# SANTOS GLNG OFFSET PLAN AND ACQUITTAL SUMMARY

EPBC Act Approval 2012/6615 (Stage 7)

Document Number: 0007-650-EMP-0041

4 October 2024

Santos

| Date | Rev | Reason For Issue | Reviewed | Endorsed | Approved |
|---|---|---|---|---|---|
| 4 October 2024 | 0 | For DCCEEW submission | AB | 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 Regulations 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 4 / 10 / 2024

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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 Fairview Stage 7 development of the GFD Project under EPBC 2012/6615 (herein referred to as Stage 7).

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 7 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 7 of the GFD Project (Section 3)
- a reconciliation of impacts and offsets for Stages 1-6 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 7 of the GFD Project, namely Kentucky (Lot 1 WT37), Mt Tabor (Lot 6 CHS25; Offset areas 1 and 2) and Bottle Tree (Lot 7 TR39) (Section 6)
- demonstration of how each MNES offset requirement is acquitted (Section 7)
- offset area management plans (OAMP) for the Kentucky offset area (Appendix A), Mt Tabor offset area (Appendix B) and Bottle Tree offset area (Appendix C).

# 2. Approval Conditions

Table 1 provides a summary of the conditions related to offsets under EPBC 2012/6615 for Stage 7 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 7 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 Kentucky OAMP (Appendix A) and Mt Tabor OAMP (Appendix B), and Section 2.10 of the Bottle Tree 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 7 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 7 of the GFD Project, as described in Section 3.<br>A reconciliation of impacts for Stage 1-6 of the GFD Project is included in Section 4. |
| 14 | The Offset Management Plan must include:<br>a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities;<br>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;<br>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;<br>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;<br>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;<br>f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary);<br>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;<br>h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria;<br>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;<br>j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and | The Kentucky offset area, Mt Tabor offset area and Bottle Tree offset area are proposed to be secured to acquit offset requirements for Stage 7 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 and Appendix C). A summary of how each requirement has been addressed is provided below and further detailed in the OAMPs.<br>a. The method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities is discussed in Section 3.2.<br>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 7 of the GFD Project is provided in Section 3.2.3.<br>c. A description of the proposed Kentucky, Mt Tabor and Bottle Tree 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 7 of the GFD Project is provided in Section 7.<br>d. Details of the baseline field surveys and ecological condition are provided in Section 2.4 of the Kentucky OAMP (Appendix A) and Section 2.5 of the Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C). Shapefiles of the offset area will be submitted with this offset plan.<br>e. Details on the connectivity and the landscape context are provided in Section 2.2 of the Kentucky OAMP (Appendix A) and Bottle Tree OAMP (Appendix C) and Section 2.3 of the Mt Tabor OAMP (Appendix B).<br>f. Performance criteria, trigger levels and remedial actions for management activities are discussed in Section 6 of the Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C).<br>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 Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C).<br>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 Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C).<br>i. Risks to the successful implementation of the OAMP are outlined in Section 5 of the Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C). |

| Condition number | Condition | How the conditions are met |
|---|---|---|
| | k. the proposed legal mechanism for securing the offset. | j. The timing for implementation of the management and monitoring program is provided in Section 9 of the Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C).<br>k. Details on how the offset area for Stage 7 of the GFD Project has been legally secured are provided in Section 2.8 of the Kentucky OAMP (Appendix A) and Mt Tabor OAMP (Appendix B), and Section 2.9 of the Bottle Tree OAMP (Appendix C). |
| 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.<br>The offset areas on Kentucky, Mt Tabor Offset area 1 and Bottle Tree have been protected via a Voluntary Declaration under section 19E and 19F of the VM Act.<br>See Section 2.8 of the Kentucky OAMP (Appendix A) and Mt Tabor OAMP (Appendix B), and Section 2.9 of the Bottle Tree OAMP (Appendix C) 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:<br>a. include the information required for the Offset Management Plan at condition 14 for the next project phase;<br>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 and may be subtracted from the obligations required for the 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<br>c. demonstrate how the offset builds on offsets already secured for previous project stages and will contribute to a larger strategic offset for cumulative project impacts. | The Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C) have been prepared to satisfy offset requirements for Stage 7 of the GFD Project.<br>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 and Appendix C).<br>b. A reconciliation of impacts for Stage 1-6 of the GFD Project is included in Section 4.<br>c. The Mt Tabor Offset area 1 has previously been used to compensate for impacts associated with the GLNG Project under EPBC Act approval 2012/6615. The 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 Bottle Tree offset area has previously been used to compensate for impacts associated with the GLNG Project under EPBC Act approvals 2008/4059 and 2008/4096.<br>d. The Mt Tabor and Bottle Tree offset areas will have surplus area remaining after acquittal of Stage 7 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.<br>Stage 7 will not commence until the OAMPs for this project stage have been approved. |

# 3. Significant Residual Impacts

## 3.1. Staging plan

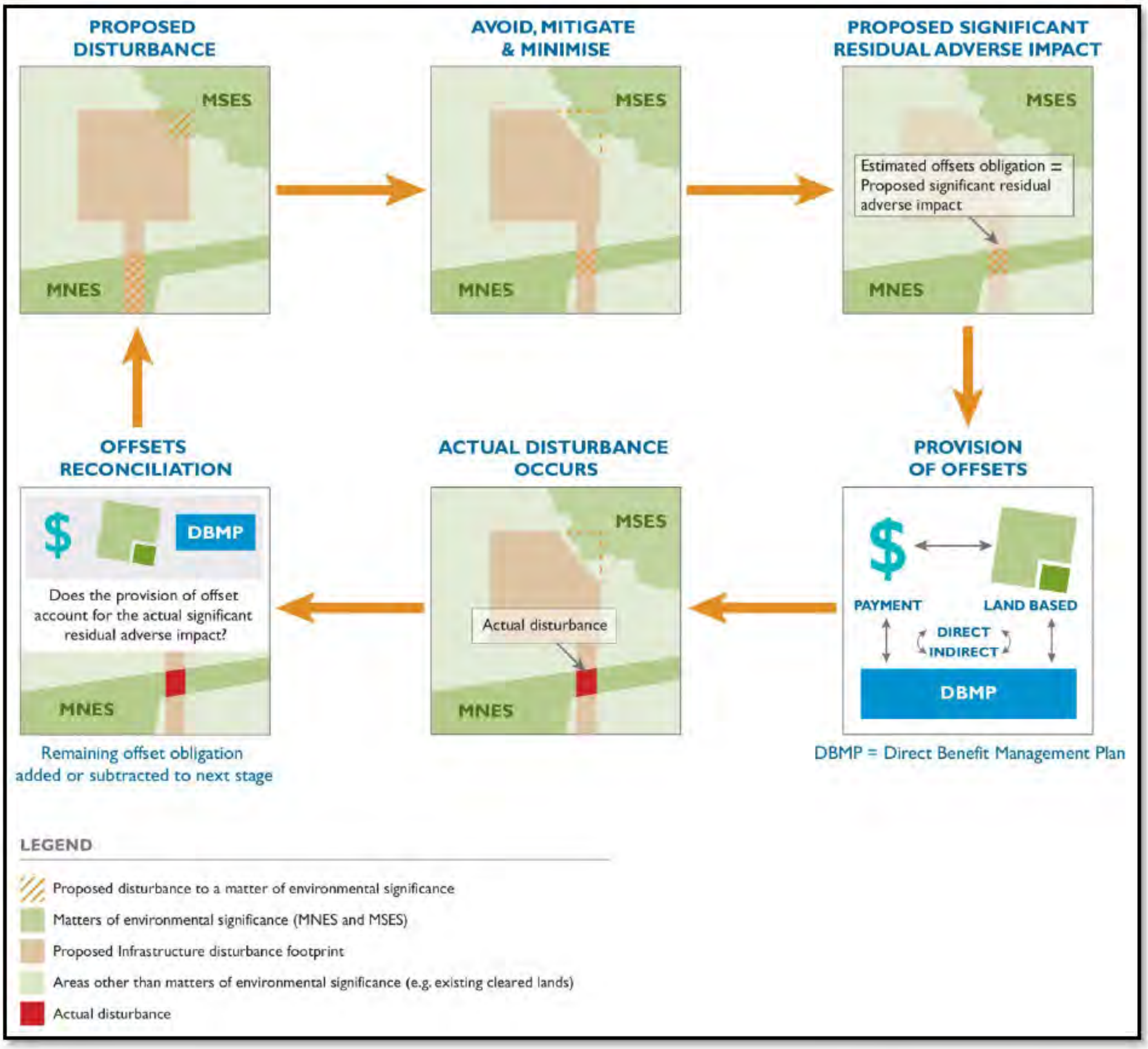
Environmental offsets for the Santos GFD Project will be acquitted in stages. For each offset stage of the GFD Project an environmental offset plan will be developed to:

- 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 7 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 7 impacts

### 3.2.1. Stage 7 development area

The Stage 7 development area is located approximately 60 km east-northeast of Injune in south central Queensland, sitting entirely within Subregion 24 (Carnarvon Ranges) of the Brigalow Belt Bioregion (Sattler and Williams, 1999) and wholly located within the Banana Shire Council area. The Stage 7 development area occurs across parts of the Scotia, Arcadia and Fairview gas fields and includes several lot plans: 3FT845130, 28FT313, 19FT1028, 6FT801, 2SP247967, 4FT835681, 46FTY1813, 55FTY1153, 5TR839674, 8SP261936, 62FTY1809, 1AB81, 2AB247,1SP290079, 9SP262435, PL91, PL92, PL99, PL100 and PL232 (AECOM 2020; Boobook 2021; Boobook 2023a,b,c,d,e; Boobook 2024).

The development area consisted of a mix of remnant and regrowth vegetation which has a long history as a pastoral settlement where vegetation clearing has been extensive for cattle grazing and cropping.

### 3.2.2. Ecological surveys and assessments

Ecological assessments of the Stage 7 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 September 2019 and May 2024 to confirm the vegetation communities, flora/fauna species and habitat values present within the development area (AECOM 2020; Boobook 2021; Boobook 2023a,b,c,d,e; Boobook 2024).

Formal survey sites were established in a number of vegetation assessment units, based on identifiable vegetation characteristics across the broader project area (AECOM 2020; Boobook 2021; Boobook 2023a,b,c,d,e; Boobook 2024). At each site 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).
- *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al*. 2022).

**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 Environment, Science and Innovation [DESI] 2023a; Department of Resources [DoR] 2023a).
- EPBC Act Protected Matters Search Tool (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2023).
- Wildlife Online fauna and flora records (DESI 2023b).
- Protected Plants Flora Survey Trigger Map (DESI 2023c).
- Wetlands and waterways mapping (DESI 2023d, 2022e; DoR 2023a).
- Landscape terrestrial and aquatic values (DESI 2023a, 2023d).
- Regulated vegetation and other Matters of State Conservation Significance (DESI 2023d; DoR 2023a, 2023b).
- Atlas of Living Australia (ALA) flora and fauna records within 10 km of the approximate centre of the Site (ALA 2023).

### 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) (DESI 2023a) 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 at 232 sites, 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 2019).

### 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 (AECOM 2020, Boobook 2021; Boobook 2023a,b,c,d,e,; Boobook 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 2023a,b,c,d,e; Boobook 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 7 development area to determine the known or potential presence of MNES (AECOM 2020; Boobook 2021; Boobook 2023a,b,c,d,e; Boobook 2024).

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 7 development area.

The extent of the residual impact for each MNES was determined by assessing a conservative 'best guess' scenario, i.e. 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 7 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 7 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 7 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, 2023a).

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 7 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 | All remnant RE 11.9.5 was mapped as Brigalow TEC, where *Acacia harpophylla* was dominant in the canopy and the vegetation otherwise met the condition criteria. Regrowth patches of RE 11.9.5 were also mapped as TEC, except in some extensively disturbed patches where non-native plant cover exceeded 50%. | 11.9.5 | 0.59 |
| **Threatened species** | | | | |
| Collared Delma (*Delma torquata)* | V | Habitat includes eucalypt woodland with potentially suitable shelter sites (e.g. small rocks, woody debris). All areas of remnant and functional regrowth of the nominated REs are considered potential habitat.<br>A disturbance area was calculated on the basis of mapped remnant vegetation and functional ecologically sensitive areas considered to possess sufficient microhabitat features to provide habitat for this species. Therefore, this species is considered to be potentially present. Using precautionary principle, all impacts to this species will be offset. | 11.3.2, 11.3.19, 11.3.39, 11.5.9, 11.9.2, 11.9.7, 11.9.10, 11.10.1, 11.10.3, 11.10.7, 11.10.7a, 11.10.9, 11.10.11, 11.10.13 | 313.19 |
| Yakka Skink (*Egernia rugosa*) | V | Eucalypt woodland and non-remnant areas with potentially suitable shelter sites (e.g. large logs, log piles) are present within parts of the Site.<br>Mapped Essential Habitat is based on known records within the nominated RE and includes all remnant vegetation and regrowth of the nominated RE. Mapped General Habitat includes all remnant vegetation and regrowth of the nominated RE. This may include sub-optimal habitat. | 11.3.2, 11.3.19, 11.3.39, 11.5.9, 11.9.2, 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, 11.10.13 | 313.78 |

| MNES | Status under EPBC Act[1] | Distribution and known habitat use | Potentially suitable RE | Disturbance area (ha) |
|---|---|---|---|---|
| Dunmall's Snake (*Furina dunmalli*) | V | Potentially suitable foraging and shelter habitat is present and widespread in remnant and regrowth REs within the Site.<br>Mapped General Habitat includes all remnant vegetation and regrowth of the nominated RE. | 11.3.2, 11.3.19, 11.3.39, 11.9.2, 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, 11.10.13 | 308.13 |
| Red Goshawk (*Erythrotriorchis radiatus*) | E | Suitable breeding habitat (i.e. permanent water bodies and riparian habitat with tall trees) is absent within the Site, but potential foraging habitat (e.g. open areas near water, forests and woodlands) is present at the Site. Species requires tall trees close to permanent water for nest sites but may forage at a distance from this habitat.<br>Mapped General Habitat includes all areas of remnant and regrowth of the nominated RE. | 11.3.2, 11.3.19, 11.3.25, 11.3.39, 11.9.2, 11.9.4, 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, 11.10.13 | 311.78 |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | V | Suitable habitat (i.e. grassy woodland) is present within the Site. The species has been recorded from Fairview Gas Field. This species usually inhabits areas near a water source, and nests and forages in a wide range of grassy woodland and open forest types. | 11.3.2, 11.3.19, 11.3.25, 11.3.39, 11.5.9, 11.9.2, 11.9.7, 11.9.10, 11.10.1, 11.10.3, 11.10.7, 11.10.7a, 11.10.9, 11.10.11, 11.10.13 | 316.82 |
| Northern Quoll (*Dasyurus hallucatus*) | E | The site is within the species' historical range and areas of potentially suitable den sites (i.e. rock holes/crevices) are present within the Site.<br>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. | 11.3.2, 11.3.19, 11.3.25, 11.3.39, 11.5.9, 11.9.2, 11.9.4, 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, 11.10.13 | 317.43 |

