily visible through litter bed.	<60%	Very thin litter layer <10mm	Low	Surface fires will not spread.
Litter well connected. Some areas of bare soil or rock. Soil surface occasionally visible through litter bed.	60–80%	Thin litter layer 10–25mm	Moderate	Litter connected well enough to allow fire spread to overcome bare patches.
Litter well connected. Little bare soil.	80–90%	Established litter with layers of leaves ranging from freshly fallen to decomposing. 20–30mm	High	Surface fires spread easily with a continuous fire edge.
Litter completely connected.	>90%	Thick litter layer 25–45mm	Very High	Surface fires spread easily. Increasing flame depth and residence time.
Litter completely connected.	>95%	Very thick layer of litter >35mm	Extreme	Surface fires spread easily. Increasing flame depth and residence time.

Assess surface hazard over a plot 10m in radius. Assessing multiple plots will give better results. For each plot litter bed depth should be an average of five measurements (McCarthy 2004) or more.

See Section 9.3 for application of surface fuel hazard ratings for the Vesta fire behaviour tables.

The following visual guide can be used to assist in assessing surface litter cover. Each quarter of any one square has the same percent cover.



6 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 6.2 Examples of surface fine fuel hazard

Low		
Moderate		
High		
Very High		
Extreme		

7. Determining the combined surface and near-surface fine fuel hazard rating

Assessments of surface and near-surface fuels must be combined together before an Overall Fuel Hazard rating can be determined. The near-surface fuel rating is used to adjust the surface fine fuel hazard rating, according to Table 7.1.

To determine the effect of near-surface fine fuel hazard:

1. Select the **surface fuel hazard rating** from column 1
2. Select the **near-surface fuel hazard rating** from column 2
3. Select the resulting **combined rating** value 3
4. Use this value to determine the Overall Fuel Hazard rating using the Table 8.1.

Table 7.1 Determining the combined surface and near-surface fine fuel hazard rating

1 Surface fine fuel hazard rating	2 Near-surface fine fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
	3 Combined surface and near-surface fine fuel hazard rating				
Low	L	L	M	H	VH
Moderate	M	M	H	VH	E
High	H	VH	VH	VH	E
Very High	VH	VH	E	E	E
Extreme	E	E	E	E	E

8. Determining Overall Fuel Hazard

Overall Fuel Hazard = (sum of the influences of) Bark Hazard + Elevated Fine Fuel Hazard + Combined Surface and Near-surface Fine Fuel Hazard.

The following table is used to combine the assessed levels of Bark, Elevated and Combined Surface and Near-surface Fuel Hazard to give an Overall Fuel Hazard rating.

To determine the Overall Fuel Hazard rating:

1. Select the row that corresponds to the **Bark Hazard** ❶
2. Select the row that corresponds to the **Elevated Fine Fuel Hazard** ❷
3. Select the column that corresponds to the assessed level of **Combined Surface and Near-surface Fine Fuel Hazard** ❸
4. Identify where these two intersect and this will provide you with the corresponding Overall Fuel Hazard rating.

Table 8.1 Determining the Overall Fuel Hazard rating

❶ Bark Hazard	❷ Elevated Fine Fuel Hazard	❸ Combined Surface and Near-surface Fine Fuel Hazard *				
		L	M	H	VH	E
Low or Moderate	L	L	M	M	H	H
	M	L	M	M	H	H
	H	L	M	H	VH	VH
	VH	VH	VH	VH	VH	VH
	E	E	E	E	E	E
High	L	L	M	H	H	H
	M	L	M	H	H	H
	H	L	H	H	VH	VH
	VH	VH	VH	VH	VH	E
	E	E	E	E	E	E
Very High or Extreme	L	L	VH	VH	VH	E
	M	M	VH	VH	E	E
	H	M	VH	E	E	E
	VH	E	E	E	E	E
	E	E	E	E	E	E

* Combined Surface and Near-surface Fine Fuel Hazard is a measure of the Surface Fine Fuel Hazard adjusted to account for the level of near-surface fine fuel (see Table 7.1).

9. Interpreting and applying Overall Fuel Hazard

9.1 Chances of extended first attack success

The chances of extended first attack being successful[1] for a fire ignited in these fuels under the reference extended first attack conditions (Appendix 1) is approximately as follows:

Table 9.1 Chances of extended first attack success

GFDI[2]	FFDI[3]	Overall Fuel Hazard rating[4]				
		Low	Moderate	High	Very High	Extreme
0–2	0–5					
3–7	6–11					
8–20	12–24					
20–49	25–49					
50–74	50–74					
75–99	75–99					
100+	100+					

Chance of extended first attack success is greater than 95% (almost always succeeds)

Chance of extended first attack success is between 95% and 50% (succeeds most of the time)

Chance of extended first attack success is between 49% and 10% (fails most of the time)

Chance of extended first attack success is less than 10% (almost always fails)

Notes:

1. Extended first attack is deemed successful when a fire is controlled by 0800hrs the day after ignition and at less than 400 hectares.
2. GFDI is the Grass Fire Danger Index at the time of ignition and is assumed to be the highest GFDI expected before 0800hrs the next day.
3. FFDI is the Forest Fire Danger Index at the time of ignition and is assumed to be the highest FFDI expected before 0800hrs the next day.
4. Chance of success is for a fire ignited in fuels with this Overall Fuel Hazard rating.
5. Predicted outcomes will differ if the conditions vary from those listed in the reference extended first attack conditions.
6. Predicted outcomes based on expert opinion and informed by work carried out by Wilson (1992b, 1993), McCarthy *et al*. (1998a, 2001) and Plucinski *et al*. (2007).

9.2 Indicative fuel loads (t/ha)

In the absence of local data obtained by sampling fuel loads destructively the following table of indicative fuel load data from Project Vesta and Victorian studies may be useful. These tonnes per hectare figures may be applied to the Forest Fire Danger Meter Mark V (McArthur 1973) for predicting forward rate of spread and flame height for forest fires.

Table 9.2 Indicative fuel loads (t/ha)

Fuel	Fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
Bark	0	1	2	5	7
Elevated	0–1	1–2	2–3	3–5	5–8
Near-surface	1–2	2–3	3–4	4–6	6–8
Surface	2–4	4–10	8–14	12–20	16–20+

9.3 Determining Vesta fuel hazard scores

The following table translates fuel hazard ratings for each fuel layer into Project Vesta fuel hazard scores. These scores can be used with the fire behaviour prediction tables in publications such as Gould *et al*. (2007b).

To determine the Vesta fuel hazard score:

1. Select the row that corresponds to the fuel hazard rating for required fuel layer (1)
2. Select the Vesta fuel hazard score column that corresponds to the same layer (2)
3. Identify where these two intersect and this will provide you with the corresponding Vesta fuel hazard score.

Table 9.3 Determining Vesta fuel hazard scores

	Vesta fuel hazard score (2)			
Fuel hazard rating (1)	**Surface**	**Near-surface**	**Elevated**	**Bark**
Low	1	1	1	0
Moderate	2	2	2	1
High	3	3	3	2
Very High	3.5	3.5	3.5	3
Extreme	4	4	4	4

Notes:

- Surface and near-surface hazard score and near-surface height (cm) is required for fire spread prediction.
- Rate of spread and elevated fuel height (m) is required for flame height prediction.
- Rate of spread, surface and bark fuel hazard scores are required for prediction of spotting distance.

Acknowledgements

This Fuel Hazard Assessment Guide updates and continues to develop work previously conducted by a number of authors. Andrew Wilson laid the foundations for this guide, with the conceptual framework presented in Research Report No. 31; and the visual guides for assessing the influence of bark and elevated fuels on suppression difficulty in the *Eucalypt Bark Hazard Guide and Elevated Fuel Guide* (Reports 32 and 35, respectively). Greg McCarthy (2004) detailed a method for rapidly assessing surface fine fuels in Research Report No. 44.

These three techniques were brought together in the first three editions of the *Overall Fuel Hazard Guide* (McCarthy, Tolhurst and Chatto, 1998b, 1998c, 1999). A subsequent unpublished edition of the guide, produced by Kevin Tolhurst (2005), provided greater detail on the assessment of near-surface fuels. In 2006, Mike Wouters adapted the guide for South Australian conditions, and incorporated the preliminary results from Project Vesta (CSIRO and Department of Conservation and Environment, Western Australia). Further information and results from the final Project Vesta report (Gould *et al.* 2007a) have also been incorporated.

Thanks to Lachie McCaw (Department of Environment and Conservation, Western Australia), Mike Wouters (Department of Environment and Heritage, South Australia), Jim Gould and Miguel Cruz (CSIRO) for their advice and comments during the production of this guide. Thanks must also go to the many other people across Australia who have provided comments and feedback during the production of the guide.

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Appendix 1. Reference extended first attack conditions

This guide assesses the impact of fuels in suppressing a fire during extended first attack, using local resources. Several factors affect the success of an extended first attack. Therefore, to consider the impact of fuels alone, the other factors must be treated as if they were constant. Table A1 below adapted from Wilson (1993) summarises reference extended first attack conditions for four fuel types.

Table A1. Revised reference extended first attack conditions

Fuel type	Forest fuels	Grass fuels	Mallee and scrub fuels	Heath fuels
Examples of typical resources (on scene within the designated arrival time)	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters	5 x 4WD heavy tankers (4000l) each with 5 firefighters	Small dozer (D4) or tractor with scrub roller 1 to 2 small 4WD tankers (400l) 6 firefighters	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters
Extended attack resources	Potential additional resources deployed to the fire during extended first attack may include heavy tankers, large plant (dozers, graders or tractors) and fire bombing aircraft.			
Arrival time	Within 60 minutes of detection			
Suppression workload	A single fire			
Topography and terrain	Burning on level ground with good access			
Fuel availability[1]	MDF is 10 or AFF is 1.0	100% grass curing	MDF is 10 or AFF is 1.0	
Wind speed[2]	20km/h	30km/h		20km/h
Fire danger rating system[3]	McArthur FFDI	McArthur GFDI	McArthur FFDI	

Notes:

1. MDF (McArthur Drought Factor) is calculated using the Forest Fire Danger Meter (McArthur 1973) and is a measure of the short-term availability of forest fuels. AFF (Available Fuel Factor) is used in Western Australia to define the proportion of litter fuel available for burning (Sneeuwjagt & Peet 1998).
2. Wind speed is measured at 10m height in the open above ground level.
3. FFDI is the McArthur Forest Fire Danger Index, GFDI is the McArthur Grass Fire Danger Index.

The rationale for the reference first attack conditions is documented in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep).

Appendix 2. Sample fuel assessment field work form v3

Date Assessed:	Assessors:
Sampling Location:	Veg Type:

Plot Information			
Plot No.			
Zone:			
Easting (GDA94 MGA UTM):			
Northing (GDA94 MGA UTM):			

Canopy height (Assess over a 20m radius)			
Average Height to Top of Canopy:	m	m	m
Average Height to Base of Canopy:	m	m	m

Bark fuel (Assess over a 20m radius)															
Stringybark Fuel Hazard:	NP	M	H	VH	E	NP	M	H	VH	E	NP	M	H	VH	E
Ribbon Bark Fuel Hazard:	NP	M	H	VH		NP	M	H	VH		NP	M	H	VH	
Other Bark Fuel Hazard:	L	M	H			L	M	H			L	M	H		

Select the Bark Hazard rating from above that will be used to determine Overall Fuel Hazard. (Only use the Stringybark hazard rating if more than 10% of the trees are Stringybark **AND** it has the highest rating. Otherwise use the bark with next highest rating.)

Bark Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Elevated fuel layer (Assess over a 10m radius)															
Elevated % Cover:	%					%					%				
Elevated % Dead	%					%					%				
Elevated Fuel Ave Height (m)	m					m					m				
Elevated Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Near-surface fuel layer (Assess over a 10m radius)															
Near-surface % Cover:	%					%					%				
Near-surface % Dead	%					%					%				
NS Average Height (cm):	cm					cm					cm				
NS Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

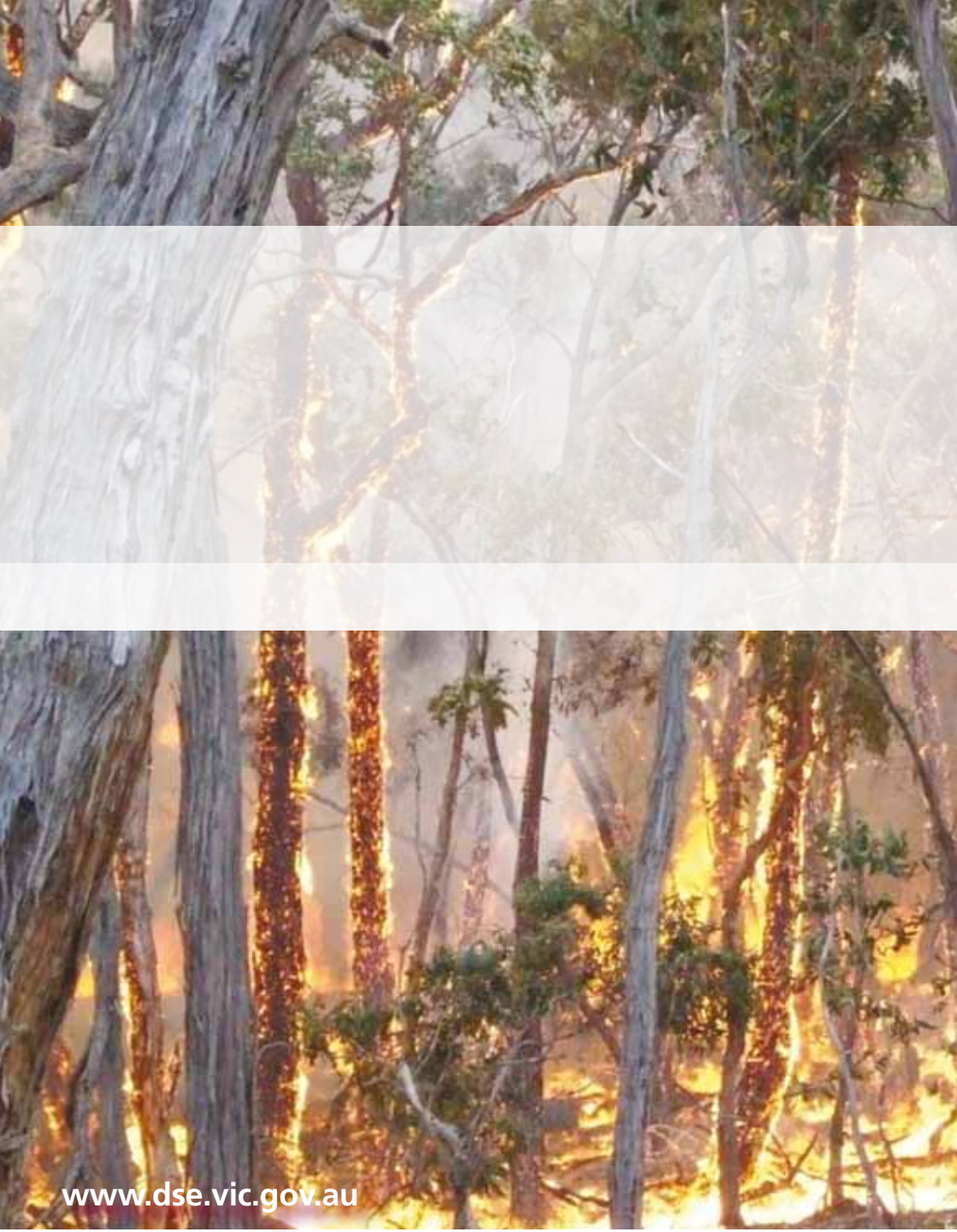
Surface fuel layer (Assess over a 10m radius)															
Surface Litter % Cover:	%					%					%				
Average Litter Depth (mm):	mm					mm					mm				
Surface Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Combined Surface and Near-surface Fine Fuel Hazard calculation (refer Section 7)															
Combined Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Overall Fuel Hazard calculation (refer Section 8)															
Overall Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Are the plots representative of the average fuels across the sampling location?	Yes	No

If no, explain any significant difference between plots. For example, wet gully runs through the sampling area, no plots were located in this gully.



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Appendix E

MNES habitat quality score method

Summary

The habitat quality score for each MNES will be assessed based on a combination of assessment methods outlined in the *BioCondition Assessment Manual*, the GTDTHQ and the methods outlined below in order to be consistent with the requirements under the EPBC Act guideline for the OAG.

MNES habitat quality score method

The habitat quality for each MNES for use in the OAG, is required to consider three attributes:

- site condition
- site context
- species stocking rate.

The following sections provide an overview of the methodology used to calculate habitat quality. All three components will be assessed for threatened fauna and flora; however, for threatened ecological communities (i.e. Brigalow TEC) only site condition and site context components will form the habitat quality score.

Site Condition

Method

The site condition score for each MNES will be calculated generally in accordance with the site-based attribute assessment methodology of the *BioCondition Assessment Manual*, outlined in the GTDTHQ. Site condition is determined through a site-based assessment of 13 ecological attributes to describe the structure and function of the vegetation community, compared to the expected range for a relatively undisturbed (intact) community (i.e. RE benchmark).

The results of site-based assessment are scored based on the scoring guide provided in the *BioCondition Assessment Manual* to determine the site condition score for each MNES at each relevant monitoring site, out of 80.

Offset assessment guide requirements

In accordance with the OAG the condition of a site is considered in relation to the ecological requirements of a threatened species or ecological community including:

- What is the structure and condition of the vegetation on the site?
- What is the diversity of relevant habitat species present (including both endemic and non-endemic)?
- What relevant habitat features are on the site?

Table E1 summarises how each of the requirements of the OAG are considered as part of determining the site condition score for an offset value.

Table E1 – Assessment of site condition

Habitat quality component	Assessment process
What is the structure and condition of the vegetation on the site?	The structure and condition of the vegetation is assessed generally in accordance with the site-based attribute assessment methodology from the *BioCondition Assessment Manual*. This assessment measures a suite of ecological attributes to describe the structure, function and integrity of the vegetation community, compared to the same vegetation community in a relatively undisturbed (intact) state (i.e. a benchmark). The condition of the vegetation community has a direct influence on its ability to support and provide habitat for biodiversity values.
What is the diversity of relevant habitat species present (including endemic and non-endemic)?	The site condition component from the *BioCondition Assessment Manual* assesses different attributes of a vegetation community comparing the relevant species richness for particular attributes against a published benchmark, including native tree, shrub, grass and forb species richness. The results of these assessments can be used to confirm the presence and diversity of habitat species relevant to the offset value.
What relevant habitat features are on the site?	The offset area for each value was initially determined based on ground-truthed RE and the presence of known habitat features identified as part of field surveys of the area, in accordance with species conservation advice and other species-specific sources endorsed by Queensland and/or Commonwealth Governments. Ongoing site condition assessments for each offset value will continue to confirm the presence of relevant habitat features within previously shortlisted, suitable vegetation communities as well as assessing their condition against the published benchmark.

Site Context

Method

The method to calculate site context for a site is based on a combination of the landscape context attributes assessment method outlined in Section 6 of the *BioCondition Assessment Manual* as well as an assessment of threats that occur on or near the site to ensure the requirements for site context under the OAG are adequately assessed.

Subregion assessment

The first step is to determine whether the given site is located within a fragmented or intact subregion in Queensland. Fragmented subregions are defined in the *BioCondition Assessment Manual* as those subregions where the amount of remnant vegetation is less than 65%, with remaining subregions considered intact. Section 6 of the *BioCondition Assessment Manual* identifies the bioregions and subregions considered either fragmented or intact. All impact and offset monitoring sites were located within fragmented subregions.

The following components were assessed through a GIS desktop analysis at each relevant monitoring site for each MNES.

Patch size (fragmented subregion)

Patch size is the size of the patch/assessment unit being assessed and any directly connecting remnant vegetation. To calculate the patch size score:

1. The area of remnant vegetation in which the monitoring site is located is measured, summing together with this all other directly connecting areas of remnant vegetation. Where a monitoring site is within an area not considered remnant vegetation (i.e. regrowth vegetation), the patch size is 0 ha.
2. Determine the score for this attribute by matching with the class ranges in Table E2.

Connectedness (fragmented subregion)

The proportion of the assessment unit's boundary which is connected to remnant vegetation is measured. To calculate the connectedness score:

1. The percentage of remnant vegetation along the boundary of the assessment unit patch containing the monitoring site was measured.
2. Determine the score for this attribute by matching with the class ranges in Table E2.

Context (fragmented subregion)

Assessment of context involves measuring the percentage of remnant vegetation within a one kilometre buffer around the monitoring site. To calculate the context score:

1. Create a 1 km buffer around the monitoring site.
2. Measure the percentage of remnant vegetation within the 1 km buffer.
3. Determine the score for this attribute by matching with the thresholds in Table E2.

Table E2 – Site context scoring guide

Attribute		Score				
Size of Patch	Score	0	2	5	7	10
	Description	<5 ha	5-25 ha	26-100 ha	101-200 ha	>200 ha
Connectedness	Score	0	2		4	5
	Description	0-10%	>10%-<50%		50-75%	>75% or >500 ha
Context	Score	0	2		4	5
	Description	<10%	>10-30%		>30-75%	>75%

Threats

The measure of threat is calculated for each MNES and is undertaken generally in accordance with Section 2.4.4.4 (Absence of threats) of the GTDTHQ. This attribute indicates the magnitude of all known or potential threats within, or within close proximity to, the matter area that may negatively impact on the species' habitat and/or the species' ability to exist and persist in the matter area.

A list of known and potential threats are first collated from the literature, including relevant conservation advices and other matter-specific sources endorsed by Queensland and/or Commonwealth Governments. Through a combination of desktop assessments and site-based assessments, a refinement of identified threats for each matter is undertaken (whether involving the removal or addition of threats), resulting in a final list of threats considered to retain a level of scope or severity.

Scope refers to the proportion of the matter's habitat or local population within the matter area that can reasonably be expected to be affected by the threat within ten years given the continuation of current circumstances and trends. Scope is scored on a five-point rating scale:

1. *Very High*: The threat is likely to be pervasive in its scope, affecting the species' habitat or the species' local population across all or most (80-100%) of its occurrence or population within the matter area.
2. *High*: The threat is likely to be widespread in its scope, affecting the species' habitat or the species' local population across a majority (60-79%) of its occurrence or population within the matter area.
3. *Medium*: The threat is likely to be restricted in its scope, affecting the species' habitat or the species' local population across some (40-59%) of its occurrence or population within the matter area.
4. *Low*: The threat is likely to be narrow in its scope, affecting the species' habitat or the species' local population across small proportion (20-39%) of its occurrence or population within the matter area.

5. *Very Low*: The threat is likely to be very narrow in its scope, affecting the species' habitat or the species' local population across a negligible proportion (1-19%) of its occurrence or population within the matter area.

Severity refers to the level of damage (given the identified scope) from the given threat to the matters' habitat/local population that can reasonably be expected given the continuation of current circumstances and trends. As with scope, severity is scored on a five-point rating scale:

1. *Very High*: Within the scope, the threat is likely to destroy or reduce the species' habitat/local population by 80-100% within ten years or three generations.
2. *High*: Within the scope, the threat is likely to seriously degrade or reduce the species' habitat/local population by 40-79% within ten years or three generations.
3. *Medium*: Within the scope, the threat is likely to moderately degrade or reduce the species' habitat/local population by 11-39% within ten years or three generations.
4. *Low*: Within the scope, the threat is likely to only slightly degrade or reduce the species' habitat/local population by 6-10% within ten years or three generations.
5. *Very Low*: Within the scope, the threat is likely to have a negligible damage or will only degrade or reduce the species' habitat/local population by 1-5% within ten years or three generations.

Using the rating scores for scope and severity, a score is assigned between 1 and 25 for each matters' threat factor in accordance with the threat matrix in Table E3 below, whereby a score of 1 represents a very high threat and 25 poses very low threat.

Table E3 – Threat matrix for scoring each threat factor according to its scope and severity

Threat Matrix			Severity				
			Very High	High	Medium	Low	Very Low
			1	2	3	4	5
Scope	Very High	1	1	2	3	4	5
	High	2	2	4	6	8	10
	Medium	3	3	6	9	12	15
	Low	4	4	8	12	16	20
	Very Low	5	5	10	15	20	25

The methodology prescribed in the GTDTHQ calculates the final score for the 'absence of threats' attribute as that of the lowest scoring (i.e., most threatening) threat factor. However, the current method has taken a more conservative approach by considering the average score for all threat factors, excluding all those with a score of 25 (i.e., excluding threat factors characterised as ones of very low severity and very low scope).

The total site context score for each MNES at each relevant monitoring site is calculated out of 45, based on the following:

1. Summing the patch size, connectedness and context scores, out of 20.
2. Calculating the average threats score, out of 25.
3. Calculating a final weighted score for site context as:
    a. 50% weighting of the combined patch size, connectedness and context
    b. 50% weighting of the threats score.

Offsets Assessment Guide requirements

In accordance with the OAG, site context is assessed based on the relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of a threatened species or ecological community, as well as identifying known or potential threats including:

- What is the connectivity with other suitable/known habitat or remnants?
- What is the importance of the site in relation to the overall species population or the occurrence of the community?
- What threats occur on or near site?

Table E4 summarises how each of the requirements above are considered as part of determining the site context score for an offset value.

Table E4 – Assessment of site context

Habitat quality component	Assessment process
What is the connectivity with other suitable/known habitat or remnants?	This component is assessed through: • Patch size – measuring the size of the patch of remnant vegetation being assessed and any directly connecting remnant vegetation. • Connectedness – measuring the proportion of the remnant patch that a given monitoring site is located within which is connected to remnant vegetation.
What is the importance of the site in relation to the overall species population or the occurrence of the community?	This component is assessed through the *BioCondition Assessment Manual* measure of context, representing the percentage of remnant vegetation within a 1 km buffer around a given monitoring site. The greater the proportion of suitable/known habitat and remnant vegetation within the buffer area the more likely the site and surrounding areas will support a viable, self-sustaining, source-meta-population of the species or community.
What threats occur on or near site?	This component is based on the assessment of the scope and severity of confirmed and potential threats occurring within, or within close proximity to the site for each MNES. A list of matter-specific threats is provided in Tables F9 – F17.

Species habitat index

Method

Species habitat index was calculated generally in accordance with the species habitat attribute assessment methodology outlined in the GTDTHQ, as well as the requirements for species stocking rate under the OAG. Table E5 summarises the method to be used to calculate the species habitat index score, out of 20. Species habitat attributes indicate a matter area's capacity to support a species for all or part of its life cycle, whether permanently or from time to time.

Each sub-component of species habitat index scoring method has been tailored for each MNES to take into account species-specific habitat requirements in accordance with conservation advices and other species specific sources endorsed by Queensland and/or Commonwealth Governments, as well as an assessment of the role of the site population in regards to the overall species population.

Table E5 – Method to assess species habitat index

Component	Sub-component/scoring	Score
Quality and availability of food and habitat required for foraging	A species-specific assessment of the quality and availability of food and habitat required for foraging, assigned as a score between 1 and 5, where: • a score of **1** represents very limited species-specific foraging habitat (e.g., litter and stone cover for collared delma), conditions or food resources available • a score of **5** represents species-specific foraging habitat, conditions or food resources are present for all relevant stages of the life cycle.	1 – 5
Quality and availability of habitat required for shelter and breeding	A species-specific assessment of the quality and availability of habitat required for shelter and breeding. Habitat required for shelter may include habitat factors required to avoid predation or other threats, rest or seeking shelter from the elements. The result of the assessment assigns a score between 1 and 5, where: • a score of **1** represents very limited species-specific shelter and breeding habitat (e.g., presence of large coarse woody debris for yakka skink), conditions or resources available • a score of **5** represents presence of abundant, available species-specific shelter and breeding habitat, conditions and resources for all relevant stages of the life cycle	1 – 5
Quality and availability of habitat required for mobility	A species-specific assessment of quality and availability of habitat required for mobility. Habitat required for mobility relates to the species' ability to move within the matter and, if relevant, to and from adjacent patches of habitat. The result of the assessment assigns a score between 1 and 5, where: • a score of **1** represents an almost complete barrier to mobility between patches of suitable habitat for the given matter, either by natural barriers (e.g., steep mountain ranges, cliffs, unsuitable habitats) or artificial barriers (e.g., infrastructure (roads, rail, mines) or extensive areas of treeless, unsuitable habitat) • a score of **5** represents limited barriers to mobility, with contiguous remnant vegetation affording relatively unimpeded movement or functional connectivity between suitable habitat patches for the given matter.	1 – 5
Role of site location to species overall population	Site not or unlikely to be critical to species' survival – Site is unlikely to support a population of the species and the site is within the given species' geographical range. The site contains low quality food, foraging and shelter habitat, with limited mobility capacity to other areas of suitable habitat.	1
	Site likely to support habitat critical to species' survival – the site is likely to support a population of the species and the site is within the given species' geographical range. The site contains moderate quality food, foraging and shelter habitat, with moderate mobility capacity to other areas of suitable habitat.	3
	Site known to support habitat critical to species' survival – there is evidence of one or more species records within the last 10 years within 5 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4
	Site is critical to the species' survival – there is evidence of multiple species records within the last 10 years and site contains high quality food, foraging and shelter habitat, with limited mobility to other areas of suitable habitat.	5

Offsets Assessment Guide requirements

In accordance with the OAG species stocking rate is assessed based on the usage and/or density of a species at a particular site and the role of the site population in regards to the overall species population viability or community extent, including:

- What is the presence of the species on the site? (i.e. confirmed / modelled).
- What is the density of species known to utilise the site?
- What is the role of the site population in regards to the overall species population?

Table E6 summarises how each of the requirements above are considered as part of determining the species habitat index score for an offset value.

Table E6 – Assessment of species stocking rate

Habitat quality component	Assessment process
What is the presence of the species on the site? (i.e. confirmed / modelled).	The components assessed as part of the method quantify the presence, density and role of the site's ability to actually or likely support a species population. It also provides a measure of the quality and availability of food, foraging habitat, shelter and breeding habitat for each species. The relative presence and density of the MNES on the site will be assessed as part of ongoing targeted surveys undertaken in accordance with the *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre *et al*. 2014), *Survey Guidelines for Australia's Threatened Birds* (DEWHA 2010), *Survey guidelines for Australia's threatened reptiles* (DSEWPaC 2011) and other species-specific survey guidelines endorsed by Queensland and/or Commonwealth Government.
What is the density of species known to utilise the site?	
What is the role of the site population in regards to the overall species population?	

Final habitat quality score

Table E7 provides a summary of the components used to score habitat quality for each MNES and the maximum score and relevant weighting for each component. The habitat quality score for each MNES is calculated as the average score across each of the monitoring sites within a given assessment unit (RE), area-weighted for the contribution of those REs to the offset area.

Table E7 – Scores for each attribute contributing to each of the three habitat quality score components, including their weightings. These scores are assigned for each monitoring point

Site condition			Site context				Species habitat index			
Attributes	**Score**	**Weighting**	**Attributes**	**Score**	**Weighting**		**Attributes**	**Score**	**Weighting**	
Recruitment of woody perennial species	5	6.25%	Size of patch	10	50%	25%	Quality and availability of food and habitat required for foraging	5	50%	16.7%
Native plant species richness - trees	5	6.25%	Connectivity	5		12.5%	Quality and availability of habitat required for shelter and breeding	5		16.7%
Native plant species richness - shrubs	5	6.25%	Context	5		12.5%	Quality and availability of habitat required for mobility	5		16.7%
Native plant species richness - grasses	5	6.25%	Threats	25	50%		Role of site location to species overall population in the state	5	50%	
Native plant species richness - forbs	5	6.25%	-	-	-		-	-	-	
Tree canopy height	5	6.25%	-	-	-		-	-	-	
Tree canopy cover	5	6.25%	-	-	-		-	-	-	
Shrub canopy cover	5	6.25%	-	-	-		-	-	-	
Native perennial grass cover	5	6.25%	-	-	-		-	-	-	
Organic litter	5	6.25%	-	-	-		-	-	-	
Large trees	15	18.75%	-	-	-		-	-	-	
Coarse woody debris	5	6.25%	-	-	-		-	-	-	
Non-native plant cover	10	12.5%	-	-	-		-	-	-	
Total	**/80**	**100%**	**Total**	**/45**	**100%**		**Total**	**/20**	**100%**	
Site condition weighting		**30%**	**Site context weighting**		**30%**		**Species habitat index weighting**		**40%**	

Table E8 – Threats and species-specific considerations informing habitat quality scoring for collared delma

Component	Attribute	Species-specific considerations
Site context	Threats	• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat • Alteration of ground cover as a consequence of unsuitable fire regime • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds • Predation by feral predators (e.g., cats, foxes, wild dogs) • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter) • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing
Species habitat index	Quality and availability of food and habitat required for foraging	• Presence and abundance of evidence of small invertebrates • Presence and cover of leaf litter and loose stones, used as shelter by prey
	Quality and availability of habitat required for shelter and breeding	• Presence and cover of leaf litter and loose stones considered suitable for sheltering
	Quality and availability of habitat required for mobility	• Presence and cover of litter and loose stones • Extent of suitable habitat as well as presence and extent of contiguous remnant/regrowth cover

Table E9 – Threats and species-specific considerations informing habitat quality scoring for yakka skink

Component	Attribute	Species-specific considerations
Site context	Threats	• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat • Predation by feral predators (e.g., cats, foxes, pigs) • Alteration of ground cover as a consequence of unsuitable fire regime • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter) • Destruction of potential shelter habitat associated with rabbit warren ripping

Component	Attribute	Species-specific considerations
		• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds
Species habitat index	Quality and availability of food and habitat required for foraging	• Evidence and abundance of insect and other arthropod prey • Presence and quality of ground foraging habitat, particularly leaf litter and native grass cover
	Quality and availability of habitat required for shelter and breeding	• Presence and abundance of coarse woody debris, particularly large, hollow-bearing logs used as shelter • Any direct evidence of occupation (e.g., burrows, communal defecation sites)
	Quality and availability of habitat required for mobility	• Extent of suitable habitat as well as presence and extent of contiguous remnant/regrowth cover

Table E10 – Threats and species-specific considerations informing habitat quality scoring for Dunmall's snake

Component	Attribute	Species-specific considerations
Site context	Threats	• Alteration of ground cover as a consequence of unsuitable fire regime • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat • Predation by feral predators (e.g., cats, foxes, pigs) • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds
Species habitat index	Quality and availability of food and habitat required for foraging	• Presence and cover of leaf litter and coarse woody debris, used as shelter by prey
	Quality and availability of habitat required for shelter and breeding	• Presence and abundance of coarse woody debris, particularly large, hollow-bearing logs used as shelter
	Quality and availability of habitat required for mobility	• Extent of suitable habitat as well as presence and extent of contiguous remnant/regrowth cover

Table E11 – Threats and species-specific considerations informing habitat quality scoring for red goshawk

Component	Attribute	Species-specific considerations
Site context	Threats	• Loss of suitable foraging habitat through land clearing and effects associated with fragmentation of large contiguous patches of forest and woodland, particularly large trees in alluvial valleys • Potential of reduced prey (e.g., medium sized birds) as a consequence of unsuitable fire regime • Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity • Lack of permanent freshwater, both in proximity to shelter habitat (i.e. tall trees) as well as role in supporting medium-sized bird prey
Species habitat index	Quality and availability of food and habitat required for foraging	• Presence and abundance of medium-sized birds • Presence and abundance of suitable habitat for medium-sized birds (i.e. intact canopy, shrubs, wetlands etc)
	Quality and availability of habitat required for shelter and breeding	• Presence and abundance of trees ≥ 18 m, • Presence of an intact, contiguous canopy cover • Remoteness from human disturbance, characterised by large contiguous tracts of remnant and regrowth vegetation
	Quality and availability of habitat required for mobility	• Extent of suitable habitat as well as presence and extent of contiguous remnant/regrowth cover

Table E12 – Threats and species-specific considerations informing habitat quality scoring for squatter pigeon (southern)

Component	Attribute	Species-specific considerations
Site context	Threats	• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat • Change in ground layer composition as a consequence of grazing and ecosystem engineering actions by rabbits (e.g. burrowing, soil turnover) • Change in ground layer composition and trampling ground nests as a consequence of livestock grazing and feral horse browsing, especially in grassy, alluvial areas

Component	Attribute	Species-specific considerations
		• Change in ground layer composition, including thickening of understorey structure, as a consequence of unsuitable fire regime • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds • Predation by feral predators (e.g., cats, foxes)
Species habitat index	Quality and availability of food and habitat required for foraging	• Presence and quality of low, open grassy woodland • Proximity to water • Presence of sparse to mid-dense native grass cover
	Quality and availability of habitat required for shelter and breeding	• Presence and quality of open grassy woodland
	Quality and availability of habitat required for mobility	• Extent of suitable habitat as well as presence and extent of contiguous remnant/regrowth cover

Table E13 – Threats and species-specific considerations informing habitat quality scoring for northern quoll

Component	Attribute	Species-specific considerations
Site context	Threats	• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat • Poisoning through ingestion of cane toads (*Rhinella marina*) • Loss of ground cover as a consequence of unsuitable fire, resulting in risk of increased predation and/or reduced food • Loss of ground cover as a consequence of livestock grazing • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds • Predation by feral predators (e.g., cats, foxes, wild dogs) • Poisoning through 1080 baiting

Component	Attribute	Species-specific considerations
Species habitat index	Quality and availability of food and habitat required for foraging	• Presence and quality of habitat for prey (i.e., insects, small vertebrates), namely the abundance and diversity of litter, woody debris, logs, surface rocks, crevices, grass and shrub layers. • Proximity of foraging habitat and food within 1 km of shelter sites
	Quality and availability of habitat required for shelter and breeding	• Presence and proximity to rocky den sites, characterised by deep clefts and fissures in rocks
	Quality and availability of habitat required for mobility	• Extent of suitable habitat as well as presence and extent of contiguous remnant/regrowth cover • Presence and quality of grass and shrub layers • Presence of temporary shelter such as boulders, logs. • Presence of known or potential predators (e.g., cats, dogs) • Proximity of shelter sites within 5 km

Table E14 – Threats and species-specific considerations informing habitat quality scoring for koala

Component	Attribute	Species-specific considerations
Site context	Threats	• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat • Mortality due to vehicle collision • Predation by feral predators, particularly wild or domesticated dogs • Alteration of the structure of suitable habitat, including loss of primary feed trees, as well as direct mortality as a consequence of unsuitable fire regime • Evidence for the presence of disease within the population (i.e., *Chlamydia pecorum*)
Species habitat index	Quality and availability of food and habitat required for foraging	• Extent and dominance of myrtaceous trees (i.e., *Eucalyptus*, *Angophora*, *Corymbia*) • Abundance and extent of large trees used for foraging

Component	Attribute	Species-specific considerations
		• Presence of favoured feed species (e.g., *E. tereticornis, E. camaldulensis, E. major, E. longirostrata*), as well as other feed trees (*E. chloroclada, E. populnea, E. crebra, E. melanophloia, E. orgadophila, Corymbia citriodora*) • Presence of nearby waterbodies and ephemeral or perennial watercourses
	Quality and availability of habitat required for shelter and breeding	• Presence and extent of large myrtaceous trees (i.e., *Eucalyptus*, *Angophora*, *Corymbia*)
	Quality and availability of habitat required for mobility	• Extent of suitable habitat as well as presence and extent of contiguous remnant/regrowth cover

Table E15 – Threats and species-specific considerations informing habitat quality scoring for south-eastern long-eared bat

Component	Attribute	Species-specific considerations
Site context	Threats	• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat • Alteration of the structure of suitable habitat (e.g. mix of shrubby and open structure habitat) including loss of hollow-bearing trees as a consequence of unsuitable fire regime • Impacts on understorey habitat suitability as a consequence of livestock grazing and feral horse browsing, impacting habitat for flying invertebrate prey in the understorey • Competition for hollows from native fauna species (e.g., parrots and cockatoos) and non-native fauna species (e.g., European honeybees, common myna), especially where hollows are limited
Species habitat index	Quality and availability of food and habitat required for foraging	• Presence of an intact, mature canopy cover • Presence and extent of white cypress pine (*Callitris glaucophylla*) favoured as foraging habitat
	Quality and availability of habitat required for shelter and breeding	• Presence and abundance of decorticating and loose bark on trees used for shelter and breeding • Presence and abundance of small tree hollows used for shelter and breeding
	Quality and availability of habitat required for mobility	• Extent of suitable habitat as well as presence and extent of contiguous remnant/regrowth cover

Table E16 – Threats and species-specific considerations informing habitat quality scoring for large-eared pied bat

Component	Attribute	Species-specific considerations
Site context	Threats	• Potential of reduced foraging opportunities and flying invertebrate productivity as a consequence of unsuitable fire regime • Loss of sandstone roosting/maternity sites, whether through occupation by pest animal species (e.g., goats) or impacts to structural integrity from uncontrolled wildfire • Predation by feral predators (e.g., foxes)
Species habitat index	Quality and availability of food and habitat required for foraging	• Presence of an intact, mature canopy cover • Presence of heterogenous forest matrix providing forest edges suitable/favourable for foraging
	Quality and availability of habitat required for shelter and breeding	• Presence of sandstone cliff lines with deep fissures, particularly horizontal fissures and/or caves
	Quality and availability of habitat required for mobility	• Extent of suitable habitat as well as presence and extent of contiguous remnant/regrowth cover

Appendix E

Springwater Offset Area Management Plan

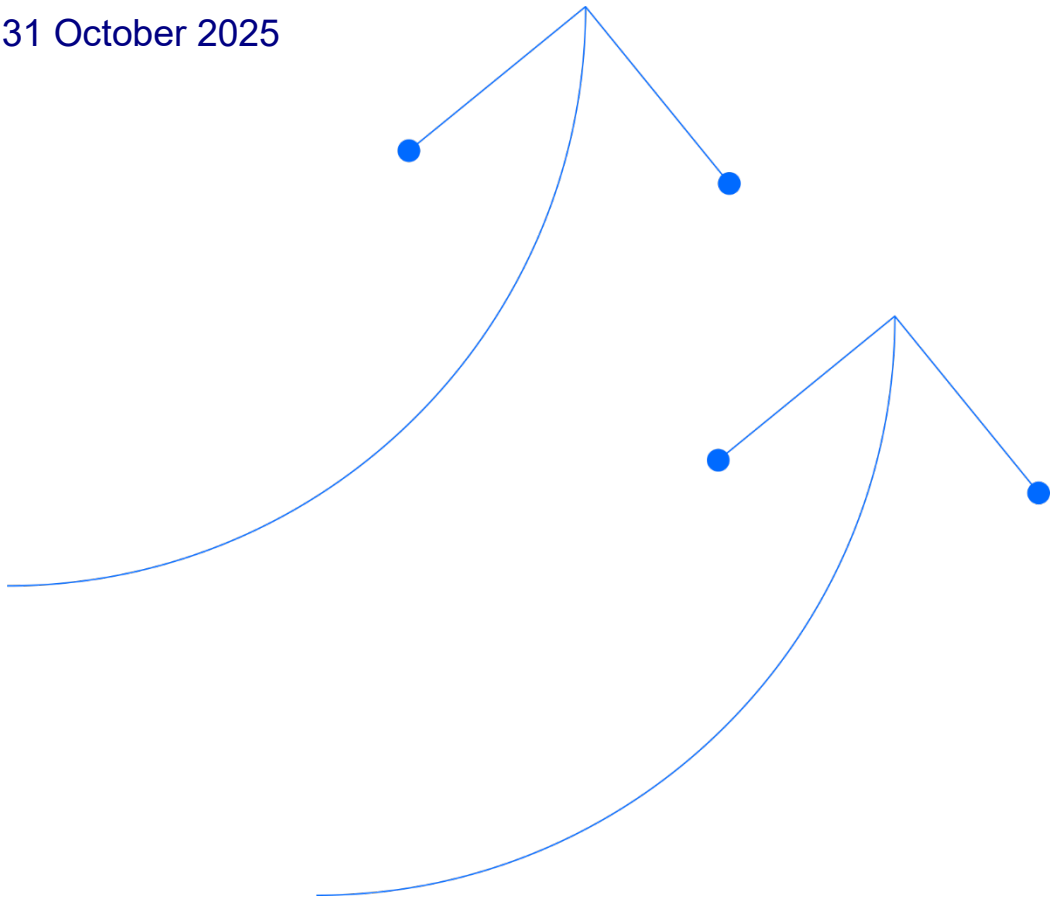
Santos

SANTOS GLNG SPRINGWATER OFFSET AREA MANAGEMENT PLAN

EPBC Act Approval 2012/6615 (Stage 8)

Document Number: 0007-650-EMP-0048

31 October 2025



Date	Rev	Reason For Issue	Reviewed	Endorsed	Approved
9 May 2025	0	For DCCEEW submission	AB	AB	DG
31 October 2025	1	Updated based on DCCEEW review	JK	AB	DG

Declaration of Accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or document to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulation 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed [redacted]

Full Name (please print) [redacted]

Organisation (please print) Santos Ltd

Date 31 / 10 / 2025

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Abbreviations

Acronym	Description
BPA	Biodiversity Planning Assessment
CSG	Coal Seam Gas
°C	Degrees Celsius
DAF	Department of Agriculture and Forestry (Qld)
DCCEEW	Department of Climate Change, Energy, the Environment and Water; formerly Department of Agriculture, Water and the Environment.
DEHP	Department of Environment and Heritage Protection (DEHP); now Department of Environment, Technology, Science and Innovation
EMP	Environmental Management Plan Guidelines
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
GIS	Geographical Information System
GLNG	Gladstone Liquefied Natural Gas
GTDTHQ	Guide to Determining Terrestrial Habitat Quality
GTP	Gas Transmission Pipeline
ha	Hectare
km	Kilometre
MNES	Matters of National Environmental Significance
m	Metre
mm	Millimetre
NP	National Park
OAG	*Offsets Assessment Guide*
OAMP	Offset Area Management Plan
PMAV	Property Map of Assessable Vegetation
RE	Regional Ecosystem
REDD	Reginal Ecosystem Description Database
SEVT	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions
SSMP	Significant Species Management Plan
spp	species
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
VM Act	*Vegetation Management Act 1999* (Qld)

Executive summary

This offset area management plan (OAMP) has been prepared to address the offset requirements for matters of national environmental significance (MNES) associated with Stage 8 of the Santos Gas Fields Development (GFD) Project.

Santos will draw down on 50.29 ha area of the existing 871.72 ha offset area secured in the northwest of the Springwater property (Lot 8 on Plan SP261936); referred to as the Springwater Offset Area (SOA). The offset area will partially acquit MNES offset requirements for Stage 2, Stage 3, Stage 4 and Stage 8 of the GFD project under EPBC 2012/6615. It is anticipated that there will be no surplus offset values remaining in the SOA following approval of the Stage 8 OAMP (Table ES 1).

The Springwater property is located within the Santos GFD Project tenements approximately 36 km north-east of Injune. Current land uses at the Site include cattle grazing, irrigated cropping, tree plantations and petroleum activities. The property is contiguous with large areas of remnant vegetation in the north on Beilba State Forest, 'Fairview' Holding and Expedition (Limited Depth) National Park, to the northeast on Expedition Resource Reserve, and to the south on Hallett State Forest. Desktop and field surveys of the Springwater property have been completed to confirm the presence of offset values and suitability to satisfy the Project's offset obligations as follows:

1. During 2015

- Preliminary desktop assessment of biodiversity offset values
- Detailed field assessment to ground truth vegetation and confirm presence of environmental values
- Targeted flora and fauna surveys and habitat assessments

2. October 2017 (Spring/early summer)

- Detailed offset monitoring in accordance with commitments in the Stage 1 OAMP

3. November 2018 (Spring/early summer)

- Rapid offset monitoring in accordance with commitments in the Stage 1 OAMP

4. October 2020 (Spring/early summer)

- Rapid offset monitoring in accordance with commitments in the Stage 1 OAMP

The results of these assessments were used to identify the values and quality of the offsets in the SOA.

The outcome of this OAMP is to acquit the offset obligations under EPBC 2012/6615. The SOA will be managed and monitored, based on an adaptive management framework, to achieve the interim performance targets and completion criteria presented in Table ES 2.

The key management actions to be implemented include:

- restricting access to the offset area
- management and restoration of regrowth TEC
- maintenance and upgrades of existing access tracks, fencing and firebreaks
- fire management through strategic grazing and fuel hazard reduction burns
- weed management
- pest animal management.

Ongoing monitoring events will be undertaken to assess the effectiveness of the management actions and progress of the offset area in achieving the interim performance targets and completion criteria, including:

- biannual offset area inspections
- biomass monitoring
- fuel load monitoring
- weed monitoring

- pest animal monitoring
- rapid monitoring events
- habitat quality assessments
- brigalow stem counts
- photo monitoring.

Annual reports will be prepared to detail progress of the offset area in achieving the interim performance targets and completion criteria for each management year including the results of management and monitoring activities completed.

The offset area is protected via a Voluntary Declaration under Sections 19E and 19F of the *Vegetation Management Act 1999* (Qld; VM Act). The Voluntary Declaration will remain in place for the life of EPBC 2012/6615.

Table ES 1 – Summary of the Springwater offset area and acquittal for Stage 8 of EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Habitat within the Springwater offset area (ha)	Offset area (ha)[2]				% acquittal of Stage 8[3]	Surplus area (ha)[4]
				Approved for Stage 2 under EPBC 2012/6615	Approved for Stage 3 under EPBC 2012/6615	Approved for Stage 4 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615		
Threatened ecological communities									
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC)	E	0.51	368.6	53.0	198.0	65.6	27.2	539.18	0
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community (SEVT TEC)	E	0.50	57.4	-	-	26.0	4.1	83.25	0
Threatened fauna species									
Collared Delma (*Delma torquata*)	V	49.49	785.9	284.0	339.5	-	46.1	16.10	0
Yakka Skink (*Egernia rugosa*)	V	39.99	785.9	279.0	350.5	-	46.1	16.60	0
Dunmall's Snake (*Furina dunmalli*)	V	49.98	785.9	284.0	351.5	-	46.1	15.94	0
Red Goshawk (*Erythrotriorchis radiatus*)	E	25.61	852.9	-	288.0	-	50.2	23.15	0
Black-breasted Button-quail (*Turnix melanogaster*)	V	0.50	57.4	-	5.7	19.0	4.1	101.55	0
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	V	32.11	445.8	-	75.0	-	18.9	8.49	0
Northern Quoll (*Dasyurus hallucatus*)	E	26.11	852.9	-	251.0	-	50.2	27.25	0
Koala (*Phascolarctos cinereus*)	E	36.56	445.8	217.0	156.0	-	18.9	6.11	0
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	50.48	852.9	340.0	371.0	-	50.2	14.33	0
Large-eared Pied Bat (*Chalinolobus dwyeri*)	E	32.61	852.9	-	251.0	-	50.2	18.18	0

[1] E = Endangered; V = Vulnerable.
[2] 'Approved' values are offset areas as presented and approved in OAMPs for that stage (as required by the OAGs), whereas 'secured' values are offset areas actually used for that stage (e.g. the maximum amount of habitat required for MNES with shared habitat, or surplus habitat remaining).
[3] Balance of the offset requirement satisfied on another property.
[4] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 5 of this OAMP to understand how areas are accounted for in each stage.

Table ES 2 – Interim performance targets and completion criteria

Metric	Interim performance targets			Completion criteria
	Year 5	Year 10	Year 15	Year 20
Assessment Units - Advanced regrowth REs: 11.9.5, 11.9.7 and young regrowth REs: 11.9.5, 11.9.7, 11.10.7				
Tree canopy height	Increased	Increased to within 50% of remnant height	Increased to within 75% of remnant height	Remnant (VMA) structure and floristics
Canopy recruitment	Increased, or 100%	Increased, or 100%	Increased, or 100%	Increased, or 100%
Tree canopy cover	Increased	Increased to within 50% of remnant cover	Increased to within 75% of remnant cover	Remnant (VMA) structure and floristics
Shrub layer cover	Increased	Increased	Increased	Increased
Coarse woody debris	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant
Native plant species richness	Increased for four life forms	Increased for four life forms	Increased for four life forms	Increased for four life forms
Non-native plant cover	Decreased, or is below 5%	Decreased, or is below 5%	Decreased, or is below 5%	Decreased, or is below 5%
Native perennial grass cover	Increased	Increased	Increased	Increased
Litter cover	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant
Access and development	Limited	Limited	Limited	Limited
BioCondition metric scores	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing
Clearing	No clearing has occurred	No clearing has occurred	No clearing has occurred	No clearing has occurred
Weeds	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover
Pest animals	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events
Assessment Units - Remnant REs: 11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7				
Tree canopy height	Has not decreased	Has not decreased	Has not decreased	Has not decreased
Canopy recruitment	Increased, or 100%	Increased, or 100%	Increased, or 100%	Increased, or 100%
Tree canopy cover	Has not decreased	Has not decreased	Has not decreased	Has not decreased
Shrub layer cover	Increased	Increased	Increased	Remnant (VMA) structure and floristics
Coarse woody debris	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant
Native plant species richness	Increased for four life forms	Increased for four life forms	Increased for four life forms	Increased for four life forms
Non-native plant cover	Decreased, or is below 5%	Decreased, or is below 5%	Decreased, or is below 5%	Decreased, or is below 5%
Native perennial grass cover	Increased	Increased	Increased	Increased
Litter cover	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant
Access and development	Limited	Limited	Limited	Limited
BioCondition metric scores	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing
Clearing	No clearing has occurred	No clearing has occurred	No clearing has occurred	No clearing has occurred
Weeds	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover

Metric	Interim performance targets			Completion criteria
	Year 5	Year 10	Year 15	Year 20
Pest animals	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events

Table ES 3 – SOA baseline and completion criteria habitat quality scores

Offset value	Baseline habitat quality score (rounded)	Completion criteria habitat quality score (Year 20)
Threatened ecological community		
Brigalow TEC	6.71 (7)	8
SEVT TEC	8.36 (8)	9
Threatened fauna species		
Collared Delma	5.57 (6)	7
Yakka Skink	5.88 (6)	7
Dunmall's Snake	5.57 (6)	7
Red Goshawk	5.81 (6)	7
Black-breasted Button-quail	6.31 (6)	7
Squatter Pigeon	6.05 (6)	7
Northern Quoll	5.62 (6)	7
Koala	5.55 (6)	7
South-eastern Long-eared Bat	6.12 (6)	7
Large-eared Piet Bat	5.81 (6)	7

1. Introduction

The Santos GFD Project involves the development of Coal Seam Gas (CSG) resources in the Surat and Bowen Basins in Queensland, to supply gas via a 430 km gas transmission pipeline (GTP) to the liquified natural gas (LNG) facility located on Curtis Island. Throughout the development of the Santos GFD Project and in accordance with Santos GFD Project approvals, potentially impacted environmental values are systematically identified and assessed and in order of preference are avoided, minimised, or mitigated.

The Santos GFD Project is required to provide environmental offsets for significant residual impacts on matters of national environmental significance (MNES) in accordance with approvals granted under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth, EPBC Act).

The purpose of this Offset Area Management Plan (OAMP) is to outline the management objectives, actions and outcomes necessary to fulfil Santos GFD's statutory offset requirements. Under the Santos GFD Project approval (EPBC 2012/6615), Santos GFD may carry out the action in project stages over time. Santos GFD must deliver environmental offsets for residual significant impacts to Matters of National Environmental Significance (MNES) over time. This Offset Management Plan has been prepared for Stage 8 of the GFD Project.

For the purposes of the GFD Project approval (EPBC 2012/6615), this OAMP will offset impacts associated with Stage 8 of the GFD Project by means of the Springwater Offset Area (SOA). Stage 8 includes proposed development for impacts across the Arcadia, Fairview and Roma gas fields. The impacts to be offset are outlined in Table 1 and will draw down on the approved surplus areas within the SOA (Figure 1 and Figure 2).

Table 1 – Impacted MNES required to be offset for Stage 8 of the GFD Project under EPBC 2012/6615

MNES	Status under EPBC Act	Disturbance area (ha)
Threatened ecological communities		
Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC)[1]	Endangered	0.51
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community (SEVT TEC)[1]	Endangered	0.50
Threatened fauna species		
Collared Delma (*Delma torquata*)	Vulnerable	49.49
Yakka Skink (*Egernia rugosa*)	Vulnerable	39.99
Dunmall's Snake (*Furina dunmalli*)	Vulnerable	49.98
Red Goshawk (*Erythrotriorchis radiatus*)	Endangered	25.61
Black-breasted Button-quail (*Turnix melanogaster*)	Vulnerable	0.50
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	Vulnerable	32.11
Northern Quoll (*Dasyurus hallucatus*)	Endangered	26.11
Koala (*Phascolarctos cinereus*)	Endangered	36.56
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	Vulnerable	50.48
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Endangered	32.61

[1] Offset requirements for these MNES are acquitted on other properties for Stage 8.

1.1. Purpose

This OAMP is written consistent with the *Environmental Management Plan* (EMP) *Guidelines* (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2024), and provides a detailed management and monitoring framework for the Springwater offset area in accordance with the requirements for Stage 8 of EPBC 2012/6615 as presented in Table 2 below.

The following table (Table 3) details how this OAMP satisfies the requirements of a comprehensive EMP, and how the following information in this plan aligns with the EMP Guidelines set by DCCEEW (2024).

Table 2 – Approval conditions satisfied through this OAMP

Condition number	Condition	How the conditions are met
EPBC Act Approval 2012/6615		
11	The approval holder must ensure that environmental offsets comply with the principles of the EPBC Act *Environmental Offsets Policy*.	This plan complies with the principles of the EPBC Act Environmental Offsets. An assessment against these principles for each of the matters potentially impacted by Stage 8 of the project is provided in Section 2.9.
12	The approval holder may carry out the action in project phases. The approval holder must deliver environmental offsets for residual significant impacts to protected matters for each project phase.	The action will be carried out in phases. This Project OAMP covers Stage 8 of the GFD Project as described in Section 1.
13	The approval holder must submit an Offset Management Plan for the Minister's written approval. The Offset Management Plan may be prepared and submitted to the Minister for written approval in stages. If the approval holder submits the Offset Management Plan in stages, each version of the Offset Management Plan must address the known and predicted impacts of the completed, current, and next proposed project phases.	This plan has been submitted for the Minister's written approval. This Project OAMP covers Stage 8 of the GFD Project as described in Section 1.
14	The Offset Management Plan must include for the first project phase: a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities; b. results from pre-disturbance surveys and/or an alternative approved methodology (if used) for the project phase as required under conditions 4 and 5; c. details of the offset areas required to address predicted residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities for the project phase; d. a survey and description of the current condition (prior to any management activities) of each offset area proposed, including existing vegetation (the baseline condition). This must include a shapefile of each offset property boundary; e. information about how the offset areas provide connectivity with other relevant habitats and biodiversity corridors, including a map depicting the offset areas in relation to other habitats and biodiversity corridors; f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary); g. a description of the management measures that will be implemented for the protection of EPBC threatened species, EPBC migratory species and EPBC communities, including a discussion of how measures outlined take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans; h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria; i. a description of potential risks to the successful implementation of the plan, and a description of the contingency measures that would be implemented to mitigate against these risks; j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and k. the proposed legal mechanism and timing for legally securing the offset.	a) The method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities is discussed in Section 3 of the Acquittal document. b) Details of the relevant field assessments are provided in Section 2.4. c) The offset area is the Springwater Offset Area (SOA) details of the SOA are provided in Section 2.6. d) Details of the baseline surveys are provided in Section 2.4. e) The connectivity and the landscape context of the SOA are discussed in detail in Section 2.2. f) Performance criteria, trigger levels, completion criteria and remedial actions for management activity undertaken in the SOA are discussed in Section 4. g) Management measures implemented for the protection of MNES, including how measures outlined take into account relevant conservation advice and are consistent with the measures in relevant recovery plans and threat abatement plans are provided in Section 6. h) The monitoring program for the SOA is outlined in Section 7. i) Risks to the successful implementation of this plan are outlined in Section 2.8. j) An implementation Schedule is provided in Section 7.6. k) Section 2.8 details how the offset for GFD Project has been legally secured.
15	The currently approved Offset Management Plan must be implemented by the approval holder.	This offsets plan complements previous offsets plans and proposals submitted for approval. Once approved, this plan will be implemented.
16	The approval holder must register and legally secure offsets for the first project phase identified in the Offset Management Plan within two years of commencement of the first project phase.	On 6 April 2018, a voluntary declaration over the SOA was certified, thereby satisfying the legal security requirement. The SOA is an area of high nature conservation value under section 19F of the *Vegetation Management Act 1999* (Qld, VM Act). See Section 2.8 for details.
17	The approval holder must register and legally secure offsets for a project phase which are sufficient to acquit the predicted residual significant impacts of that project phase.	The offset for Stage 4 of the GFD Project is secured as an area of high nature conservation value secured for the purposes of an environmental offset under section 19F of the VM Act. See Section 2.8 for details.
18	If the approval holder submits the Offset Management Plan in stages, the approval holder must prepare and submit the Offset Management Plan revised to address each subsequent project phase, for written approval by the Minister. Each revised Offset Management Plan must: a. include the information required for the Offset Management Plan at condition 14 for the next project phase; b. include a reconciliation of actual and predicted but yet to be actualised residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities against offsets secured for the commenced project phases. Secured offsets in excess of requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases may be subtracted from the obligations	A new OAMP will be submitted for all subsequent stages of the project. A reconciliation of the actual residual significant impacts associated with Stage 1, Stage 2, Stage 3 and Stage 4 of the GFD Project is provided in Section 4 of the Acquittal document.

Condition number	Condition	How the conditions are met
	required for subsequent project phases. Any shortfall in secured offsets relative to the requirements arising from actual and predicted but yet to be actualised impacts of any commenced project phases must be added to the obligations required for the next project phase; and c. demonstrate how the offset builds on offsets already secured for previous project phases and will contribute to a larger strategic offset for cumulative project impacts.	
19	The approval holder must not commence the project phase until the Offset Management Plan for that project phase has been approved by the Minister in writing.	This management plan is submitted for the approval of the Minister.

Table 3 – Alignment of OAMP with EMP Guidelines

Key content	Reference within OAMP	Reference to EMP guideline
Conditions of approval	Section 1.1, Table 2 details the approval conditions satisfied through this OAMP.	Section 3, page 8
Property information and baseline data	Section 2 describes the Bottle Tree property, Sub-section 2.4 lists the history of ecological surveys undertaken at the Springwater property, including baseline surveys, and Sub-section 2.5 describes the ground-truthed environmental values of the property.	Section 3
Offset values	Section 3 describes and details the offset values of this OAMP, and Section 4 lists the associated environmental outcomes.	Section 3
Adaptive management framework and program	Section 5 describes the adaptive management framework to be applied through this OAMP, and Section 4, details the environmental outcomes to be achieved. Section 6, Table 12 describes the management program.	Section 3, page 11-12
Management program entailing objectives, triggers, and actions	Section 6.1, Table 12 details the management objectives, performance targets, method of management actions, and measurable milestones of progression in terms of monitoring actions, monitoring timing and frequency, management triggers and corrective actions.	Section 3, page 11-12
A detailed monitoring program	Section 7 breaks down the monitoring program into six Sub-sections, and details the program timing, frequency, methods.	Section 3, page 11-12
A detailed monitoring and implementation schedule	Section 7.6, Table 21 summaries the overall schedule of the monitoring program inclusive of timing, activity, location of activity, method and reliability of method.	Section 3, page 11-12
Risk assessment and management actions to avoid, mitigate and manage risks	Section 6 and Appendix B identifies risks which have been identified as potentially impeding to the outcomes of environmental management objectives.	Section 4, pages 13-14
Risk matrix	Table B3 in Appendix B applies a risk matrix including residual risk rating following mitigation measures, management triggers and corrective actions.	Section 4, pages 13-14
Maintenance of monitoring records	Section 8 details the reporting obligations of this OAMP and how information will be stored for the lifetime of the approval.	Section 3, page 9

2. Springwater Property

As discussed in the Stage 1-4 Offset Area Management Plans, Santos GLNG has identified the Springwater property as containing suitable environmental values to acquit offset obligations incurred by the development of the GFD Project.

2.1. Property overview

Springwater is a 12,636-ha grazing property described as Lot 8 on Plan SP261936 and is located within the local government area of Maranoa Regional Council, approximately 46 km east-northeast of Injune, Queensland (Figure 1). The offset management area is in the northwest sections of the Springwater property. The SOA is bounded by the Hutton Creek in the west and the property boundary of Fairview Station in the north and the east.

Springwater is located within subregion 24 (Carnarvon Ranges) of the Brigalow Belt South bioregion (Sattler and Williams 1999). Current land uses at the Site include cattle grazing, irrigated cropping, tree plantations and petroleum activities. The property is contiguous with large areas of remnant vegetation in the north on Beilba State Forest, 'Fairview' Holding and Expedition (Limited Depth) National Park, to the northeast on Expedition Resource Reserve, and to the south on Hallett State Forest. The Site is owned and managed by Santos (Table 4).

Surface geology mapping for the Springwater property shows that it is comprised entirely of Lower Jurassic sediments (Forbes 1968). The west and much of the southeast of the Site features plateaux of the Boxvale Sandstone Member, falling to valleys and low undulating hills with sandy and clay soils derived from the Evergreen Formation. Plateaux of the Boxvale Formation are also present in the far northeast of the Site. Hutton Creek enters the Site in the central north and cuts a steep gorge eastward through the Precipice Sandstone to meet the Dawson River in the central east of the Site. Soils in this region are coarse sands with expansive areas of surface rock especially within close proximity to Hutton Creek and the Dawson River. Vegetation is dominated by dry sclerophyll Eucalyptus and Acacia woodlands with pockets of semi-evergreen vine thicket (SEVT) in sheltered south-facing parts of the plateau scarps and slopes and within gorges. The dominant land zone (Sattler and Williams 1999) in this area is land zone 10 (coarse-grained sediments) with a small areas of land zone 9 (fine-grained sediments) on slopes and valleys and land zone 3 (alluvium) along Hutton Creek and the Dawson River. Hutton Creek and the Dawson River are part of the Fitzroy River Basin.

The sandstone plateaus throughout the SOA have historically been cleared for grazing and are currently utilised for timber plantations. The steep slopes that have formed between the tops of the plateaus and the valleys and gorges associated with Hutton Creek are largely intact remnant and regrowth vegetation. These valleys and gorges as well as the waterway itself provide a natural barrier to prevent cattle access to the SOA from the north, west and east. The presence of Hutton Creek enhances the overall value of the offset area, particularly the narrow patches in the west of the SOA. Much of the riparian vegetation associated with Hutton Creek is not part of the SOA because it falls outside of the Springwater property. However, this vegetation together with the narrow patches of offset in the west of the SOA provides a valuable corridor on a local scale.

Infrastructure in the SOA includes gas-gathering infrastructure predominately located within the timber plantation. Within the areas utilised as an environmental offset there are minor access tracks and fire trails. A large pipeline corridor has been retained along the south-eastern edge of the SOA. This pipeline corridor has been located to ensure that the connectivity between the SOA and the larger patches of remnant vegetation to the north remains unaffected. At present, there is no immediate plans to develop the proposed pipeline and the vegetation within the pipeline corridor is being managed in the same way as the surrounding offset areas.

Table 4 summarises Springwater landholder and property details.

Table 4 – Springwater landholder and property details

Landholder and Property Details	
Registered Owner/s on Title:	Santos GLNG Pty Ltd (JV representative) Total GNG Australia PAPL (Downstream) Pty Ltd KGLNG Liquefaction Pty Ltd
ABN/ACN:	ABN 12 131 271 648 (Santos GLNG Pty Ltd)
Postal Address:	PO Box 329, Roma Queensland 4455
Lot on plan(s):	Lot 8 on Plan SP261936
Tenure:	Freehold
Area:	12,636 ha
Primary Local Government Area:	Maranoa Regional Council
Permits	
Coal Exploration Permit:	EPC 1110[A] – TILOX RESOURCS PTY LTD, expires 27 May 2028
Mineral Development Licence	MDL 3045 – TILOX RESOURCES PTY LTD, expires 30 Nov 2026
Petroleum Lease	PL 92 – SANTOS TOGA PTY LTD, expires 29 Nov 2029 PL 99[A] – SANTOS TOGA PTY LTD, expires 15 Dec 2033 PL 100[A] – SANTOS TOGA PTY LTD, expires 15 Dec 2033 PL 232[A] – SANTOS TOGA PTY LTD, expires 31 Dec 2035
Pipeline Licence	PL 166[A] – SANTOS GLNG PTY LTD, expires 17 Nov 2051 PPL 180[A] – AUSTRALIA PACIFIC LNG CSG TRANSMISSIONS PTY LIMITED, expires 20 Mar 2063 PPL 92[A] – SANTOS TOGA PTY LTD, expires 19 Aug 2044 PPL 164[A] – SANTOS TOGA PTY LTD, expires 1 Jun 2051 PPL 118[A] – SANTOS GLNG PTY LTD, expires 18 May 2056 PPL 2066[A] – SANTOS TOGA PTY LTD, expires 6 Apr 2052

[A] Relevant permit, while overlapping with the property (8SP261936), does not overlap with the SOA

148°30'0"E
149°0'0"E
149°30'0"E
25°0'0"S
25°30'0"S
26°0'0"S
26°30'0"S

Serocold State Forest
Mount Nicholson State Forest
Nuga Nuga National Park
Expedition National Park
Palmgrove National Park (scientific)
Theodore State Forest
Carnarvon National Park
PL 451
PL 236
PL 440
PL 235
Bandana State Forest
PL 450
Presho State Forest
McLeay State Forest
PL 1062
Eden State Forest
PL 420
Expedition (Limited Depth) National Park
Boxvale State Forest
PL 1059
PPL 169
PL 1017
PL 421
Gwambagwine State Forest
Forrest State Forest
Howe State Forest
Carnarvon Highway
PL 234
PL 233
Belington Hut State Forest
PL 90
Oakvale State Forest
Doonkuna State Forest
PL 91
Expedition Resources Reserve
Beilba State Forest
PL 232
PL 457
PL 92
8SP261936
Stephenton State Forest
PL 1012
Hallett State Forest
PL 100
PL 99
Moorabinda Nature Refuge
Mount Armour Nature Refuge
Waroonga State Forest
Walhallow State Forest
Gubberamunda State Forest 3
Gubberamunda State Forest 2
Gubberamunda State Forest 1
Taboonbay State Forest
Dinoun State Forest
Woodduck State Forest
Emu State Forest
Combabula State Forest
PL 1019
PL 322
PL 314
PL 1021
PL 1020
PL 315
PL 323
PL 313
Warrego Highway
Raglan Street
PL 316
PL 317
PL 318
PL 1123
Inglebogie State Forest
Yuleba State Forest

SANTOS

Location diagram

Figure 1
Project context

- Springwater
- Santos PLs
- Santos Petroleum Pipeline Licences

Statewide Corridors
- Regional
- State

Protected areas
- National Park
- National Park (scientific)
- State Forest
- Resources Reserve
- Nature Refuge

CO2 AUSTRALIA

N

0 10 20 30
Kilometres

Date: 5/05/2025 Coordinate System: GDA2020 Scale: 1:52,500,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Statewide Corridors v1.6
- Protected areas
- Resource licenses
AUTHOR: J. Cousin

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Springwater\Springwater_OAMP_mapping_20250416\Springwater_OAMP_mapping_20250416.aprx

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2.2. Connectivity

On a continental scale the SOA forms part of the Great Eastern Ranges (GER) corridor, identified as one of Australia's large-scale connectivity conservation areas. The GER extends more than 2,800 kilometres (km) from the Australian Alps near Melbourne to the Atherton Tablelands near Cairns and beyond in far north Queensland. The Springwater property is mapped adjacent to a state biodiversity corridor, corresponding to Hutton Creek (Figure 1). Biodiversity corridors have been mapped as part of the Queensland Government's Biodiversity Planning Assessments which assess the biodiversity significance of land in a bioregion. The mapping of corridors within the Brigalow Belt Bioregion, in which the Springwater property is located, has focused on those corridors that link adjacent bioregions or connect wildlife refugia. Corridors identified as of state significance are considered of the greatest importance at the bioregional scale.

At a state and regional scale, the SOA lies at the southern extent of a large patch of vegetation linking Expedition National Park in the north and Carnarvon National Park in the west. These large tracks of remnant vegetation have been identified in the Biodiversity Planning Assessment (BPA) mapping. A BPA identifies the terrestrial ecological values in a region, or bioregion, according to their conservation significance. A Biodiversity Planning Assessment (BPA) is available for the Brigalow Belt Bioregion and contains the corridors criteria (Criteria J) and the Context and Connection criteria (Criteria G):

- Corridors (Criteria J) - Areas identified under this criterion qualify either because they are existing vegetated corridors important for contiguity including regrowth or cleared areas that could serve this purpose if revegetated. Some examples of corridors include riparian habitats, transport corridors and "stepping stones".
- Context and Connection (Criteria G) – this criterion represents the extent to which a Remnant Unit incorporates, borders or buffers areas such as significant wetlands, endangered ecosystems, and the degree to which a Remnant Unit is connected to other vegetation.

A review of this data at a regional scale shows that these large tracks of remnant vegetation have predominantly been identified in the BPA data as having "State" or "Regionally" significant corridors (Criteria J) and having a "Very High" or "High" context and connection (Criteria G). Any increase in extent or condition of the ecological communities within the SOA will increase the extent and quality of these significant areas of habitat and biodiversity corridors.

148°56'0"E
148°57'0"E
148°58'0"E
25°41'0"S
25°42'0"S
25°43'0"S
25°44'0"S
Bullock Gully
Hutton Creek
Hutton Creek

SANTOS

Figure 2
Property overview

Springwater
Springwater offset area

Watercourse
Major watercourse
Creekline
Minor drainage line
Drainage contour

EPBC 2012/6615 offset area
Stage 2
Stage 3
Stage 4
Stage 8

N

0 0.5 1
Kilometres

Location diagram

Queensland
Brisbane

AUTHOR: J. Cousin
DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses

Date: 5/05/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:18,500@A3

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Springwater\Springwater_OAMP_mapping_20250416\Springwater_OAMP_mapping_20250416.aprx

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2.3. Climate

The Springwater property is characterised by a hotter wet season (typically November to March) and a cooler dry season (typically April to October) (see Figure 3). Weather records from the Injune weather station (#43015), approximately 36 km south-west of Springwater, show the mean monthly rainfall for the period 1961-1990 ranges from 24.9 mm (September) to 94.6 mm (January) (Bureau of Meteorology [BoM] 2024). Mean monthly maximum temperatures range from 19.6 °C (July) to 33.7°C (January) and mean monthly minimum temperatures range from 3°C (July) to 19.2°C (January) (BoM 2024).

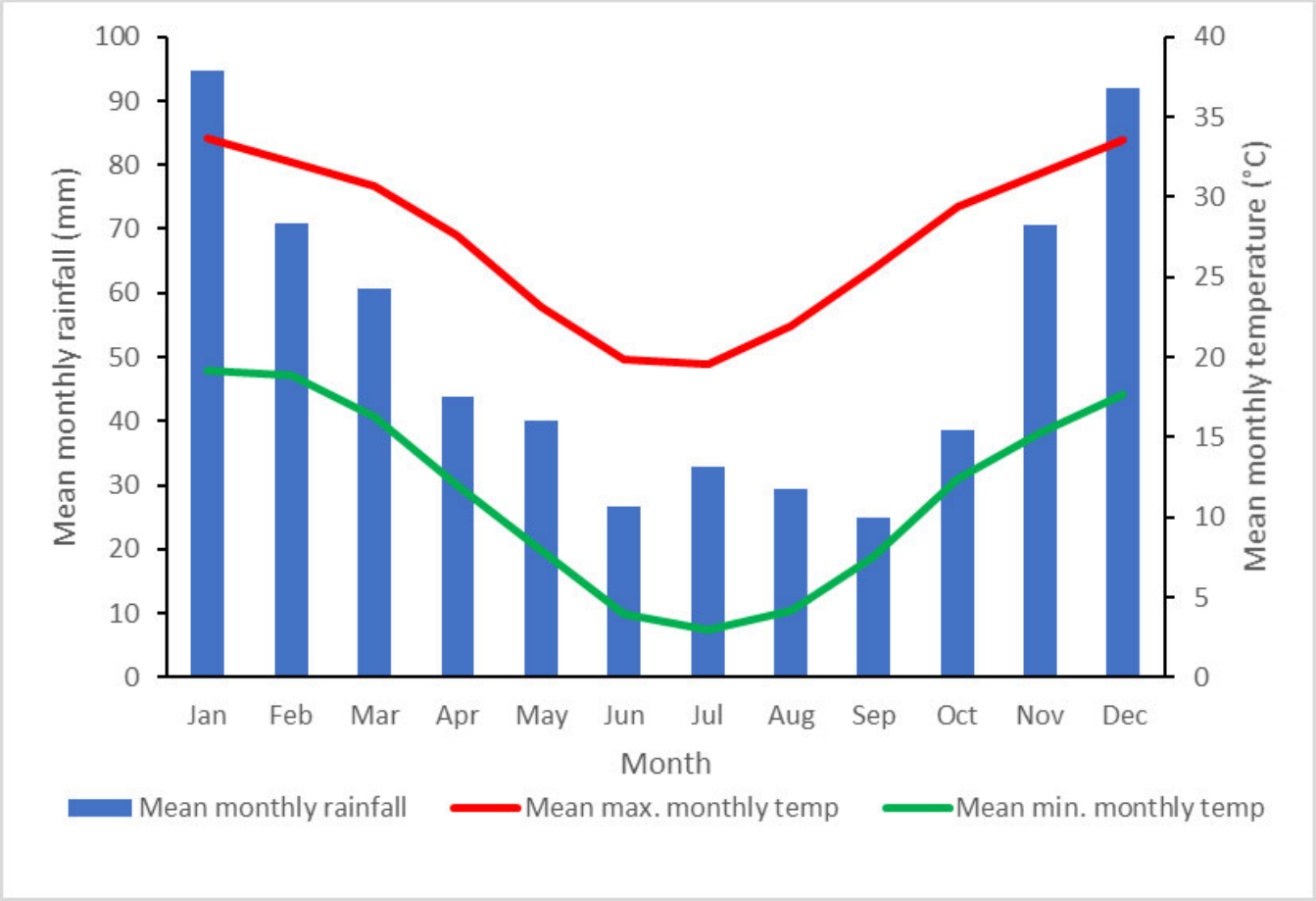

Figure 3 – Mean monthly temperature and rainfall records from Injune Post Office weather station (ID: 43015) 1961-1990 (www.bom.gov.au)

2.4. On-ground property assessments

Santos has dedicated 871.72 ha for environmental offsets within the SOA on Springwater property (Figure 2).