| MNES | Status under EPBC Act[1] | Distribution and known habitat use | Potentially suitable RE | Disturbance area (ha) |
|---|---|---|---|---|
| Koala<br>(*Phascolarctos cinereus*) | E | Likely to be present.<br>Suitable habitat (i.e. Eucalyptus-dominated woodlands and open forests) is present and widespread within the Site, which is within the known range of the species.<br>Essential Habitat includes eucalypt-dominated riparian and floodplain REs. Mapped General Habitat includes all other remnant and regrowth of RE dominated by Myrtaceae species. | 11.3.2, 11.3.19, 11.3.25, 11.3.39, 11.9.2, 11.9.7, 11.9.10, 11.10.1, 11.10.7, 11.10.7a, 11.10.11, 11.10.13 | 269.57 |
| South-eastern Long-eared Bat<br>(*Nyctophilus corbeni*) | V | Likely to be present.<br>Potentially suitable foraging and roosting habitat is present in remnant woodland within the Site, which is within the known range of the species.<br>Mapped General Habitat includes all areas of remnant vegetation and regrowth that may be suitable for foraging or shelter. | 11.3.2, 11.3.19, 11.3.25, 11.3.39, 11.9.2, 11.9.4, 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, 11.10.13 | 311.78 |
| Large-eared Pied Bat<br>(*Chalinolobus dwyeri*) | E | Potentially suitable habitat (i.e. caves and crevices in rocky hills and cliff lines) is present within the Site, which is within the known range of the species.<br>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). | 11.3.2, 11.3.19, 11.3.25, 11.3.39, 11.9.2, 11.9.4, 11.9.5, 11.9.7, 11.9.10, 11.10.1, 11.10.3, 11.10.13 | 257.80 |

[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 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 insectivore that forages over intact and disturbed landscapes. It does not breed in Australia during its summer presence and roosts opportunistically in tall trees, arriving and leaving in the dark. | 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 | 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 |
| Birds | Fork-tailed Swift (*Apus pacificus*) | No: this species is an aerial feeding insectivore that forages over a wide range of intact and disturbed landscapes. It does not breed in Australia and has rarely been recorded roosting, in trees or on cliffs, during its 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 | 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 |
| Birds | Cattle Egret (*Ardea ibis*) | No: There is limited suitable habitat (riverine pools) within the development area and the development will not disturb this habitat | No: No loss of potential habitat will occur. | No: Disturbance within the development area is unlikely to permanently impact on movement of the species, hence no isolation or fragmentation of populations is predicted. | No: No potential habitat within the development area will be disturbed by the development. | None known | None known | No: No potential habitat within the development area will be disturbed by the development. | No |
| Birds | Eastern Great Egret (listed as great Egret A. alba) (*Ardea modesta*) | No: There is limited suitable habitat (riverine pools) within the development area and the development will not disturb this habitat | No: No loss of potential habitat will occur. | No: Disturbance within the development area is unlikely to permanently impact on movement of the species, hence no isolation or fragmentation of populations is predicted. | No: No potential habitat within the development area will be disturbed by the development. | None known | None known | No: No potential habitat within the development area will be disturbed by the development. | No |

| 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 | Common Sandpiper (*Actitis hypoleucos*) | No: There is limited suitable habitat (riverine pools) within the development area and the development will not disturb this habitat | No: No loss of potential habitat will occur. | No: Disturbance within the development area is unlikely to permanently impact on movement of the species, hence no isolation or fragmentation of populations is predicted. | No: No potential habitat within the development area will be disturbed by the development. | None known | None known | No: No potential habitat within the development area will be disturbed by the development. | No |
| Birds | White-bellied Sea-Eagle (*Hieraaetus leucogaster*) | No: Limited suitable habitat (riverine pools (foraging) and riparian trees (roosting, nesting) within the development area and the development will not disturb this habitat | No: No loss of potential habitat will occur. | No: Disturbance within the development area is unlikely to permanently impact on movement of the species, hence no isolation or fragmentation of populations is predicted. | No: Very limited potential habitat within the development area which will not be disturbed by the development. | None known | None known | No: Very limited potential habitat within the development area which will not be disturbed by the development. | No |
| Birds | White-throated Nightjar (*Eurystomus mystacalis*) | 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 | Shining Bronze-cuckoo (*Chrysococcyx lucidus*) | | | | | | | | No |
| Birds | Black-eared Cuckoo (*Chrysococcyx osculans*) | | | | | | | | No |
| Birds | Oriental Cuckoo (*Cuculus optatus*) | | | | | | | | No |
| Birds | Pallid Cuckoo (*Cuculus pallidus*) | | | | | | | | No |
| Birds | Channel-billed Cuckoo | | | | | | | | No |

| 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 | |
| | (*Scythrops novaehollandiae*) | | | | | | | | |
| Birds | Rainbow Bee-eater (*Merops ornatus*) | | | | | | | | No |
| Birds | Dollarbird (*Eurystomus orientalis*) | | | | | | | | No |
| Birds | Forest Kingfisher (*Todiramphus macleayii*) | | | | | | | | No |
| Birds | Sacred Kingfisher (*Todiramphus sanctus*) | | | | | | | | No |
| Birds | Black-faced Cuckoo-shrike (*Coracina novaehollandiae*) | | | | | | | | No |
| Birds | Rufous Fantail (*Rhipidura rufifrons*) | | | | | | | | No |
| Birds | Spangled Drongo (*Dicrurus bracteatus*) | | | | | | | | No |
| Birds | Australian Magpie Lark (*Grallina cyanoleuca*) | | | | | | | | No |
| Birds | Satin Flycatcher (*Myiagra cyanoleuca*) | | | | | | | | No |
| Birds | Silvereye (*Zosterops lateralis*) | | | | | | | | No |

# 4. Impact and Offset Reconciliation for Stage 1-6

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.

Table 4, Table 5 and Table 6 provide a summary of the proposed significant residual impacts on MNES required to be offset for Stages 2 through 6 of the GFD Project across the Springwater, Mt Tabor, Cobbadah 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), 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), approved on 23 September 2021 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), 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 0, 19 July 2023), in review 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).

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 2-6 of the GFD Project are yet to be 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 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 | 369.3 | 6.8 | 6.2 | 53.0 | 0.6 | 24.8 | 198.0 | - | 3.3 | 65.6 | 4.1 |
| Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community (SEVT TEC) | E | 57.5 | - | - | - | - | - | - | - | 1.5 | 26.0 | 18.5 |
| **Threatened species** | | | | | | | | | | | | |
| Collared Delma (*Delma torquata*) | V | 768.4 | 55.9 | 49.0 | 284.0 | 6.9 | 48.3 | 339.5 | - | 433.4 | - | 87.6 |
| Yakka Skink (*Egernia rugosa*) | V | 768.4 | 54.8 | 48.2 | 279.0 | 6.6 | 48.0 | 350.5 | - | 435.6 | - | 87.6 |
| Dunmall's Snake (*Furina dunmalli*) | V | 768.4 | 55.9 | 49.0 | 284.0 | 6.9 | 48.3 | 351.5 | - | 435.2 | - | 87.6 |
| Red Goshawk (*Erythrotriorchis radiatus*) | E | 837.3 | - | - | - | - | 31.0 | 288.0 | - | 438.3 | - | 137.0 |
| Black-breasted Button-quail (*Turnix melanogaster*) | V | 57.5 | - | - | - | - | 0.6 | 5.7 | - | 1.8 | 19.0 | 25.5 |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | V | 429.6 | - | - | - | - | 10.8 | 75.0 | - | 436.0 | - | 42.6 |
| Northern Quoll (*Dasyurus hallucatus*) | E | 837.3 | - | - | - | - | - | 251.0 | - | 298.9 | - | 137.0 |
| Koala (*Phascolarctos cinereus*) | E | 429.6 | 42.1 | 37.5 | 217.0 | 4.6 | 23.1 | 156.0 | - | 287.8 | - | 42.6 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | V | 837.3 | 55.9 | 49.0 | 340.0 | 6.9 | 50.2 | 371.0 | - | 438.3 | - | 137.0 |
| Large-eared Pied Bat (*Chalinolobus dwyeri*) | E | 837.3 | - | - | - | - | - | 251.0 | - | 374.9 | - | 137.0 |

[1] E = Endangered; V = Vulnerable.