2.4.1. Biodiversity offset values 2015

During 2015, Boobook Ecological Consulting were engaged to provide a detailed report of the potential biodiversity offset values at Springwater property (Boobook, 2015). Ecological values of the property were assessed to determine the property's value in terms of meeting offset requirements.

2.4.2. Assessment and monitoring events

In 2016 the Santos GLNG Gas Fields Development Project Stage 1 Offset Plan 2016 – 2021 (Offset Area Management Plan [OAMP]) for the Springwater Offset Area (SOA) was approved (Santos 2016). In October 2017, Terrestria Pty Ltd conducted a detailed offset monitoring event in the SOA in accordance with commitments made

in the Stage 1 OAMP. As part of that plan Santos GLNG have committed to complete several ecological assessment and monitoring tasks over the next 20 years. The field assessments are informed by the results of previous assessments.

2.4.3. Detailed assessment and monitoring event spring/early summer 2017

The monitoring event was scheduled to coincide with spring / early summer, the optimal time of year for flora and fauna surveys in the Brigalow Belt Bioregion (Eyre et.al., 2012). Between the 16th and 21st of October 2017, Terrestria Pty Ltd conducted a detailed monitoring event (Terrestria, 2018). The results of the 2015 and the 2017 assessments were used to identify the values and quality of the offsets in the SOA. The requirements for the detailed monitoring event conducted in 2017 included:

- General field assessment as outlined in Section 9.1.2 of the Stage 1 OAMP;
- Establishing and completing 10 BioCondition sites; one in each of the vegetation units identified in Table 4 of the Stage 1 OAMP as well as photo monitoring points;
- Threatened flora survey and assessment to identify the locations of any threatened flora species and to map the extent of threatened flora habitat for all EVNT species listed under either the NC Act or the EPBC Act present within the SOA. All flora species observed whilst undertaking threatened flora surveys were documented;
- Fauna surveys targeting the species listed in Table 5 of the Stage 1 OAMP (Note: all fauna species observed during fauna surveys were documented); and
- In addition to the BioCondition canopy cover, additional canopy cover analysis was conducted to assess the two Brigalow regrowth communities (regrowth and young regrowth). This involved an additional 2 x 50m transects to assess canopy cover. The location of the start and finish were marked with flagging tape and GPS so the same transect can be assessed in 2018. Note: This assessment replaces the Geographic Information System (GIS) canopy analysis discussed in Section 9.1.1 of the Stage 1 OAMP.

2.4.4. Rapid assessment and monitoring event spring/early summer 2018

Field assessments of the SOA were conducted during spring and early summer (12 - 16 November 2018) to coincide with the optimal time of year for flora and fauna surveys in the Brigalow Belt Bioregion (Eyre et al., 2012). The location of the field assessment was informed by the results of previous site assessments (i.e. Boobook, 2015). During flora and fauna surveys, fences, tracks and existing gas field infrastructure were inspected to ensure access and development has been excluded from the SOA and that grazing can be properly controlled.

2.4.4.1. Rapid assessment and monitoring event spring/early summer 2020

In Spring and early Summer 2020 (12-16 October 2020), Terrestria conducted offset monitoring in the SOA in accordance with commitments made in the Stage 1 OAMP. This assessment fulfils the commitments to perform yearly ‘Rapid Assessment’ of the baseline BioCondition sites established in February 2020.

During each rapid monitoring field assessment, the following will be conducted:

- Fences tracks and existing gas field infrastructure will be inspected to ensure grazing has been excluded from all the Springwater Management Areas and access and development has been excluded from the SOA.
- An unbounded timed meander flora and fauna survey will be conducted. The survey will be conducted in accordance with the timed meander survey methodology contained within the Queensland Department of Environment and Heritage Protection’s Flora Survey Guidelines (DEHP 2016). The following will be conducted:
  - An assessment of the presence and abundance of dominant flora and fauna species.
  - A dedicated flora survey of the ground layer to assess groundcover species richness and recruitment of native flora species.
  - The presence and abundance of weed species.
  - The presence of pest fauna.
  - Photos will be taken at designated and fixed photo monitoring points.
  - General observations regarding the presence and condition of erosion, the presence and extent of any other threatening processes.

  - The condition of regrowth Brigalow and the presence of any areas containing >10,000 stems per hectare that may requiring thinning.
  - The presence and extent of any other threatening processes.

A summary of the BioCondition scores and other ecological input data is provided in Appendix A.

2.5. Ground-truthed vegetation and habitat mapping

The vegetation communities within the SOA have been classified and mapped in accordance with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al*. 2012). In addition, the quality of the patches was divided into four categories:

- Remnant: woody vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy (Neldner *et al*. 2012).
- Non-Remnant:
  - Advanced regrowth: areas previously cleared or disturbed (e.g. by wildfire) and containing well advanced woody vegetation floristically and structurally consistent with the RE but typically <70% of the height and <50% density of the RE. Such regrowth with appropriate management will likely achieve remnant status (potentially <30 years).
  - Young regrowth: areas previously cleared or disturbed (e.g. by wildfire) and containing varying densities of woody vegetation floristically consistent with the RE type. Such regrowth lacks structural elements typical of the RE but with appropriate management may eventually achieve remnant status (likely >30 years).
  - Cleared: areas previously cleared or otherwise significantly disturbed which have little or no woody vegetation present and are currently unsuitable as biodiversity offsets. and <50% density of the RE. Such regrowth with appropriate management will likely achieve remnant status.

2.5.1. Vegetation description

The SOA contains six regional ecosystem vegetation communities. A summary of the vegetation communities present, the relevant site condition scores from BioCondition and whether the vegetation community is also an EPBC Act listed TEC are outlined in Table 5 below and shown in Figure 4. A detailed summary of the BioCondition scores and other calculator inputs for the offset site is provided in Appendix A.

2.5.2. Habitat description

Following the results of detailed field assessments, known habitat requirements for each fauna species surveyed were assessed against on-ground microhabitat observations within each habitat type to categorise the quality of habitat present into Essential or General Habitat (Boobook 2020). The habitat definitions, ‘essential’ and ‘general’, used by Boobook were provided in the Santos Fauna Habitat model (Aurecon, 2014) and are as follows:

- Essential habitat is defined as an area containing essential resources for the maintenance of species populations (e.g., habitat for breeding, roosting, foraging and shelter), for either migratory or non-migratory species, from known records and/or expert advice.
- General habitat is defined as areas or locations that are used by transient individuals or where species have been recorded but there is insufficient information to assess the area as ‘essential habitat’. It may be defined from known records and expert knowledge of habitat relationships, despite the absence of records. Areas classified as ‘general’ may include areas of sub optimal habitat.

Table 6 provides a summary of the extent of suitable habitat available within the Springwater offset area for the project’s MNES offset requirements based on the results of detailed field assessments (Boobook, 2015). An additional description of the offset area for each MNES is provided in Section 3.

Table 5 – Ground-truthed RE mapped within the Springwater offset area

RE	Description	Springwater offset area (ha)					
		Total area	Approved for Stage 2 under EPBC 2012/6615	Approved for Stage 3 under EPBC 2012/6615	Approved for Stage 4 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615	Surplus
11.10.7 Remnant	*Eucalyptus crebra* and *E. melanophloia* woodland with associated *Callitris glaucophylla*; midlayer composed of *C. glaucophylla*, *Acacia decora* and *A. longispicata*; shrub layer composed of Hovea longipes, *Notelaea microcarpa* and *Cryptandra amara*; grassy ground layer composed of *Aristida* spp., *Chrysopogon fallax* and *Ancistrachne uncinulata*.	232.8	217.0	64.3	-	9.0	0.0
11.10.7 Regrowth	*Eucalyptus melanophloia* low woodland; midlayer composed of *Psydrax johnsonii, Notelaea microcarpa, Eremophila mitchellii* and *Callitris glaucophylla*; grassy ground layer dominated by *Themeda triandra*.	48.5					
11.10.7 Young regrowth	*Eucalyptus crebra* and / or *E. melanophloia, Acacia longispicata* low open forest (young regrowth); sparse midlayer dominated by *Alphitonia excelsa* and canopy recruits; grassy ground layer dominated by *Aristida* spp. and *Eremochloa bimaculata.*	9.0					
11.10.7a Remnant	*Eucalyptus crebra +/- Callitris glaucophylla +/- Angophora leiocarpa +/- Eucalyptus spp.* woodland	109.1	17.4	91.6	-	-	0.0
11.9.5 Remnant	*Acacia harpophylla* open woodland; midlayer composed of canopy recruits, *Eremophila mitchellii, Geijera parviflora* and *Pittosporum spinescens*; low shrub layer dominated by Carissa ovata; grassy ground layer composed of *Paspalidium caespitosum, Enteropogon ramosus, Ancistrachne uncinulata* and *Aristida* sp. Contributing to the Brigalow TEC offset area.	311.5	47.6	209.3	65.6	27.2	0.0
11.9.5 Regrowth	*Acacia harpophylla* low open forest (advanced regrowth); very sparse shrub layer of canopy recruits; very sparse ground layer of *Paspalidium caespitosum*. Contributing to the Brigalow TEC offset area.	38.2					
11.9.5 Young regrowth	*Acacia harpophylla* low woodland (young regrowth); shrub layer composed of *Carissa harpophylla, Eremophila mitchellii* and canopy recruits; grassy ground layer dominated by *Cenchrus ciliaris*. Contributing to the Brigalow TEC offset area.	18.9	18.9	-	-	-	0.0
11.3.25 Remnant	*Angophora floribunda, Eucalyptus camaldulensis* and *Casuarina cunninghamiana* fringing woodland; midlayer (confined to channel edges) composed of *Melaleuca viminalis*; dense ground layer dominated by *Lomandra longifolia, Imperata cylindrica* and *Entolasia marginata.*	9.5	9.5	-	-	-	0.0
11.9.4 Remnant	Semi-evergreen vine thicket Contributing to the SEVT TEC offset area.	57.4	21.6	5.7	26.0	4.1	0.0
11.9.7 Remnant	*Eucalyptus populnea* woodland; midlayer comprised of canopy recruits, *Eremophila mitchellii, Geijera parviflora, Atalaya hemiglauca, Psydrax odorata* and *Denhamia oleaster*; shrub layer composed of *Hovea longipes* and *Carissa ovata*; grassy ground layer dominated by *Aristida* sp., *Bothriochloa decipiens, Themeda triandra* and *Chloris ventricosa*.	26.9	26.9	-	-	9.9	0.0
11.9.7 Young regrowth	*Eucalyptus populnea* low woodland; midlayer dominated by *Eremophila mitchellii*; grassy ground layer composed of *Cenchrus ciliaris* and *Aristida* sp.	9.9					
Total		**871.7**	**358.9**	**370.9**	**91.6**	**50.2**	**0.0**

Table 6 – Extent of suitable habitat for MNES on the Springwater offset area

MNES	Potentially suitable REs	Habitat mapping rules	Mapped extent of potential habitat (ha)
Threatened ecological communities			
Brigalow TEC	11.9.5	Remnant and regrowth RE 11.9.5 where *Acacia harpophylla* are dominant in the canopy and that the vegetation otherwise met condition criteria (DoTE 2013).	368.6
SEVT TEC	11.9.4	Remnant RE 11.9.4, listed as a component RE for this TEC (TSSC 2001).	57.4
Threatened fauna species			
Collared Delma (*Delma torquata*)	11.9.5, 11.9.7, 11.10.7, 11.10.7a	Mapped General Habitat includes all areas of remnant and regrowth vegetation of the nominated RE.	785.9
Yakka Skink (*Egernia rugosa*)	Essential Habitat: 11.9.7, 11.10.7, 11.10.7a General Habitat: 11.9.5	Mapped Essential Habitat is based on known records within the nominated RE and includes all remnant and regrowth vegetation of the nominated RE. Mapped General Habitat includes all remnant and regrowth vegetation of the nominated RE. This may include sub-optimal habitat.	785.9
Dunmall's Snake (*Furina dunmalli*)	11.9.5, 11.9.7, 11.10.7, 11.10.7a	Mapped General Habitat includes all remnant and regrowth vegetation of the nominated RE.	785.9
Red Goshawk (*Erythrotriorchis radiatus*)	11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7, 11.10.7a	This species requires tall trees close to permanent water for nest sites but may forage at a distance from this habitat. Mapped General Habitat includes all areas of remnant and regrowth vegetation of the nominated RE.	852.9
Black-breasted Button-quail (*Turnix melanogaster*)	11.9.4	Mapped General Habitat includes all areas of remnant and regrowth vegetation of the nominated RE. Note that this species is dependent on large patches of habitat, such that small, isolated patches of otherwise suitable habitat may not be occupied.	57.4
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	11.3.25, 11.9.7, 11.10.7, 11.10.7a	Mapped General Habitat includes all areas of remnant and regrowth vegetation of the nominated RE.	445.8
Northern Quoll (*Dasyurus hallucatus*)	11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7, 11.10.7a	Mapped Essential Habitat includes all nominated RE within 1 km of shelter habitat (extensive areas of dissected sandstone with deep crevices and caves). Mapped General Habitat includes all remnant and regrowth vegetation of the nominated RE in a buffer 1 to 5 km of potentially suitable shelter habitat.	852.9
Koala (*Phascolarctos cinereus*)	11.3.25, 11.9.7, 11.10.7, 11.10.7a	High Quality Habitat includes remnant eucalypt woodland and forest associated with Hutton Creek. Lesser Quality Habitat includes all immature regrowth of suitable REs.	445.8
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7, 11.10.7a	Mapped General Habitat includes all areas of remnant and regrowth vegetation that may be suitable for foraging or shelter.	852.9
Large-eared Pied Bat (*Chalinolobus dwyeri*)	11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7, 11.10.7a	Mapped Essential Habitat includes all areas of remnant and regrowth vegetation of the nominated RE within 5 km of potentially suitable shelter habitat.	852.9

148°56'0"E
148°57'0"E
148°58'0"E
25°41'0"S
25°42'0"S
25°43'0"S
25°44'0"S
Bullock Gully
Hutton Creek

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Figure 4
Ground-truth vegetation

Springwater
Springwater offset area
Property access track

Watercourses
Major watercourse
Creekline
Minor drainage line
Drainage contour

Ground-truthed vegetation
11.3.25
11.9.4
11.9.5
11.9.5 (adv regrowth)
11.9.5 (young regrowth)
11.9.7
11.9.7 (young regrowth)
11.10.7,Remnant
11.10.7 (adv regrowth)
11.10.7 (young regrowth)
11.10.7a

CO2 AUSTRALIA

N

0 0.5 1
Kilometres

Date: 5/05/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:18,500@A3

Location diagram
Queensland
Brisbane

AUTHOR: J. Cousin
DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Springwater\Springwater_OAMP_mapping_20250416\Springwater_OAMP_mapping_20250416.aprx

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2.6. Offset area

The offset area is in the northwest of the Springwater property and is bounded by the Hutton Creek in the west and the property boundary of Fairview Station in the north and the east.

The sandstone plateaus throughout the SOA have historically been cleared for grazing and are currently utilised for timber plantations. The steep slopes that have formed between the tops of the plateaus and the valleys and gorges associated with Hutton Creek are largely intact remnant and regrowth vegetation. These valleys and gorges as well as the waterway itself provide a natural barrier to prevent cattle access to the SOA from the north, west and east. The presence of Hutton Creek enhances the overall value of the offset area, particularly the narrow patches in the west of the SOA. Much of the riparian vegetation associated with Hutton Creek is not part of the SOA because it falls outside of the Springwater property.

However, this vegetation together with the narrow patches of offset in the west of the SOA provides a valuable corridor on a local scale.

Infrastructure in the SOA includes gas-gathering infrastructure predominately located within the timber plantation. Within the areas utilised as an environmental offset there are minor access tracks and fire trails. A large pipeline corridor has been retained along the south-eastern edge of the SOA. This pipeline corridor has been located to ensure that the connectivity between the SOA and the larger patches of remnant vegetation to the north remains unaffected. At present, there is no immediate plans to develop the proposed pipeline and the vegetation within the pipeline corridor is being managed in the same way as the surrounding offset areas.

Environmental offsets for the Santos GFD project will be acquitted in stages (refer to Acquittal document [Santos 2025]). This OAMP has been prepared for Stage 8 of the GFD project in accordance with Condition 18 of EPBC 2012/6615, with the minimum offset area required to be secured for the MNES determined in accordance with the EPBC Act OAG, presented as part of *Santos GLNG Offset Plan and Acquittal Summary: EPBC Act Approval 2012/6615, Stage 8* (Santos 2025).

The following OAMPs have been prepared and approved for Stage 1, Stage 2, Stage 3 and Stage 4 of the GFD project:

- The Santos GLNG Gas Fields Development Project Stage 1 OAMP (Document Number: 0007-650-PLA-0008) was approved on 31 October 2016 and was written to support gas field developments in Scotia Gas Field Petroleum Lease (PL) 176.
- The Santos GLNG Gas Fields Development Project, Stage 2 OAMP (Document Number: 0030-650-EMP-0001 [Rev 2]) was approved on 29 June 2018 and was written to support gas field developments in Maisey Gas Field (PL 176).
- The Santos GLNG Gas Fields Development Stage 3 OAMP, (Rev 1) was approved on 17 May 2021 and was written to support gas field developments in Scotia Gas Field (PL 176), and Arcadia Gas Field on (PL 90, PL 234 and PL 421).
- The Santos GLNG Gas Fields Development Stage 4 OAMP, (Rev 0) was approved on 23 September 2021 and was written to support gas field developments in Scotia Gas Field (PL 176), and Arcadia Gas Field on (PL 90, PL 234 and PL 421).

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Table 7 – Summary of the Springwater offset area and acquittal for Stage 8 of EPBC 2012/6615

MNES	Status under EPBC Act[1]	Stage 8 disturbance area (ha)	Habitat within the Springwater offset area (ha)	Offset area (ha)				% acquittal of Stage 8[2]	Surplus area (ha)[3]
				Approved for Stage 2 under EPBC 2012/6615	Approved for Stage 3 under EPBC 2012/6615	Approved for Stage 4 under EPBC 2012/6615	To be secured for Stage 8 under EPBC 2012/6615		
Threatened ecological communities									
Brigalow TEC	E	0.51	368.6	53.0	198.0	65.6	27.2	539.18	0
SEVT TEC	E	0.50	57.4	-	-	26.0	4.1	83.25	0
Threatened fauna species									
Collared Delma (*Delma torquata*)	V	49.49	785.9	284.0	339.5	-	46.1	16.10	0
Yakka Skink (*Egernia rugosa*)	V	39.99	785.9	279.0	350.5	-	46.1	16.60	0
Dunmall's Snake (*Furina dunmalli*)	V	49.98	785.9	284.0	351.5	-	46.1	15.94	0
Red Goshawk (*Erythrotriorchis radiatus*)	E	25.61	852.9	-	288.0	-	50.2	23.15	0
Black-breasted Button-quail (*Turnix melanogaster*)	V	0.50	57.4	-	5.7	19.0	4.1	101.55	0
Squatter Pigeon (southern) (*Geophaps scripta scripta*)	V	32.11	445.8	-	75.0	-	18.9	8.49	0
Northern Quoll (*Dasyurus hallucatus*)	E	26.11	852.9	-	251.0	-	50.2	27.25	0
Koala (*Phascolarctos cinereus*)	E	36.56	445.8	217.0	156.0	-	18.9	6.11	0
South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	50.48	852.9	340.0	371.0	-	50.2	14.33	0
Large-eared Pied Bat (*Chalinolobus dwyeri*)	E	32.61	852.9	-	251.0	-	50.2	18.18	0

[1] E = Endangered; V = Vulnerable.
[2] Balance of the offset requirement satisfied on another property.
[3] Surplus areas do not have a direct linear relationship with MNES habitat – refer to Section 4 of the Acquittal document (Santos 2025) and Table 5 of this OAMP to understand how areas are accounted for in each stage.

2.7. Development and land use

Santos has comitted to excluding any development for the project from the SOA.

The areas on the Springwater property outside of the offset area may be utilised for petroleum and/or farming infrastructure and facilities; however, no infrastructure will be located within the offset area or impact the offset area's ability to achieve the completion criteria outlined in this OAMP

2.8. Offset protection

Under Queensland legislation, one option of a legal securing mechanism for an offset area is declaring the area of high nature conservation value under section 19F of the VM Act, where it is secured in perpetuity for the purposes of an environmental offset.

In October 2017, Santos GLNG wrote to the Queensland Department of Natural Resources Mines and Energy (DNRME) requesting that the SOA be declared as an area of high nature conservation value under section 19F of the VM Act (a voluntary declaration). On 26 February 2018 the DNRME wrote to the Santos GLNG informing that the SOA meets the requirements of a Voluntary Declaration under the VM Act and on 1 April 2018 Santos GLNG agreed to the offer. On 6 April 2018, the voluntary declaration was certified, thereby satisfying the legal security requirement of Condition 16.

The offset area will be mapped as a Category A area on the Property Map of Assessable Vegetation (PMAV). A Category A area on a PMAV is described as an "Area subject to compliance notices, offsets and voluntary declarations". The Voluntary Declaration will remain in place for the life of EPBC 2012/6615. The Voluntary Declaration may only be removed in accordance with the provisions of the VM Act or if the chief executive administering the VM Act considers it necessary.

2.9. EPBC Act Environmental Offset Policy

Table 7 outlines how the GLNG Project offset obligations acquit on the Springwater offset area to meet the requirements of the EPBC Act *Environmental Offsets Policy*.

Table 8 – Assessment against Principles of the Offset Policy

Principle	How the principle is met in this offset proposal
1. deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The Springwater offset area partially acquits MNES offset requirements under Stage 8 EPBC 2012/6615 as outlined in Table 7. The Springwater offset area will be managed and monitored to improve the quality of Brigalow TEC, SEVT TEC and viability of habitat for threatened fauna species. This will include the management of regrowth vegetation to become self-sustaining functional remnant vegetation communities. This OAMP sets out specific management objectives with interim performance targets and completion criteria. Management actions are outlined with accompanying adaptive management triggers and corrective actions in the event that monitoring identifies that interim performance targets are not attained, or completion criteria are not attained and/or maintained. The offset area will be managed and monitored from approval of the OAMP for a minimum of 20 years. It is anticipated that the completion criteria will be achieved within a 20-year period.

Principle	How the principle is met in this offset proposal
2. be built around direct offsets but may include other compensatory measures	MNES offset obligations under EPBC 2012/6615 will be acquit through the delivery of direct land-based offsets on the Springwater offset area and additional land based offset areas to be secured by Santos.
3. be in proportion to the level of statutory protection that applies to the protected matter	The threatened status of the impacted protected matters is considered in the OAG in calculating the area of the offset to be provided.
4. be of a size and scale proportionate to the residual impacts on the protected matter	The size of the offset area to be secured for offset obligations has been calculated in accordance with the OAG (Appendix A).
5. effectively account for and manage the risks of the offset not succeeding	This OAMP has been developed in consideration of known and identified threats to the offset values to manage the risk of failing to the achieve the completion criteria and overall environmental outcomes for the offset area. Threats to the offset site are managed by through the implementation of the management measures discussed in Section 6, including: • fire prevention and management, • weed monitoring and control, • clearing protection, • management of grazing, and • restricted access. The relevant risks were identified based on a review of current literature (i.e. conservation advices, recovery plans etc) and identification of potential site-specific risks based on the results of field surveys and discussions with the landholder. The results of the risk assessment, presented in Appendix C, have informed the adaptive management process including the identification of threats to offset values, management objectives, performance criteria, management actions, monitoring programs, adaptive management triggers and corrective actions. If the offset cannot attain and maintain the completion criteria, then additional offsets will be provided to compensate for the impact and the failed offset (see Section 5).
6. be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	The environmental outcomes proposed to be achieved through the implementation of this OAMP are based on additional management and monitoring measures conducted as part of business as usual on the Springwater property. For example, under the *Biosecurity Act 2014* (Qld) a person has a general biosecurity obligation to: take all reasonable and practical steps to prevent or minimise each biosecurity risk. The steps proposed in this OAMP are above reasonable and practical steps required to control feral animals and weeds in central Queensland. Once the Voluntary Declaration has been secured over the offset area, environmental laws prevent other land uses inconsistent with this OAMP being approved over this part of the property.
7. be efficient, effective, timely, transparent, scientifically robust and reasonable	The Springwater offset area has been identified to be suitable using an evidence based and scientifically robust approach.

Principle	How the principle is met in this offset proposal
	The environmental outcomes to be achieved through this OAMP will be delivered progressively over 20 years. The offset area will be legally secured through a Voluntary Declaration under the VM Act, therefore any vegetation clearing contravention of this OAMP is not permissible without specific Queensland government approval. The preparation and implementation of this OAMP supports the efficient, effective, timely, transparent, and scientifically robust approach to providing offsets.
8. have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced	This OAMP includes a detailed monitoring program which will assess the effectiveness of the management actions undertaken and the progress of the offset area in achieving the environmental outcomes. The results of all management and monitoring programs will be included in annual reports. An implementation schedule for monitoring and management is provided in Section 7.6 which will be reviewed at least annually to ensure the timely implementation of this OAMP.

3. Offset Values

The following sections provide a description of the offset area and potential threats that will be managed as part of this OAMP for each MNES offset value. Figure 5 presents the MNES offset areas on Springwater.

3.1. Brigalow TEC

Brigalow TEC within the offset area comprises areas of remnant and mature regrowth RE 11.9.5 (Figure 5).

Areas of remnant and mature regrowth are in relatively good condition and meet the requirements for Brigalow TEC (as listed under the EPBC Act). Canopy cover is relatively closed, weed cover is negligible and abundant fallen timber is generally present. This habitat provides suitable foraging values for a variety of forest bird species that prefer a closed canopy. There is abundant shelter for ground fauna (particularly reptiles) in the form of fallen logs and low shrubs. Peeling bark is common in this habitat providing refuge for arboreal reptiles. These communities have low disjunct canopies ranging from dense to very sparse, little to no shrub layer development and ground layers devoid of fallen woody material and litter being dominated by exotic grasses and bare earth.

3.2. SEVT TEC

The SEVT TEC within the offset area comprises areas of remnant and mature regrowth RE 11.9.4 (Figure 5).

These areas include the presence of large rocks with extensive areas of rocky crevice habitat. The canopy is relatively low and tended to be sparse in some areas. The shrub and ground layer is patchy but dense in some areas. Where a suitable shrub/low tree layer occurs, there is a thick leaf litter layer. Fallen timber is generally abundant. This habitat provides significant value in the form of potential shelter sites for several target threatened species including Northern Quoll, Large-Eared Pied Bat and Collared Delma and Yakka Skink (Terrestria 2020).

A number of larger fauna on the site will use this habitat as daytime shelter areas including a range of macropods such as Herbert's Rock-wallaby and Wallaroo (*Macropus robustus*). This habitat also provides suitable foraging values for a variety of smaller forest bird species that prefer a closed canopy and dense low vegetation such as White-browed Scrubwren, fantails and fairywrens. Fan-tailed Cuckoo (*Cacomantis flabelliformis*) and Eastern Yellow Robin were only recorded in this habitat. There is abundant shelter for ground fauna (particularly reptiles) in the form of rock crevices and low shrubs, particularly reptiles but also small mammals such as dasyurids and rodents (Terrestria 2020).

3.3. Collared Delma

Habitat for Collared Delma within the offset area comprises areas of RE 11.3.25, 11.9.5, 11.9.7, 11.10.7, 11.10.7a (Figure 5).

Collared Delma is known to occur in REs on land zones 3, 9 and 10 (DCCEEW 2025c). The species appears to require rocks, timber, bark, or other surface debris for shelter (DCCEEW 2025c). The patches of Brigalow and SEVT understorey also provides significant value in the form of potential shelter sites including areas comparing abundant fallen timber and thick leaf litter layer in addition to presence of large rocks and extensive rock crevice habitat.

3.4. Yakka Skink

Habitat for Yakka Skink within the offset area comprise RE 11.9.5, 11.9.7, 11.10.7, 11.10.7a (Figure 5).

The species is commonly found under partly buried rocks and logs, or in abandoned animal burrows. Older growth communities contain good structure in the form of developed shrub and ground layers and fallen timber and deep leaf litter. Fallen woody material is common in this community and large boulders providing potential shelter opportunities.

3.5. Dunmall's Snake

Habitat for Dunmall's snake within the offset area comprises RE 11.9.5, 11.9.7, 11.10.7, 11.10.7a (Figure 5).

The species occurs in a variety of habitats including forests to woodlands (including *Eucalyptus*, *Acacia*, *Callitris* species) on sandy soils, cracking clay soils with Brigalow scrub, and dry vine scrub (Terrestria 2020). Areas of remnant and mature regrowth REs on land zones 3, 9 and 10 are considered suitable foraging and shelter. The species was confirmed in the Springwater offset area in March 2024 in a patch of remnant RE 11.9.4.

3.6. Red Goshawk

Habitat for Red Goshawk within the offset area comprise RE 11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7 and 11.10.7a (Figure 5).

Red Goshawk is a highly mobile species with a large home range. Breeding habitat is in intact tall forest associated with major drainage lines; however, the species may often forage much further away from these areas (DCCEEW 2025f).

3.7. Black-breasted Button-quail

Habitat for Black-breasted Button quail within the offset area comprises RE 11.9.4 (Figure 5).

SEVT (RE 11.9.4) and Brigalow (RE 11.9.5) communities provide suitable habitat for black-breasted button-quail which is known to support the species in the Brigalow Belt South bioregion (DCCEEW 2025l). Black-breasted button-quail is known to prefer SEVT communities and other closed forest types with dense leaf litter and low shrubs (DCCEEW 2025l). Within areas of SEVT vegetation where a suitable shrub/low tree layer occurs there is a thick leaf litter layer. Within areas of remnant Brigalow vegetation areas of scattered shrubs are present, often of SEVT species. The managed recovery of regrowth vegetation (particularly SEVT) to remnant status over time is considered one of the best ways to provide habitat for this species.

3.8. Squatter Pigeon

Habitat for Squatter Pigeon within the offset area comprise RE 11.3.25, 11.9.7, 11.10.7 and 11.10.7a (Figure 5).

The Squatter Pigeon favours open-forests to sparse, open-woodlands and scrub that are close to water bodies or watercourses. Permanent water associated with the large permanent dam provides habitat opportunities for this species.

3.9. Northern Quoll

Habitat for Northern Quoll within the offset area comprises areas of RE 11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7, and 11.10.7a (Figure 5).

This species is dependent on the presence of suitable shelter habitat in the form of caves and deep crevices in extensive rock formations (commonly sandstone) and forages in associated woodland and forest habitat (DCCEEW 2025d). Patches of Brigalow TEC and SEVT TEC provides significant value in the form of potential den and shelter habitat suitable den sites. The offset area is located within the species historical range, although recent records for the species are lacking (DCCEEW 2025d).

3.10. Koala

Habitat for the Koala within the offset area comprises areas of remnant and regrowth RE 11.3.25, 11.9.7, 11.10.7 and 11.10.7a (Figure 5).

Koala habitat is broadly defined as eucalypt forests and woodlands or shrubland with emergent eucalypt species and can include both remnant and regrowth communities, provided adequate mature Koala food trees are present (DCCEEW 2025j). Potential habitat for the Koala within the Springwater offset area is widespread.

3.11. South-eastern Long-eared Bat

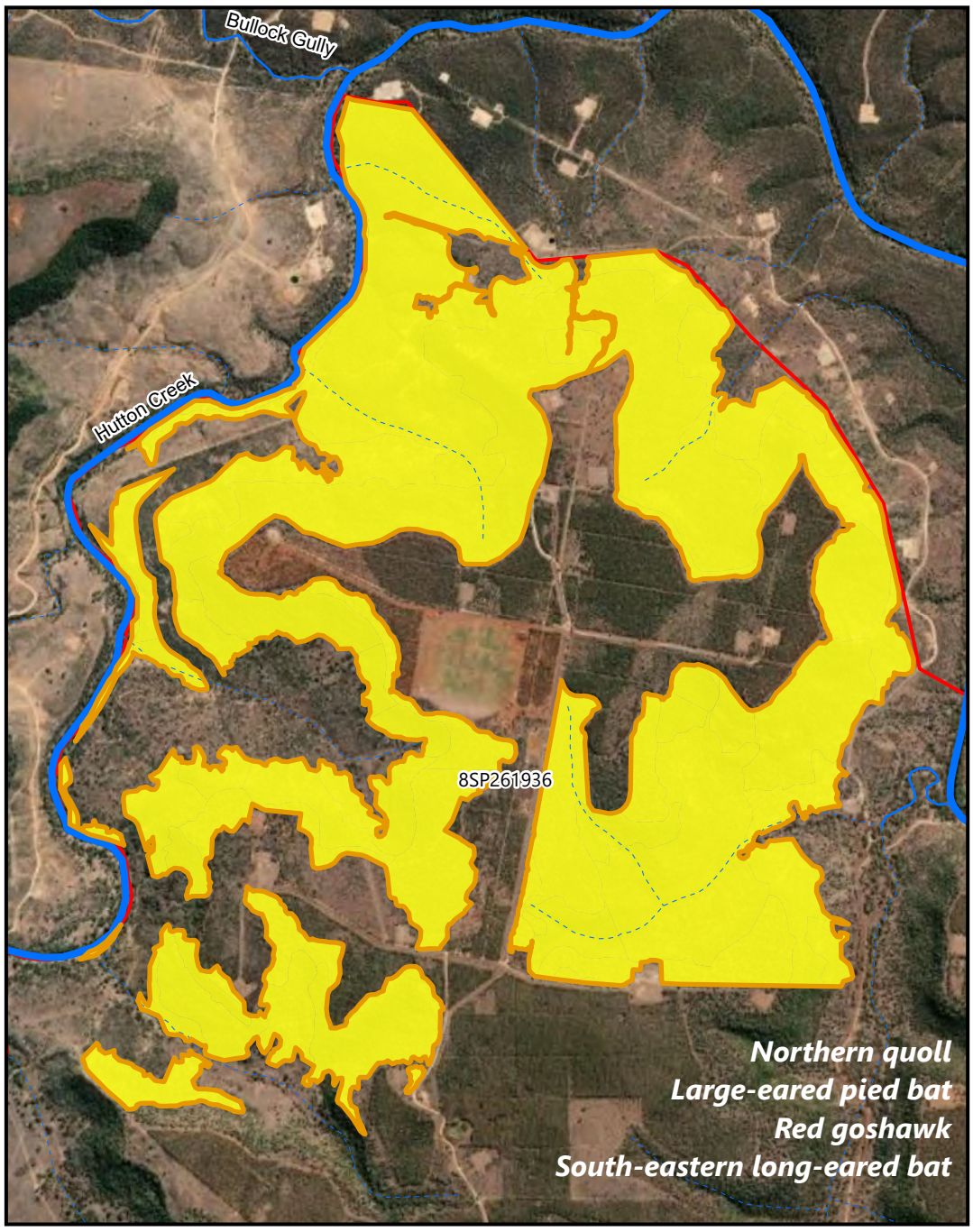
Habitat on the Springwater offset area for South eastern Long-eared bat includes RE 11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7 and 11.10.7a (Figure 5).

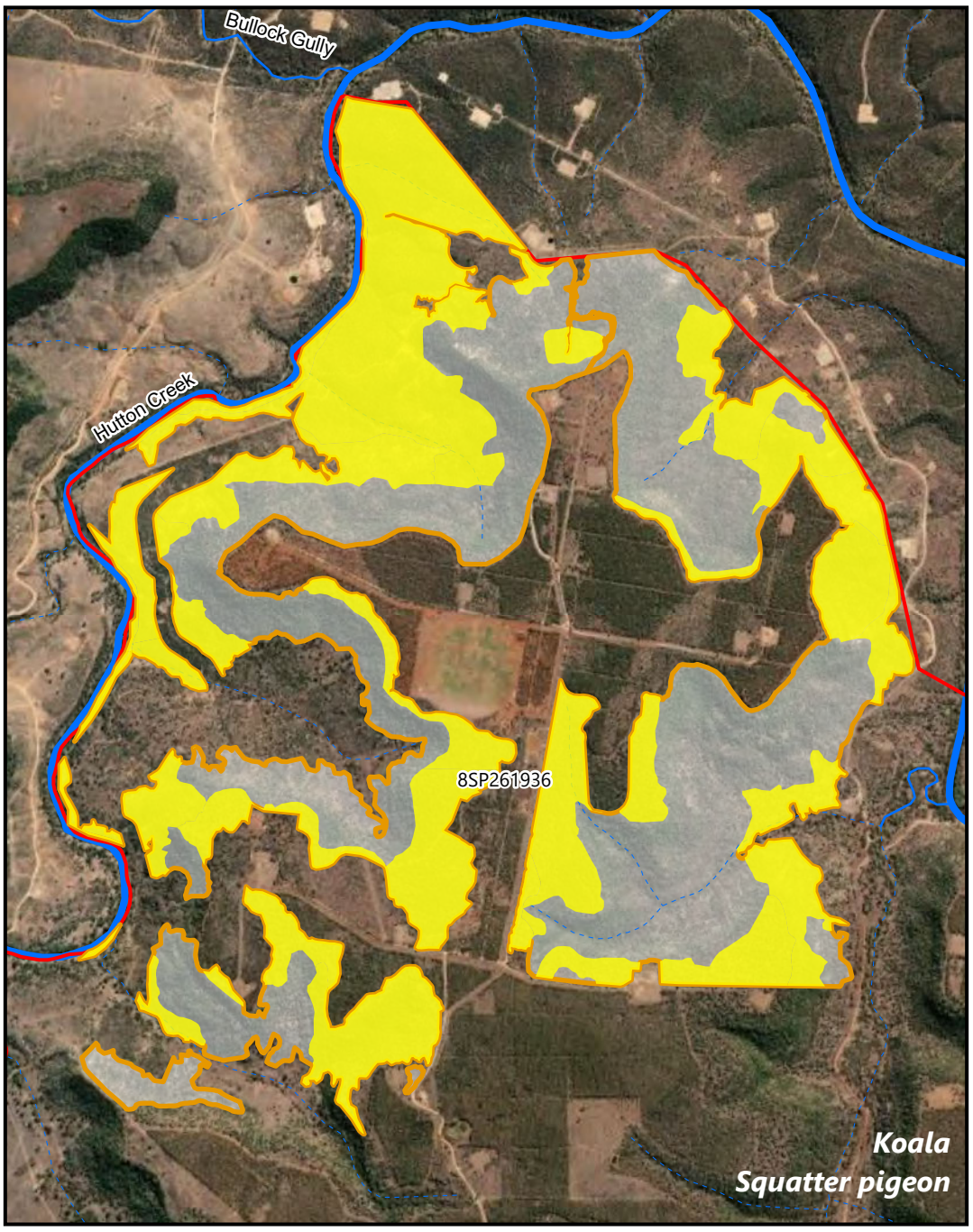
The species is known to occur in a variety of dry forest habitats including River Red Gum, open woodland, mallee, brigalow and other arid and semi-arid habitats. The preferred habitat is mallee and Callitris woodlands (Pennay et al., 2011), and habitats that have a distinct canopy with a dense, cluttered understorey (Turbill and Ellis, 2006). It roosts in tree hollows or under bark (NSW NPWS, 2003). Surveys suggest the species requires large tracts of forest to occur (Turbill et al., 2008) including older regrowth communities that contain good structure in the form of developed shrub and ground layers and fallen timber and deep leaf litter.

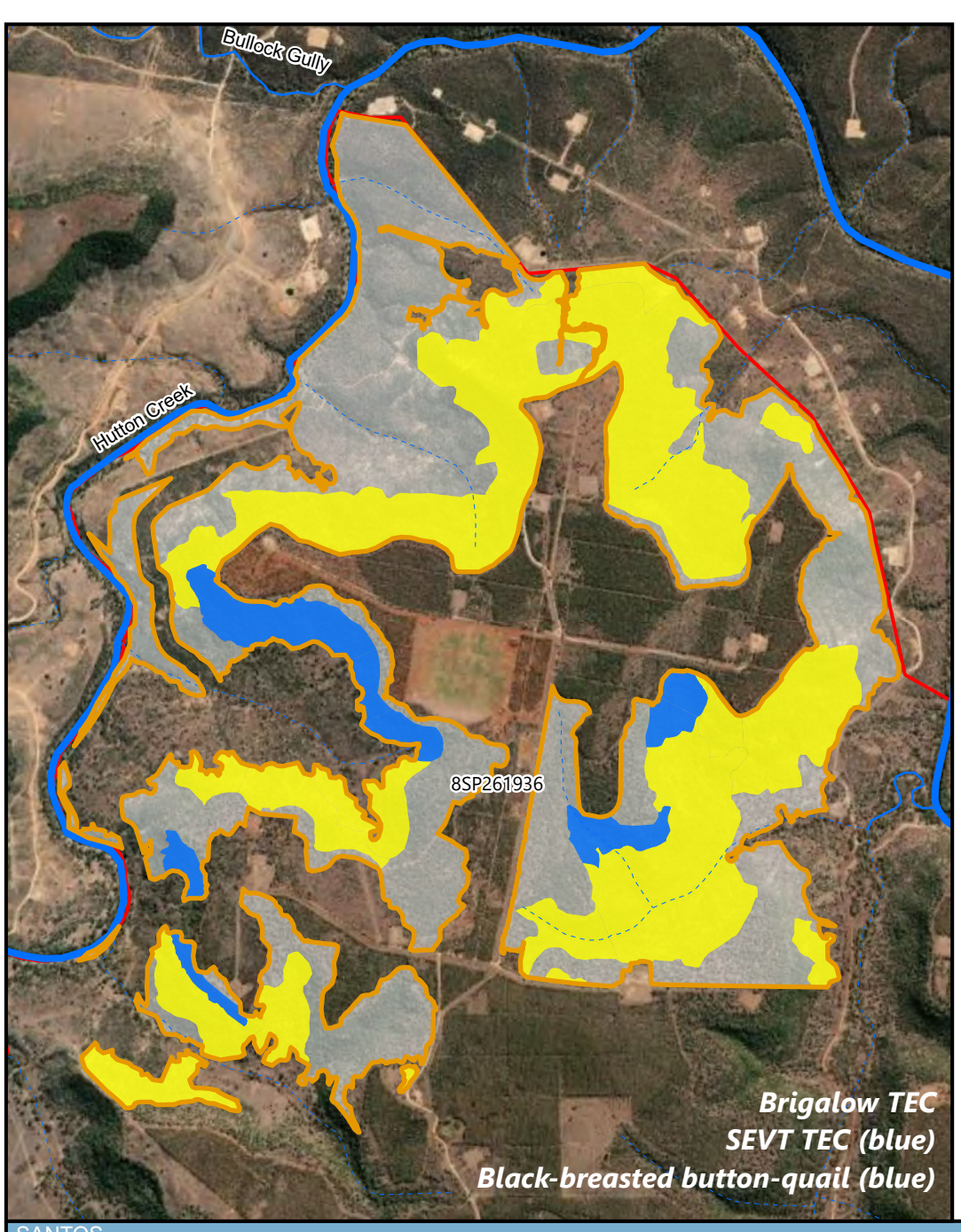
3.12. Large-eared Pied Bat

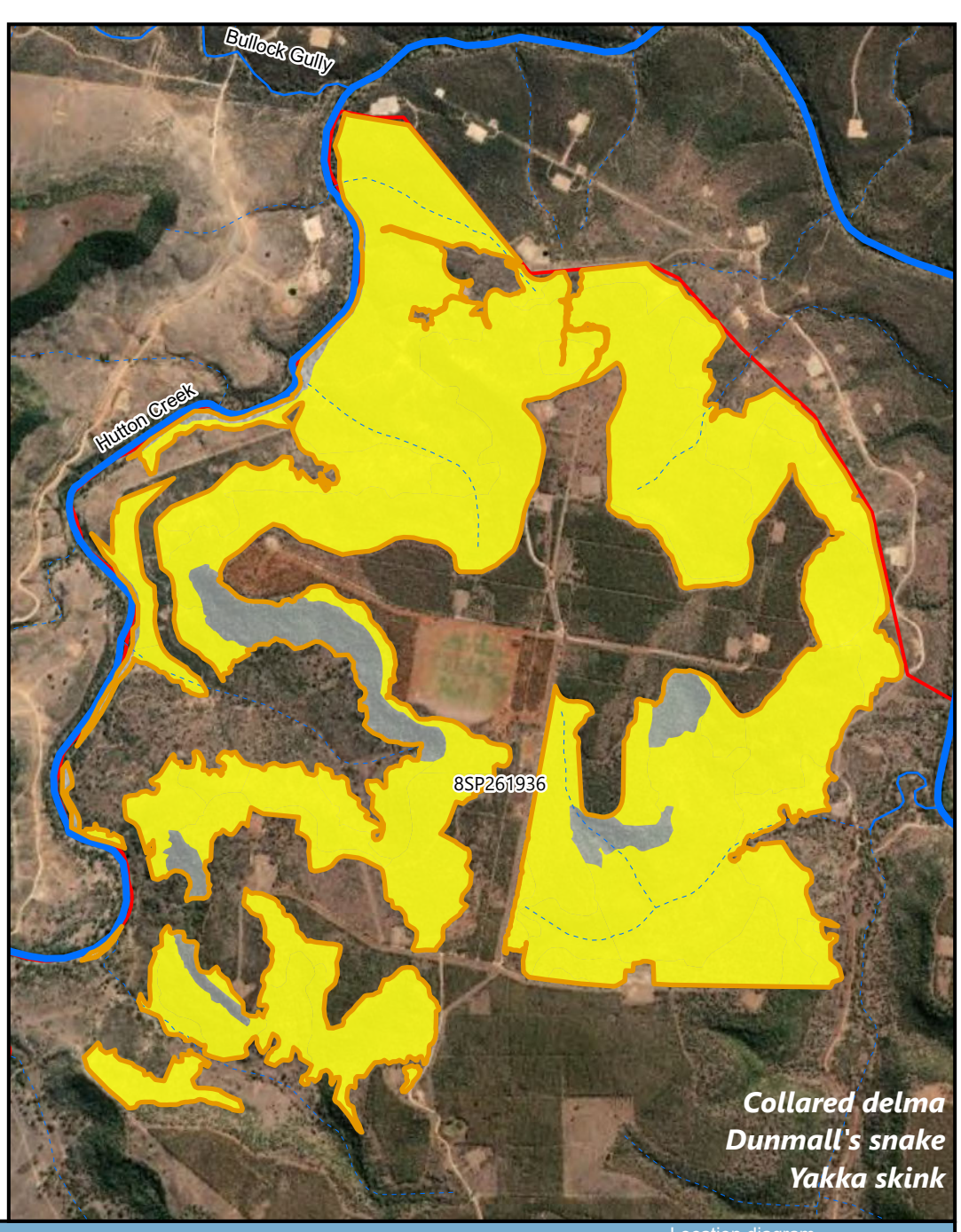
Habitat for Large-eared Pied Bat within the offset area comprise RE 11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7 and 11.10.7a (Figure 5).

Suitable foraging habitat for the species occurs across much of the offset area within areas of adjacent remnant and mature regrowth vegetation. The species requires a combination of sandstone cliffs/escarpments to provide roosting habitat that is adjacent to fertile woodlands preferably box gum or river/rainforest corridors for foraging (DCCEEW 2025b).









SANTOS

Location diagram

Figure 5
MNES habitat

Springwater property
Springwater offset area
MNES habitat

Watercourses
Regional-scale
Major watercourse
Creekline
Minor drainage line
Drainage contour

CO2 AUSTRALIA

N

0 0.5 1
Kilometres

Date: 29/10/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:35,000@A3

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
AUTHOR: J. Cousin

Path: H:\6_Biodiversity\Projects\Santos\20250416_Roma_Stage8_OAMPs\Springwater\Springwater_OAMP_mapping_20250416\Springwater_OAMP_mapping_20250416.aprx

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4. Environmental Outcomes to be Achieved

The outcome of this OAMP is to partially acquit the offset obligations for Stage 8 under EPBC 2012/6615 (conditions 11-19) in accordance with the EPBC Act *Environmental Offsets Policy*. Progress towards achieving these outcomes will be measured against the interim performance targets and criteria defined in Table 9 as well as habitat quality scores for MNES outlined in Table 10.

Through the implementation of management and monitoring activities outlined in Section 6.2 and 7, the condition of the vegetation and offset values within the offset area will be improved from the baseline habitat quality to achieve the completion criteria within 20 years of commencement of the OAMP and be maintained for the life of the approval (i.e. until 31 March 2066).

Table 9 – Interim performance targets and completion criteria for the Springwater offset area

Metric	Interim performance targets			Completion criteria
	Year 5	Year 10	Year 15	Year 20
Assessment Units - Advanced regrowth REs: 11.9.5, 11.9.7 and young regrowth REs: 11.9.5, 11.9.7, 11.10.7				
Tree canopy height	Increased	Increased to within 50% of remnant height	Increased to within 75% of remnant height	Remnant (VMA) structure and floristics
Canopy recruitment	Increased, or 100%	Increased, or 100%	Increased, or 100%	Increased, or 100%
Tree canopy cover	Increased	Increased to within 50% of remnant cover	Increased to within 75% of remnant cover	Remnant (VMA) structure and floristics
Shrub layer cover	Increased	Increased	Increased	Increased
Coarse woody debris	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant
Native plant species richness	Increased for four life forms	Increased for four life forms	Increased for four life forms	Increased for four life forms
Non-native plant cover	Decreased, or is below 5%	Decreased, or is below 5%	Decreased, or is below 5%	Decreased, or is below 5%
Native perennial grass cover	Increased	Increased	Increased	Increased
Litter cover	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant
Access and development	Limited	Limited	Limited	Limited
BioCondition metric scores	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing
Clearing	No clearing has occurred	No clearing has occurred	No clearing has occurred	No clearing has occurred

Metric	Interim performance targets			Completion criteria
	Year 5	Year 10	Year 15	Year 20
Weeds	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover
Pest animals	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events
Assessment Units - Remnant REs: 11.3.25, 11.9.4, 11.9.5, 11.9.7, 11.10.7				
Tree canopy height	Has not decreased	Has not decreased	Has not decreased	Has not decreased
Canopy recruitment	Increased, or 100%	Increased, or 100%	Increased, or 100%	Increased, or 100%
Tree canopy cover	Has not decreased	Has not decreased	Has not decreased	Has not decreased
Shrub layer cover	Increased	Increased	Increased	Remnant (VMA) structure and floristics
Coarse woody debris	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant
Native plant species richness	Increased for four life forms	Increased for four life forms	Increased for four life forms	Increased for four life forms
Non-native plant cover	Decreased, or is below 5%	Decreased, or is below 5%	Decreased, or is below 5%	Decreased, or is below 5%
Native perennial grass cover	Increased	Increased	Increased	Increased
Litter cover	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant	Increased, or remains constant
Access and development	Limited	Limited	Limited	Limited
BioCondition metric scores	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing	Have not declined as a result of fire or grazing
Clearing	No clearing has occurred	No clearing has occurred	No clearing has occurred	No clearing has occurred

Metric	Interim performance targets			Completion criteria
	Year 5	Year 10	Year 15	Year 20
Weeds	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover	Weed control activities have prevented an increase in weed cover
Pest animals	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events	Decrease in pest fauna trapped during trapping events

Table 10 – SOA Baseline Habitat Quality Scores

MNES	Baseline habitat quality score (rounded)	Completion criteria habitat quality score (Year 20)
Threatened ecological communities		
Brigalow TEC	6.71 (7)	8
SEVT TEC	8.36 (8)	9
Threatened fauna species		
Collared Delma	5.57 (6)	7
Yakka Skink	5.88 (6)	7
Dunmall's Snake	5.57 (6)	7
Red Goshawk	5.81 (6)	7
Black-breasted Button-quail	6.31 (6)	7
Squatter Pigeon	6.05 (6)	7

MNES	Baseline habitat quality score (rounded)	Completion criteria habitat quality score (Year 20)
Northern Quoll	5.62 (6)	7
Koala	5.55 (6)	7
South-eastern Long-eared Bat	6.12 (6)	7
Large-eared Piet Bat	5.81 (6)	7

5. Approach to Management

This OAMP is based on an adaptive management approach which involves 'flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood' (National Research Council 2004).

5.1. Adaptive management

Adaptive management includes two key phases:

- establishment of the key components of a management framework including engaging stakeholders, developing clear and measurable objectives and performance criteria, identification and selection of potential management actions and the development of monitoring protocols which enable the evaluation of progress towards achieving objectives, and which will effectively contribute to the adaptive management decision making process.
- an iterative learning phase which involves utilisation of the management framework to learn about the natural resource system and iteratively adapt management strategies and approaches based on what is learned (Williams 2011).

The implementation of this OAMP will use the adaptive management framework, as illustrated in Figure 6, to detect changes in the condition of offset values, incorporate learnings from other similar management activities/conservation advice and inform decisions on corrective actions to ensure that interim performance targets and completion criteria are attained and maintained for the life of the approval. The offset site will be managed and monitored, as a minimum for the life of the approval and until the completion criteria have been achieved.

Section 6 details the overall environmental outcome of this OAMP, interim performance targets and completion criteria for each offset value and management objectives to be achieved as part of this OAMP. Attainment and maintenance of the completion criteria will be assessed based on the results of ongoing management and monitoring events and will be presented as part of compliance reporting commitments to the Commonwealth Government (see Section 8).

If an interim performance target has not been achieved, or a completion criterion (once attained) has not been maintained, or an adaptive management trigger is identified, corrective actions will be implemented. Where there is uncertainty as to the cause of the management trigger (e.g., failure to achieve the interim performance target), the event or circumstance triggering corrective action will be reviewed, and management actions in this Offset Plan may be revised accordingly.

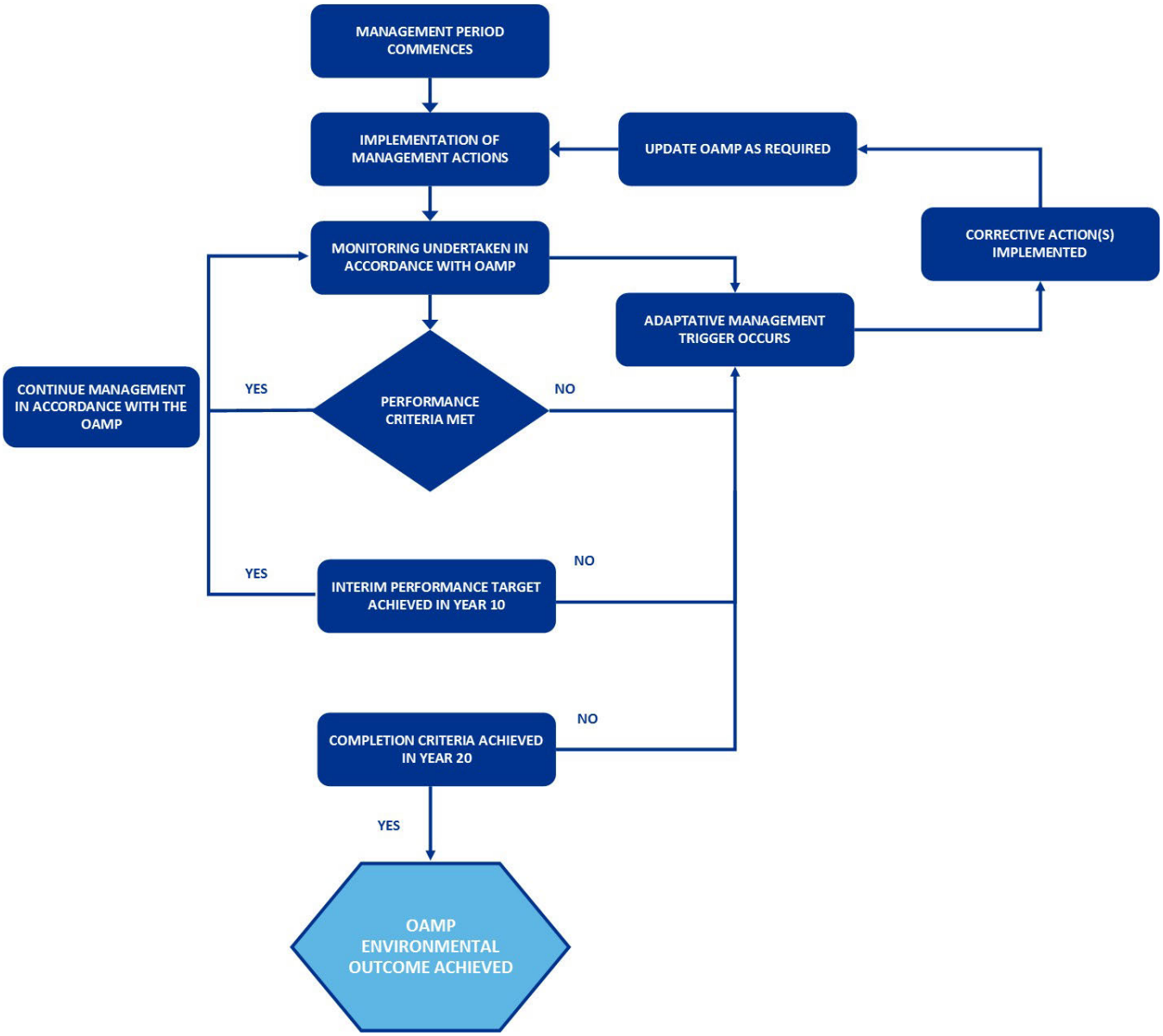

Figure 6 – Adaptive management process for implementation of the OAMP

5.2. Managing uncertainty

The management of natural systems involves uncertainty which can affect the success of the management measures in achieving the objectives and performance criteria. Williams (2011) and Williams and Brown (2016) identify four kinds of uncertainty, outlined Table 11, with how they have been addressed through the development of this Offset Plan.

Table 11 – Four kinds of uncertainty (Williams and Brown 2016)

Uncertainty	Description	Addressed how
Environmental variation	Caused by external factors that act upon natural systems, but which are not influenced by the resource conditions and dynamics, for	Largely outside of the control of the manager (Williams 2011). Influence is considered in the analysis of the effectiveness of the adaptive management approach, the analysis of the ability to achieve and

Uncertainty	Description	Addressed how
	example variation in rainfall or temperature.	maintain performance criteria and when considering the need for corrective actions.
Partial observability	Includes potential uncertainty arising from variation in the collection of data during monitoring events, and from being unable to completely observe the natural system in its entirety (Williams & Brown 2016).	Addressed in this OAMP through the development of a monitoring program based on scientifically tested and repeatable methods.
Partial controllability	Relates to the difference between the intended effect of the management measures to be implemented through this OAMP and the actual effect of their implementation on the ground (Williams & Brown 2016).	Address through adherence to an adaptive management approach including regular monitoring of conformance with performance criteria, assessment of adaptive management triggers, the implementation of corrective actions, review, and amendments to the OAMP, and reporting to ensure that management measures are being effectively implemented on the ground.
Structural and process uncertainty	Concerns a lack of knowledge or understanding regarding biological and ecological processes and relationships, and differing views regarding how natural systems respond to management (Williams & Brown 2016).	Addressed through the adaptive management approach. Following the results of ongoing management, monitoring and reporting, the OAMP will be reviewed and updated as required to incorporate learnings, updated conservation advice and best practice management techniques.

5.2.1. Timing for implementation of the OAMP

The offset area will be managed and monitored until the interim performance targets and completion criteria are achieved. It is anticipated that through the adaptive management approach, interim performance targets and completion criteria will be achieved within the proposed 20-year management period. However, if the interim performance targets and/or completion criteria for offset values have not been achieved within the anticipated timeframes, management and monitoring will continue beyond the 20-year management period in accordance with this Offset Plan until the completion criteria have been achieved. Once attained, completion criteria will be maintained for at least the life of the EPBC Act Approval.

5.2.2. Risk of offset failure

Appendix C presents an assessment of the risk of failure to achieve the OAMP objectives for the offset values.

Based on the adaptive approach to management and the proposed management and monitoring program, it is considered that the management objectives, interim performance targets and completion criteria (see Table 9) will be successfully achieved.

If interim performance targets are not achieved for one or more offset values by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people / groups with the aim of identifying appropriate additional management interventions.

It should be noted that unavoidable temporary perturbations such as severe drought, or insect/fungal pest invasion that may cause a temporary decrease in metrics such as canopy or shrub cover from which the community still may recover within the next 5-year period should not preclude assessment of a satisfactory increase in ecological condition by the completion date.

If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required Stage 8 offset requirements in accordance with the offsets assessment guide. The revised OAMP will be submitted to the Commonwealth Government.

6. Management Program

6.1. Management Objectives

A summary of the management objectives and performance criteria for the SOA is presented in Table 12, and the complete adaptive management process for this OAMP is encapsulated in Table 14. The management measures provided in Table 13 take into account the information the relevant conservation advices, recovery plans and threat abatement plans for each MNES. Management actions, monitoring events, adaptive management triggers and corrective actions have been assigned to each management objective and performance criteria.

The environmental outcome sought through this OAMP is to improve the condition of vegetation in the SOA according to the interim performance targets and completion criteria detailed in Table 9, such that the habitat quality score for each MNES is improved from the baseline, as summarised in Table 10.

Table 12 – Summary of the management objectives and performance criteria

Management objectives	Performance criteria
Achieve the completion criteria and habitat quality improvements for offset values, which include the habitat quality scores in this OAMP.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events to achieve the scores in the completion criteria.
Maintain the extent of offset value habitat within the SOA.	No unapproved and/or intentional clearing of habitat within the offset area, except for clearing that is required for fencing, access, firebreaks and public safety.
Ensure that any livestock grazing for fire management and weed control maintains and enhances the ground cover attributes for MNES and does not result in the degradation of habitat and vegetation	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events
	Biomass levels of at least 1,500 kg/ha are retained at each of the monitoring sites at the end of the dry season.
	Livestock are only observed to be in the offset management areas undertaking strategic grazing.
Manage regrowth of Brigalow TEC vegetation (RE 11.9.5) to accelerate structural development	Maintenance of Brigalow TEC regrowth in accordance with interim performance targets and completion criteria.
Manage invasive weed species to reduce degradation of MNES habitat	Decrease in relative abundance of weed species at 80% of monitoring sites from subsequent monitoring events No new weed species are identified at any monitoring site (based on subsequent monitoring events)
Minimise predation risk by pest animals to threatened fauna species	Reduction in Catling* Index for the relevant pest animal from the first year of offset management
Minimise degradation of MNES habitat by rabbits.	Maintain rabbit impact category as ‘acceptable’.
Minimise degradation of MNES habitat by feral pigs.	Reduction in mean feral pig abundance score from the first year of management
Reduce the risk of adverse impacts on MNES habitat associated with unplanned fire	No unplanned fire within the SOA Increase in habitat quality scores as a result of implementation of any fire management measures.

Management objectives	Performance criteria
Achieve the interim performance targets and completion criteria for each offset value within 5, 10, 15 and 20 years, respectively.	The interim performance targets are achieved for all offset values by year 5,10 and 15. The completion criteria are achieved for all offset values by year 20.

* Catling index provides a measure of relative abundance of wild dogs, foxes and feral cats within the offset area. The Catling index will be measured as the percentage of camera nights in which the pest species was observed as part of fauna camera monitoring for the species, as outlined in Section 7.4.

Table 13 – Recovery actions for each MNES and their associated threats

MNES	Threats	Recovery/management actions
Threatened ecological communities		
Brigalow TEC	Threats to the TEC have been determined based on conservation advice and the Threat Abatement Plan (DCCEEW 2025a): • Clearing of regrowth vegetation. • Inappropriate fire regimes and management. • Pest plant infestation. • Potential knowledge gaps. • Increased grazing by livestock.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025a): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4).
SEVT TEC	Threats to the TEC have been determined based on conservation advice and the Threat Abatement Plan (DCCEEW 2025k): • Clearing of regrowth vegetation. • Inappropriate fire regimes • Invasion by introduced pasture species. • Increased grazing by livestock. • Disturbance by pest animals.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025k): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4).
Threatened fauna species		
Collared Delma (*Delma torquata)*	Threats to the species have been determined based on conservation advice (DCCEEW 2025c): • Alteration of ground cover as a consequence of unsuitable fire regime. • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Predation by feral predators (e.g., cats, foxes, wild dogs). • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025c): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.6 and 7.3).

MNES	Threats	Recovery/management actions
	• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.	
Yakka Skink (*Egernia rugosa*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025e): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Destruction of potential shelter habitat associated with rabbit warren ripping. • Predation by feral predators (e.g., cats, foxes, pigs). • Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). • Destruction of potential shelter habitat associated with rabbit warren ripping. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025e): • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Weed management and monitoring (see Sections 6.2.6 and 7.3) • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Biomass monitoring (see Section 7.2).
Dunmall's snake (*Furina dunmalli)*	Threats to the species have been determined based on conservation advice (DCCEEW 2025g): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Predation by feral predators (e.g., cats, foxes, pigs). • Change in ground layer composition as a consequence of livestock grazing and feral horse browsing. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Alteration of ground cover as a consequence of unsuitable fire regime.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025g): • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.6 and 7.3) • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2).
Red Goshawk (*Erythrotriorchis radiatus*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025f): • Loss of suitable foraging habitat through land clearing and effects associated with fragmentation of large contiguous	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025f): • Exclusion of cattle from the offset area (see Section 6.2.3).

MNES	Threats	Recovery/management actions
	patches of forest and woodland, particularly large trees in alluvial valleys. • Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity. • Potential of reduced prey (e.g., medium sized birds) as a consequence of unsuitable fire regime.	• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2).
Black-breasted Button-quail (*Turnix melanogaster*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025l): • habitat loss through clearing • habitat degradation by overgrazing by stock and pest animals (e.g. feral pigs), and • fire regimes that remove understorey, coarse woody debris and ground litter.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025l) • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.6 and 7.3)
Squatter pigeon (*Geophaps scripta scripta*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025h): • Change in ground layer composition as a consequence of grazing and ecosystem engineering actions by rabbits (e.g. burrowing, soil turnover). • Predation by feral predators (e.g., cats, foxes). • Change in ground layer composition and trampling ground nests as a consequence of livestock grazing and feral horse browsing, especially in grassy, alluvial areas. • Change in ground layer composition, including thickening of understorey structure, as a consequence of unsuitable fire regime.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025h): • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.6 and 7.3)

MNES	Threats	Recovery/management actions
Northern Quoll (*Dasyurus hallucatus*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025d): • Poisoning through ingestion of cane toads (*Rhinella marina*). • Loss of ground cover as a consequence of unsuitable fire, resulting in risk of increased predation and/or reduced food. • Loss of ground cover as a consequence of livestock grazing. • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Alteration of habitat suitability through the presence and extent of non-native, invasive weeds. • Predation by feral predators (e.g., cats, foxes, wild dogs). • Poisoning through 1080 baiting.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025d) and recovery objectives outlined in Hill and Ward (2010): • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). • Exclusion of cattle from the offset area (see Section 6.2.3). • Weed management and monitoring (see Sections 6.2.6 and 7.3)
Koala (*Phascolarctos cinereus*)	Threats to the species have been determined based on conservation advice and the Recovery Plan (DCCEEW 2025j): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. • Mortality due to vehicle collision. • Predation by feral predators, particularly wild or domesticated dogs. • Alteration of the structure of suitable habitat, including loss of primary feed trees, as well as direct mortality as a consequence of unsuitable fire regime. • Evidence for the presence of disease within the population (i.e., *Chlamydia pecorum*).	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025j): • Exclusion of cattle from the offset area (see Section 6.2.3). • Restricting unauthorised entry into the offset area and managing access tracks and movement of vehicles within the offset area (see Sections 6.2.1 and 6.2.2). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4). • Weed management and monitoring (see Sections 6.2.6 and 7.3) • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Biomass monitoring (see Section 7.2).
South-eastern long-eared bat (*Nyctophilus corbeni*)	Threats to the species have been determined based on conservation advice (DCCEEW 2025i): • Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.	The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2025i): • Exclusion of cattle from the offset area (see Section 6.2.3). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4).

MNES	Threats	Recovery/management actions
	• Alteration of the structure of suitable habitat (e.g. mix of shrubby and open structure habitat) including loss of hollow-bearing trees as a consequence of unsuitable fire regime. • Impacts on understorey habitat as a consequence of livestock grazing, impacting habitat for understorey invertebrate prey. • Competition for hollows from native fauna species (e.g., parrots and cockatoos) and non-native fauna species (e.g., European honeybees, common myna), especially where hollows are limited.	• Weed management and monitoring (see Sections 6.2.6 and 7.3) • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Biomass monitoring (see Section 7.2).
Large-eared pied bat (*Chalinolobus dwyeri)*	Threats to the species have been determined based on conservation advice and the Recovery Plan (DCCEEW 2025b): • Potential of reduced foraging opportunities and flying invertebrate productivity as a consequence of unsuitable fire regime. • Predation by feral predators (e.g., foxes) • Loss of sandstone roosting/maternity sites, whether through occupation by pest animal species (e.g., goats) or impacts to structural integrity from uncontrolled wildfire.	The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2025b): • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). • Strategic grazing for fuel load management (see Section 6.2.4). • Biomass monitoring (see Section 7.2). Biomass monitoring (see Section 7.2). • Pest animal management and monitoring (see Sections 6.2.7 and 7.4).

Table 14 – Management objectives, performance criteria, adaptive management triggers and corrective actions

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
Achieve the completion criteria and habitat quality improvements for offset values, which include the habitat quality scores in this OAMP.	Increase the habitat quality scores for each offset value at each habitat quality assessment site based on the results of baseline and subsequent monitoring events to achieve the scores in the completion criteria.	Implementation of the management actions and adaptive management framework as outlined in this OAMP	Repeatable, measurable BioCondition monitoring at fixed monitoring locations to calculate comparable Habitat Quality scores in accordance with GTDTHQ (version 1.2; DEHP 2017) over the lifetime of the OAMP.	Fixed transects were established and assessed as part of the baseline in 2017 (see Figure 8). Transect locations were randomly stratified and are representative of offset values across vegetation communities and condition	BioCondition assessments will be undertaken every two years from the 2017 baseline for the first six years, and then every three years thereafter.	Monitoring of offset value habitat quality scores will be undertaken in accordance with Section 7, including: Offset area inspections (Section 7.1). Habitat quality assessments to determine habitat quality scores (Section 7.5). The results of monitoring events will be compared against the habitat quality scores in the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8)	Habitat quality scores for interim performance targets are not achieved for one or more offset values by: • Year 5 • Year 10 • Year 15 or • Year 20	**Step 1: Investigate cause of trigger:** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s:** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures or revising the type of measures to be implemented. • For offset values that have not achieved interim performance targets by year 15, for those offset values, Santos will obtain advice from scientific advisory groups with the aim of identifying appropriate additional management interventions. • In the very unlikely event that it is considered that the completion criteria will not be achieved, Santos will discuss the provision of additional offset options with the Commonwealth Government
Maintain the extent of offset value habitat within the SOA.	No unapproved and/or intentional clearing of habitat within the offset area, except for clearing that is required for fencing, access, firebreaks and public safety.	Protection of the SOA offset area via a Voluntary Declaration under section 19E and 19F of the VM Act as described in Section 2.8.	The offset area will be legally protected from unapproved vegetation clearing activities through compliance with the Voluntary Declaration under Section 19E and 19F of the VM Act, and declared an area of high nature conservation value. See Section 2.8	The entirety of the offset area is subject to the conditions of the Voluntary Declaration under the VM Act.	Restrictions outlined in Table 16 will be implemented for the lifetime of the project and OAMP.	Reporting to the Commonwealth Government consistent with any EPBC approval	Any activities in contravention of the Voluntary Declaration	**Step 1: Investigate cause of trigger:** • e.g., unauthorised access • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s:** The appropriate corrective actions will be implemented and may include additional fencing and/or signage and security for the SOA
		Comply with the restrictions outlined in Section 6.2.1. Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in accordance with Sections 6.2.2 and 6.2.3 and 7.5. If vegetation clearing is required	Compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks will also be assessed as part of offset area inspections (Section 7.1).			Compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks will also be assessed as part of offset area inspections	Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with the restrictions outlined in Sections 6.2.2 and 6.2.3	**Step 1: Investigate cause of trigger:** • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately. • Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s:**

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
		for fencing, access, firebreaks or public safety, all activities will be planned, recorded and monitored.						The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.
Ensure that any livestock grazing for fire management and weed control maintains and enhances the ground cover attributes for MNES and does not result in the degradation of habitat and vegetation	Increase the richness and average % cover of native perennial grasses at each habitat quality assessment site based on the results of baseline and subsequent monitoring events	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses in accordance with Section 6.2.5. Implementation of strategic grazing to promote the establishment of preferred foraging grass species including modifying the frequency, intensity and/or duration of grazing events. Excluding livestock grazing during wet periods (approximately December to March), which is typically the peak growing and flowering season for native grasses. Construct additional fencing should the current fencing be considered insufficient to manage the strategic grazing regime	Livestock grazing will be excluded from all offset management areas except during strategic grazing events, which will play an important role in reducing fuel loads. Best management practices will be employed as follows: • minimum of 1,500 kg/ha of dry matter will be retained at the end of the dry season • stock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover .	The location and extent of grazing exclusion areas will be reviewed annually based on the results of management and monitoring events	Strategic livestock grazing effort (i.e. the number of cattle and their exposed time to an area) will be managed at the discretion of the landholder and/or property manager of whom is responsible for cattle management. To minimise erosion and subsequent impacts on water quality, strategic grazing will be excluded where rainfall causes inundated or waterlogged soils	Habitat quality assessments will be undertaken in accordance with Section 7.5. These will include assessment of % cover of native perennial grasses	Decrease in the richness and average ground layer cover at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events	**Step 1: Investigate cause of trigger:** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action(s):** The appropriate corrective actions will be implemented and may include: • Modifying the strategic grazing regime, including modifying the frequency, intensity and/or duration of grazing events. • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime. • Installing additional watering points for livestock to manage livestock in accordance with the grazing regime.
	Biomass levels of at least 1,500 kg/ha are retained at each of the monitoring sites at the end of the dry season.	Implementation of the strategic grazing regime to protect and maintain environmental values in accordance with Section 6.2.5.				Biomass monitoring will be undertaken in accordance with Section 7.2	Biomass monitoring results indicate less than 1,500 kg/ha of biomass is present at any of the monitoring sites at the end of the dry season	**Step 1: Investigate cause of trigger:** • Investigate the reason for the decrease in biomass at the end of the dry season • Identify appropriate corrective actions **Step 2: Implementation of corrective action(s):** Corrective actions will be implemented and may include the following: • Re-evaluating the strategic grazing regime to assess the suitability of grazing to ensure no less than 1,500 kg/ha of biomass is retained at the end of the dry season.

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
								• Removal of stock or spelling grazing from the offset management area in which less than 1,500 kg/ha of biomass was identified. • Amending livestock management practices in the Offset Plan, including amending stocking rates, and/or duration and/or frequency of strategic grazing. • Evaluating the location of existing fencing to ensure it is enough to control livestock as part of strategic grazing and investigate if additional fencing is required to be constructed. • Constructing additional fencing to control livestock movements.
	Livestock are only observed to be in the offset management areas undertaking strategic grazing.	Existing fencing is always maintained as outlined in Section 6.2.3. Construction of additional fencing as required.				Offset area inspections will be undertaken at least twice a year (Section 7.1) and will include monitoring to assess the following: • condition of fencing to identify any necessary maintenance requirements. • presence of livestock within the offset management area.	Livestock are observed within an offset management area when not permitted within that area Damaged fencing is observed	**Step 1: Investigate cause of trigger:** • Investigate the reason why livestock have entered the offset area • Identify appropriate corrective actions **Step 2: Implementation of corrective action(s):** Corrective actions will be implemented and may include the following: • If livestock are identified in the offset management areas, notify the onsite Environmental Supervisor or relevant responsible person, and remove stock immediately. • Repair fencing to ensure its condition is satisfactory to exclude livestock. • Construct additional fencing should the current fencing be considered insufficient to exclude livestock.
Manage regrowth of Brigalow TEC vegetation (RE 11.9.5) to accelerate structural development	Maintenance of Brigalow TEC regrowth in accordance with interim performance targets and completion criteria.	Selective regrowth thinning of Brigalow TEC where regrowth of Brigalow vegetation (RE 11.9.5) occurs at >10,000 stems per hectare	Where recommended, thinning will be undertaken using mechanical methods.	Within areas of regrowth Brigalow TEC.	If deemed necessary based on the results of ongoing monitoring events.	Habitat quality assessment in accordance with Section 7.5	Brigalow TEC regrowth exceeds 10,000 stems per hectare based on previous monitoring events	**Step 1: Investigate cause of trigger:** • Identify whether mechanical thinning is appropriate **Step 2: Implementation of corrective action(s):** • Corrective actions including mechanical thinning of regrowth Brigalow TEC may be carried out.
Manage invasive weed species to reduce degradation of MNES habitat	Decrease in relative abundance of weed species at 80% of monitoring sites from subsequent monitoring events No new weed species are identified at any monitoring site (based on subsequent monitoring events)	Implement weed control actions in accordance with Section 6.2.6 Adhere to weed hygiene restrictions.	Weed treatment methods will be suitable to the target weed species and may include biological, chemical, or mechanical control. See Section 6.2.6 for more detail.	The results of weed monitoring activities will inform the location for weed treatment and control.	Weed treatment and control will be undertaken at optimal timing according to the lifecycle of the target species, i.e. before seeding.	Undertake weed monitoring in accordance with Section 7.3	An increase in relative abundance of weed species at more than 15% of monitoring sites from subsequent monitoring events A new weed species is identified at one or more monitoring sites	**Step 1: Investigate cause of trigger:** Investigate the increase in relative weed abundance Identify appropriate corrective actions **Step 2: Implementation of corrective action(s):** Corrective actions will be implemented and may include the following: • Reviewing adherence to weed management control measures as outlined in Section 6.2.6. • Amending weed hygiene restrictions. • Providing additional weed awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to. • Revising weed control methods. • Increasing the frequency and intensity of weed control. • Updating weed control methods in the OAMP and targeted weed control programs.