**Table 5 – Reconciliation of predicted significant residual impacts associated with Stage 4 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 (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) | Surplus remaining (ha) (after Stage 4) |
|---|---|---|---|---|---|---|
| **Threatened ecological communities** | | | | | | |
| Brigalow TEC | E | - | - | 3.24 | - | - |
| SEVT TEC | E | - | - | 1.5 | - | - |
| **Threatened species** | | | | | | |
| Collared Delma (*Delma torquata*) | V | 5,124.6 | - | 433.4 | 4,173.0 | 951.6 |
| Yakka Skink (*Egernia rugosa*) | V | 4,239.0 | - | 435.6 | 4,173.0 | 66.0 |
| Dunmall's Snake (*Furina dunmalli*) | V | 5,124.6 | - | 435.2 | 4,173.0 | 951.6 |
| Red Goshawk (*Erythrotriorchis radiatus*) | E | 5,124.6 | - | 438.3 | 4,173.0 | 951.6 |
| Black-breasted Button-quail (*Turnix melanogaster*) | V | - | - | 1.8 | - | - |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | V | 5,124.6 | - | 436.0 | 4,173.0 | 951.6 |
| Northern Quoll (*Dasyurus hallucatus*) | E | 5,124.6 | - | 298.9 | 4,173.0 | 951.6 |
| Koala (*Phascolarctos cinereus*) | E | 5,124.6 | - | 287.8 | 4,173.0 | 951.6 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | V | 5,124.6 | - | 438.3 | 4,173.0 | 951.6 |
| Large-eared Pied Bat (*Chalinolobus dwyeri*) | E | 5,124.6 | - | 374.9 | 4,173.0 | 951.6 |

[1] E = Endangered; V = Vulnerable.

**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 | | | | | Stage 6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cobbadah | | | Kentucky | | Residual Stage 5 impacts reconciled and included in Stage 6 (ha) | Predicted Stage 6 impacts including reconciled Stage 5 (ha) | Kentucky | |
| | | | | Area of suitable habitat within the offset area (ha) | Offset area secured (ha)2 | Surplus remaining (ha) (after Stage 5) | Area of suitable habitat within the offset area (ha)3 | Offset area secured (ha) | | | Offset area secured (ha) | Surplus remaining (ha) (after Stage 6) |
| **Threatened ecological communities** | | | | | | | | | | | | |
| Brigalow TEC | E | - | 6.5 | 74.6 | 72.2 | 2.4 | - | - | - | - | - | - |
| **Threatened species** | | | | | | | | | | | | |
| Collared Delma (*Delma torquata*) | V | - | 143.6 | 774.0 | 557.7 | 216.3 | 1,323.7 | 806.5 | - | 9.6 | 133.0 | 384.2 |
| Yakka Skink (*Egernia rugosa*) | V | - | 140.8 | 565.7 | 557.7 | 8.0 | 1,375.4 | 806.5 | - | 14.6 | 133.0 | 435.9 |
| Dunmall's Snake (*Furina dunmalli*) | V | - | 144.0 | 565.7 | 557.7 | 8.0 | 1,375.4 | 806.5 | - | 14.6 | 133.0 | 435.9 |
| Koala (*Phascolarctos cinereus*) | E | - | 116.3 | 491.1 | 485.5 | 5.6 | 1,323.7 | 806.5 | - | 9.5 | 133.0 | 384.2 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | V | - | 144.0 | 1,051.8 | 557.7 | 494.1 | 1,375.4 | 806.5 | - | 14.6 | 133.0 | 435.9 |

[1] E = Endangered; V = Vulnerable.

# 5. EPBC Act Offset Framework

Offsets for Stage 7 are proposed to be secured on the Kentucky, Mt Tabor and Bottle Tree properties, as detailed in Section 6. Table 7 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 7 – 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 Kentucky, Mt Tabor and Bottle Tree offset areas acquit MNES offset requirements under EPBC 2012/6615 as outlined in Table 8 of this offset plan.<br>The offset areas will be managed and monitored to improve the quality and viability of habitat for MNES fauna species.<br>The Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C) 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 Kentucky, Mt Tabor and Bottle Tree 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 D) and is presented as part of the Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C). |
| 5. effectively account for and manage the risks of the offset not succeeding | The Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C) 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.<br>Threats to the offset site are managed by through the implementation of the management measures, including:<br>• fire prevention and management<br>• weed and pest animal monitoring and control<br>• clearing protection |

| Principle | How the principle is met in this offset proposal |
|---|---|
| | • management of grazing<br>• restricted access.<br>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 Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (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. |
| 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 Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C) 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.<br>Now that a Voluntary Declaration has been secured over the Kentucky, Mt Tabor Offset area 1 and Bottle Tree offset areas, environmental laws prevent other land uses inconsistent with the OAMP being approved over these parts of the properties.<br>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 (refer to Appendix B for additional detail). |
| 7. be efficient, effective, timely, transparent, scientifically robust and reasonable | The Kentucky, Mt Tabor and Bottle Tree offset areas have been identified to be suitable using an evidence based and scientifically robust approach, as detailed in the Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C).<br>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.<br>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 Kentucky OAMP (Appendix A), Mt Tabor OAMP (Appendix B) and Bottle Tree OAMP (Appendix C) 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.<br>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 7 of the GFD Project under EPBC 2012/6615 on the Kentucky, Mt Tabor and Bottle Tree offset areas. The following section provides 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. 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.

An OAMP for the Kentucky offset area was originally approved in December 2021 by the Commonwealth Government for EPBC 2008/4096 and 2008/4059. In March 2022 an updated version of the Kentucky OAMP was approved for Stage 5 of the GFD Project (EPBC 2012/6615), drawing down on surplus areas of suitable MNES habitat within the approved Kentucky offset area. A separate OAMP has been prepared to acquit offset requirements for Stage 7 of the GFD Project (EPBC 2012/6615), utilising the remaining surplus offset areas within the approved Kentucky 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 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 A.

## 6.2. 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.

An OAMP for the Mt Tabor offset area was approved by the Commonwealth Government on 3 November 2022 for Stage 4 of the GFD Project under EPBC 2012/6615 (referred to as Offset area 1). This OAMP has been updated to include proposed acquittal of offset requirements for Stage 7 of the GFD Project (EPBC 2012/6615), which draws down on surplus areas of suitable MNES habitat within the approved offset area (Offset area 1) as well as including an additional new offset area (Offset area 2), adjacent to the approved area, within the Mt Tabor property (Appendix B). 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 B.

## 6.3. 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.

An OAMP for the Bottle Tree offset area was approved by the Commonwealth Government in December 2021 for the GLNG Project under EPBC 2008/4096 and 2008/4059. A separate OAMP has been prepared to acquit offset requirements for Stage 7 of the GFD Project (EPBC 2012/6615), drawing down on surplus areas of suitable MNES habitat within the approved Bottle Tree offset area (Appendix C). 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 C.