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
Minimise predation risk by pest animals to threatened fauna species	Reduction in Catling* Index for the relevant pest animal from the first year of offset management	Implement control actions for pest animals in accordance with Section 6.2.7.	Species-specific methodology in accordance with Section 6.2.7 involving a combination of: • Ground baiting • Trapping • Shooting • Poisoning	The requirement for and location of pest animal management will be strategically and safely designed, informed by pest animal monitoring results.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results.	Undertake monitoring for pest animals in accordance with Section 7.4	An increase in Catling* Index for the relevant pest animal from the first year of offset management and subsequent monitoring events.	**Step 1: Investigate cause of trigger:** • Investigate the reason for the increase in Catling index (or relative abundance, or change in rabbit impact category) from year 1/subsequent monitoring events • Identify appropriate corrective actions **Step 2: Implementation of corrective action(s):** Corrective actions will be implemented and may include the following: • Reviewing adherence to pest management control measures. • Increasing the frequency and intensity of pest animal control. • Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the OAMP and targeted pest animal control programs.
Minimise degradation of MNES habitat by rabbits.	Maintain rabbit impact category as 'acceptable'.	Implement control actions for rabbits in accordance with Section 6.2.7.	• Baiting • Fumigation • Trapping • Shooting			Undertake monitoring for rabbits in accordance with Section 7.4	Rabbit impact category measured as 'monitor closely', or 'unacceptable'.	
Minimise degradation of MNES habitat by feral pigs.	Reduction in mean feral pig abundance score from the first year of management	Implement control actions for feral pigs in accordance with Section 6.2.7.	• Trapping • Shooting • Poisoning			Undertake monitoring for feral pigs in accordance with Section 7.4	An increase in mean feral pig abundance score from first year and subsequent monitoring events.	
Reduce the risk of adverse impacts on MNES habitat associated with unplanned fire	No unplanned fire within the SOA Increase in habitat quality scores as a result of implementation of any fire management measures.	Implement fire management according to Section 6.2.4.	Unplanned fire risk will be managed through: • establishment and regular maintenance (grading) of a firebreak around the SOA • carefully monitored and managed fuel loads	A firebreak will be maintained by grading along: • all existing and proposed fence lines • all existing accesst racks bordering or traversing the SOA The requirement for and location of any strategic grazing management will be strategically and safely designed, informed by biomass monitoring results.	Maintenance and grading of existing/proposed fence lines to be undertaken where appropriate and necessary. Strategic grazing, if utilised, will only be permitted in the offset area on a managed and limited basis to control weeds and reduce fuel loads.	Habitat quality assessments to determine habitat quality scores will be undertaken in accordance with Section 7.5	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger:** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores. • Review adherence to the fire management measures. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s:** • The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass monitoring. • Increasing the frequency of weed control measures. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks.
Achieve the interim performance targets and completion criteria for each offset value within 5, 10, 15 and 20 years, respectively.	The interim performance targets are achieved for all offset values by year 5,10 and 15. The completion criteria are achieved for all offset values by year 20.	All management actions outlined in Section 6.2 will be implemented to ensure that the interim performance targets and completion criteria are achieved.	All management actions detailed in Section 6.2 will be implemented where necessary and practicable.	All management methods and actions will take place where required within the SOA with the aim of achieving the management objectives, including the interim performance	All management actions will be ongoing, and occur during the most appropriate season depending on the activity.	Monitoring of the offset area will be undertaken in accordance with Section 7 including: Offset area inspections (Section 7.1). Habitat quality assessments to determine habitat quality scores (Section 7.5) The results of monitoring events will	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15 Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger:** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s:** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions.

Management objective	Performance criteria	Management action	Methodology	Location	Timing or frequency	Monitoring activity	Management trigger	Corrective actions
				criteria and completion criteria.		be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).		• Increasing the frequency and intensity of pest animal and weed control measures or revising the type of measures to be implemented. • Modifying the fire management measures, to better support enhancement of offset values.

6.2. Management Actions

Figure 7 shows the three management areas in the SOA. Table 15 summarises management actions in each area.

Table 15 – Summary of management actions in each management area

Management activity	Management area(s)
Access and development to be limited	All management areas
Fire to be excluded	All management areas
Livestock exclusion	All management areas (with the exception of strategic grazing events)
Strategic grazing	Management Area 1 and potentially Management Area 2 if needed
Clearing prohibition	All management areas
Weed control	All management areas
Feral animal control	All management areas
Regrowth thinning of Brigalow TEC	Regrowth Brigalow where thickening has occurred to >10,000 stems per hectare (Brigalow TEC only, parts of Management Area 3)

The management measures to be implemented within the SOA have been developed considering the relevant conservation advice for each MNES value and are consistent with the measures in relevant recovery plans and threat abatement plans. Table 13 details the species threats and relevant management measures for each MNES being offset.

6.2.1. General restrictions

The general restrictions presented in Table 16 will be implemented to ensure the completion criteria and management objectives are achieved.

Table 16 – Offset area restrictions

Restrictions	Details
Access	• Access into the offset area will be restricted to authorised personnel only. • The SOA will be demarcated as an exclusion zone in the Santos GIS • Existing and new fences will be used to restrict access into offset area. Fences will be installed along southern perimeter of Hutton Creek providing a natural access barrier to the north, west and east • Signs will be installed in prominent locations (i.e., at access points into the offset area) which recognise that the areas are protected for conservation purposes. The signs will advise that access into the offset area is restricted to authorised personnel only
Weed hygiene	• Weed hygiene measures will be implemented to prevent the movement of weed material into the offset area. • All persons entering the offset area will be required to ensure vehicles and equipment are weed free. • All contractors entering the offset area must hold a current weed hygiene certificate or equivalent for all vehicles and equipment. • Evidence is to be provided on request to the landowner and Santos environmental advisors that vehicles, slashers, or any machinery implementing management actions are clean prior to entry to minimise potential weed spread.

Restrictions	Details
Vehicles	• Vehicle movement will be limited to designated access tracks in the offset area and access will be restricted to authorised personnel only. • Vehicles will travel to track conditions to minimise the risk of vehicle strike to fauna.
Vegetation clearing	• Clearing will be excluded from the offset area through demarcation and protection by means of Voluntary Declaration under the VM Act. Clearing for timber gathering and development will also be excluded. • Clearing of native vegetation will not be permitted within the SOA as part of any management and monitoring activities associated with the OAMP, except for clearing that is required for: – maintenance of access tracks and/or fire breaks – fence construction and maintenance and – ensure public safety or as directed by emergency management response personnel in the event of unplanned fire or other emergency or associated procedure. • If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be appropriately planned, recorded, and monitored. • Machinery will not be allowed on site after heavy or prolonged rainfall events until after the site has dried to allow for safe movement of traffic.

6.2.2. Access tracks

Existing access tracks will be utilised to facilitate necessary management, maintenance and monitoring activities as part of this OAMP. If existing access tracks become impassable (through erosion or vegetation regrowth), maintenance activities of these tracks (e.g. grading) will be prioritised over alternative track alignments. Gully crossings are likely to be subject to periodic, ongoing maintenance because of erosion following rain events.

Existing and new access tracks will be no wider than 5 m and vegetation disturbance will be minimised.

6.2.3. Fencing

To support strategic grazing and the exclusion of livestock at other times, fences in the SOA will be assessed and, where required to assist with livestock control for weed and fuel load management, additional fencing will be installed. To minimise impacts to birds and bats all new fences will use a single strand of high tensile steel wire on the top strand (barbed wire will not be used).

Any vegetation disturbance associated with new fence construction will be minimised in accordance with Table 15.

Regular inspections of all fencing will be undertaken in accordance with Section 7.1, and repairs to the fences will be made as required.

6.2.4. Fire management

Fire will be excluded from the SOA. Unplanned fire risk will be managed through:

- establishment and regular maintenance (grading) of a firebreak around the SOA, and
- carefully monitored and managed fuel loads.

The firebreak will be maintained by grading along:

- all existing/proposed fence lines, and
- all existing access tracks bordering or traversing offset area.

Strategic grazing will be used to control fuel loads, where appropriate/necessary (see Section 6.2.5). As increasing grazing intensity is correlated with an increase in weedy cover (Franks 2002), and a decrease in native grass species richness, grazing will be permitted in the offset area on a managed and limited basis to control weeds and reduce fuel loads. Best management practices will be employed as follows:

- a minimum of 1,500 kg/ha of dry matter will be retained at the end of the dry season, and
- stock will only be permitted in the offset area to reduce fuel loads and reduce exotic pasture grass cover.

The suitability of conditions for undertaking a grazing event will be informed by biomass monitoring events (see Section 7.2). Following a wet season spell and prior to a strategic grazing event in pasture areas of the offset area, a feed budgeting assessment will be undertaken. The feed budgeting assessment will determine the stocking rate based on the amount of feed available within pasture areas and the amount of feed desired in these areas at the end of the grazing event.

6.2.5. Grazing

Livestock grazing will be excluded from all offset management areas except during strategic grazing events, which will play an important role in reducing fuel loads. As increasing grazing intensity is correlated with an increase in weedy cover (Franks 2002), and a decrease in native grass species richness, best management practices will be employed as follows:

- minimum of 1,500 kg/ha of dry matter will be retained at the end of the dry season, and
- stock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover.

To minimise erosion and subsequent impacts on water quality, strategic grazing will be excluded where rainfall causes inundated or waterlogged soils. The location and extent of grazing exclusion areas will be reviewed annually based on the results of management and monitoring events.

The suitability of conditions for undertaking a grazing event will be informed by biomass monitoring events as described in Section 8.2. Regular inspections of all fencing will be undertaken in accordance with Section 7.1 and repairs to the fences will be made as required.

6.2.6. Weed management

Weed management in the SOA will aim to minimise the introduction, establishment and spread of restricted and prohibited pest plants under the *Biosecurity Act 2014* (Qld) and other invasive species, not regulated under the *Biosecurity Act 2014* (Qld), that present a threat to vegetation communities and species habitat in the offset area. Weed management will focus on reducing the extent of existing weeds as well as minimising the risk of introduction of additional weed species to the offset areas.

The presence of buffel grass and parthenium as well as other exotic weed and pasture species poses the greatest threat to vegetation communities in the offset area, with areas supporting buffel grass contributing to a groundcover biomass up to 20 times that of similar, intact vegetation communities (Walker et al. 1981). Elevated biomass increases the risk of uncontrolled fires, particularly in Brigalow TEC (Butler & Fairfax 2003).

Reductions in the extent of buffel grass and parthenium are most effectively achieved by maximising the competitive advantage of native ground cover species. This requires native species richness and abundance to be maximised. In historically grazed environments the most effective way to ensure high species richness is through conservatively managed cattle grazing (Fensham 1998). Conservative cattle grazing requires maintenance of enough biomass to maximise grass growth and appropriate spelling to allow for native species to set seed.

Accordingly, a strategic grazing regime will be implemented to reduce the presence and biomass of exotic pasture grasses in the offset areas (refer to Section 6.2.5). To supplement this, weeds will be managed using chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets, for the relevant weed species.

6.2.7. Pest animal management

Pest animals are present or have the potential to be present within or in the immediate vicinity of the SOA, and pose the following threats:

- predation of fauna by wild dogs, foxes and cats, and
- erosion and degradation of habitat and competition by feral pigs and rabbits.

Pest animal control will occur twice annually. Each trapping program is over a two-week period with the first trapping program occurring during March to April and the second trapping program occurring during October to December. This timing aligns with increased dog activity during the breeding season and avoids the colder months where cat activity and breeding is limited.

Pest animal control activities will be conducted generally in accordance with the *Biosecurity Act 2014* (Qld). Table 17 provides examples of approved species-specific pest animal control measures recommended by the

Queensland and Commonwealth governments. Results of pest animal assessments will be reviewed following each reporting event to inform the need for, location and timing of species-specific control measures in subsequent years.

Table 17 – Examples of species-specific control methods for pest animal species

Species	Status under *Biosecurity Act 2014* (Qld)	Example control method	Reference
Wild dog (*Canis familiaris*)	Category 3,4,6	• Ground baiting • Foot hold traps • Shooting	(DAF 2024a)
Fox (*Vulpes vulpes*)	Category 3,4,5,6	• Ground baiting • Trapping • Shooting	(DAF 2024b)
Feral cat (*Felis catus*)	Category 3,4,6	• Night shooting • Poisoning • Trapping	(DAF 2023a)
Pig (*Sus scrofa*)	Category 3,4,6	• Trapping • Shooting • Poisoning	(DAF 2023b)
Rabbit (*Oryctolagus cuniculus*)	Category 3,4,5,6	• Baiting • Fumigation • Trapping • Shooting	(DAF 2023c)

6.2.8. Brigalow vegetation management

Selective regrowth thinning of Brigalow TEC may be required where regrowth of Brigalow vegetation (RE 11.9.5) occurs at >10,000 stems per hectare. Restoration thinning using mechanical methods can accelerate structural development.

The requirement for management by mechanical thinning will be informed by monitoring events (see Section 7.5)

148°56'0"E
148°57'0"E
148°58'0"E
25°41'0"S
25°42'0"S
25°43'0"S
25°44'0"S
Bullock Gully
Hutton Creek

SANTOS

Location diagram

Figure 7
Management areas

Springwater
Property access track
Fence
Gas pipelines
Gas wells

Watercourses
Major watercourse
Creekline
Minor drainage line
Drainage contour

Management areas
Management area 1
Management area 2
Management area 3

CO2 AUSTRALIA

N

0 0.5 1
Kilometres

Date: 5/05/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:18,500@A3

AUTHOR: J. Cousin
DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
Gas pipelines and wells supplied by Santos

Path: P:\GISData\Projects\Santos\20250416_Roma_Stage8_OAMPs\Springwater\Springwater_OAMP_mapping_20250416\Springwater_OAMP_mapping_20250416.aprx

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7. Monitoring

Ongoing monitoring is required to ensure the OAMP meets the performance criteria and management objectives, and ultimately attains the completion criteria. A monitoring programme has been developed, detailed in the following sections and in Table 22.

The results of the monitoring program will be used to inform operational management decisions, including adaptive implementation of this OAMP to ensure the performance criteria and management objectives, and ultimately interim performance targets and completion criteria are met.

The monitoring results will also be used to assess adherence to performance criteria, and to determine when corrective actions are required to be implemented. The results will also be compared to those from previous monitoring events to assess change over time and to inform the ongoing implementation of the OAMP.

7.1. Offset area inspections

The aim of offset area inspections is to enable a general assessment of the offset area to identify any potential issues that may require remedial action to be undertaken. Inspections will be undertaken twice per year for the duration of the management period to assess the following:

- condition of fencing, gates and signs and existing gas field infrastructure,
- condition of access tracks,
- condition of firebreaks,
- compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks,
- incidence of erosion within offset area, particularly around permanent and semi-permanent waterbodies or areas subject to inundation or waterlogging,
- damage/degradation resulting from pest animal activity within the offset area,
- signs of land degradation and over-grazing,
- presence of weed/invasive species,
- exclusion of livestock, and
- incidental fauna observations and any additional risks to offset values (i.e. evidence of vehicle strike).

7.2. Biomass monitoring

Biomass monitoring for fire management will be undertaken twice a year, at the end of the wet season and end of the dry season, to:

- determine the risk of fire to the offset site, and
- inform fire management strategies.

Biomass is at its greatest at the end of the wet season (April) with fire risk greatest towards the end of the dry season (September/October). Biomass will be monitored within the offset areas using appropriate photo standards which will be used to determine dry matter yields and subsequently fuel loads. Biomass monitoring will be undertaken at the same permanent weed monitoring sites established as part of the baseline surveying.

Fuel loads will be managed through strategic grazing events (see Section 6.2.5) if the biomass assessment at the end of the wet season shows that biomass is greater than 1,500 kg/ha.

The stocking rate of these strategic grazing events will be determined through a feed budgeting assessment (see Section 7.2.1) undertaken prior to a grazing event in the offset area. A feed budgeting assessment is a recognised method of determining the stocking rate based on the amount of feed available and the amount of feed desired at the end of the grazing event (i.e. >1,500 kg/ha).

7.2.1. Feed budgeting assessment

The process for undertaking a feed budget assessment will include the following sequence of activities:

- Determine the current amount of feed present (kg/ha) using appropriate photo standards available on the Future Beef website[1].
- Determine the amount of feed desired (kg/ha) at the end of the grazing event.
- Calculate the total useable feed (kg/ha) by subtracting the feed desired from the feed present.
- Determine utilisation (i.e. the proportion of useable feed that livestock can use).
- Determine the feed available for the grazing animal (kg/ha) by multiplying the total useable feed by the utilisation rate.
- Calculate the safe stocking rate by:
  - determining the feed consumption per day (kg/day),
  - determining the number of days feed is required (days),
  - calculating the feed requirement per head (kg/hd) by multiplying the feed consumption per day by the number of days,
  - calculating the stocking rate (ha/hd) by dividing the feed requirement per head by feed available, and
  - calculate the number of stock (head) by dividing the area of the paddock by the stocking rate.

The amount of feed available prior to the grazing event will be estimated using the appropriate photo standards available on the Future Beef website. The “Dry Season Feed Budget” worksheet will then be used to calculate the required stocking rate for the grazing event.

At the completion of the grazing event, photo standards will be used to assess ground cover and ecosystem biomass. Should the grazing event be required to be extended (e.g. as a result of additional rainfall and resultant grass growth and potential weed flowering), the feed budget assessment will be recalculated using the “Dry Season Feed Budget” worksheet.

7.2.2. Fuel load monitoring

Fuel load monitoring will be undertaken in accordance with the *Overall Fuel Hazard Assessment Guide* (Hines *et al*. 2010; Appendix D). Fuel load assessment monitoring will include a baseline survey in year 1 (post-wet season; April), with ongoing fuel load assessment monitoring conducted every year at the same time and location as biomass monitoring post wet season. Monitoring will focus on assessing the key structural layers of the fine fuels that burn in bushfires, specifically bark, elevated fuels, near-surface fuels and surface fuels. This will allow for a rapid assessment of each fuel layer, which in in turn is given a hazard rating and are then combined to provide an overall fuel hazard rating of low, moderate, high, very high or extreme.

The fuel hazard rating will be monitored to compare any changes from previous assessments. In conjunction with results of habitat quality assessments, the results of the fuel load assessments will be used to determine if fuel hazard reduction burns are required within the offset area. Weed management and strategic grazing within the offset area will also be undertaken to maintain fuel hazard rating below extreme.

7.3. Weed monitoring

Weed monitoring sites will be randomly stratified, fixed monitoring sites representative of offset values and incorporating natural variability such as aspect (e.g., a mix of north-, east-, south- and west-facing monitoring sites), community type – (e.g. woodland, riparian). There will also be fixed monitoring sites at strategic trafficable areas (e.g., entry gates, creek crossings, stock watering points) to monitor potential introduction and/or irruptions of prohibited and restricted weed species.

The offset area will be monitored for weeds every two years (post wet season) to determine the species richness and abundance, for the duration of the management period. The results of this monitoring will inform the methods for weed treatment and control (see Section 6.2.6).

[1] See https://futurebeef.com.au/knowledge-centre/pastures-forage-crops/pasture-photo-standards/.

Non-native plant cover is also assessed as part of the habitat quality assessments detailed in Section 7.5, and the presence of weed species will also be recorded as part of the general offset area inspections (see Section 7.1), where noted.

Weed monitoring will target the declared and environmental weeds known to occur over Springwater: Buffel Grass (*Cenchrus ciliaris*), Green Panic (*Megathyrsus maximus*), Parthenium (*Parthenium hysterophorus*) and Harrisia Cactus (*Harrisia martini*).

7.4. Pest animal monitoring

The offset area will be monitored for evidence of pest animals every two years (post-wet season), including a baseline survey in year 1 of the distribution and abundance of pest animals.

Based on the results of year 1 surveys, pest animal monitoring sites will be established in year 1. Monitoring of pest animals will target areas of known impacts/movements (e.g. along topographic features, including creeks, pads, paths, ridge-tops and roads) to not only maximise the success of encountering pest animals, but target monitoring in environments that are more regularly impacted (e.g. drainage lines, moist gullies and around swamps and lagoons favoured by feral pigs; Hone 1995). The location of pest animal monitoring sites will be assessed prior to each monitoring event.

Pest animal monitoring will also be undertaken in association with and immediately prior to the pest animal control activities (Section 6.2.7). Initial monitoring results will determine the degree of effort required to control the pest population and post control monitoring will determine the degree of success of control operations.

Monitoring of pest animals will involve the deployment of motion sensing infra-red cameras to determine pest animal species present in the offset area and an indicative estimate of abundance through the calculation of the Catling Index for fox, wild dog and feral cat (Table 18).

Methods for determining the presence and relative abundance for foxes, wild dogs, feral cats, rabbits and feral pigs are presented in Table 18. Evidence of pest animals will be documented during the offset area inspections (see Section 7.1)

Table 18 – Pest animal monitoring methodology

Pest animal	Methodology to be implemented
Fox Wild dog Feral cat	To assess the relative abundance of foxes and feral cats within the offset area, camera monitoring will be undertaken as follows to provide a measure of the Catling index for each species. The Catling index will be measured as the percentage of camera nights in which the pest species was observed. An increase or decrease in the Catling index value between subsequent monitoring events will represent an increase or a decrease in the relative abundance of pest species and a measure of the success of pest animal control. • fauna monitoring cameras will be placed in the offset area • cameras will be placed along tracks and left in place for a minimum of three consecutive nights • an analysis of the camera footage will be undertaken to determine the percentage of camera nights with animal captures for each species observed. This percentage represents the Catling index (Mitchell and Balogh 2007b, c).
Feral pig	An assessment of the presence or absence of feral pig signs[a] as a measure of the relative abundance of feral pigs within the offset area in accordance with Mitchell and Balogh (2007a) and Hone (1988), will be undertaken as follows: • nominate randomly stratified sites across the offset area in environments that are more regularly impacted (e.g. drainage lines, moist gullies, around swamps etc) • calculate an abundance score for each transect as the percentage of 'present' feral pig signs • calculate the mean abundance score (and variance) across all transects in the offset area.

Pest animal	Methodology to be implemented
	The average frequency of occurrence across the offset area will be used as an index of abundance and compared between subsequent monitoring events to assess the effectiveness of feral pig control. Furthermore, changes to scores for individual sites/transects can point to areas to target control activities. [a] Feral pig signs can include rooting, wallows, dung, footprints, travel pads, plant damage and tree rubs, as well as the physical presence of feral pigs.
Rabbit	An assessment of rabbit impact in accordance with Cooke *et al.* (2014) will be undertaken as follows. Randomly stratified, permanent monitoring points, a 2-ha patch of habitat is traversed over 15-20 minutes assessing: • Rabbit abundance – a measure of the presence and number of rabbit warrens and the abundance of any faecal pellets (including 'buck-heaps' or latrines) – measured on a scale of 0 – 5. • Seedling abundance – a measure of the presence and abundance of native vegetation seedlings encountered during the 15-20-minute traverse – measured on a scale of 0 – 5. • Rabbit damage – a measure of seedlings (< 0.5 m height) with evidence of rabbit damage, identified as 45˚ 'secateurs-like' cuts through smaller stems, defoliation and gnawing of bark – measured on a scale of 0 – 5. From this assessment, a 'corrected regeneration score' is calculated from the seedling abundance and rabbit damage score. This measure corrects for seedling regeneration as a function of observed rabbit damage and is subsequently used to calculate overall rabbit impact with the rabbit abundance score (refer to Cooke *et al.* [2014]). Overall rabbit impact is assigned as one of three categories – 'acceptable', 'monitor closely' or 'unacceptable', as determined from a combination of the score for rabbit abundance and the corrected regeneration score.

7.5. Habitat quality assessments

The first detailed monitoring event of the SOA was completed in spring/summer 2017, including BioCondition sites established in all major vegetation assessment units. The location of all permanent BioCondition sites are presented in Figure 8 and in Table 19.

All determinations of habitat quality will be made in accordance with the *Guide to assessing terrestrial habitat quality: Methods for assessing habitat quality under the Queensland Environmental Offsets Policy (Version 1.2*, DEHP 2017), and converted to scores out of 10.

7.5.1. Rapid monitoring events

Rapid monitoring events will be carried out each year there is not full monitoring of habitat quality (i.e. BioCondition [Section 7.5.2], targeted fauna survey [Section 7.5.4] and flora surveys [Section 7.5.5]) at the same fixed transect locations used for habitat quality assessments (Figure 8).

These will be aligned with the offset area inspections (see Section 7.1) and carried out by suitably qualified ecologists between spring and early summer (September – mid December) to coincide with the optimal time of year for flora and fauna surveys in the Brigalow Belt Bioregion (Eyre *et al*. 2015).

During each rapid monitoring field assessment, the following will be conducted:

- An unbounded timed meander flora survey will be conducted. The survey will be conducted in accordance with the timed meander survey methodology contained within the Queensland Department of Environment and Heritage Protection's Flora Survey Guidelines (DEHP 2016).
- Fauna surveys will be conducted throughout the rapid monitoring events. Early morning and late evening bird surveys will be conducted during floristic surveys and surveys for the presence of all fauna species will be conducted throughout the day by the ecologists.

7.5.2. Habitat quality assessment (BioCondition)

Vegetation condition and habitat quality for each MNES will be assessed in accordance with the *Guide to Determining Terrestrial Habitat Quality*, developed by the Queensland Government to measure the habitat quality of a land-based offset (DES 2020). The guide is based on the methodology set out in the BioCondition Assessment Manual (Eyre *et al.* 2015) and compared to control sites (BioCondition benchmarks), as developed by the Queensland Herbarium.

Fixed transects were established in 2017 (refer to Figure 8) and these will be repeated every two years for the first six years following the 2017 baseline, and then every three years thereafter.

All ecological surveys and assessments will be undertaken by suitably qualified ecologists.

Table 19 – Location of permanent habitat quality monitoring sites (GDA2020 Zone 55 projection)

Monitoring site	RE[1]	Easting	Northing
SW01	11.10.7	694910	7157208
SW02	11.10.7	694796	7156294
SW03	11.3.25	694431	7156391
SW04	11.9.5	695918	7156744
SW05	11.9.4	696445	7154784
SW06	11.10.7a	694648	7155153
SW07	11.9.5	696022	7153332
SW08	11.10.7	694336	7153505
SW09	11.9.5	696137	7155645
SW10	11.9.5	697109	7153420
SW11	11.9.7 (yng)	697030	7154131
SW12	11.10.7 (adv)	697457	7154963
SW13	11.9.5 (adv)	696023	7156903
SW14	11.9.5 (yng)	695762	7153268
SW15	11.10.7a	695105	7153739

[1] Yng = young regrowth, Adv = advanced regrowth.

7.5.3. Photo monitoring

For each BioCondition site, photo-monitoring points have been established.

Photo monitoring is a qualitative analysis technique that provides the opportunity for visual time series analysis of changes in vegetation composition, structure, and integrity. In areas where active management is being undertaken, photo monitoring offers a simple and effective visual means by which to capture the response of the vegetation to management actions. Photo monitoring will be conducted at all fixed habitat quality assessment monitoring sites, in accordance with the *Guide to Determining Terrestrial Habitat Quality*. Timing of photo monitoring will therefore align with habitat quality assessment monitoring and will be undertaken at the same fixed transect sites used for the rapid monitoring events and habitat quality assessments (Figure 8).

7.5.4. Targeted fauna surveys

Targeted fauna surveys are conducted to assess fauna species richness of the SOA. The targeted fauna survey methods will focus on the relevant specific significant species that are unlikely to be detected effectively during the rapid assessment surveys due to cryptic behaviour or localised habitat requirements. Targeted surveys for

species are based on the ecology, habitat requirements and behavioural aspects of the species of interest. Methodology, search effort and timing are provided in Table 20.

Targeted fauna surveys will be carried out in conjunction with BioCondition surveys, every two years for the first six years following the 2017 baseline, and then every three years thereafter.

Table 20 – Fauna species survey methods

Technique	Regime	Target and method
Elliot B Box trap or Cage trap	Four per site over four consecutive nights, checked early morning, reopened late afternoon.	Baited with a mixture of oats, peanut butter, vegetable oil and sardines. Placed within suitable micro-habitat for Northern Quoll.
Funnel trap	Six at each of five trap sites over four consecutive nights, checked early morning and afternoon.	Placed in pairs either side along a 30m drift fence. Targeting Dunmall's Snake and Collared Delma.
Anabat	Three units overnight for four consecutive nights	Left overnight on site near entrances to possible roost sites for Large-eared Pied Bat, if considered present, and/or along flyways and near waterbodies.
Harp trap	Two per night for four consecutive nights, locations chosen based on presence of suitable flyways.	Targeting South-eastern Long-eared Bat, which is not identifiable by ultrasonic calls. Also Large-eared Pied Bat.
Camera trap	10 over at least 14 consecutive nights	Focused on stations baited with a mixture of oats, peanut butter, vegetable oil and sardines. Targeting Northern Quoll and possibly Yakka Skink (Meek *et al.*, 2014).
Spotlighting	Meander along watercourses.	Targeting Koala. This will also target Dunmall's Snake.
Spotlighting	Rocky areas.	Targeting Northern Quoll and Collared Delma.
Spotlighting	By vehicle along tracks.	Targeting Dunmall's Snake.
Scat search	Conducted in habitat considered suitable for target species.	Targeting Koala and Northern Quoll. The Spot Assessment Technique (SAT), or a variation, were used to survey for Koalas within suitable habitat within the site.
Bird survey	At waterbodies.	Targeting Australian Painted Snipe, Australasian Bittern and Squatter Pigeon.
Bird survey	Meander along watercourses during the day.	Targeting nest sites for Red Goshawk. Includes diurnal Koala Search.
Track traverse	By vehicle and on foot.	Targeting Squatter Pigeon.
Diurnal herpetofauna search	Late morning/early afternoon.	Conducted by two searchers, duration is determined by site-specific habitat quality and presence of suitable micro-habitat. Targeting Collared Delma, Dunmall's Snake and Yakka Skink.
Platelet search	In suitable habitat.	Targeting Black-breasted Button-quail.

7.5.5. Flora surveys and habitat mapping

Threatened flora surveys will be conducted throughout the SOA. Timed meander surveys are conducted in each of the vegetation units listed in Table 5 to identify and locate EVNT plants. The timed meander survey are conducted in accordance with Section 4.1 of the *Flora Survey Guidelines* (DEHP 2016).

Flora surveys and habitat mapping will be carried out in conjunction with BioCondition surveys and targeted fauna surveys, every two years for the first six years following the 2017 baseline, and then every three years thereafter.

148°56'0"E 148°57'0"E 148°58'0"E

25°41'0"S 25°42'0"S 25°43'0"S 25°44'0"S

Bullock Gully

Hutton Creek

SW01 SW13 SW04 SW03 SW02 SW09 SW06 SW12 SW05 SW11 SW15 SW08 SW10 SW07 SW14

SANTOS

Location diagram

Figure 8
Monitoring sites

Springwater
Property access track
Fence
Habitat quality monitoring site

Watercourses
Major watercourse
Creekline
Minor drainage line
Drainage contour

Ground-truthed vegetation
11.3.25
11.9.4
11.9.5
11.9.5 (adv regrowth)
11.9.5 (young regrowth)
11.9.7
11.9.7 (young regrowth)
11.10.7
11.10.7 (adv regrowth)
11.10.7 (young regrowth)
11.10.7a

CO2 AUSTRALIA

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Kilometres

Queensland
Brisbane

AUTHOR: J. Cousin
DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses

Date: 5/05/2025 Coordinate System: GDA2020 MGA Zone 55 Scale: 1:18,500@A3

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7.6. Implementation schedule

Table 21 and Table 22 summarise the implementation schedule for the management, monitoring and reporting activities presented in this OAMP.

Table 21 – Implementation of management actions

Activity		Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Related monitoring
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
General restrictions (Section 6.2.1)	Access, vehicles, vegetation clearing, weed hygiene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	At all times	General offset inspections (Section 7.1)
Access tracks (Section 6.2.2)	Maintenance/new tracks	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
Fencing (Section 6.2.4)	Construction of additional fencing to support livestock exclusion and strategic grazing	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required	
	Maintenance	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪		
Fire management (Section 6.2.5)	Fire excluded	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	At all times	Biomass monitoring (Section 7.2)
Grazing (Section 6.2.5)	Strategic grazing	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	As required based on the results of biomass monitoring, and informed by weed monitoring	Biomass monitoring (Section 7.2) Weed monitoring (Section 7.3)
Weed management (Section 6.2.6)	Buffel grass and other weeds	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities in addition to strategic grazing to be undertaken as required	Weed monitoring (Section 7.3)
Pest animal management (Section 6.2.7)	Wild dog (*Canis familiaris*), Feral cat (*Felis catus*), Fox (*Vulpes vulpes*), Rabbit (*Oryctolagus cuniculus*), Pig (*Sus scrofa*)	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Control activities to be undertaken as required	Pest animal monitoring (Section 7.4)
Brigalow vegetation management (Section 6.2.3)	Restoration/regrowth Brigalow vegetation (RE 11.9.5)	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Thinning to be undertaken as required, according to habitat quality assessments	Habitat quality assessment (Section 7.5.5)
Reporting (Section 8)	Annual reporting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	OAMP audit every 5 years	Reporting (Section 8)
	Update OAMP					▪					▪					▪					▪		

Table 22 – OAMP monitoring events

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Survey/monitoring guidelines	Reliability
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Offset area inspections (Section 7.1)	Twice yearly inspections of: • fencing, gates, signs and existing access tracks • firebreaks • compliance with restrictions for vegetation clearing • incidence of erosion • damage/ degradation resulting from pest animal activity • signs of land degradation and over-grazing • weeds/invasive species • exclusion of livestock • incidental fauna observations and any additional risks to offset values (e.g. evidence of vehicle strike)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Inspections will be undertaken at least twice a year. Usually at the end of the wet season and the end of the dry season, with one of the inspections occurring prior to the submission of the annual report.	See Section 7.1 for a list of potential issues to be inspected.	General assessment of the offset management areas to identify any potential issues that may require remedial action to be undertaken within the subsequent year of management.
Biomass monitoring (Section 7.2)	Biomass monitoring for fire management and to inform strategic grazing regime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Twice every year at the end of the wet season (March/April) and towards the end of the dry season (October).	Assessment against Future Beef photo standards (Section 7.2).	Methodology developed by the Queensland Government.
Weed monitoring (Section 7.3)	Ongoing weed surveys to assess the effectiveness of weed control		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓	Every two years including a survey in the dry season and a survey post wet season.	*NSW Guidelines for Monitoring Weed Control and Recovery of Native Vegetation* (Auld 2009). Photo monitoring of selected sites to assess visual changes in weed species and infestations over time. Use of precision unmanned aerial vehicles (drone) technology, aerial	Assessment undertaken generally in accordance with published, reputable guidelines.

Survey or monitoring objective	Monitoring activity	Management years ✓ Activity required ▪ Activity to be carried out as required																				Timing	Survey/monitoring guidelines	Reliability
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
																							imagery and/or remote sensing.	
Pest animal monitoring (Section 7.4)	Ongoing pest animal surveys to assess the effectiveness of pest animal control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Twice annually, according to Section 7.4.	Monitoring method outlined in Section 7.4.	Assessment undertaken generally in accordance with published monitoring techniques developed by the NSW Government.
Habitat quality assessment (baseline surveys completed in 2017) (Section 7.5)	Rapid monitoring events		✓		✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		Each year there is no full BioCondition assessment.	See Section 7.5.1.	
	Targeted fauna and flora surveys	✓		✓		✓			✓			✓			✓			✓			✓	BioCondition assessments will be undertaken every two years from the 2017 baseline for the first six years, and then every three years thereafter.	GTDTHQ (version 1.2; DEHP 2017). See methods outlined in Section 7.5.4.	Assessment undertaken in accordance with method developed by the Queensland Government and aligns with the EPBC Act *Environmental Offsets Policy* measure of 'habitat quality' and is intended to provide a consistent framework for environmental offsets in Queensland.
	BioCondition transects	✓		✓		✓			✓			✓			✓			✓			✓			
	Photo monitoring	✓		✓		✓			✓			✓			✓			✓			✓		Photos at each photo monitoring point will be taken in a north, east, south and westerly direction. A record of the photographs will be maintained, including GPS co-ordinates, date and time of each photograph and the direction in which the photograph was taken.	Based on best practice photo monitoring techniques, see Appendix 4 of *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2.* (Eyre *et al.* 2015).

8. Reporting

Reports detailing the progress against the management outcomes detailed in Section 4 will be prepared by the suitably qualified ecologist responsible for conducting the monitoring, within two weeks following each monitoring event. The report will contain, at a minimum:

- a description of the monitoring conducted, when it was conducted, and by whom,
- a discussion of the weather in the lead up to and during the monitoring,
- results of photo monitoring,
- site data including site description and location and results for all site-based condition attributes,
- rapid assessment site data including site description and location and results (if relevant that year),
- an overview of the management actions that were implemented since the last report (i.e., if thinning of Brigalow occurred, or pest animal and weed control),
- details of any triggers that have been exceeded and the remedial actions that are implemented,
- an overview of the progress of the management area in achieving the performance criteria and how any risks or threats have impacted on the area, and
- an indication of any risks or potential threats that have become apparent to the management area since the development of this management plan, and activities to be undertaken to manage these threats and/or risks.

This plan will be reviewed and audited every 5 years and/or if the risks to the offsets success identified in Section 5.2.2 have been identified. Annual reports discussing compliance with the commitments within this plan will be published on the Santos website.

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Appendix A

Baseline habitat quality scores for the Springwater offset area

Table A1: Baseline site condition and site context data for Springwater offset area

Site	SW01	SW02	SW03	SW04	SW05	SW06	SW07	SW08	SW09	SW10	SW11	SW12	SW13	SW14	SW15
RE	11.10.7	11.10.7	11.3.25	11.9.5	11.9.4	11.10.7a	11.9.5	11.10.7	11.9.5	11.9.7	11.9.7	11.10.7	11.9.5	11.9.5	11.10.7a
Site type*	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Yng	Adv	Adv	Yng	Rem
Site condition															
Recruitment of woody perennial species in EDL (/5)	3	3	5	3	5	5	5	5	5	5	5	5	3	3	5
Native plant species richness – trees (/5)	2.5	2.5	2.5	5	5	2.5	5	2.5	2.5	2.5	2.5	2.5	5	5	5
Native plant species richness – shrubs (/5)	0	2.5	5	5	5	2.5	5	2.5	5	5	2.5	5	5	2.5	2.5
Native plant species richness – grasses (/5)	3.75	2.5	3.75	5	1.25	2.5	2.5	2.5	5	2.5	3.75	2.5	5	3.75	2.5
Native plant species richness – forbs (/5)	2.5	2.5	5	3.75	2.5	1.25	0	1.25	2.5	1.25	1.25	3.75	3.75	1.25	2.5
Tree canopy height (/5)	5	5	5	5	5	5	5	5	5	5	3	5	3	3	5
Tree canopy cover (/5)	2	5	5	5	5	2	5	2	2	3	5	5	2	5	5
Shrub canopy cover (/5)	5	3	5	3	3	5	3	3	3	3	5	3	5	5	5
Native grass cover (/5)	3	5	3	5	5	3	3	2	3	4	5	5	5	5	5
Organic litter (/5)	4	4	3	5	5	5	3	5	5	3	5	5	3	5	5
Large trees (/15)	0	0	0	0	15	10	5	5	15	0	0	0	0	5	15
Coarse woody debris (/5)	5	5	5	2	5	5	2	5	5	5	5	5	2	2	2
Non-native plant cover (/10)	10	10	5	10	10	3	3	5	10	10	0	10	3	3	3
Total	45.75	50	52.25	56.75	71.75	51.75	46.5	45.75	68	49.25	43	56.75	44.75	48.5	62.5
Maximum	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
FINAL site condition score (/10)	**5.72**	**6.25**	**6.53**	**7.09**	**8.97**	**6.47**	**5.81**	**5.72**	**8.50**	**6.16**	**5.38**	**7.09**	**5.59**	**6.06**	**7.81**
Site context															
Size of patch (/10)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Connectedness (/5)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Context (/5)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Ecological Corridors (/6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Maximum	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
FINAL site context score (/10)	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**	**6.92**

* Site type: Rem – remnant; Adv – regrowth (advanced); Yng – regrowth (young).

Table A2: Baseline habitat quality score data for Springwater offset area

Site	SW01	SW02	SW03	SW04	SW05	SW06	SW07	SW08	SW09	SW10	SW11	SW12	SW13	SW14	SW15
RE	11.10.7	11.10.7	11.3.25	11.9.5	11.9.4	11.10.7a	11.9.5	11.10.7	11.9.5	11.9.7	11.9.7	11.10.7	11.9.5	11.9.5	11.10.7a
Site type*	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Rem	Yng	Adv	Adv	Yng	Rem
Site condition score (/10)	5.72	6.25	6.53	7.09	8.97	6.47	5.81	5.72	8.50	6.16	5.38	7.09	5.59	6.06	7.81
Site context score (/10)	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92
Threatened Ecological Communities – Habitat quality score /10 (site condition 70%, site context 30%)															
Brigalow TEC	-	-	-	7.04	-	-	6.15	-	8.03	-	-	-	5.99	6.32	-
SEVT TEC	-	-	-	-	8.36	-	-	-	-	-	-	-	-	-	-
Species habitat index (/10)															
Collared Delma	6.15	6.15	-	6.15	-	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15
Yakka Skink	7.38	7.38	-	7.38	-	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38
Dunmall's Snake	6.15	6.15	-	6.15	-	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15
Red Goshawk	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89
Black-breasted Button-quail	-	-	-	-	6.15	-	-	-	-	-	-	-	-	-	-
Squatter Pigeon	8.12	8.12	8.12	-	-	8.12	-	8.12	-	8.12	8.12	8.12	-	-	8.12
Northern Quoll	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15	6.15
Koala	6.15	6.15	6.15	-	-	6.15	-	6.15	-	6.15	6.15	6.15	-	-	6.15
South-eastern Long-eared Bat	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12
Large-eared Pied Bat	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89
Threatened fauna species– Habitat quality score /10 (site condition 30%, site context 30%, species habitat index 40%)															
Collared Delma	5.33	5.49	-	5.74	-	5.56	5.36	5.33	6.16	5.46	5.23	5.74	5.29	5.43	5.96
Yakka Skink	5.64	5.80	-	6.05	-	5.86	5.67	5.64	6.47	5.77	5.54	6.05	5.60	5.74	6.27
Dunmall's Snake	5.33	5.49	-	5.74	-	5.56	5.36	5.33	6.16	5.46	5.23	5.74	5.29	5.43	5.96
Red Goshawk	5.52	5.67	5.76	5.93	6.49	5.74	5.54	5.52	6.35	5.65	5.41	5.93	5.48	5.62	6.14
Black-breasted Button-quail	-	-	-	-	6.31	-	-	-	-	-	-	-	-	-	-
Squatter Pigeon	5.82	5.98	6.07	-	-	6.05	-	5.82	-	5.95	5.72	6.24	-	-	6.45
Northern Quoll	5.33	5.49	5.57	5.74	6.31	5.56	5.36	5.33	6.17	5.46	5.23	5.74	5.29	5.43	5.96
Koala	5.33	5.49	5.57	-	-	5.56	-	5.33	-	5.46	5.23	5.74	-	-	5.96
South-eastern Long-eared Bat	5.82	5.98	6.07	6.24	6.80	6.05	5.85	5.82	6.66	5.95	5.72	6.24	5.79	5.93	6.45
Large-eared Pied Bat	5.52	5.68	5.76	5.93	6.49	5.74	5.54	5.52	6.35	5.65	5.41	5.93	5.48	5.62	6.14

Note: Data is only provided for REs that the threatened community or species is associated with.
* Site type: Rem – remnant; Adv – regrowth (advanced); Yng – regrowth (young).

Table A3: Baseline final habitat quality score for Springwater offset area

RE	Area (ha)	Brigalow TEC	SEVT TEC	Collared Delma	Yakka Skink	Dunmall's Snake	Red Goshawk	Black-breasted Button-quail	Squatter Pigeon	Northern Quoll	Koala	South-eastern Long-eared Bat	Large-eared Pied Bat
11.10.7	400.1	-	-	5.57	5.88	5.57	5.75	-	6.06	5.57	5.57	6.06	5.75
11.3.25	11.6	-	-	-	-	-	5.76	-	6.07	5.57	5.57	6.07	5.76
11.9.4	57.5	-	8.36	-	-	-	6.49	6.31	-	6.31	-	6.80	6.49
11.9.5	369.3	6.71	-	5.60	5.91	5.60	5.78	-	-	5.60	-	6.09	5.78
11.9.7	27.0	-	-	5.34	5.65	5.34	5.53	-	5.84	5.35	5.34	5.84	5.53
TOTAL	865.5	-	-	-	-	-	-	-	-	-	-	-	-
Final area-weighted habitat quality score (/10)		6.71	8.36	5.57	5.88	5.57	5.81	6.31	6.05	5.62	5.55	6.12	5.81
Final score (rounded)		**7**	**8**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**

Note: Data is only provided for REs that the threatened community or species is associated with.

Appendix B

Risk assessment

Risk assessment summary

The following risk assessment assesses the potential risk of failing to achieve the management objectives, interim performance targets and completion criteria for the offset area as outlined in this OAMP.

For each risk identified, the potential consequence of the risk (rated from 1 [no impact] to 6 [irreversible impact; Table B1] was assessed against the likelihood of that risk occurring [Table B2] to determine a risk rating. The risk rating was evaluated by using the matrix in Table B2.

The consequence and likelihood of each risk was first considered without the management measures in place to provide an initial risk rating. The consequence and likelihood of each risk occurring was then reassessed following the implementation of the management measures to provide a residual risk rating.

Table B3 provides the risk register which was used to document the findings of the risk assessment process.

Table B1 – Consequence rating relative to offset value

	Consequence
I	No impact to MNES Value
II	Small-scale impact to MNES
III	Moderate-scale impact to MNES
IV	Large-scale impact to MNES
V	Extensive population or community scale impact to MNES
VI	Irreversible impact to MNES

Table B2 – Likelihood classification and risk matrix

Santos Risk Matrix

Santos

Consequence							
	Safety	**Negligible Harm** + No bodily damage or minimal harm or impairment (hours to days)	**Minor Harm** + Short term impairment (days to weeks)	**Moderate Harm** + Temporary disablement or medium term impairment (weeks to months)	**Severe Harm** + Long term/life altering disablement or impairment	**Single Fatality OR Critical Life Threatening Injuries**	**Multiple Fatalities**
	Environment	+ No impact to Environmental Value (EV).	+ Small-scale impact to EV(s) of conservation significance + Potential surface or groundwater impact.	+ Moderate-scale impact to EV(s) of conservation significance + Localised surface or groundwater impact.	+ Large-scale impact to EV(s) of conservation significance + Moderate-scale surface water impact; + Localised impact to groundwater with potential or known beneficial use.	+ Extensive population or community scale impact to EV(s) of conservation significance + Extensive impact to other EV(s).	+ Irreversible impact to EV(s).
	Community & Reputation	+ No actual or potential community criticism + Details remain within Santos sites and/or offices	+ Minor level local community criticism (< week) + No reputation impact	+ Local community criticism (> week) or one-day community protest + Local company reputation impacted	+ State-level community criticism or protest over multiple days/locations + State-based company reputation impacted + Very short-term share price impact (< week)	+ National community criticism or large scale protest + Company reputation and approvals impacted + Shareholder intervention or short-term share price impact (< month)	+ Sustained national community criticism or widespread protest + Industry reputation and approvals impacted + Changes at executive/board level or long-term share price impact (> month)
	Financial (A$)	< $30k	$30k to $300k	$300k to $3m	$3m to $30m	$30m to $300m	> $300m
	Workforce	+ Will require some staff attention over several days. + No actual or potential impact to culture	+ Will require several days local management time. + Minor impact to employee engagement and limited staff turnover	+ Will require head office staff and take several weeks of site management time. + Moderate impact to employee engagement and staff turnover above industry average with some key roles	+ Will require several weeks of senior management time + Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession	+ Will require several months of senior management time + Impact to employee engagement (< 18 months), high staff turnover and attraction issues	+ Will require more than a year of senior management involvement and operations severely disrupted + Impact to employee engagement (> 18 months), significant key role turnover and attraction issues
	Compliance	+ Non-conformance with legislation, instruments (e.g. tenure licence) or contract + No regulatory or punitive action	+ Minor breach of legislation, instruments or contract + Notification/report to; request for information by; and/or administrative/ warning notice from the regulator + LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator	+ Limited number of minor breaches of legislation, instruments or contract + Statutory notice from the regulator + LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator	+ Systemic minor breaches (or one moderate breach) of legislation, instruments or contract + Company charged with an offence with minor penalty/fine + LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases	+ Systemic moderate breaches (OR single material breach) of legislation, instruments or contract + Company charged with an offence with moderate penalty/fine	+ Material breaches of legislation, instruments or contract + Company or officers charged with an offence with material penalty/fine, or loss of tenure/operatorship

Likelihood		I	II	III	IV	V	VI
ALMOST CERTAIN (< 4 monthly) Occurs in almost all circumstances OR could occur *within days to weeks*	f	Low	Medium	High	Very High	Very High	Very High
LIKELY (4 monthly - 1 yearly) Occurs in most circumstances OR could occur *within weeks to months*	e	Low	Medium	High	High	Very High	Very High
OCCASIONAL (1 - 3 yearly) Has occurred before in Santos OR could occur *within months to years*	d	Low	Low	Medium	High	High	Very High
POSSIBLE (3 - 10 yearly) Has occurred before in the industry OR could occur *within the next few years*	c	Very Low	Low	Low	Medium	High	Very High
UNLIKELY (10 - 30 yearly) Has occurred elsewhere OR could occur *within decades*	b	Very Low	Very Low	Low	Low	Medium	High
REMOTE (30 - 100 yearly) Requires exceptional circumstances and is unlikely even in the long term OR only occurs as a *"one in 100 year event"*	a	Very Low	Very Low	Very Low	Low	Medium	Medium

Table B3 – Risk assessment and management

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
Achieve the completion criteria and habitat quality improvements for offset values and remnant status for those regrowth vegetation communities.	Completion criteria and habitat quality improvements are not achieved.	Degradation of habitat.	D	IV	H	Implementation of this OAMP, including the management actions and monitoring program outlined in Section 6 and Section 7. Implementation of the adaptive management process outlined in Section 5. Obtain advice with the aim of identifying appropriate additional management interventions if interim performance targets are not achieved for one or more offset values by year 5,10 or 15. If it is considered that the completion criteria cannot be achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the offsets assessment guide. The revised OAMP will be submitted to the Commonwealth Government.	Management actions to support the improvement of the offset area condition, and thereby achieve completion criteria, will be implemented as outlined in this OAMP for the lifetime of the OAMP. Habitat quality assessment will be undertaken in year 1 and then every two years for the first six years, and then every three years thereafter. Interim habitat quality score performance targets are defined for years 5, 10, and 15.	B	IV	L	Monitoring of offset value habitat quality scores and condition of habitat will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Rapid monitoring events (Section 7.5.1). • Habitat quality assessments to determine habitat quality scores (Section 7.5.2). • Targeted fauna surveys (Section 7.5.4). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of the offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime to better support enhancement of offset values. • For offset values that have not achieved interim performance targets by year 5, 10 or 15 for those offset values, Santos will obtain advice from suitably qualified people/groups with the aim of identifying appropriate additional management interventions. If it is considered that the completion criteria cannot be

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
													achieved, Santos will update this OAMP proposing alternative offset areas in order to acquit the required offset requirements in accordance with the offsets assessment guide. The revised OAMP will be submitted to the Commonwealth Government.
Maintain the extent of offset value habitat within the offset area.	Habitat or vegetation loss through land clearing.	Violation to the voluntary declaration and this OAMP, resulting in a loss of biodiversity and extent of threatened species habitat.	D	V	H	Protection of the offset area via a Voluntary Declaration under Sections 19E and 19F of the VMA, as described in Section 2.9.	Conditions of the Voluntary Declaration under Section 19E and 19F of the VM Act will place for the life of EPBC 2012/6615. Restrictions outlined in Table 13 will therefore be implemented for the lifetime of the project and OAMP.	B	V	M	Reporting to the Commonwealth Government consistent with EPBC approval.	Any activities in contravention of the Voluntary Declaration and this OAMP.	**Step 1: Investigate cause of trigger** • Investigate reasons why unapproved clearing occurred e.g. unauthorised access • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Addition fencing, signage and/or security for the offset area • Restoration of the impacted area
						Comply with the restrictions outlined in Table 13. Construction and maintenance of access tracks, fencing and firebreaks will be undertaken in accordance with Sections 6.2.2, 6.2.4 and 6.2.5. Restoration of impacted areas subject to any unauthorised clearing.	At all times				Offset area inspections will be undertaken twice per year for the duration of the management period and will report on any major or noticeable changes to the extent of offset value habitat.	Clearing for access, fencing, firebreaks or public safety is not undertaken in accordance with the restrictions outlined in Section 6.2.	**Step 1: Investigate cause of trigger** • If restrictions for clearing associated with fencing, access, firebreaks or public safety are not adhered to, Santos will ensure that all clearing activities cease immediately. • Investigate the reason for unapproved or unintentional clearing. • Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat.

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
													• Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks. • Prior to the establishment of fences, access tracks, and firebreaks, the area to be cleared will be clearly marked out with flagging tape and checked prior to clearing. • Rehabilitation of the impacted area.
Ensure that the livestock grazing restrictions for fire management and weed control assist in the enhancement of ground cover attributes for offset values and does not result in the degradation of habitat.	Degradation of offset value habitat quality as a result of livestock grazing.	Over grazing induced suppression and displacement of native flora and fauna species, reflected in environmental monitoring results and annual reports.	E	III	H	Implementation of strategic grazing to reduce fuel loads and control exotic pasture grasses and promote the establishment of native perennial grass species in accordance with Section 6.2.5. Annual biomass monitoring to inform strategic grazing regimes. Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.5.1 and 7.5.2 including an assessment of % cover of native perennial grasses.	Biomass monitoring will be undertaken twice a year, at the end of the wet season and end of the dry season. Offset area inspections and rapid monitoring events will be undertaken once and twice per year, respectively, for the duration of the management period and will report on any major or noticeable changes to livestock grazing regimes.	B	III	L	Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 7.5.1 and 7.5.2. These will include assessment of % cover of native perennial grasses.	Decrease in the richness and average % cover of native perennial grasses at one or more habitat quality assessment sites based on the results of baseline and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reason for the decrease in richness and average % cover of native perennial grasses • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime. • Installing additional watering points for

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
													livestock to manage livestock in accordance with the grazing regime.
Minimise predation risk by wild dogs to threatened fauna species.	Predation of threatened fauna by wild dogs.	Reduction in the abundance and diversity of native fauna species within the offset area, as well as possible reduction in the population density and growth of threatened species.	D	III	M	Regular monitoring for pest animals will be undertaken in accordance with the methods detailed in Section 7.4 and pest animal control will be implemented following the results of monitoring in accordance with Section 6.2.7.	The requirement for and timing of pest animal management will be informed by annual pest animal monitoring results. Frequency and duration of management will be appropriate to the target species biology, and extent of occurrence.	C	III	L	Undertake monitoring for wild dogs in accordance with Section 7.4.	An increase in Catling* Index for wild dogs from year 1 and subsequent monitoring events.	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an increase in the: – Catling* index for wild dogs, feral cats and/or foxes – relative abundance of feral pigs and horses. • Review adherence to pest management control measures as outlined in Section 6.2.7 • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency and intensity of pest animal control. • Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. • Updating pest animal control methods in the OAMP and targeted pest animal control programs.
Minimise predation risk by foxes to threatened fauna species.	Predation of threatened fauna by foxes.		D	III	M			C	III	L	Undertake monitoring for feral cats in accordance with Section 7.4.	An increase in Catling* Index for feral cats from year 1 and subsequent monitoring events.	
Minimise predation risk by feral cats to threatened fauna species.	Predation of threatened fauna by cats.		D	III	M			C	III	L	Undertake monitoring for foxes in accordance with Section 7.4.	An increase in Catling* Index for foxes from year 1 and subsequent monitoring events.	
Minimise degradation of offset value habitat by feral pigs.	Degradation of habitat by feral pigs.		D	III	M			C	III	L	Undertake monitoring for feral pigs in accordance with Section 7.4.	An increase in mean feral pig abundance score from year 1 and subsequent monitoring events.	
Minimise degradation of offset value habitat by feral horses.	Degradation of habitat by feral horses.		D	III	M			C	III	L	Undertake monitoring for feral horses in accordance with Section 7.4. Undertake monitoring for feral pigs in accordance with Section 7.4.	An increase in the observed presence of feral horses across monitoring events.	
Manage invasive weed species to reduce degradation of offset value habitat.	Invasion of habitat by weed species, including exotic grasses.	An increase in either the abundance or diversity of weed species.	D	III	M	Regular weed monitoring will be undertaken in accordance with Section 7.3.	Weed treatment and control will be undertaken at optimal timing according to the lifecycle of the target	C	III	L	Undertake weed monitoring in accordance with Section 7.3.	An increase in species richness and relative abundance of weed species at more than 20% of	**Step 1: Investigate cause of trigger** • Investigate potential sources or reasons that may have attributed to an

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
						Based on the results of monitoring events, weeds will be managed using biological, chemical and/or mechanical control in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets, for the relevant weed species (see Section 6.2.6).	species, i.e. before seeding. Frequency and duration of management will be appropriate to the target species biology, severity and extent of infestation.					monitoring sites from year 1 and subsequent monitoring events. A new weed species is identified at one or more monitoring sites.	increase in species richness and/or relative abundance of weeds. • Investigate potential sources or reasons for the occurrence of the new weed species. • Review adherence to weed management control measures as outlined in Section 6.2.6 • Review adherence to weed hygiene restrictions as outlined in Section 6.2.1 • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Amending weed hygiene restrictions. • Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to. • Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld). • Increasing the frequency and intensity of weed control. • Updating weed control methods in the OAMP and targeted weed control programs.
Reduce the risk of adverse impacts to offset value habitat by inappropriate fire regimes or unplanned fire.	Decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events as a result of fire	Decrease in the habitat quality score for any offset value from baseline and subsequent monitoring events as a result of fire	D	IV	H	Fuel loads within the offset area will be managed through strategic livestock grazing and fuel hazard reduction burns as outlined in Section 6.2.5.	If deemed necessary, fuel load management will be carried out when required during suitable climatic conditions, as outlined in Section 6.2.5.	B	IV	L	Habitat quality assessments to determine habitat quality scores will be undertaken in accordance with Section 7.5.2.	As a result of fire management measures, or an unplanned fire, there is a decrease in the habitat quality score for any offset value	**Step 1: Investigate cause of trigger** • Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores.

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
	management measures, or an unplanned fire.	management measures, or an unplanned fire.				Firebreaks will be established and maintained around the boundary of the offset area, with green firebreaks established where the offset area joins native vegetation. Firebreaks will be maintained at least annually in mid / late autumn and, or early spring to remove overhanging trees or fallen debris and dense vegetation.					Rapid monitoring events will be undertaken to assess the general condition of vegetation in accordance with Section 7.5.1.	from baseline and subsequent monitoring events.	• Review adherence to the fire management measures as outlined in Section 6.2.5. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Increasing the frequency of biomass monitoring. • Increasing the frequency of weed control measures. • Amending the strategic grazing regime. • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks. • Review timing and intensity of fuel hazard reduction burns in accordance with the Regional Ecosystem Description Database (REDD) fire management guidelines and conservation advice for the particular offset value.
Regrowth Brigalow vegetation managed to meet the criteria for remnant status.	Regrowth Brigalow does not achieve remnant status within the OAMP timeframes.	Selective thinning is not a successful action to achieve the desired stem count and/or improving condition of Brigalow TEC	D	III	M	Selective regrowth thinning of Brigalow TEC where regrowth of Brigalow vegetation (RE 11.9.5) occurs at >10,000 stems per hectare in accordance with Section 6.2.3.	Selective thinning will be undertaken as required based on the results of monitoring events (Section 7.5.5)	C	III	L	Habitat quality assessments (Section 7.5.2). Brigalow regrowth assessment (Section 7.5.5).	Brigalow regrowth exceeds 10,000 stems per hectare based on previous monitoring events.	**Step 1: Investigate cause of trigger** • Investigate the reasons why stem density is >10,000 stems/ha and whether management intervention is required. mechanical thinning is effective and appropriate **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include:

Management objective	Risk description	Event or circumstance	Initial risk rating			Control strategies	Timing, Frequency or Duration	Residual risk rating			Monitoring Activity	Management Trigger	Corrective Action
			Likelihood	Consequence	Risk level			Likelihood	Consequence	Risk level			
													• Increasing the frequency thinning activities • Revise the type of thinning method used
Achieve the interim performance targets and completion criteria for each offset value within 5, 10, 15 and 20 years, respectively.	Interim performance targets are not achieved for offset values by year 5, 10 or 15. Completion criteria are not achieved for offset values by year 20.	Offset fails to achieve the interim performance targets and completion criteria within the anticipated 5-, 10-, 15- and 20-year timeframes, respectively.	E	III	H	Monitoring of the offset area will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Offset value assessments (Section 7.5). The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 7.5.5).	Management methods and actions will occur during seasonally suitable timing, in collaboration with the landholder and contractor undertaking the scope of work. Monitoring will occur in accordance with the implementation schedule, see Section 9.	B	III	L	Monitoring of the offset area will be undertaken in accordance with Section 7 including: • Offset area inspections (Section 7.1). • Offset value assessments (Section 7.5) The results of monitoring events will be compared against the interim performance targets and completion criteria to determine the progress of offset area and recorded as part of reporting (Section 8).	Interim performance targets are not achieved for one or more offset values by year 5, 10 or 15. Completion criteria are not achieved for one or more offset values by year 20.	**Step 1: Investigate cause of trigger** • Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. • Re-evaluate the suitability of the relevant management measures in the OAMP. • Identify appropriate corrective actions. **Step 2: Implementation of corrective action/s** The appropriate corrective actions will be implemented and may include: • Third party review of the OAMP to provide input on the effectiveness of the management actions. • Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented. • Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values.

Appendix C

MNES habitat quality score method

Calculation of a habitat quality score for each MNES considers three attributes:

- site condition
- site context
- species stocking rate.

Site condition

The site condition score for each MNES is calculated generally in accordance with the site condition assessment method outlined in Section 5 of the GTDTHQ (version 1.2; DEHP 2017). Site condition is determined through a field-based assessment of 13 ecological attributes to describe the structure and function of the vegetation community, compared to the expected range for a relatively undisturbed community (i.e. RE benchmark).

The results of the field-based assessment are scored based on the scoring guide provided in the GTDTHQ to determine the site condition score for each MNES at each relevant monitoring site out of 80.

Site context

The method to calculate site context for a site is based on the site context assessment method provided in the GTDTHQ. The following components were assessed through a GIS desktop analysis at each relevant monitoring site for each MNES:

- Patch size: the size of the patch/assessment unit being assessed and any directly connecting suitable/known habitat and remnant vegetation. To calculate the patch size score:
  - Measure the area of vegetation in which the assessment unit is contained and add on all other directly connecting areas of suitable or known habitat for the threatened species or community and remnant vegetation. Suitable or known habitat will be based on mapped vegetation comprising regional ecosystems known or likely to support the MNES value based on the conservation advice or other species-specific sources endorsed by Queensland and/or Commonwealth Governments. Where the connecting patch comprises an RE that is known or suitable habitat, then 100% of the area of that RE is attributed to the total patch size area. Where the connecting RE is not considered known or suitable habitat (i.e. non-compliant RE); however, is a remnant RE, only 10% of the area of that RE is attributed to the total patch size area sum. The reduced weighting for non-compliant REs acknowledges the importance of these REs in contributing to the overall patch size through its contribution to potential dispersal of species, and the supporting role of these REs for maintaining connectivity to potential source meta-populations.
  - Determine the score for this attribute by matching with the class ranges in Table E 1.
- Connectedness: measure the proportion of the assessment unit's boundary which is connected to suitable/known habitat and remnant vegetation. To calculate the connectedness score:
  - Measure the percentage of suitable/known habitat and remnant vegetation along the boundary of the assessment unit.
  - Determine the score for this attribute by matching with the class ranges in Table E 1.
- Context: measure the percentage of suitable/known habitat and remnant vegetation within a 1 km buffer around the site/assessment unit. To calculate the context score:
  - Create a 1 km buffer around the monitoring site.
  - Measure the percentage cover of remnant vegetation within the buffer area.
  - Determine the score for this attribute by matching with the thresholds Table E 1.
  - Ecological corridors: to calculate the ecological corridor score:

- Determine the proximity of the site to state, bioregional, regional or sub-regional corridors (terrestrial or riparian).
- Determine the score from Table E 1 based on whether the site is located within (wholly or partly); shares a common boundary with; or is not within a corridor.

Table C1 - Site context scoring guide

Attribute	Scoring guide					
Size of Patch	Score	0	2	5	7	10
	Description	<5 ha	5-25 ha	26-100 ha	101-200 ha	>200 ha
Connectedness	Score	0	2		4	5
	Description	0-10%	>10%-<50%		50-75%	>75% or >500 ha
Context	Score	0	2		4	5
	Description	<10%	>10-30%		>30-75%	>75%
Ecological corridors	Score	0	4		6	
	Description	Not within	Sharing a common boundary		Within (whole or part)	

The total site context score for each MNES at each relevant monitoring site is calculated out of 26.

Species habitat index

A quantitative method is used to determine the species habitat index score for each fauna and flora MNES based on the species habitat index assessment method used as part of the GTDTHQ.

Table E 2 to Table E 6 summarise the method for calculating species habitat index score out of 50 for Collared Delma, Yakka Skink, Dunmall's Snake, Red Goshawk and South-eastern Long-eared Bat. Each sub-component of species habitat index scoring method is tailored for each MNES to consider species-specific habitat requirements and threats in accordance with conservation advices and other species-specific sources endorsed by Queensland and/or Commonwealth governments.

In the absence of the GTDTHQ including a species habitat index for flora species, the habitat condition scores for Brigalow TEC included a species presence index out of three, whereby: 0 = absent/not confirmed, 2 = single confirmed specimen, 3 = multiple confirmed specimens. The habitat condition score was then calculated as a combination of site condition and site context for the RE assessment unit (representing 60% of the score), with species stocking rate converted to a score out of 3 and contributing 40%.

Table C2 - Species habitat index scoring for Collared Delma

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting some damage to critical microhabitat including deep cracks in clay soils, fallen timber and logs. However, some microhabitat still occurs on site in patches. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species. • No foxes and/or feral cats observed or known within the vicinity of the site. Successful active pest animal management implemented on site.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for coarse woody debris OR leaf litter. • Highly disturbed ground layer.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. small skinks and geckos.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes coarse woody debris AND/OR leaf litter. • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. small skinks and geckos.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.

Component	Level	Score	Description
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower-than-average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table C3 - Species habitat index scoring for Yakka Skink

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. Overgrazing by livestock resulting in irreversible damage to microhabitat including logs, dense leaf litter and fallen bark. • Overgrazing by livestock resulting in irreversible damage to microhabitat including coarse woody debris, dense leaf litter and decorticated bark. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.

Component	Level	Score	Description
			• Site is actively managed for conservation purposes to enhance habitat for threatened species. • No foxes and/or feral cats observed or known within the vicinity of the site. Successful active pest animal management implemented on site.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for coarse woody debris OR leaf litter. • Highly disturbed ground layer.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND 50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. soft plant materials and fruits and a wide variety of invertebrates.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes coarse woody debris AND leaf litter. • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. soft plant materials and fruits and a wide variety of invertebrates.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 OR >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows, large hollow logs).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range OR • Site has very few records for migratory species.
	Likely to be critical to species' survival Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival:	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND

Component	Level	Score	Description
	Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.		• The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • The population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table C4 - Species habitat index scoring for Dunmall's Snake

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural landuse and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting some damage to critical microhabitat including deep cracks in clay soils, fallen timber and logs. However, some microhabitat still occurs on site in patches. • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species. • No foxes and/or feral cats observed or known within the vicinity of the site. Successful active pest animal management implemented on site.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Evidence of some disturbance to ground layer reducing habitat condition for known food sources, e.g. small skinks and geckos.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR <50% of the RE benchmark value for coarse woody debris.

Component	Level	Score	Description
			• Limited evidence of potential shelter habitat.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >90% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. fallen timber and ground litter, cracks in alluvial clay soils).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower-than-average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table C5 - Species habitat index scoring Red Goshawk

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development, timber production or agricultural land use and/or subject to ongoing degradation. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Site is mostly cleared and does not support habitat for prey species such as medium sized birds.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site may have a history of clearing; however patches of remnant forest and regrowth occur frequently providing suitable habitat for prey (i.e. medium sized birds).
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) to allow for recruitment of native species. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees AND/OR <10% tree canopy cover. • Prey species rarely observed and habitat does not support a viable population of prey (medium sized birds).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes large trees AND/OR >10%-<50% (or >200%) tree canopy cover. • Prey species observed and habitat supports a viable population of prey (medium sized birds).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes large trees AND/OR >50-<200% tree canopy cover. • Prey species observed frequently and habitat supports a healthy population of prey (medium sized birds).
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for large trees, AND • Very few or no occurrences of large, mature trees near a watercourse for nesting.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for large trees, AND • Infrequent occurrences of large, mature trees near a watercourse for nesting.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for large trees, AND • Frequent occurrences of large, mature trees near a watercourse for nesting.
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR

Component	Level	Score	Description
			• Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table C6 – Species habitat index scoring for Black-breasted Button-quail

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Habitat is not protected through legislation and/or is likely to be cleared for development or agricultural landuse and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to groud layer vegetation that provide foraging and breeding habitat • No management of invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*), • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Removal of fallen timber.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural landuse. • Strategic pulse livestock grazing resulting in irreversible damage to groud layer vegetation that provide foraging and breeding habitat • Some management of invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*), • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No foxes and/or feral cats observed or known within the vicinity of the site and no known or observed evidence of predation. • Successful active weed management implemented on site. • Successful active pest animal management implemented on site. • Habitat protected as part of a legally binding mechanism for an offset and/or National Park and/or Nature Refuge, with management aimed at maintaining or improving habitat.

Component	Level	Score	Description
			• Livestock grazing excluded from habitat at all times (except for need for fuel load control through strategic grazing, if required) • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <30% of benchmark for organic litter
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% - 70% of benchmark for organic litter
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >90% of benchmark for organic litter
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <30% benchmark for shrub cover AND <30% of benchmark for coarse woody debris
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% benchmark for shrub cover AND >50% of benchmark for coarse woody debris
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% benchmark for shrub cover AND >70% of benchmark for coarse woody debris
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Likely to be critical to species' survival Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation

Component	Level	Score	Description
	shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.		
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation

Table C7 – Species habitat index scoring for Squatter Pigeon (southern)

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Habitat is not protected through legislation and/or is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Overgrazing by livestock resulting in irreversible damage to ground layer vegetation that provides foraging and breeding habitat. • No management of invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*). • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site. • No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Removal of fallen timber.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural land use. • Strategic pulse livestock grazing resulting in irreversible damage to ground layer vegetation that provide foraging and breeding habitat. • Some management of invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*). • Foxes and/or feral cats observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No foxes and/or feral cats observed or known within the vicinity of the site and no known or observed evidence of predation. Successful active pest animal management implemented on site. • Successful active weed management implemented on site. • Habitat protected as part of a legally binding mechanism for an offset and/or National Park and/or Nature Refuge, with management aimed at maintaining or improving habitat. • Livestock grazing excluded from habitat at all times (except for need for fuel load control through strategic grazing, if required). • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for grass species richness OR native perennial grass cover <20% or >90%. • Habitat not within 3 km of permanent water source.

Component	Level	Score	Description
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes grass species richness OR perennial grass cover 40-90%. • Habitat within 3 km of permanent water source.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for grass species richness OR perennial grass cover approximately 20-40%. • Habitat within 3 km of permanent water source.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for grass species richness OR perennial grass cover <20% or >90%. • Habitat not within 3 km of permanent water source.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for grass species richness OR perennial grass cover 40-90%. • Breeding habitat within 1 km of permanent water source or foraging habitat within 3 km of water source.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for grass species richness OR perennial grass cover 20-40%. • Breeding habitat within 1 km of permanent water source.
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Likely to be critical to species' survival Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.

Component	Level	Score	Description
	shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.		
	Critical to species survival Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation.

Table C8 – Species habitat index scoring for Northern Quoll

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • Many cane toads present on site equally a high possibility of death by ingestion and poisoning. • Overgrazing by livestock resulting in irreversible damage to microhabitat such as fallen timber. • Known presence of foxes and/or feral cats on site and within adjacent properties and/or known or observed evidence of predation. No active pest animal management on site OR pest management is using 1080 baiting. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting in some damage to critical microhabitat including fallen timber and logs. • Cane toads present on site but not in high numbers. • Foxes and/or feral cats observed on site or on adjacent properties, however pest animal management occurs on site. 1080 not used on site. • Active fire management and/or low risk of uncontrolled fire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No foxes and/or feral cats observed on site or on adjacent properties. Successful pest management occurs onsite without the use of 1080. • No cane toads present on site or very little activity recorded. • Site is actively managed for conservation purposes to enhance habitat for threatened species. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing). • Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 OR <50% of the RE benchmark value for coarse woody debris AND/OR leaf litter. • Highly disturbed ground layer. • No rocky outcrops on site.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for attributes coarse woody debris OR leaf litter. • Some suitable denning sites (rocky outcrops, cliffs, rocks walls etc) found on site.

Component	Level	Score	Description
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes coarse woody debris AND/OR leaf litter. • Limited evidence of disturbance to ground layer likely to support known food sources, e.g. reptiles and small mammals. • Frequent denning sites (rocky outcrops, cliffs, rocks walls etc) found on site.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for coarse woody debris. • Limited evidence of potential shelter habitat (i.e. rocky outcrops, caves, rock crevices, logs or tree stumps, large hollow logs).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND >50% of the RE benchmark for coarse woody debris. • Evidence of disturbance to ground layer with presence of potential shelter sites (i.e. rocky outcrops, caves, rock crevices, logs or tree stumps, large hollow logs).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for coarse woody debris. • No evidence of disturbance to ground layer with presence of potential shelter sites (i.e. rocky outcrops, caves, rock crevices, logs or tree stumps, large hollow logs).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.

Component	Level	Score	Description
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple species records within the last 10 years within 15 km of the site and site contains high quality food, foraging and shelter habitat, AND • Site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation.

Table C9 – Species habitat index scoring for Koala

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Known presence of wild dogs on site and within adjacent properties and/or evidence of predation known or observed and. No active pest animal management on site. • Public vehicle access to site, with evidence of death through vehicle strike observed or likely. • Habitat is not protected through legislation and/or is likely to be cleared for development or agricultural land use and/or subject to ongoing degradation. • No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Wild dogs observed on site or within adjacent properties and/or limited evidence of known or observed predation. Active pest animal management implemented on site. • Restricted access to the site by authorised personnel only, with no public vehicle access. • Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural land use. • Active fire management and/or low risk of uncontrolled fire on site, including from adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• No wild dogs observed or known within the vicinity of the site and no known or observed evidence of predation. Successful active pest animal management implemented on site. • Restricted access to the site for authorised personnel only, with no public vehicle access. Reduced speed limits in place and/or driver awareness and/or signs to identify species habitat and/or exclusion fencing to prevent Koalas accessing road. • Habitat protected as part of a legally binding mechanism for an offset and/or National Park and/or Nature Refuge, with management aimed at maintaining or improving habitat. • Active fire management, with controlled burns on site and low risk of uncontrolled fire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Minimum of one eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, with limited foraging potential for the species.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Minimum of one eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, and provides known foraging habitat for the species including Koala food trees known to support Koalas within the region, AND • >50% of the RE benchmark for number of large trees attribute.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Minimum of two eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, and provides known foraging habitat for the species including Koala food trees known to support Koalas within the region, AND

Component	Level	Score	Description
			• >70% of the RE benchmark for attributes number of large trees, OR • 1 Koala food tree species known to support Koalas within the region that alone accounts for >50% of the canopy.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Minimum of one eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, with limited sheltering or dispersal habitat potential for the species.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Minimum of one eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, and provides known habitat for the species including emergent trees likely to support shelter and/or dispersal habitat for Koalas, AND • >50% of the RE benchmark for attributes number of large trees and/or canopy cover and/or canopy height.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Minimum of two eucalypt species present (including species from the genera Eucalyptus, Corymbia, Angophora and Lophostemon) that is known from the RE, and provides known habitat for the species including emergent trees known to support shelter and/or dispersal habitat for Koalas, AND • >70% of the RE benchmark for at least two of the three following attributes: number of larger trees, canopy cover and canopy height
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • The site is likely to support only a small or relictual population of the species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.

Component	Level	Score	Description
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely or known to support a relatively higher than average population density of the species, likely to represent a source metapopulation.

Table C10: Species habitat index scoring South-eastern Long-eared Bat

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development, timber production or agricultural land use and/or subject to ongoing degradation. No active fire management on site, with habitat either frequently burnt and/or subject to a high risk of uncontrolled wildfire on site, including from adjacent properties. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Overgrazing resulting in a lack of understorey habitat that supports invertebrate prey.
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. Active fire management and/or low risk of uncontrolled fire on site, including from adjacent properties. • Strategic livestock grazing resulting in some degradation to the understory habitat that supports invertebrate prey however, patches of habitat occur on site. • Active fire management and/or low risk of uncontrolled fire on site, including on adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. Active fire management, with controlled burns on site and low risk of uncontrolled fire on site, including from adjacent properties. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) allowing for recruitment of native saplings. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees. OR • <10% tree canopy cover.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark value for large trees, OR • >10% - <50% tree canopy cover.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark value for large trees, OR • >50% - <200% tree canopy cover.
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees. • Limited evidence of dead trees and/or hollows for roosting.
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark value for large trees. • Evidence of some dead trees and/or hollows for roosting.
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark value for large trees. • Evidence of dead trees and/or hollows for roosting.
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide.

Component	Level	Score	Description
			• The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping-stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape.
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a species population and site is within geographical range of the species although the site contains low quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site, AND • The site contains habitat likely to support a population at or lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • The population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Table C11 – Species habitat index scoring for Large-eared Pied Bat

Component	Level	Score	Description
Threats to species	High threat level (i.e. likely to result in death, irreversible damage): site subject to a high level of threat, whether being part of a highly fragmented system, without and core area, and previous, present and future management realising an ongoing threat	1	• Suitable habitat on site is likely to be cleared for development, timber production or agricultural land use and/or subject to ongoing degradation. • No active fire management on site, with the site either frequently burnt and/or subject to a high risk of uncontrolled fire on site, including from adjacent properties. • Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation. • Foxes known on site and no active pest management in place.