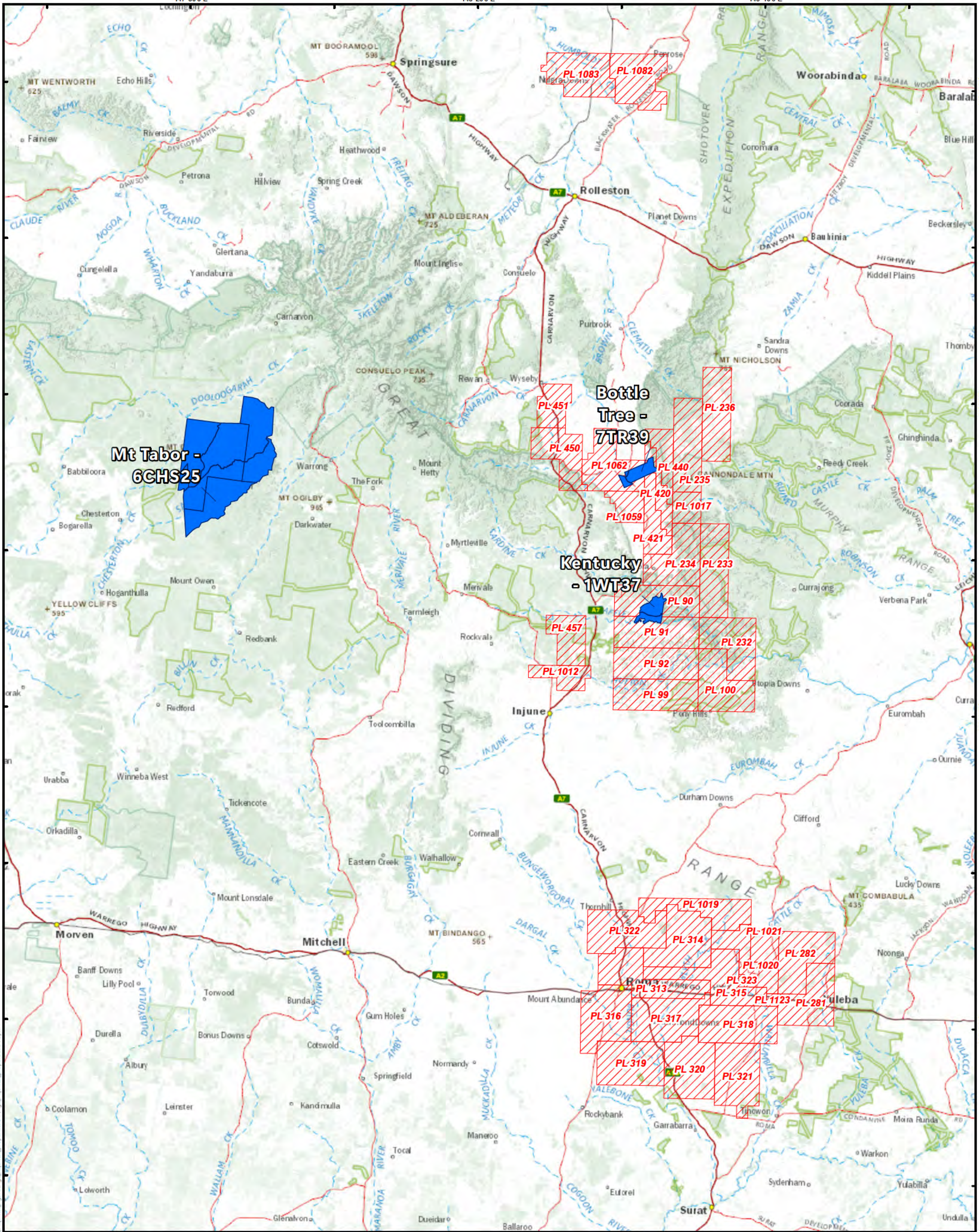



**Figure 2**
**EPBC 2012/6615**
**Stage 7 offset properties**

Offset property
Santos Petroleum Lease

CO2 AUSTRALIA


N

0 25 50
Kilometres

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

Date: 19/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:1,000,000@A3

Path: P:\GISData\Projects\Santos\20240919_Phase7_OAMP_acquital_figure\Fig2_Aquital_propertiesOV\Fig2_Aquital_propertiesOV.aprx

# 7. Offset Acquittal

Table 8 presents a summary of the offset areas to be secured to acquit offset requirements for Stage 7 of the GFD Project under EPBC 2012/6615 on Kentucky, Mt Tabor and Bottle Tree, 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.

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 Kentucky, Mt Tabor and Bottle Tree, and are discussed in detail as part of the OAMPs (see Appendix A, Appendix B and Appendix C). The location of the offset on each property is shown in Appendix A Figure 2 p. 6, Appendix B Figure 2 p. 7 and Appendix C Figure 2 p. 7.

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 D. 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 7 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 2020b). 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 7 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 E.

In the absence of detailed habitat quality assessments within particular development areas for Stage 7 or for some MNES offset requirements (including Brigalow TEC), 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 and Appendix C).

**Table 8 – Offset acquittal for Stage 7 of the GFD Project under EPBC 2012/6615**

| MNES | Status under EPBC Act[1] | Impact area (ha) | Kentucky offset area | | | Mt Tabor offset area 1 | | | Mt Tabor offset area 2 | | | Bottle Tree offset area | | | Total % acquittal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Offset area to be secured under OAG (ha) | % acquittal | Surplus area available (ha) | Offset area to be secured under OAG (ha) | % acquittal | Surplus area available (ha) | Offset area to be secured under OAG (ha) | % acquittal | Surplus area available (ha) | Offset area to be secured under OAG (ha) | % acquittal | Surplus area available (ha) | |
| **Threatened ecological communities** | | | | | | | | | | | | | | | |
| Brigalow TEC | E | 0.6 | - | - | - | - | - | - | - | - | - | 19.7 | 599.41% | 152.9 | 599.41% |
| **Threatened species** | | | | | | | | | | | | | | | |
| Collared Delma (*Delma torquata*) | V | 313.2 | 384.2 | 13.47% | 0.0 | 951.6 | 33.36% | 0.0 | 2,036.5 | 71.40% | 312.3 | 19.7 | 1.38% | 152.9 | 119.61% |
| Yakka Skink (*Egernia rugosa*) | V | 313.8 | 435.9 | 17.80% | 0.0 | 66.0 | 2.69% | 0.0 | 1,908.2 | 77.91% | 0.0 | 19.7 | 1.61% | 152.9 | 100.01% |
| Dunmall's Snake (*Furina dunmalli*) | V | 308.1 | 435.9 | 15.53% | 0.0 | 951.6 | 33.91% | 0.0 | 2,036.5 | 72.58% | 312.3 | 19.7 | 1.40% | 153.4 | 123.42% |
| Red Goshawk (*Erythrotriorchis radiatus*) | E | 311.8 | 435.9 | 12.59% | 0.0 | 951.6 | 27.48% | 0.0 | 2,036.5 | 58.81% | 312.3 | 19.7 | 1.14% | 153.4 | 100.02% |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | V | 316.8 | 384.2 | 13.32% | 0.0 | 951.6 | 32.98% | 0.0 | 2,036.5 | 70.58% | 312.3 | - | - | - | 116.88% |
| Northern Quoll (*Dasyurus maculatus*) | E | 317.4 | 435.9 | 14.42% | 0.0 | 951.6 | 31.49% | 0.0 | 2,036.5 | 67.38% | 312.3 | - | - | - | 113.29% |
| Koala (*Phascolarctos cinereus*) | E | 269.6 | 384.2 | 12.83% | 0.0 | 951.6 | 31.78% | 0.0 | 2,036.5 | 68.01% | 312.3 | - | - | - | 112.62% |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | V | 311.8 | 435.9 | 15.35% | 0.0 | 951.6 | 33.51% | 0.0 | 2,036.5 | 71.73% | 312.3 | 19.7 | 1.39% | 153.4 | 121.98% |
| Large-eared Pied Bat (*Chalinolobus dwyeri*) | E | 257.8 | 435.9 | 17.76% | 0.0 | 951.6 | 38.77% | 0.0 | 2,036.5 | 82.97% | 312.3 | - | - | - | 139.50% |

[1] E = Endangered; V = Vulnerable.

# 8. References


AECOM (2020). *Santos Scotia Ecology Report.* Prepared by AECOM Australia Pty Ltd for Santos Limited. November 2020. Brisbane, QLD.