Component	Level	Score	Description
	Moderate threat level: site subject to a moderate, realised level of threat, being part of a fragmented system, with edge effects resulting in a high edge/core area ratio and/or with previous, present and future management resulting in a moderate level of threat	7	• Suitable habitat on site is likely to undergo some level of continued clearing for development or agricultural land uses. • Strategic livestock grazing resulting in some degradation to the understory habitat that supports invertebrate prey however, patches of habitat occur on site. • Active fire management and/or low risk of uncontrolled fire on site, including on adjacent properties.
	Low threat level (i.e. likely to survive): no actual or realised threats occur on or near the site. Site not part of fragmented system, with no edge effects, and no immediate threat from present or future management	15	• Suitable habitat on site is unlikely to undergo any level of clearing for development or agricultural land uses. • Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) allowing for recruitment of native saplings. • Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties. • Site is actively managed for conservation purposes to enhance habitat for threatened species.
Quality and availability of food and foraging habitat	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND <50% of the RE benchmark value for large trees OR <10% tree canopy cover. • Little to no areas of suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark for attributes large trees OR >10%-<50% tree canopy cover. • Some areas of suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for attributes large trees OR >50-<200% tree canopy cover. • Frequent areas of suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
Quality and availability of shelter	Poor: Very limited species-specific habitat, conditions or resources available	1	• Overall BioCondition score <5 AND/OR <50% of the RE benchmark value for large trees, AND/OR • Limited evidence of suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
	Moderate: Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited	5	• Overall BioCondition score >5 - <8 AND/OR >50% of the RE benchmark for large trees, AND/OR • Some infrequent suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
	High: Species-specific habitat, conditions or resources for all relevant stages of the life cycle present	10	• Overall BioCondition score >8 AND >70% of the RE benchmark for large trees, AND • Frequent suitable habitat for roosting (e.g. cliffs, escarpments or rocky outcrops).
Species mobility capacity	Severely restricted (76–100% reduction)	1	• The site is functionally isolated from other appropriate habitat for the species, with much of the landscape considered a barrier to species mobility, including natural barriers (e.g. mountain ranges, unsuitable habitats, major rivers/water bodies) and/or artificial barriers (e.g. such as roads, rail, mines), or developments that create treeless areas more than 2 km wide. • The site is small compared with the known habitat known or likely to support the species. • The site is generally representative of one likely to only support a relictual population, with little opportunity for dispersal from source metapopulations.
	Highly restricted (51–75% reduction)	4	• The site is likely isolated to regular movement of the species into or out of habitat contiguous to the site, resulting in the site only likely to support a relictual population or, at best, a sink population, with very irregular dispersal from nearby populations.
	Moderately restricted (26–50% reduction)	7	• The site is representative of a stepping stone in the landscape between other patches of appropriate habitat for the species, with potential regular movement of the species into or out of habitat contiguous to the site, OR • Given the presence of appropriate habitat, the site is large enough to likely support a self-sustaining population either representative of a source metapopulation, or a nearby satellite population.
	Minor restriction (0–25% reduction)	10	• The site is limited in its barrier to movement by the species, or the site is sufficiently large to support a known source population of a likely or known metapopulation in the landscape, OR • The site is likely to support only a small or relictual population of the species.

Component	Level	Score	Description
Role of site location to species overall population in the state	Not or unlikely to be critical to species' survival: Site likely to support only a small or relictual species population or community, not near the geographical limit of the species/community range OR there are very few records for migratory species.	1	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site is likely to support only a small or relictual population or community - it is not near the geographical limit of the species/community range, OR • Site has very few records for migratory species.
	Likely to be critical to species' survival: Site supports an important species population for breeding or dispersal, or a community that is a contiguous or functional link between known, important or key source species populations or communities at the landscape to regional scale OR is an important stopover habitat for migratory species.	3	• Site likely to support a population of the species and site is within geographical range of the species and site contains moderate quality food, foraging and shelter habitat, OR • Site supports an important population for breeding or dispersal, or a community that is a contiguous or a functional link between known, important or key source species populations or communities at the landscape to regional scale, OR • Site is an important stopover habitat for migratory species.
	Known to be critical to species' survival: Site known to support evidence of one or more species records within the last 10 years within 5 km of the site AND site contains greater than moderate quality food, foraging and shelter habitat, with greater than moderate mobility capacity to other areas of suitable habitat.	4	• Evidence of one or more species records within the last 10 years within 15 km of the site and site contains greater than moderate quality food, foraging and shelter habitat, AND • Site contains habitat likely to support a population at a lower than average population density for the species, likely to be representative of a sink population from a nearby source metapopulation.
	Critical to species survival: Site supports a key source species population for breeding and/or dispersal or community at the state to national scale, necessary for maintaining genetic diversity AND/OR the population is outside or near the geographical limit of the species/community range OR is critical stopover habitat for migratory species at the national or state scale.	5	• Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat, AND • Site supports a key source population for breeding and/or dispersal or a community at the state to national scale necessary for maintaining genetic diversity, AND/OR • Population is outside or near the geographical limit of the species/community range, OR • Site is critical stopover habitat for migratory species at the national or state scale.

Appendix D

Overall Fuel Hazard Assessment Guide

Department of Sustainability and Environment

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management

report no. 82

State Government Victoria

Overall fuel hazard assessment guide

4th edition July 2010

Fire and adaptive management, report no. 82

By Francis Hines, Kevin G Tolhurst, Andrew AG Wilson and Gregory J McCarthy

This publication was produced with the support of the Attorney-General's Department of the Australian Government, who part funded this project through the Natural Disaster Resilience Grants Program.

Images have been provided by Department of Sustainability and Environment – Victoria, Department of Environment and Heritage – South Australia, Country Fire Service – South Australia, Department of Conservation and Environment – Western Australia and Christian Pearson – Misheye. Katy Friend drew the illustrations.

Cover image: Elaine – Atchison Rd Fire, Victoria, January 2008. Bark Hazard – Extreme, Elevated Fuel Hazard – Moderate, Near-surface Fuel Hazard – Low, Surface Fuel Hazard – Very High. Overall Fuel Hazard – Extreme. Fire burning under FFDI 17 – High.

Published by the Victorian Government Department of Sustainability and Environment
Melbourne, July 2010

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Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

Printed by Stream Solutions
Printed on 100% Recycled paper

ISBN 978-1-74242-676-1 (print)
ISBN 978-1-74242-677-8 (online)

For more information contact the DSE Customer Service Centre 136 186

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1. About this guide

1.1 Purpose

The main purpose of this guide is to allow people to:

- make a rapid, visual assessment of fuel arrangement, and
- gain an understanding of how this will affect the chances of controlling a bushfire.

1.2 Audience

This guide has been principally designed to provide information on fuel arrangement to be used by:

- firefighters to assess the difficulty of controlling a bushfire.

Information on fuel arrangement may also be used by:

- asset owners and managers to assess potential bushfire risks to assets
- land and fire managers to provide a measurable objective and trigger for fuel management in fire management plans
- personnel to identify which key attributes and fuel layers are contributing the most to the hazard
- personnel to plan and conduct planned burns
- personnel to assess the effectiveness of planned burning or mechanical hazard reduction
- fire behaviour analysts to produce fire-spread predictions and community warnings.

Those who use the guide for these other purposes need to be mindful of its limitations and how the results are applied and interpreted.

1.3 What fuel is assessed

This guide is for assessing fine fuels that burn in bushfires. Fine fuels are the fuels that burn in the continuous flaming zone at the fire's edge. They contribute the most to the fire's rate of spread and flame height. Typically, they are dead plant material, such as leaves, grass, bark and twigs thinner than 6mm thick, and live plant material thinner than 3mm thick. Once ignited, these fine fuels generally burn out within two minutes.

This guide focuses on assessing the key structural layers of the fine fuel complex, in particular those of bark, elevated, near-surface and surface fuels.

1.4 How the fuel is assessed

Each fuel layer is assessed simply and visually. Assessing the fuel takes only a few minutes and is based on the premise that the eye is better able to integrate local variations in fuel than systematic measurement. Each fuel layer is assessed in turn and given a hazard rating. Particular emphasis is placed on how the fuel is arranged within each of these layers. The hazard ratings are then combined to produce an Overall Fuel Hazard Rating that ranges from Low to Extreme.

1.5 Why fuel arrangement is more important than fuel load

The image below highlights the effect that changing the arrangement of the fuel can have on fire behaviour. Both fires were ignited at the same time in the same way. Both fires are burning in the same fuel load, approximately two broadsheets of newspaper over a 20cm diameter area. The fuel on the right was laid flat and has little vertical orientation. The fuel on the left was crumpled up, which gave it more vertical orientation and exposed more of the surface to the air. As a result, the fire on the left shows significantly greater flame height and the fuel is consumed much faster.

The simple difference in the arrangement of the fuel significantly affects the resulting fire behaviour. The effect would not be discerned if the fuel assessment was based purely on fuel load. An assessment of fuel hazard takes into account the fuel arrangement. It gives a better indication of potential fire behaviour and suppression difficulty.

1.6 Suppression difficulty is not just about fire behaviour

This guide has been mainly developed to allow people to assess the impact of fuel arrangement on suppression difficulty. An assessment of suppression difficulty (how hard it is to control a bushfire) is not based solely on the anticipated fire behaviour. Many other factors affect the chances of a firefighting operation succeeding, including resources, fire size and terrain.

In order to consider the impact of fuels, the other factors need to be treated as if they are constant. The factors that have been held constant are referred to as the Reference Extended First Attack Conditions. Further detail on these conditions is contained in Appendix 1.

1.7 Basis of the Overall Fuel Hazard classification

A comprehensive explanation of this guide is contained in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep.).

This assessment guide updates and builds on work previously published by Wilson (1992a, 1992b, 1993), McCarthy *et al*. (1998a, 1998b, 1998c, 1999, 2001), the Department of Environment and Heritage (2006) and Gould *et al*. (2007a, 2007b).

Classifying Overall Fuel Hazard is complex, with few available measurements. Therefore, we have relied on the perceptions of experienced fire personnel (e.g. fire behaviour specialists, fire managers and firefighters). The collective experience of these personnel is vast, with a broad geographic base across Australia.

1.8 Need for continual learning and development

Although our knowledge about fuels has many gaps, this guide is based on the best available information and experience. The authors acknowledge that this guide will need to change and improve as more information is obtained.

Observers of firefighting operations can improve future editions of this guide by carefully recording what they see. Observations, comments and feedback can be emailed to fire.monitoring@dse.vic.gov.au.

2. How to use the guide

This guide has been kept concise and should not be considered as a standalone document. To produce reliable and consistent results requires extra knowledge which may be gained through local hands-on training in fuel assessment.

2.1 Application

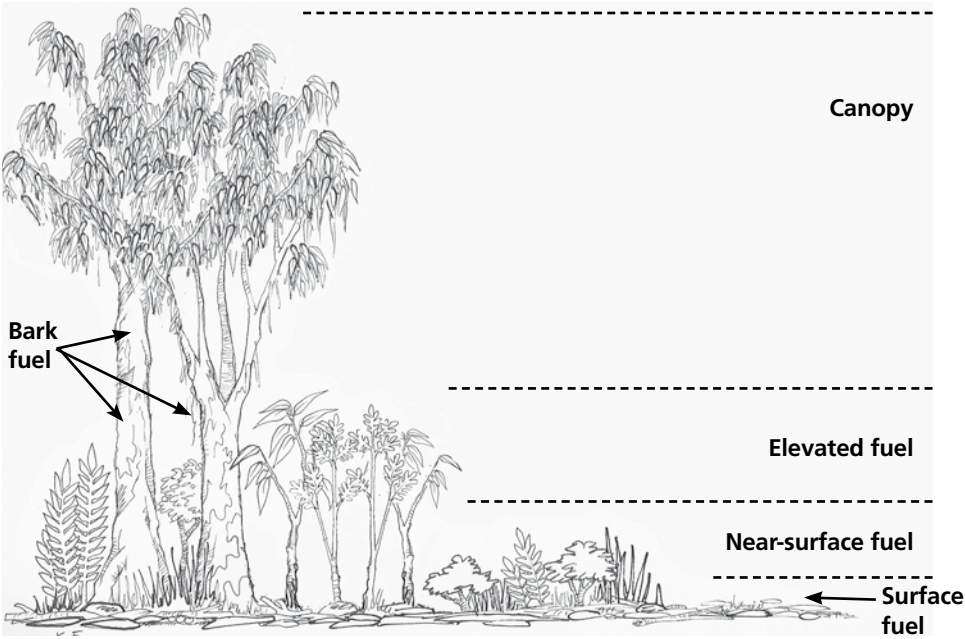
This guide is a tool for rapidly assessing fuel arrangement and its effect on the chances of controlling a bushfire. It may also be used for a range of other fire management purposes, as shown in the table below. Users of this guide should understand the underlying assumptions and limitations before applying it, particularly if applying it for purposes other than the assessment of suppression difficulty.

Application	Methodology
Assess suppression difficulty	Assess the fuels in which the fire may occur or is actually occurring.
Assess fuels for predicting potential risk to assets	Assess the fuels immediately adjacent to the asset as part of an assessment of possible radiant heat loads and defendable space. Assess the fuels further away from the asset; paying particular attention to areas that may generate spotting, such as ridges. Assessments should be focused, particularly in the direction of likely fire attack.
Assess the need for, or success of, fuel management activities	Assess the average fuels across the nominated area by sampling within major vegetation types, slopes and aspects.
Plan and conduct planned burns	Assess the variability in fuels across the nominated area by sampling within major vegetation types, slopes and aspects. Pay particular attention to areas where the burn may escape, such as the tops of gullies, ridge tops and areas adjacent to planned burn boundaries.
Assess fuels for predicting fire behaviour	Assess the fuel values needed as inputs for the appropriate fire behaviour model.

2.2 Fuel layers

Fuel in forests, woodlands and shrublands can be divided into four layers, each based on its position in the vegetation profile (Fig 2.1). This guide focuses on assessing the key structural layers of the fine fuel complex, those of bark, elevated, near-surface and surface fuels.

Figure 2.1 Fuel layers and bark



Use the following descriptions to determine how to separate vegetation into fuel layers.

Layer	Description	Contribution to suppression difficulty
Canopy	• Crowns of the tallest layer of trees. • Under some conditions canopy fuels can play a significant role in fire behaviour and suppression difficulty. Currently, however, these fuels are not assessed as part of Overall Fuel Hazard.	
Bark fuel	• Bark on tree trunks and branches, from ground level to canopy.	Spotting
Elevated fuel	• Fuels are mainly upright in orientation. • Generally most of the plant material is closer to the top of this fuel layer. • Sometimes contains suspended leaves, bark or twigs. • Fuels that have a clear gap between them and the surface fuels. • Can be highly variable in ground coverage. • Low-intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.	Influences the flame height and rate of spread of a fire.
Near-surface fuel	• Live and dead fuels, effectively in touch with the ground, but not lying on it. • Fuel has a mixture of vertical and horizontal orientation. • Bulk of the fuels are closer to the ground than to the top of this layer, or are distributed fairly evenly from the ground up. • Sometimes contains suspended leaves, bark or twigs. • Coverage may range from continuous to having gaps many times the size of the fuel patch. • Low-intensity fire (flame height of less than 0.5m) will consume most or all of this fuel. • Fuel in this layer will always burn when the surface fuel layer burns.	Influences the rate of spread and flame height of a fire.
Surface fuel (litter)	• Leaves, twigs, bark and other fine fuel lying on the ground. • Predominantly horizontal in orientation.	Influences the rate of spread of a fire.

This guide is for assessing fine fuels only. Coarse fuels including logs are not considered. See Section 1.3 for further details.

The descriptions of the fuel layers exclude references to species' names or common vegetation forms, such as shrubs. During a plant's life it may transition back and forth between different layers. For example, juvenile bracken fern can be classified as near-surface fuel before becoming elevated fuel as it matures. Once it dies and collapses it may become near-surface fuel again.

2.3 Assessment based on key attributes of fuel hazard

A fuel hazard rating of Low, Moderate, High, Very High or Extreme is assigned to each fuel layer by assessing it against the key attributes listed below.

Key attribute	
Horizontal continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel beside it. Identifies which of surface, near-surface or elevated fuels will determine the average flame height.
Vertical continuity of the layer	Determines how readily a piece of burning fuel may ignite the fuel above it.
Amount of dead material in the layer	Determines how much dead material is present to burn and thus help with igniting the live (green) fuels.
Thickness of the fuel pieces	Determines whether the fuel pieces will burn in the flaming front of the fire.
Total weight of fine fuel	Determines the weight of fine fuel contributing to the flaming front of the fire.

The descriptions in the hazard assessment tables do not cover all possible combinations of the key attributes. Users will need to exercise judgement and make an assessment using all key attributes when actual conditions fit between the descriptions.

2.4 Using the descriptions and photographs

This is **not** a photographic guide for assessing fuels. The **descriptions** for each of the key attributes should be used as the basis for determining the fuel hazard rating. Photographs cannot adequately show all of the key attributes that are important in determining fuel hazard. The photographs are provided to illustrate **some** of the key attributes for each fuel hazard rating. They do not represent all possible variations of that particular hazard rating.

2.5 Area of assessment

Within an area of interest fuels are assessed in small patches or plots. The size and number of plots depends on the reason for assessing the fuels. Some applications (such as for input into fire behaviour models) may require a more rigorous and systematic approach to sampling. Other applications (such as assessing fuel hazard during firefighting operations) will necessitate a more rapid informal approach. For whatever purpose the guide is being used it is recommended that the following principles be applied:

- Any assessment of fuels should try to assess the variability in fuels across an area by assessing the fuels at multiple plots.
- The size and number of plots should reflect the level of reliability required of the results.
- For surface, near-surface and elevated fuel layers the result of assessing the plot should reflect the average state of that fuel layer.
- For bark hazard the result of assessing the plot should be based on the trees with the highest rating.
- Always record with the result the name and the version of the guide used.

2.6 Tips for assessing fuel hazard

The process of assessing fuel hazard using this guide is largely subjective. Implementing the following techniques will help to improve accuracy and reliability:

- Identify and agree on examples of the highest rating of fuel hazard for each layer that occur locally. These examples should be used as benchmarks.
- Conduct assessments in pairs of observers and regularly change assessment pairs.
- Assessors should be no more than one hazard rating apart when assessing each layer (e.g. Low or Medium, not Low or High).
- Use different assessors to re-assess completed work and provide feedback.

2.7 Vesta fire behaviour predictions

In dry eucalypt forest with a litter and shrub understorey the *Field guide – fuel assessment and fire behaviour prediction in dry eucalypt forest* (Gould *et al.* 2007b) provides a systematic method for assessing fuel and predicting fire behaviour (rate of spread, flame height, and spotting). The Project Vesta fuel hazard scoring system is similar to the Victorian system developed by Wilson (1992a, 1992b, 1993) and revised by McCarthy *et al*. (1999). The scale that underlies the Vesta fuel hazard scores is directly related to fire behaviour. These scores, along with height measurements of various fuel layers, are needed as inputs into the fire behaviour prediction tables in Gould *et al*. (2007b). Section 9.3 contains a table for translating the fuel hazard rating for each fuel layer into Vesta fuel hazard scores.

2.8 Effect on fire behaviour

Each table for assessing fuel hazard contains information on the effect that the fuel arrangement is likely to have on fire behaviour. This effect is for weather conditions equivalent to a Forest Fire Danger Index (FFDI) of 25 (McArthur 1973). An FFDI of 25 can be achieved in many ways. For the purposes of this guide the specific conditions required to achieve this are:

Temperature: 33°C	Relative Humidity: 25%	Wind Speed: 20km/h
Drought Factor: 10	Slope: 0°	

If weather conditions vary from those listed above the effect on fire behaviour will also vary.

2.9 Fuel assessment data sheet

Appendix 2 contains a sample field data sheet that can be used when assessing fuels.

3. Bark fine fuel

3.1 Identification

Bark fuel is the bark on tree trunks and branches. Bark lying on or near the ground or draped over understorey plants is considered to be surface, near-surface or elevated fuel.

3.2 Identifying bark types

The key attributes for assessing the effect of bark on suppression difficulty are shown below:

Key attribute	Determines	How it is assessed
Ease of ignition	• How readily the bark will ignite. • Whether the fire will burn up the trunk and into the branches of the tree.	Thickness, size and shape of bark pieces.
How bark is attached	• How likely the bark is to break off the tree.	How easily the bark breaks off the tree.
Quantity of combustible bark	• Volume of potential embers that a fire may generate.	Relative quantity of combustible bark.
Size-to-weight ratio of the bark pieces	• How far the wind is likely to carry bark pieces once they break off the tree.	Thickness, size and shape of bark pieces.
Burn out time	• Length of time a piece of bark will stay ignited once it breaks off the tree.	Thickness, size and shape of bark pieces.

Descriptions of trees have been separated into three broad bark types using three of these key attributes – ease of ignition, burn out time and size-to-weight ratio:

1. Fine fibrous barks, including stringybarks
2. Ribbon or candle barks
3. Other bark types, including smooth, platy, papery and coarsely fibrous. The reason for describing these types in some detail is to help observers distinguish them from the above two types.

3.3 Identifying Stringybark and other fine fibrous bark types

Contribution to suppression difficulty	• Bark types that can produce massive quantities of embers and short distance spotting.
Physical description	• Bark is fine fibrous material with easily visible fibres less than 1mm thick covering the whole trunk. • Bark fibres resemble the fine fibres that are twisted together to form natural string. • Old bark is retained on the trunk of the tree for decades, forming a relatively spongy fibrous mass with deep vertical fissures. • Outer bark may weather to a greyish colour, while underlying bark retains its original colour. • Bark may form large strands when peeled off. • Fine, hairlike pieces also break off from the tree when it is rubbed.
Ease of ignition	• Bark is very flammable (can be easily lit with a match when dry). • Fires will readily climb the tree and branches.
How bark is attached	• Young or new bark is held tightly to the trunk. • As bark ages it becomes less tightly held. • Old, long-unburnt bark is held very loosely.
Quantity of combustible bark	• Bark on old, long-unburnt stringybarks can be more than 10cm in depth. During fires it can produce massive quantities of embers.
Size-to-weight ratio	Burning pieces of bark tend to be either: • Very fine lightweight fibres that will be carried for less than 100m. • Small lightweight wads (about the size of a thumb) that will be carried for less than 300m. • Very large wads (bigger than a fist) that fall close to the tree.
Burn out time	• Very fine fibres of bark that will burn out within one minute. • Small wads of bark that will burn out within 2–3 minutes. • Very large wads of bark that will burn for up to 10 minutes.
Hazard accumulation	• Bark hazard can reach Extreme. • Bark hazard increases over time as the thickness and looseness of the old bark increases. • Repeated low intensity fires (<0.5m flame height) may produce a 'black sock' effect on the base of the trunk, but this may have limited effect in reducing the overall quantity of bark and the hazard.

Examples

Table 3.1 Assessing the hazard of fine fibrous bark types including stringybarks

Only use this table if at least 10% of the trees in a forest have fine fibrous bark. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[1]
How bark is attached	**Quantity of combustible bark**		
This hazard rating cannot occur when only this bark type is present.		Low	
Bark tightly held. Requires substantial effort to break off bark by hand.	Very little combustible bark. Entire trunk almost completely black or charred.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Bark is mostly tightly held with a few pieces loosely attached.	Limited amount of combustible bark. 50–90% of trunk charred. Most of the bark is charred, especially on the lower part of the trunk.	High	Infrequent spotting. Fires will climb some of these trees.
Many pieces of bark loosely held. Deep fissures present in bark.	Large amounts of combustible bark. 10–50% of trunk charred. Upper parts of the tree may not be charred at all.	Very High	Substantial spotting. Fires will climb most of these trees.
Outer bark on trees is weakly attached. Light hand pressure will break off large wads of bark. Deep fissures present in bark.	Huge amounts of combustible bark. <10% of trunk charred. Minimal evidence of charring.	Extreme	Quantity of spotting generated makes fire control very difficult or impossible. Fires will climb virtually all these trees.

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as being the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

1 FFDI 25 is a Forest Fire Danger Index of 25 (McArthur 1973). Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.2 Examples of Stringybarks and other fine fibrous bark hazard

Low	This hazard rating cannot occur when only this bark type is present.
Moderate	
High	
Very High	
Extreme	

The photos above show some of the variation possible within each bark hazard rating.

3

3.4 Identifying ribbon or candle bark types

Effect on suppression difficulty	• Bark types that can produce substantial quantities of spotting at distances greater than 2km. Will also produce short distance spotting.
Physical description	• Trees characterised by the annual shedding of old bark layers, exposing the smooth new bark underneath. • Bark is shed in the form of long strips or ribbons of bark. • Long strips of bark curl tightly inwards to form a candle-like shape (see image lower right). • Bark strips 50cm or more in length fall off and often drape around the trunk and over branches and surrounding shrubs. • Strips of bark are usually less than 2mm thick. • Bark is shed at various times of the year so that the trunk may have a mottled appearance.
Ease of ignition	• Bark is moderately flammable (can be lit with a cigarette lighter when dry). • Fires will climb up ribbons of bark.
How bark is attached	• Bark strips may drape over, or be weakly attached to, the trunk and branches.
Quantity of combustible bark	• Large quantities of bark can be retained in upper trunk and head of the tree.
Size-to-weight ratio	• Bark pieces are relatively light for their large size. • Easily transported by strong updrafts – may travel up to 30km downwind.
Burn out time	• Bark can burn and smoulder within the curled up ribbons for longer than 10 minutes.
Hazard accumulation	• Bark hazard never exceeds Very High. • Bark hazard tends to increase over the long term as ribbons accumulate on the tree. • A low intensity fire (flame height of less than 0.5m) may not reduce the hazard in this bark type.

Example

Note: Loose ribbon or candle-like bark that is retained on the trunk near ground level is not included in the assessment of ribbon or candle bark types. It is usually:
- firmly attached to the trunk of the tree
- consumed in place by a surface fire.

This bark is considered in 'Other bark types' and can also be considered as near-surface fuel.

Smooth-bark trees also shed bark as slabs or flakes. These bark types are considered in 'Other bark types'.

Table 3.3 Assessing the hazard of ribbon or candle bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site.

Key attribute Amount of combustible bark	Hazard rating	Effect on fire behaviour (at FFDI 25)[2]
This hazard rating cannot occur when only this bark type is present.	Low	
No long ribbons of bark present. Trunk and branches of trees almost entirely smooth.	Moderate	Spotting generally does not hinder fire control. Fires will not climb these trees.
Long ribbons of bark present on upper trunk (>4m above ground) and in head of trees. Lower trunk mainly smooth.	High	Infrequent spotting. Fires will climb some of these trees.
Long ribbons of bark in the head and upper trunk with: • ribbons hanging down to ground level or, • flammable bark covers trunk.	Very High	Substantial spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.	Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

2 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 3.4 Examples of ribbon or candle bark hazard

Low	This hazard rating cannot occur when only this bark type is present.
Moderate	
High	
Very High	
Extreme	This hazard rating cannot occur when only this bark type is present.

3.5 Identifying other bark types

This bark type includes all other bark types not included in the previous two types. As a result, many different tree species are grouped together. This grouping is based on the ease of ignition, burn out time and size-to-weight ratio of the bark, rather than on botanical values. These other bark types can produce limited quantities of short distance spotting.

This bark type group has been divided into several subgroups. These subgroups are described in some detail to help observers distinguish them from the other two main bark types.

3.5.1 Ironbarks and Platy barks

Physical description	• Trees characterised by layers of old, coarse bark retained on the trunk and branches. • Bark becomes rough, compacted and furrowed with age • Bark feels very abrasive when rubbed by hand. • Bark pieces tend to be more than 2mm thick when they break off. • There may be little or no evidence of charring on the bark following planned burns.
Hazard accumulation	• Bark hazard never exceeds Moderate.

Example

3.5.2 Coarsely fibrous barks

Physical description	• Trees characterised by short strand fibrous bark. • Layers of old dead bark are retained on the trunk and branches. • Unlike stringybark trees, the bark on these trees forms only short strands or chunks when peeled off. • Evidence of charring on the bark may last for up to 10 years.
Hazard accumulation	• Bark hazard never exceeds High. • Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.3 Papery barks

Physical description

- Shrubs and trees growing from 2m to 30m tall, often with flaky shedding bark.
- Old bark is retained on the trunk and branches and builds up into a thick spongy mass.
- Bark layers tend to split allowing sheets of bark to become loose and eventually peel off.
- Evidence of charring on the bark may last for up to 10 years.

Hazard accumulation

- Bark hazard never exceeds High.
- Bark hazard increases over the long term as the thickness and looseness of the old bark increases.

Example

3.5.4 Slab bark, smooth bark and small flakes

Physical description

- Trees characterised by the annual shedding of old bark layers, exposing the smooth living bark underneath.
- Bark shed is often seasonal and often annual.
- Species where the old bark tends to peel into large slabs (<50cm in length) or small flakes when shed.
- Most of the bark falls off the tree soon after it is shed.
- Some small amounts of bark may be retained on the stem or branches for several months before falling off, leading to a mottled effect.
- The mottled effect leads to discontinuous bark fuel up the tree.

Hazard accumulation

- Bark hazard never exceeds Moderate.
- Bark hazard tends to be seasonal.

Example

Table 3.5 Assessing the hazard of other bark types

If more than 10% of the trees in a forest are fine fibrous bark trees use Table 3.1 (Assessing the hazard of fine fibrous bark types) to determine the bark hazard for a site. To achieve a given hazard rating a best fit of both key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes		Hazard rating	Effect on fire behaviour (at FFDI 25)[3]
How bark is attached	**Quantity of combustible bark**		
No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.		Low	No bark present that could contribute to fire behaviour.
Bark rubs off by hand with firm pressure.	Limited amount of combustible bark.	Moderate	Spotting generally does not hinder fire control. Fires will climb some of these trees.
Light hand pressure will break bark off.	Large amounts of combustible bark.	High	Infrequent spotting. Fires will climb most of these trees.
This hazard rating cannot occur when only this bark type is present.		Very High	
This hazard rating cannot occur when only this bark type is present.		Extreme	

Assess bark hazard over a plot 20m in radius. Assessing multiple plots will give better results. Trunk is defined as the part of the tree between the ground and the branches.

See Section 9.3 for application of bark hazard ratings for the Vesta fire behaviour tables.

3 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

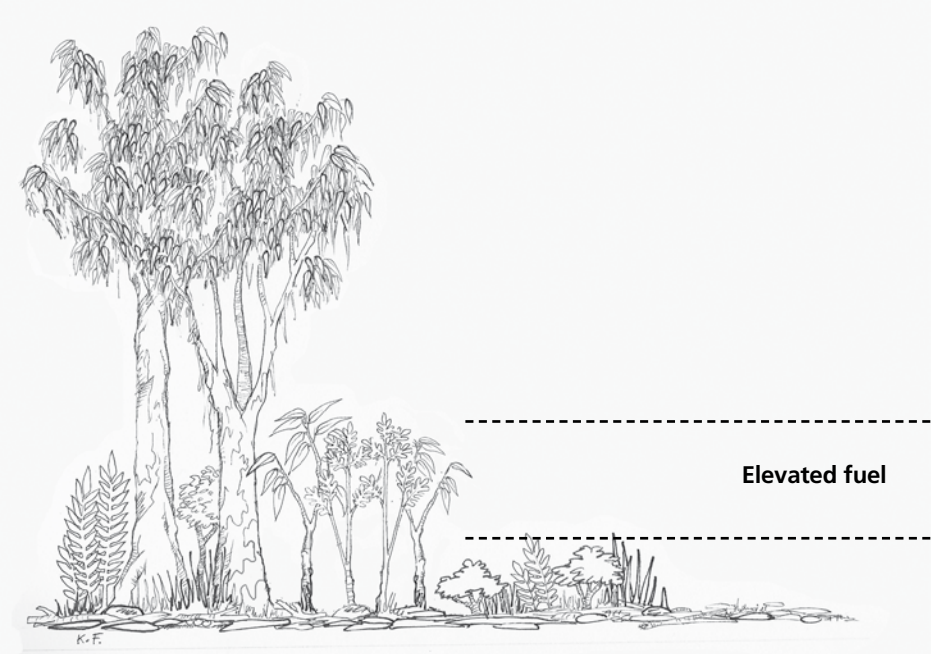
Table 3.6 Examples of other bark types

Low	No trees present. or Trunk and branches of tree entirely smooth or free from loose bark.	
Moderate		
High		
Very High	Does not occur when this is the only bark type present on a site.	
Extreme	Does not occur when this is the only bark type present on a site.	

4. Elevated fine fuel

4.1 Identification

- Fuels are mainly upright in orientation
- Generally most of the plant material is closer to the top of this layer
- Sometimes contains suspended leaves, bark or twigs
- Fuels that have a clear gap between them and the surface fuels
- Elevated fuel can be highly variable in ground coverage
- A low intensity fire (flame height of less than 0.5m) may pass beneath this layer without consuming much, if any, of it.



4.2 Assessment

The elevated fuel hazard is highest when the:

- foliage, twigs and other fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and/or horizontal and vertical continuity that promotes the spread of flames
- live foliage has low fuel moisture content.

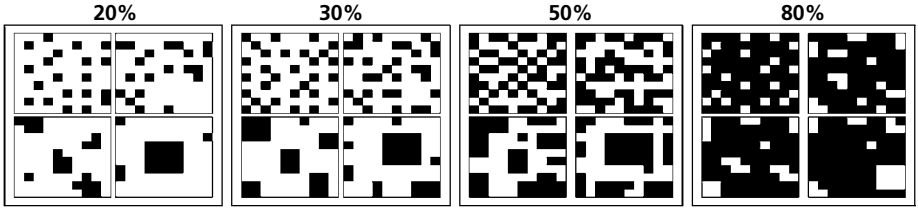
Table 4.1 Assessing elevated fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes					Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[4]
Plant Cover	% dead	Vertical continuity	Vegetation density	Thickness of fuel pieces		
<20% or low flammability species	<20%		Easy to walk in any direction without needing to choose a path between shrubs.		Low	Little or no effect.
20–30%	<20%	Most of the fine fuel is at the top of the layer.	Easy to choose a path through but brush against vegetation occasionally.		Moderate	Does not sustain flames readily.
30–50%	<20%	Most of the fine fuel is at the top of the layer.	Moderately easy to choose a path through, but brush against vegetation most of the time.		High	Causes some patchy increases in the flame height and/or rate of spread of a fire.
50–80%	20–30%	Continuous fine fuel from the bottom to the top of the layer.	Need to carefully select path through.	Mostly less than 1–2mm thick.	Very High	Elevated fuels mostly dictate flame height and rate of spread of a fire.
>70%	>30%	Continuous fine fuel from the bottom to the top of the layer.	Very difficult to select a path through. Need to push through vegetation.	Large amounts of fuel <2mm thick.	Extreme	Elevated fuels almost entirely determine the flame height and rate of spread of a fire.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



4 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 4.2 Examples of elevated fine fuel hazard

Low	Elevated fuel absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

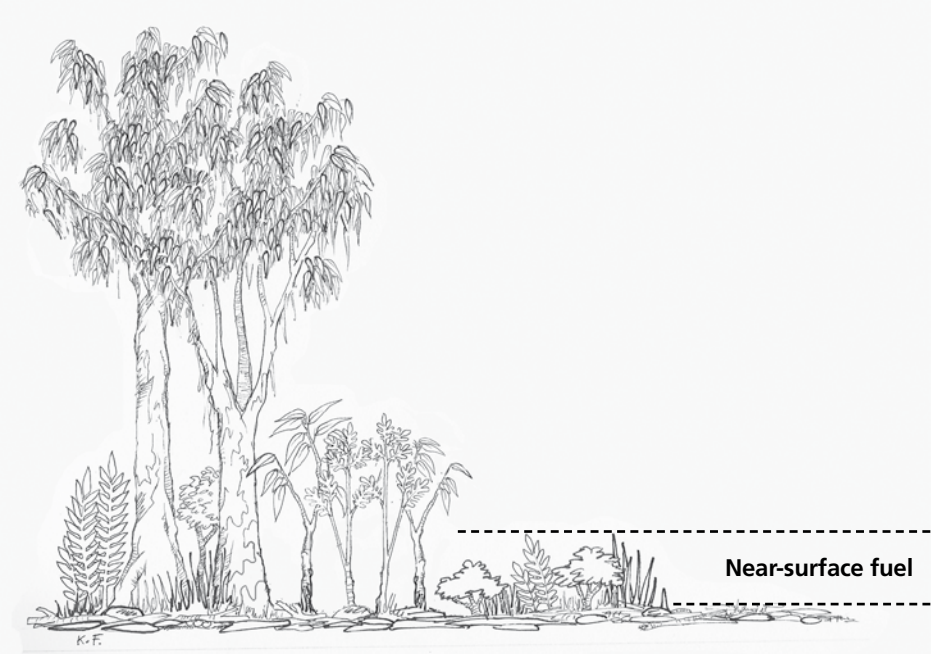
Assess elevated hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of elevated fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the elevated fuel height (m) should be the average of 10 measurements taken along a 300m walk-through. Measure the typical height from ground level.

5. Near-surface fine fuel

5.1 Identification

- Live and dead fuels effectively in touch with the ground but not lying on it
- Fuel has a mixture of vertical and horizontal orientation
- Either the bulk of the fuels is closer to the ground than the top of this layer, or is distributed fairly evenly from the ground up
- Sometimes contains suspended leaves, bark or twigs
- Coverage may range from continuous to having gaps many times the size of the fuel patch
- A low intensity fire (flame height of less than 0.5m) will consume most or all of this fuel
- Fuel in this layer will always burn when the surface fuel layer burns.



5.2 Assessment

The near-surface fuel hazard is highest when the:

- foliage, twigs and other fine fuel particles are very fine (maximum thickness 1–2mm)
- proportion of dead material is high
- fuels are arranged with a high level of density and /or horizontal and vertical continuity, that promotes the spread of flames
- live foliage has low fuel-moisture content.

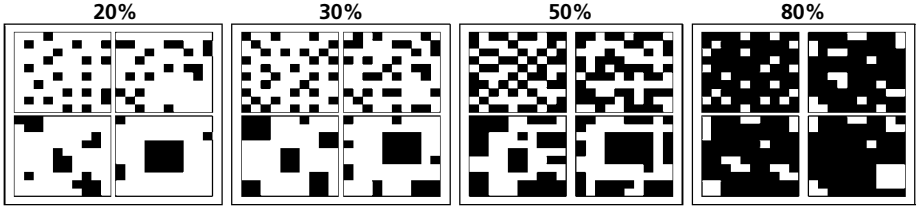
Table 5.1 Assessing near-surface fine fuel hazard

To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[5]
Plant cover	% dead	Horizontal connectivity		
<10%	<10%	Near-surface fuel is absent or virtually absent.	Low	Little or no effect.
10–20%	<20%	Gaps many times the size of fuel patches.	Moderate	Occasionally increases flame height.
20–40%	>20%	Gaps between fuel patches are greater than the size of fuel patches. Starting to obscure logs and rocks.	High	Contributes to surface fire spread and causes patchy increase to flame height.
40–60%	>30%	Fuel patches are equal to or larger than the gaps between the fuel patches.	Very High	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.
>60%	>50%	Very small gaps between fuel patches. Logs and rocks obscured.	Extreme	Contributes significantly to fire spread and flame height. A fire will spread readily in this layer without having to consume the surface layer.

Assessing plant cover

For the purpose of this guide, plant cover is defined as the amount of ground blocked out by that fuel layer if viewed while looking straight down from above. Each plant is considered opaque – any ground within the perimeter of the plant cannot be seen. The following visual guide can be used to assist in assessing plant cover. Each quarter of any one square has the same percent cover.



5 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 5.2 Examples of near-surface fine fuel hazard

Low	Near-surface fuel is absent or virtually absent	
Moderate		
High		
Very High		
Extreme		

Assess near-surface hazard over a plot 10m in radius. Assessing multiple plots will give better results.