ALA (2022). Atlas of Living Australia. Available from: http://www.ala.org.au/.

Boobook (2020). Predictive Habitat Mapping Rules for Selected MNES Fauna Species within the Roma, Fairview and Arcadia Gas Fields, Santos GLNG Project Area. Compiled by Boobook for Santos. August 2020. Roma, QLD.

Boobook (2021). Broad-scale Ecological Assessment Report, Fairview Optimisation and Electrification project. Compiled by Boobook for Santos. March 2021, Roma QLD.

Boobook (2023a). Broad-scale Ecological Assessment Report, Parts of Expedition Resources Reserve (Lot 5 on Plan TR839674), Lot 8 on Plan SP261936, Lot 1 on Plan AB81 and Lot 2 on Plan AB247 within tenements PL100 and PL232, Compiled by Boobook for Santos. August 2023, Roma Qld.

Boobook (2023b). Ecological Assessment Report, Ecological Assessment of Fairview Eastern Expedition Project. Compiled by Boobook for Santos, Roma QLD.

Boobook (2023c). Broad-scale Ecological Assessment Report. Fairview Infield Wells project. Compiled by Boobook for Santos, Roma QLD.

Boobook (2023d). Field Survey Report, Ecological Assessment for the proposed FV08-20 core hole. Compiled by Boobook for Santos, Roma QLD.

Boobook (2023e). *Ecological Assessment Report, Yebna Hub 4 Wetland Assessment*. Compiled by Boobook for Santos, Roma QLD.

Boobook (2024). Ecological Assessment Report, Ecological Assessment of Fairview Eastern Gas Expansion Project. Compiled by Boobook for Santos, Roma QLD.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2022). *EPBC Act Protected Matters Search Tool*. Department of Climate Change, Energy, the Environment and Water (Commonwealth of Australia), Canberra, ACT. Available from: https://pmst.awe.gov.au/.

Department of the Environment (DotE) (2013). Matters of National Environmental Significance. Significant Impact Guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment (Commonwealth of Australia), Canberra, ACT. Available from: https://www.environment.gov.au/epbc/publications/significant-impact-guidelines-11-matters- national-environmental-significance.

Department of Environment and Heritage and Protection (DEHP) (2014). *Queensland Environmental Offsets Policy. Significant Residual Impact Guideline. Nature Conservation Act 1992, Environmental Protection Act 1994, Marine Parks Act 2004. December 2014.* Department of Environment and Heritage Protection (State of Queensland), Brisbane, QLD.

Department of Environment and Heritage Protection (DEHP) (2017). *Guide to Determining Terrestrial Habitat Quality (Version 1.2 April 2017).* Department of Environment and Heritage Protection (State of Queensland), Brisbane, QLD.

Department of Environment and Science (DES) (2020). *Guide to Determining Terrestrial Habitat Quality (Version 1.3 February 2020)*. Department of Environment and Science (State of Queensland), Brisbane, QLD.

Department of Environment, Science and Innovation (DESI) (2023a). *Regional Ecosystem Description Database (REDD) – Version 12.1.* Queensland Herbarium, Department of Environment and Science (State of Queensland), Brisbane, QLD. Available from: https://apps.des.qld.gov.au/regional-ecosystems/.

Department of Environment, Science and Innovation (DESI) (2023b). *Request a species list (Wildlife Online search)*. Department of Environment and Science (State of Queensland), Brisbane, QLD. Available from: https://apps.des.qld.gov.au/report-request/species-list/.

Department of Environment, Science and Innovation (DESI) (2023c). *Nature Conservation Act protected plants flora survey trigger map spatial layer*. Department of Environment and Science (State of Queensland), Brisbane, QLD. Available from: https://apps.des.qld.gov.au/map- request/flora-survey-trigger/.

Department of Environment, Science and Innovation (DESI) (2023d). *Environmental reports. Matters of State Environmental Significance.* Department of Environment and Science (State of Queensland), Brisbane, QLD. Available from: https://apps.des.qld.gov.au/report-request/environment/.

Department of Environment, Science and Innovation (DESI) (2023e). *WetlandMaps – Interactive maps and wetland data in Queensland*, Department of Environment and Science (State of Queensland), Brisbane, QLD. Available from: https://wetlandinfo.des.qld.gov.au/wetlandmaps/.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010). Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment, Water, Heritage and the Arts (Commonwealth of Australia), Canberra, ACT.

Department of Resources, (DoR) (2023a). *Regulated Vegetation Management Map and Supporting Map.* Department of Natural Resources, Mines and Energy, (State of Queensland), Brisbane, QLD. Available from: https://www.dnrm.qld.gov.au/qld/environment/land/vegetation/vegetation-map-request-form.

Department of Resources, (DoR) (2023b). *Vegetation management report.* Department of Natural Resources, Mines and Energy, (State of Queensland), Brisbane, QLD. Available from: https://www.dnrm.qld.gov.au/qld/environment/land/vegetation/vegetation-map-request-form.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011). Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act. Department of Sustainability, Environment, Water, Population and Communities, (Commonwealth of Australia), Canberra, ACT.

Eyre, T.J., Ferguson, D., Hourigan, C., Smith, G. C., Mathieson, M., Kelly, A. L., Venz, M. F., Hogan, L. D. and Rowland, J. (2014). *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. Version 2.* Department of Science, Information Technology, Innovation and the Arts, (State of Queensland), Brisbane, QLD.

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual.* Version 2.2. Department of Environment and Resource Management, (State of Queensland), Brisbane, QLD.

Eyre, T.J., Kelly, A.L. and Neldner, V.J. (2011). Method for the Establishment and Survey of Reference Sites for BioCondition. Version 2.0. Biodiversity and Ecological Sciences Unit, Department of Environment and Resource Management (DERM), Queensland Government, Brisbane, QLD.

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F., Addicott, E.P. and Appelman, C.N. (2020). *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. Version 5.1. Queensland Herbarium, Queensland Department of Science, Information Technology and Innovation, (State of Queensland), Brisbane, QLD.

Queensland Herbarium (2019). *BioCondition Benchmarks for Regional Ecosystem Condition Assessment*. Department of Environment and Science, Queensland Government, Brisbane, QLD. Available from: https://www.qld.gov.au/ data/assets/pdf file/0026/67391/brb-benchmarks.pdf.

Sattler, P. and Williams, R. (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, (State of Queensland), Brisbane, QLD.

Santos (2014). *Methodology for Conducting Ecological Assessments*. *Rev 2*. Santos internal document, supplied 5/05/2014.

Santos (2015). Functional Thresholds for Assessing Regional Ecosystem Functionality. Rev 2. Santos internal document, supplied 2/11/2015.

Threatened Species Scientific Committee (TSSC) (2013). *Commonwealth Conservation Advice for Brigalow Ecological Community*. Threatened Species Scientific Committee, Department of Sustainability, Environment, Water, Population and Communities, (Commonwealth of Australia), Canberra, ACT. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/028-conservation-advice.pdf.

Santos

# Appendix A

## Kentucky Offset Area Management Plan

# SANTOS GLNG KENTUCKY OFFSET AREA MANAGEMENT PLAN

EPBC Act Approval 2012/6615 (Stage 7)

Document Number: 0007-650-EMP-0040

4 October 2024

| Date | Rev | Reason For Issue | Reviewed | Endorsed | Approved |
|---|---|---|---|---|---|
| 4 October 2024 | 0 | For DCCEEW submission | AB | AB | DG |

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# Tables



# Figures

# 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 7 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 435.9 hectare (ha) area of the existing 4,302.3 ha offset area secured on the Kentucky property (Lot 1 WT37) to partially acquit MNES offset requirements for Stage 7 of the GFD Project under EPBC 2012/6615 (Table ES 1). The remaining 3,866.4 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 and 6 of the GFD Project (EPBC 2012/6615).This OAMP relates to the 435.9 ha offset area required to partially acquit Stage 7 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 7 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* (Table ES 1). The Voluntary Declaration will remain in place for the life of EPBC 2012/6615.

### Table ES1 – Summary of Stage 7 MNES offset requirements acquitted on the Kentucky offset area

| MNES | Status under EPBC Act[1] | Impact area (ha) | Surplus area remaining on Kentucky following acquittal of EPBC 2008/4059, 2008/4096 and 2012/6615 (Stage 5 and 6) (ha) | Offset area to be secured under Stage 7 of EPBC 2012/6615 in accordance with the OAG (ha) | % acquittal[2] |
|---|---|---|---|---|---|
| Collared Delma (*Delma torquata*) | V | 313.19 | 384.19 | 384.19 | 13.47 |
| Yakka Skink (*Egernia rugosa*) | V | 313.78 | 435.86 | 435.86 | 17.80 |
| Dunmall's Snake (*Furina dunmalli*) | V | 308.13 | 435.86 | 435.86 | 15.53 |
| Red Goshawk (*Erythrotriorchis radiatus*) | E | 311.78 | 435.86 | 435.86 | 12.59 |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | V | 316.82 | 384.19 | 384.19 | 13.32 |
| Northern Quoll (*Dasyurus hallucatus*) | E | 317.43 | 435.86 | 435.86 | 14.42 |
| Koala (*Phascolarctos cinereus*) | E | 269.57 | 384.19 | 384.19 | 12.83 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | V | 311.78 | 435.86 | 435.86 | 15.35 |
| Large-eared Pied Bat (*Chalinolobus dwyeri*) | E | 257.80 | 435.86 | 435.86 | 17.76 |

[1] E = Endangered; V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties.

**Table ES2 – Interim performance targets and completion criteria for the Kentucky Stage 7 offset area**

| MNES | Baseline habitat quality score | Interim performance targets | | | Completion criteria |
|---|---|---|---|---|---|
| | | Year 5 | Year 10 | Year 15 | Year 20 |
| Collared Delma (*Delma torquata*) | 8 (8.1) | 8.3 | 8.6 | 8.8 | 9 |
| Yakka Skink (*Egernia rugosa*) | 7 (7.2) | 7.4 | 7.6 | 7.8 | 8 |
| Dunmall's Snake (*Furina dunmalli*) | 8 (8.2) | 8.4 | 8.6 | 8.8 | 9 |
| Red Goshawk (*Erythrotriorchis radiatus*) | 7 (7.2) | 7.4 | 7.6 | 7.8 | 8 |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | 8 (8.1) | 8.3 | 8.6 | 8.8 | 9 |
| Northern Quoll (*Dasyurus hallucatus*) | 8 (7.7) | 8.0 | 8.3 | 8.7 | 9 |
| Koala (*Phascolarctos cinereus*) | 8 (8.0) | 8.2 | 8.5 | 8.8 | 9 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | 8 (7.7) | 8.0 | 8.3 | 8.7 | 9 |
| Large-eared Pied Bat (*Chalinolobus dwyeri*) | 8 (7.8) | 8.1 | 8.4 | 8.7 | 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 7 of the Gas Fields Development (GFD) Project under the GLNG Project approval EPBC 2012/6615 (herein referred to as Stage 7), outlined in Table 1, on the Kentucky offset area (Figure 1).

**Table 1 – Impacted MNES required to be offset for Stage 7 of the GFD Project under EPBC 2012/6615**

| MNES | Status under EPBC Act | Impact area (ha) |
|---|---|---|
| Collared Delma (*Delma torquata*) | Vulnerable | 313.19 |
| Yakka Skink (*Egernia rugosa*) | Vulnerable | 313.78 |
| Dunmall's Snake (*Furina dunmalli*) | Vulnerable | 308.13 |
| Red Goshawk (*Erythrotriorchis radiatus*) | Endangered | 311.78 |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | Vulnerable | 316.82 |
| Northern Quoll (*Dasyurus hallucatus*) | Endangered | 317.43 |
| Koala (*Phascolarctos cinereus*) | Endangered | 269.57 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | Vulnerable | 311.78 |
| Large-eared Pied Bat (*Chalinolobus dwyeri*) | Endangered | 257.80 |

## 1.1. Purpose

This OAMP is written in conjunction with the *Environmental Management Plan* (EMP) *Guidelines* (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2024d), and provides a detailed management and monitoring framework for the Kentucky offset area in accordance with the requirements for Stage 7 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 7 of the GFD Project will be delivered in accordance with the principles of the EPBC Act *Environmental Offsets Policy*.<br>An offset area will be secured on Kentucky to partially acquit offset obligations for the MNES matters outlined in Table 1.<br>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 7 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 7 of the GFD Project. This OAMP for the Kentucky offset area is submitted as part of the offset plan to address Stage 7 of the GFD Project.<br>A reconciliation of impacts for Stage 1-6 of the GFD Project is included in the offset plan. |
| 14 | The Offset Management Plan must include:<br>a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities;<br>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;<br>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;<br>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;<br>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;<br>f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary);<br>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;<br>h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria;<br>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;<br>j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and<br>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 7 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.<br>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.<br>b. Details of the relevant field assessments within the Stage 7 GFD Project development area are provided in the offset plan, submitted in conjunction with this OAMP.<br>c. A summary of the significant residual impacts associated with Stage 7 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 7 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 7 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 OAG as described in Section 2.6.<br>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.<br>e. Details on the connectivity and the landscape context are provided in Section 2.2.<br>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.<br>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.<br>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.<br>i. Risks to the successful implementation of this plan are included in the risk assessment presented in Appendix C.<br>j. The timing for implementation of the management and monitoring program are provided in Section 9. |

| Condition number | Condition | How the conditions are met |
|---|---|---|
| | | k. Details on how the Kentucky offset area for Stage 7 of the GFD Project has been 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. |
| 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 7 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 7 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:<br>a. include the information required for the Offset Management Plan at condition 14 for the next project phase;<br>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 and may be subtracted from the obligations required for the 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<br>c. demonstrate how the offset builds on offsets already secured for previous project stages 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.<br>Stage 7 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 |