See Section 9.3 for application of near-surface fuel hazard ratings for the Vesta fire behaviour tables. For the Vesta fire behaviour tables the near-surface fuel height (cm) should be the average of 10 measurements taken over a 300m walk through. Measure the typical height from ground level.

6. Surface fine fuel

6.1 Identification

- Leaves, twigs, bark and other fine fuel lying on the ground
- Predominantly horizontal in orientation
- Usually contributes the most to fuel load or quantity
- Includes the partly decomposed fuel (duff) on the soil surface.

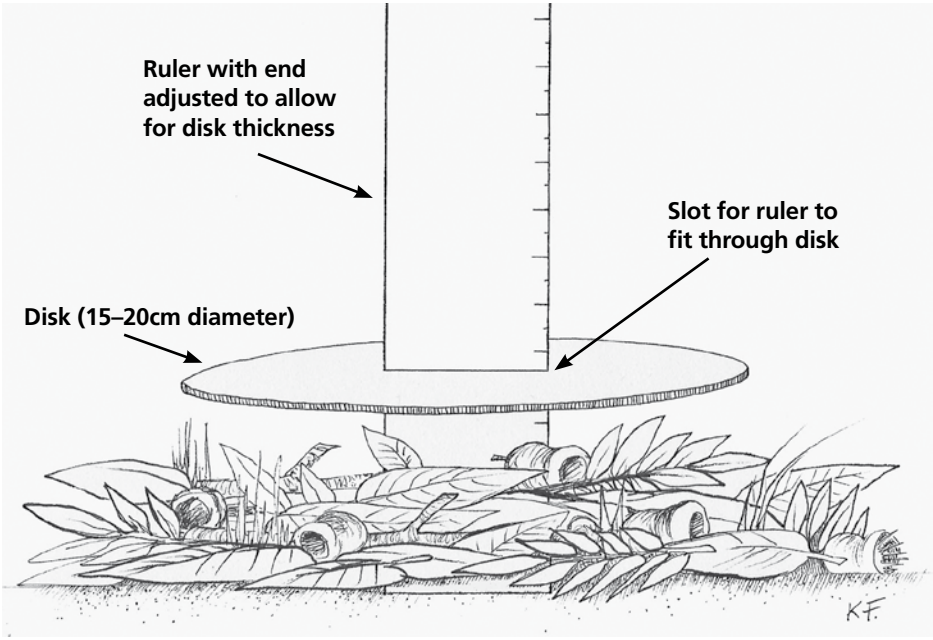
6.2 Assessment

The surface fine fuel hazard is highest when the:

- litter pieces are well connected
- surface litter cover is high, with minimal interruption from rocks, logs or patches of bare soil
- surface litter has substantial depth (greater than 30mm).

6.3 Measurement

Surface litter-bed depth should be measured using a simple depth gauge, as pictured below. This follows the methodology described in McCarthy (2004) and McCarthy *et al*. (1999).



Litter depth should be measured in areas where near-surface fuels do not obscure the litter. Fuel depth is measured using a 15cm circular disk with a ruler through a slot in its centre. To use this gauge, a small gap is made in the litter bed down to mineral soil, then the end of the ruler is placed resting on the mineral soil surface. The disk is pushed down with light pressure until its whole perimeter is in contact with the fuel. Light pressure can be described as 'enough pressure to hold a tennis ball under water'. The ruler is read off level with the top of the disk. Note that the end of the ruler needs to be adjusted to match the thickness of the disk.

Five measurements of litter bed depth should be made at each site. The average of these measurements is one of the attributes that can be used to determine the surface fine fuel hazard.

Table 6.1 Assessing surface fine fuel hazard

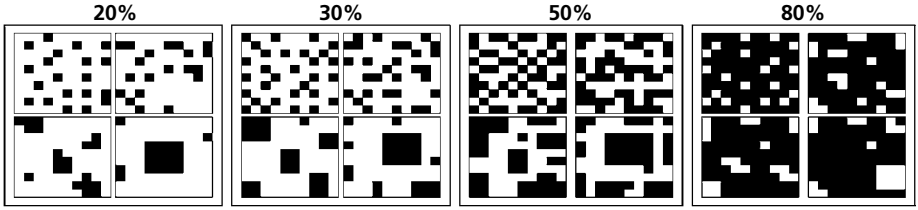
To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

Key attributes			Fuel hazard rating	Effect on fire behaviour (at FFDI 25)[6]
Horizontal connectivity	Surface litter cover	Litter-bed depth		
Litter poorly interconnected. Large areas of bare soil or rock. More soil than litter. Soil surface readily visible through litter bed.	<60%	Very thin litter layer <10mm	Low	Surface fires will not spread.
Litter well connected. Some areas of bare soil or rock. Soil surface occasionally visible through litter bed.	60–80%	Thin litter layer 10–25mm	Moderate	Litter connected well enough to allow fire spread to overcome bare patches.
Litter well connected. Little bare soil.	80–90%	Established litter with layers of leaves ranging from freshly fallen to decomposing. 20–30mm	High	Surface fires spread easily with a continuous fire edge.
Litter completely connected.	>90%	Thick litter layer 25–45mm	Very High	Surface fires spread easily. Increasing flame depth and residence time.
Litter completely connected.	>95%	Very thick layer of litter >35mm	Extreme	Surface fires spread easily. Increasing flame depth and residence time.

Assess surface hazard over a plot 10m in radius. Assessing multiple plots will give better results. For each plot litter bed depth should be an average of five measurements (McCarthy 2004) or more.

See Section 9.3 for application of surface fuel hazard ratings for the Vesta fire behaviour tables.

The following visual guide can be used to assist in assessing surface litter cover. Each quarter of any one square has the same percent cover.



6 Refer to Section 2.8 for the specific weather conditions used to achieve this FFDI.

Table 6.2 Examples of surface fine fuel hazard

Low		
Moderate		
High		
Very High		
Extreme		

7. Determining the combined surface and near-surface fine fuel hazard rating

Assessments of surface and near-surface fuels must be combined together before an Overall Fuel Hazard rating can be determined. The near-surface fuel rating is used to adjust the surface fine fuel hazard rating, according to Table 7.1.

To determine the effect of near-surface fine fuel hazard:

1. Select the **surface fuel hazard rating** from column 1
2. Select the **near-surface fuel hazard rating** from column 2
3. Select the resulting **combined rating** value 3
4. Use this value to determine the Overall Fuel Hazard rating using the Table 8.1.

Table 7.1 Determining the combined surface and near-surface fine fuel hazard rating

1 Surface fine fuel hazard rating	2 Near-surface fine fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
	3 Combined surface and near-surface fine fuel hazard rating				
Low	L	L	M	H	VH
Moderate	M	M	H	VH	E
High	H	VH	VH	VH	E
Very High	VH	VH	E	E	E
Extreme	E	E	E	E	E

8. Determining Overall Fuel Hazard

Overall Fuel Hazard = (sum of the influences of) Bark Hazard + Elevated Fine Fuel Hazard + Combined Surface and Near-surface Fine Fuel Hazard.

The following table is used to combine the assessed levels of Bark, Elevated and Combined Surface and Near-surface Fuel Hazard to give an Overall Fuel Hazard rating.

To determine the Overall Fuel Hazard rating:

1. Select the row that corresponds to the **Bark Hazard** ❶
2. Select the row that corresponds to the **Elevated Fine Fuel Hazard** ❷
3. Select the column that corresponds to the assessed level of **Combined Surface and Near-surface Fine Fuel Hazard** ❸
4. Identify where these two intersect and this will provide you with the corresponding Overall Fuel Hazard rating.

Table 8.1 Determining the Overall Fuel Hazard rating

❶ Bark Hazard	❷ Elevated Fine Fuel Hazard	❸ Combined Surface and Near-surface Fine Fuel Hazard *				
		L	M	H	VH	E
Low or Moderate	L	L	M	M	H	H
	M	L	M	M	H	H
	H	L	M	H	VH	VH
	VH	VH	VH	VH	VH	VH
	E	E	E	E	E	E
High	L	L	M	H	H	H
	M	L	M	H	H	H
	H	L	H	H	VH	VH
	VH	VH	VH	VH	VH	E
	E	E	E	E	E	E
Very High or Extreme	L	L	VH	VH	VH	E
	M	M	VH	VH	E	E
	H	M	VH	E	E	E
	VH	E	E	E	E	E
	E	E	E	E	E	E

* Combined Surface and Near-surface Fine Fuel Hazard is a measure of the Surface Fine Fuel Hazard adjusted to account for the level of near-surface fine fuel (see Table 7.1).

9. Interpreting and applying Overall Fuel Hazard

9.1 Chances of extended first attack success

The chances of extended first attack being successful[1] for a fire ignited in these fuels under the reference extended first attack conditions (Appendix 1) is approximately as follows:

Table 9.1 Chances of extended first attack success

GFDI[2]	FFDI[3]	Overall Fuel Hazard rating[4]				
		Low	Moderate	High	Very High	Extreme
0–2	0–5					
3–7	6–11					
8–20	12–24					
20–49	25–49					
50–74	50–74					
75–99	75–99					
100+	100+					

Chance of extended first attack success is greater than 95% (almost always succeeds)

Chance of extended first attack success is between 95% and 50% (succeeds most of the time)

Chance of extended first attack success is between 49% and 10% (fails most of the time)

Chance of extended first attack success is less than 10% (almost always fails)

Notes:

1. Extended first attack is deemed successful when a fire is controlled by 0800hrs the day after ignition and at less than 400 hectares.
2. GFDI is the Grass Fire Danger Index at the time of ignition and is assumed to be the highest GFDI expected before 0800hrs the next day.
3. FFDI is the Forest Fire Danger Index at the time of ignition and is assumed to be the highest FFDI expected before 0800hrs the next day.
4. Chance of success is for a fire ignited in fuels with this Overall Fuel Hazard rating.
5. Predicted outcomes will differ if the conditions vary from those listed in the reference extended first attack conditions.
6. Predicted outcomes based on expert opinion and informed by work carried out by Wilson (1992b, 1993), McCarthy *et al*. (1998a, 2001) and Plucinski *et al*. (2007).

9.2 Indicative fuel loads (t/ha)

In the absence of local data obtained by sampling fuel loads destructively the following table of indicative fuel load data from Project Vesta and Victorian studies may be useful. These tonnes per hectare figures may be applied to the Forest Fire Danger Meter Mark V (McArthur 1973) for predicting forward rate of spread and flame height for forest fires.

Table 9.2 Indicative fuel loads (t/ha)

Fuel	Fuel hazard rating				
	Low	Moderate	High	Very High	Extreme
Bark	0	1	2	5	7
Elevated	0–1	1–2	2–3	3–5	5–8
Near-surface	1–2	2–3	3–4	4–6	6–8
Surface	2–4	4–10	8–14	12–20	16–20+

9.3 Determining Vesta fuel hazard scores

The following table translates fuel hazard ratings for each fuel layer into Project Vesta fuel hazard scores. These scores can be used with the fire behaviour prediction tables in publications such as Gould *et al*. (2007b).

To determine the Vesta fuel hazard score:

1. Select the row that corresponds to the fuel hazard rating for required fuel layer (1)
2. Select the Vesta fuel hazard score column that corresponds to the same layer (2)
3. Identify where these two intersect and this will provide you with the corresponding Vesta fuel hazard score.

Table 9.3 Determining Vesta fuel hazard scores

	Vesta fuel hazard score (2)			
Fuel hazard rating (1)	**Surface**	**Near-surface**	**Elevated**	**Bark**
Low	1	1	1	0
Moderate	2	2	2	1
High	3	3	3	2
Very High	3.5	3.5	3.5	3
Extreme	4	4	4	4

Notes:

- Surface and near-surface hazard score and near-surface height (cm) is required for fire spread prediction.
- Rate of spread and elevated fuel height (m) is required for flame height prediction.
- Rate of spread, surface and bark fuel hazard scores are required for prediction of spotting distance.

Acknowledgements

This Fuel Hazard Assessment Guide updates and continues to develop work previously conducted by a number of authors. Andrew Wilson laid the foundations for this guide, with the conceptual framework presented in Research Report No. 31; and the visual guides for assessing the influence of bark and elevated fuels on suppression difficulty in the *Eucalypt Bark Hazard Guide and Elevated Fuel Guide* (Reports 32 and 35, respectively). Greg McCarthy (2004) detailed a method for rapidly assessing surface fine fuels in Research Report No. 44.

These three techniques were brought together in the first three editions of the *Overall Fuel Hazard Guide* (McCarthy, Tolhurst and Chatto, 1998b, 1998c, 1999). A subsequent unpublished edition of the guide, produced by Kevin Tolhurst (2005), provided greater detail on the assessment of near-surface fuels. In 2006, Mike Wouters adapted the guide for South Australian conditions, and incorporated the preliminary results from Project Vesta (CSIRO and Department of Conservation and Environment, Western Australia). Further information and results from the final Project Vesta report (Gould *et al.* 2007a) have also been incorporated.

Thanks to Lachie McCaw (Department of Environment and Conservation, Western Australia), Mike Wouters (Department of Environment and Heritage, South Australia), Jim Gould and Miguel Cruz (CSIRO) for their advice and comments during the production of this guide. Thanks must also go to the many other people across Australia who have provided comments and feedback during the production of the guide.

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Appendix 1. Reference extended first attack conditions

This guide assesses the impact of fuels in suppressing a fire during extended first attack, using local resources. Several factors affect the success of an extended first attack. Therefore, to consider the impact of fuels alone, the other factors must be treated as if they were constant. Table A1 below adapted from Wilson (1993) summarises reference extended first attack conditions for four fuel types.

Table A1. Revised reference extended first attack conditions

Fuel type	Forest fuels	Grass fuels	Mallee and scrub fuels	Heath fuels
Examples of typical resources (on scene within the designated arrival time)	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters	5 x 4WD heavy tankers (4000l) each with 5 firefighters	Small dozer (D4) or tractor with scrub roller 1 to 2 small 4WD tankers (400l) 6 firefighters	Small dozer (D4) 1 to 2 small 4WD tankers (400l) 6 firefighters
Extended attack resources	Potential additional resources deployed to the fire during extended first attack may include heavy tankers, large plant (dozers, graders or tractors) and fire bombing aircraft.			
Arrival time	Within 60 minutes of detection			
Suppression workload	A single fire			
Topography and terrain	Burning on level ground with good access			
Fuel availability[1]	MDF is 10 or AFF is 1.0	100% grass curing	MDF is 10 or AFF is 1.0	
Wind speed[2]	20km/h	30km/h		20km/h
Fire danger rating system[3]	McArthur FFDI	McArthur GFDI	McArthur FFDI	

Notes:

1. MDF (McArthur Drought Factor) is calculated using the Forest Fire Danger Meter (McArthur 1973) and is a measure of the short-term availability of forest fuels. AFF (Available Fuel Factor) is used in Western Australia to define the proportion of litter fuel available for burning (Sneeuwjagt & Peet 1998).
2. Wind speed is measured at 10m height in the open above ground level.
3. FFDI is the McArthur Forest Fire Danger Index, GFDI is the McArthur Grass Fire Danger Index.

The rationale for the reference first attack conditions is documented in DSE's *Overall fuel hazard assessment guide: a rationale report – fire and adaptive management report no. 83* (in prep).

Appendix 2. Sample fuel assessment field work form v3

Date Assessed:	Assessors:
Sampling Location:	Veg Type:

Plot Information			
Plot No.			
Zone:			
Easting (GDA94 MGA UTM):			
Northing (GDA94 MGA UTM):			

Canopy height (Assess over a 20m radius)			
Average Height to Top of Canopy:	m	m	m
Average Height to Base of Canopy:	m	m	m

Bark fuel (Assess over a 20m radius)															
Stringybark Fuel Hazard:	NP	M	H	VH	E	NP	M	H	VH	E	NP	M	H	VH	E
Ribbon Bark Fuel Hazard:	NP	M	H	VH		NP	M	H	VH		NP	M	H	VH	
Other Bark Fuel Hazard:	L	M	H			L	M	H			L	M	H		

Select the Bark Hazard rating from above that will be used to determine Overall Fuel Hazard. (Only use the Stringybark hazard rating if more than 10% of the trees are Stringybark **AND** it has the highest rating. Otherwise use the bark with next highest rating.)

Bark Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Elevated fuel layer (Assess over a 10m radius)															
Elevated % Cover:	%					%					%				
Elevated % Dead	%					%					%				
Elevated Fuel Ave Height (m)	m					m					m				
Elevated Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Near-surface fuel layer (Assess over a 10m radius)															
Near-surface % Cover:	%					%					%				
Near-surface % Dead	%					%					%				
NS Average Height (cm):	cm					cm					cm				
NS Fuel Hazard:	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

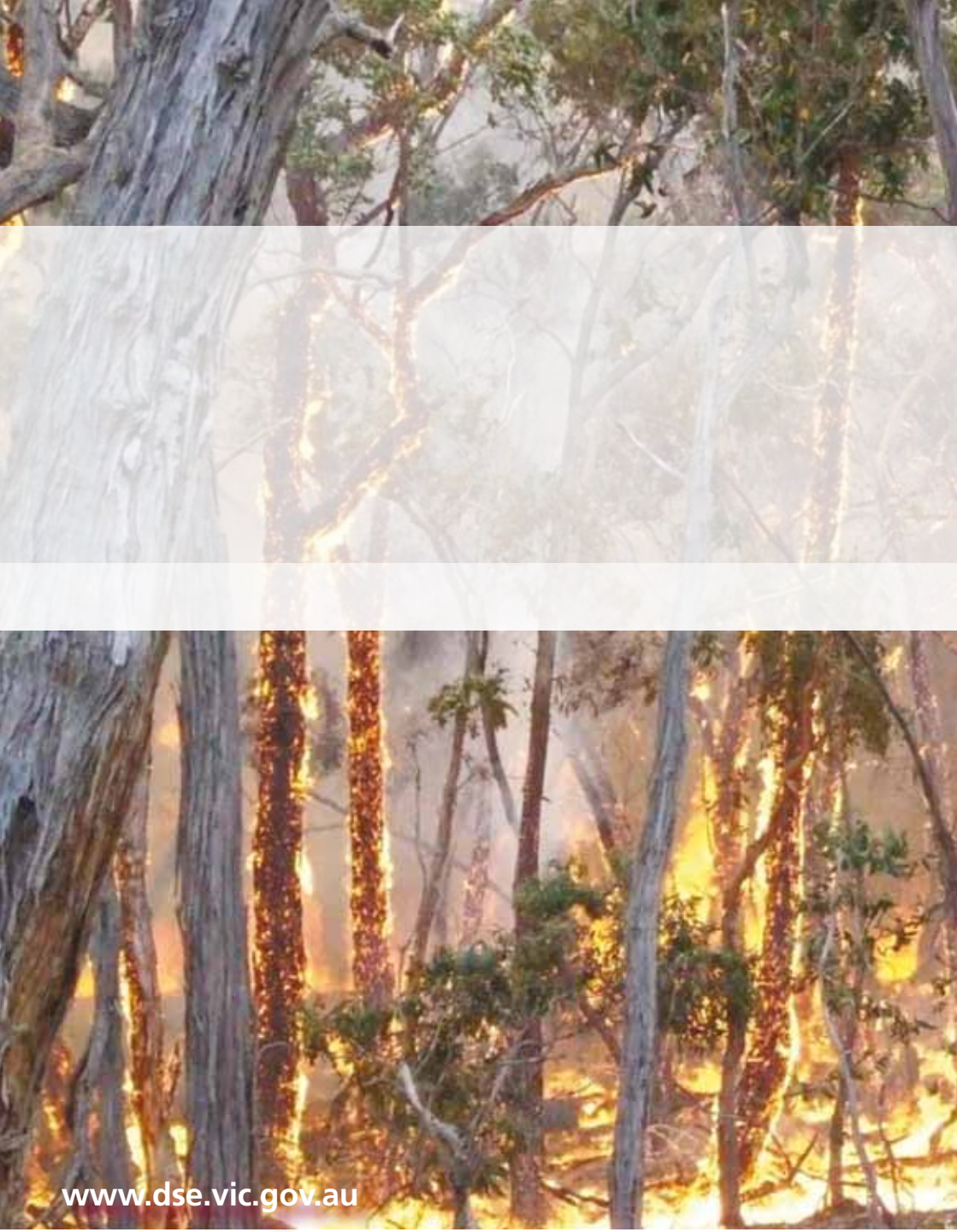
Surface fuel layer (Assess over a 10m radius)															
Surface Litter % Cover:	%					%					%				
Average Litter Depth (mm):	mm					mm					mm				
Surface Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Combined Surface and Near-surface Fine Fuel Hazard calculation (refer Section 7)															
Combined Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Overall Fuel Hazard calculation (refer Section 8)															
Overall Fuel Hazard	L	M	H	VH	E	L	M	H	VH	E	L	M	H	VH	E

Are the plots representative of the average fuels across the sampling location?	Yes	No

If no, explain any significant difference between plots. For example, wet gully runs through the sampling area, no plots were located in this gully.



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Appendix F

Offsets Assessment Guides for the Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater offset areas

Table F1 summarises the OAG inputs for the MNES to be offset on Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater. The inputs included are based on the following justifications.

Quality of impact area

The habitat quality of the impact area for each MNES was calculated as part of the ecological surveys and assessments undertaken across the Stage 8 development area (Boobook 2021a, 2022, 2023, 2024, 2025; Terrestria 2022, 2024, 2025). The habitat quality scores for each MNES were determined generally in accordance with Queensland Herbarium's BioCondition Manual and the *Guide to Determining Terrestrial Habitat Quality* (version 1.3; GTDTHQ; DES 2020). Area weighted habitat quality scores for each of the Stage 8 MNES impacts were calculated based on the final habitat quality scores calculated as part of the ecological surveys and assessments, taken from each of the relevant reports.

In the absence of detailed habitat quality assessments within particular development areas for Stage 8 or for some MNES offset requirements, a conservative approach has been adopted and the habitat quality of the impact area to be offset has been assumed to be 7. This approach is based on the rapid assessment process allowed under the GTDTHQ for the impact site only. A score of 7 represents an average score of generic remnant REs in Queensland based on Queensland Herbarium expert analysis.

Appendix G presents a summary of the area weighted MNES impact quality scores used to inform the OAG input.

Quality of offset area

A baseline habitat quality score for each MNES offset value was determined generally in accordance with the GTDTHQ (version 1.2; Department of Environment and Heritage Protection [DEHP] 2017 [Bottle Tree, Kentucky, Cobbadah and Springwater] and version 1.3; DES 2020 [Mt Tabor]) based on the results of the detailed field assessments of the offset area:

- Bottle Tree OAMP: Section 2.6, Appendix A
- Kentucky OAMP: Section 2.4, Appendix B.
- Cobbadah OMAP: Section 2.5, Appendix C.
- Mt Tabor OAMP: Section 2.5, Appendix D.
- Springwater OAMP: Section 2.5, Appendix E.

The offset areas for each MNES are based on areas of remnant and regrowth vegetation identified as suitable habitat as part of detailed field assessments and presented in the OAMPs:

- Bottle Tree OAMP: Section 2.6
- Kentucky OAMP: Section 2.5.
- Cobbadah OAMP: Section 2.5.
- Mt Tabor OAMP: Section 2.5.
- Springwater OAMP: Section 2.5.

Future quality without offset management

Bottle Tree

Prior to being acquired by Santos, the Bottle Tree property was formerly utilised for grazing purposes, with ancillary infrastructure (i.e. cattle yards, Bottle Tree house and workshop) still present on the property. Additionally, Santos holds a Coal Exploration Permit and a Petroleum and Gas Exploration Permit across the Bottle Tree property. With the potential for both petroleum and agricultural development, and without the legal

security of these vegetated areas afforded through an approved offset plan and a Voluntary Declaration under the VM Act, development could proceed, leading to a direct loss of existing and potential MNES values and a decreased level of condition across areas remaining.

Based on a business-as-usual scenario without offset management, habitat quality scores on Bottle Tree are proposed to remain unchanged despite the petroleum and grazing activities that would occur should the offset have not been secured.

Kentucky

Kentucky is wholly located across two Petroleum Leases (PL) operated by Santos (PL 90 and PL 91) and occupies approximately 12% of the land surface of PL 90. From 2015 to 2019 Santos GLNG proposed the following two different development scenarios for the Kentucky property to allow for gas field development and the provision of offsets:

- A flexible offset concept where a certain percentage of offset area was excised from the total property area and development would proceed anywhere within the property up to the percentage excised.
- Infrastructure would be scouted throughout the offset, as per the usual practice, and then these areas would be excised and the remainder of the areas of vegetation between the infrastructure would be secured as offsets.

When presented with this proposal, the Commonwealth advised that such a development within the offset areas on both properties was unacceptable. The two uses were considered incompatible due to the potential for adverse impacts on the offset areas, including edge effects, habitat alteration and increased pest animal activity.

Based on the above, in early 2020, Santos made the decision to exclude petroleum activities from the proposed offset areas on Kentucky property. Santos' long term supply plan included an appraisal program on Kentucky planned for 2021, to support a broader production program to follow. The Kentucky subproject would develop and realise an estimated 30 petajoules for an estimated value exceeding $4M. Gas value would be realised by a well spacing of approximately 1,000 m with an associated network of gas flowlines and access tracks. Steep topography across this property would result in larger than average disturbances to support safe and stable infrastructure. The decision not to proceed with the gas field development at Kentucky has been enacted using a Santos formal decision sheet process that has been endorsed by accountable persons within Santos.

The decision not to proceed with development comes at a cost to Santos, and without the legal security of these vegetated areas afforded through an approved offset plan and a Voluntary Declaration under the VM Act, development could proceed, leading to a direct loss of existing and potential MNES values and a decreased level of condition across areas remaining. Research in central Queensland has shown vegetation within 1 km of an edge was degraded as a result of edge effects and habitat fragmentation associated with linear infrastructure (Neldner *et al*. 2017). Therefore, approval of offsets have resulted in avoidance of significant impacts to MNES values consistent with the first step of the mitigation hierarchy.

The Kentucky property was previously grazed by DOCE Pty Ltd, a wholly owned subsidiary of Santos. If the offset area on Kentucky was not approved and secured Santos was planning to continue cattle grazing and the maximum return for grazing would be sought by DOCE Pty Ltd.

Eyre *et al*. (2009) identified the significant changes that grazing can cause in Brigalow Belt ecosystems. As these areas are now being used as offsets, grazing will only be used strategically and on a limited basis to manage fuel loads and control exotic weeds and pasture grasses – consequently, through the management of strategic grazing potential impacts on MNES, particularly those comprising regrowth communities, will be avoided.

Based on a business-as-usual scenario without offset management, habitat quality scores on Kentucky are proposed to remain unchanged despite the petroleum and grazing activities that would occur should the offset have not been secured.

Cobbadah

Based on a business-as-usual scenario without offset management, habitat quality scores on Cobbadah are not expected to change.

Mt Tabor

Based on a business-as-usual scenario without offset management, habitat quality scores on Mt Tabor are not expected to change.

Springwater

Based on a business-as-usual scenario without offset management, habitat quality scores on Springwater are not expected to change.

Future quality with offset management

Santos has committed to excluding all development activities from the offset areas.

The Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater offset areas will be secured and managed, to improve the quality of vegetation communities and habitat for MNES. The OAMPs will be implemented and include specific management actions aimed at reducing the impact of threatening processes and improving the quality of MNES habitat within the offset areas, including:

- Pest animal control
- Livestock management
- Weed control
- Fire management
- Regrowth restoration management.

Confidence in result – future quality

The Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater OAMPs have been developed in accordance with approved conservation advice, recovery plans and recommended threat abatement and management advice for the species, and negotiations with the landholders. The OAMPs detail specific management outcomes aimed at improving the quality of MNES habitat. Ongoing monitoring of the offset areas will also be undertaken to regularly assess the progress of the offsets and ensure the OAMPs achieve the required outcomes. The OAMPs will support an efficient, effective, timely, transparent, scientifically robust and reasonable approach to managing and monitoring the offset areas.

Risk of loss without offset

Risk of loss without offset is 0%.

Risk of loss with offset

The offset areas have been or will be secured through declaration as an area of high nature conservation value under section 19F of the VM Act, therefore the risk of loss is 0%.

Confidence in result – risk of loss

The legally binding mechanism is registered on the land title and binds all current and future landowners to ensure that the offset is protected.

Time over which loss is averted (years)

The offset areas have been or will be protected by a legally binding mechanism which will remain in effect as required by the applicable Commonwealth legislative requirements, therefore, the time over which loss is averted is considered to be the maximum allowable time of 20 years.

Time until ecological benefit (years)

The implementation of site-specific land management actions through the development and application of the OAMPs is expected to increase the quality of the offset areas by improving vegetation condition and reducing potential threats to MNES. An ecological benefit is expected to be realised in 20 years.

Table F1 – Summary of *Offsets Assessment Guide* inputs for each Stage 8 MNES on Bottle Tree, Kentucky, Cobbadah, Mt Tabor and Springwater

MNES		Threatened ecological communities		Threatened fauna species									
Inputs		Brigalow TEC	SEVT TEC	Collared Delma	Yakka Skink	Dunmall's Snake	Red Goshawk	Black-breasted button-quail	Squatter Pigeon (southern)	Northern Quoll	Koala	South-eastern Long-eared Bat	Large-eared Pied Bat
Impact													
Impact	Area (ha)	0.51	0.50	49.49	39.99	49.98	25.61	0.50	32.11	26.11	36.56	50.48	32.61
	Quality	7	7	5	6	5	6	7	6	5	6	6	6
Offsets													
Bottle Tree	Area (ha)	122.20	-	122.20	122.20	122.20	122.20	-	-	-	-	122.20	-
	Start quality	4	-	3	3	4	4	-	-	-	-	4	-
	Future quality without offset	4	-	3	3	4	4	-	-	-	-	4	-
	Future quality with offset	6	-	5	5	6	6	-	-	-	-	6	-
	Confidence in result	80%	-	80%	80%	80%	80%	-	-	-	-	80%	-
	Without offset	0%	-	0%	0%	0%	0%	-	-	-	-	0%	-
	With offset	0%	-	0%	0%	0%	0%	-	-	-	-	0%	-
	Confidence in result	90%	-	90%	90%	90%	90%	-	-	-	-	90%	-
Kentucky	Area (ha)	-	-	40.11	40.11	40.11	-	-	-	-	40.11	40.11	-
	Start quality	-	-	8	7	8	-	-	-	-	8	8	-
	Future quality without offset	-	-	8	7	8	-	-	-	-	8	8	-
	Future quality with offset	-	-	9	8	9	-	-	-	-	9	9	-
	Confidence in result	-	-	80%	80%	80%	-	-	-	-	80%	80%	-
	Without offset	-	-	0%	0%	0%	-	-	-	-	0%	0%	-
	With offset	-	-	0%	0%	0%	-	-	-	-	0%	0%	-
	Confidence in result	-	-	90%	90%	90%	-	-	-	-	90%	90%	-
Cobbadah	Area (ha)	-	1.00	-	-	-	-	-	-	-	-	-	-
	Start quality	-	8	-	-	-	-	-	-	-	-	-	-
	Future quality without offset	-	8	-	-	-	-	-	-	-	-	-	-

MNES		Threatened ecological communities		Threatened fauna species									
Inputs		Brigalow TEC	SEVT TEC	Collared Delma	Yakka Skink	Dunmall's Snake	Red Goshawk	Black-breasted button-quail	Squatter Pigeon (southern)	Northern Quoll	Koala	South-eastern Long-eared Bat	Large-eared Pied Bat
Impact													
	Future quality with offset	-	9	-	-	-	-	-	-	-	-	-	-
	Confidence in result	-	80%	-	-	-	-	-	-	-	-	-	-
	Without offset	-	0%	-	-	-	-	-	-	-	-	-	-
	With offset	-	0%	-	-	-	-	-	-	-	-	-	-
	Confidence in result	-	90%	-	-	-	-	-	-	-	-	-	-
Mt Tabor offset area 2	Area (ha)	-	-	307.42	5.38	307.42	307.42	-	307.42	307.42	307.42	307.42	307.42
	Start quality	-	-	8	8	8	7	-	7	7	7	8	8
	Future quality without offset	-	-	8	8	8	7	-	7	7	7	8	8
	Future quality with offset	-	-	9	9	9	8	-	8	8	8	9	9
	Confidence in result	-	-	80%	80%	80%	80%	-	80%	80%	80%	80%	80%
	Risk of loss without offset	-	-	0%	0%	0%	0%	-	0%	0%	0%	0%	0%
	Risk of loss with offset	-	-	0%	0%	0%	0%	-	0%	0%	0%	0%	0%
	Confidence in result	-	-	90%	90%	90%	90%	-	90%	90%	90%	90%	90%
Springwater	Area (ha)	27.15	4.11	46.06	46.06	46.06	50.17	4.11	18.91	50.17	18.91	50.17	50.17
	Start quality	7	8	6	6	6	6	6	6	6	6	6	6
	Future quality without offset	7	8	6	6	6	6	6	6	6	6	6	6
	Future quality with offset	8	9	7	7	7	7	7	7	7	7	7	7
	Confidence in result	90	90	90	90	90	90	90	90	90	90	90	90
	Without offset	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	With offset	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Confidence in result	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%

MNES	Threatened ecological communities		Threatened fauna species									
Inputs	Brigalow TEC	SEVT TEC	Collared Delma	Yakka Skink	Dunmall's Snake	Red Goshawk	Black-breasted button-quail	Squatter Pigeon (southern)	Northern Quoll	Koala	South-eastern Long-eared Bat	Large-eared Pied Bat
Impact												
Risk related time horizon/time over which loss is averted (max. 20 years)	20	20	20	20	20	20	20	20	20	20	20	20
Time until ecological benefit (years)	20	20	20	20	20	20	20	20	20	20	20	20

Appendix G

Impact area habitat quality scoring method for MNES

Summary

The habitat quality of the impact area for each MNES required to be offset was calculated as part of the ecological surveys and assessments undertaken across the Stage 8 development area (Boobook 2021a, 2022, 2023, 2024, 2025; Terrestria 2022, 2024, 2025). The habitat quality scores for each MNES were determined generally in accordance with Queensland Herbarium's BioCondition Manual and the Guide to Determining Terrestrial Habitat Quality (version 1.3; GTDTHQ; DES 2020).

To determine a suitable impact habitat quality score that captures the varying quality of MNES habitat across the different development areas for Stage 8 of the GFD Project, the collective habitat quality scores for each MNES were area weighted based on the proposed impact for each MNES within the different project areas. Impact habitat quality scores in the following reports were used:

- BioCondition and habitat quality assessment data for Roma SD22 East (Terrestria 2022).
- Broad-scale Ecological Assessment Report: Fairview Infield Wells Project (Boobook 2022).
- Clematis Creek Fauna Habitat Quality Mapping and Impact Assessment (Terrestria 2025).
- CS02 to Hub 5 Pipeline and IDP-2225 Ecological Impact Assessment (Terrestria 2024).
- *Ecological Assessment Report: Ecological Assessment of Fairview Eastern Expedition Project* (Boobook 2024).

Whilst other studies within the Stage 8 development area were undertaken and have been referred to throughout this Offset Plan, habitat quality scores were not calculated as part of these reports (Boobook 2021a, 2023, 2025; Terrestria 2022). In the absence of detailed habitat quality assessments within particular development areas or for some MNES offset requirements, a conservative approach has been adopted and the habitat quality of the impact area to be offset has been assumed to be 7. This approach is based on the rapid assessment process allowed under the GTDTHQ for the impact site only. A score of 7 represents an average score of generic remnant REs in Queensland based on Queensland Herbarium expert analysis.

The following table provides an overview of the final area weighted habitat quality scores for each MNES including details of how each habitat quality score was calculated.

Table G1 – Summary of impact area weighted habitat quality scores for each MNES

Field	Arcadia			Fairview															Roma			Final area weighted HQ score
Impact area	Clematis Creek (Terrestria 2025)			Precipice Creek ADP (Boobook 2021a)			Fairview Infield Wells (Boobook 2022)			Fairview Infield Wells 2026			Fairview Eastern Expedition (Yebna) (Boobook 2024)			CS02 to Hub 5 Pipeline and IDP-2225 (Terrestria 2024)			Roma SD22 East (Terrestria 2021)			
MNES	HQ score	Area (ha)	HQ area weighted	HQ score	Area (ha)	HQ area weighted	HQ score	Area (ha)	HQ area weighted	HQ score	Area (ha)	HQ area weighted	HQ score	Area (ha)	HQ area weighted	HQ score	Area (ha)	HQ area weighted	HQ score	Area (ha)	HQ area weighted	
Threatened ecological communities																						
Brigalow TEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.11	0.51	7.11	7.11 (7)
SEVT TEC	-	-	-	-	-	-	-	-	-	-	0.50	7.00	-	-	-	-	-	-	-	-	-	7.00 (7)
Threatened fauna species																						
Collared Delma	5.38	5.16	0.56	7.0[1]	3.60	0.94	1.51	6.47	0.36	7.0[1]	9.88	2.57	5.76	0.50	0.11	5.80	6.50	1.40	5.09	17.38	1.79	5.27 (5)
Yakka Skink	5.85	5.16	0.76	7.0[1]	3.60	0.94	1.09	6.47	0.26	7.0[1]	9.88	2.57	5.61	0.50	0.10	5.80	6.50	1.40	6.69	7.88	1.32	5.62 (6)
Dunmall's Snake	6.09	5.16	0.63	7.0[1]	3.60	0.94	0.95	6.47	0.23	7.0[1]	9.88	2.57	5.65	0.50	0.10	5.70	6.50	1.37	5.09	17.87	1.82	5.26 (5)
Red Goshawk	7.00[1]	5.16	1.41	7.0[1]	3.60	1.23	1.60	6.47	0.51	7.0[1]	10.38	3.55	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]	-	-	-	5.64 (6)
Black-breasted Button-quail	-	-	-	-	-	-	-	-	-	7.0[1]	0.50	7.00	-	-	-	-	-	-	-	-	-	7.00 (7)
Squatter Pigeon (southern)	6.15	5.16	0.99	7.0[1]	3.60	0.94	4.67	6.47	1.12	7.0[1]	9.88	2.57	6.99	0.50	0.13	5.54	6.50	1.34	-	-	-	6.10 (6)
Northern Quoll	7.0[1]	5.16	1.38	7.0[1]	3.60	1.20	0.85	6.47	0.26	7.0[1]	10.38	3.47	5.24	0.50	0.13	-[2]	-[2]	-[2]	5.77	15.84	2.50	5.44 (5)
Koala	6.81	5.16	0.96	7.0[1]	3.60	1.62	1.28	2.22	0.18	7.0[1]	2.74	1.23	6.92	0.50	0.22	6.00	6.50	2.51	5.15	17.87	1.82	5.91 (6)
South-eastern Long-eared Bat	6.47	5.16	0.66	7.0[1]	3.60	0.92	5.31	6.47	1.25	7.0[1]	10.38	2.65	5.96	0.50	0.11	6.00	6.50	1.42	-	-	-	5.93 (6)
Large-eared Pied Bat	7.88	5.16	1.25	7.0[1]	3.60	0.92	0.73	6.47	0.17	7.0[1]	10.38	2.65	5.45	0.50	0.10	5.34	6.50	1.26	7.11	0.51	7.11	5.54 (6)

Note: A cell with '-' denotes the MNES does not have habitat impacted within that area.
[1] Where the habitat quality of the impact area to be offset has been assumed to be 7 based on the rapid assessment process allowed under the GTDTHQ.
[2] Not included in assessment of that area due to being considered unlikely in area and/or having no significant impact (Boobook 2024; Terrestria 2024).