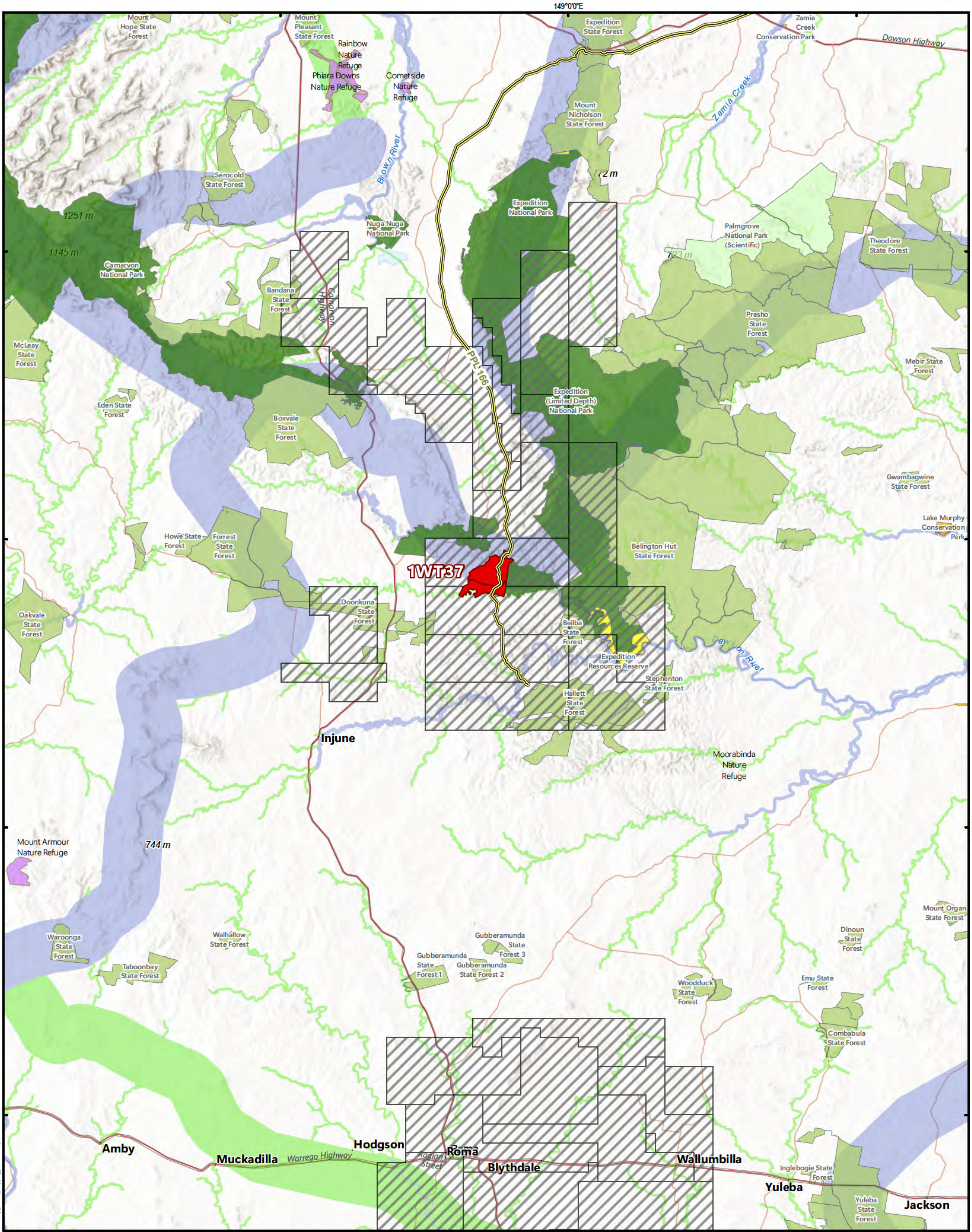



**Figure 1**
**Project Context**

| | |
|---|---|
| Kentucky | |
| Santos Petroleum Licence | |
| Santos Petroleum Pipeline Licence | |

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

***Statewide Corridors***
- Regional
- State

CO2 AUSTRALIA

N

0 20 40
Kilometres

Date: 19/09/2024 Coordinate System: GDA2020 Scale: 1:650,000@A3

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

# 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).

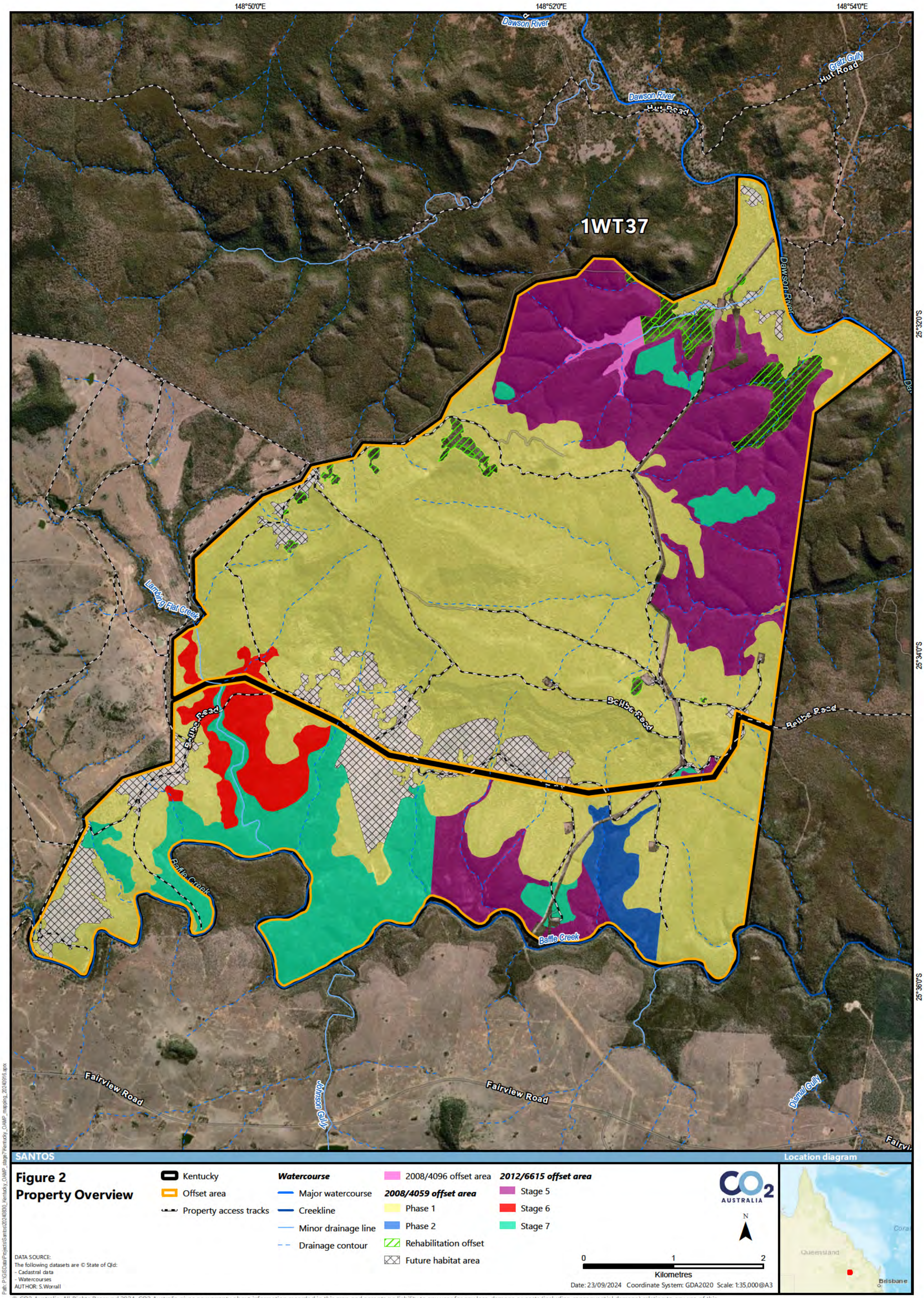
The property lies within rugged terrain and contains large vegetation remnants that are contiguous with Expedition (Limited Depth) National Park to the east and Lonesome Holding (proposed National Park) to the north. The property is located entirely within the Dawson River Catchment, part of the Fitzroy 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<br>Santos GLNG Pty Ltd<br>PAPL (Downstream) Pty Ltd<br>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 |
| Infrastructure permit | PPL 166 Santos GLNG Pty Ltd |



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
Dawson River
Hut Road
Hut Road
Gritz Gully
1WT37
Landing Flat Creek
Baffle Creek
Baffle Creek
Beilbe Road
Beilbe Road
Beilbe Road
Fairview Road
Fairview Road
Johnson Gully
Dismal Gully
SANTOS
Location diagram
Queensland
Brisbane
Figure 2
Property Overview
Kentucky
Offset area
Property access tracks
Watercourse
Major watercourse
Creekline
Minor drainage line
Drainage contour
2008/4096 offset area
2008/4059 offset area
Phase 1
Phase 2
Rehabilitation offset
Future habitat area
2012/6615 offset area
Stage 5
Stage 6
Stage 7
CO2 AUSTRALIA
N
0
1
2
Kilometres
Date: 23/09/2024 Coordinate System: GDA2020 Scale: 1:35,000@A3
DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
- Watercourses
AUTHOR: S.Worrall

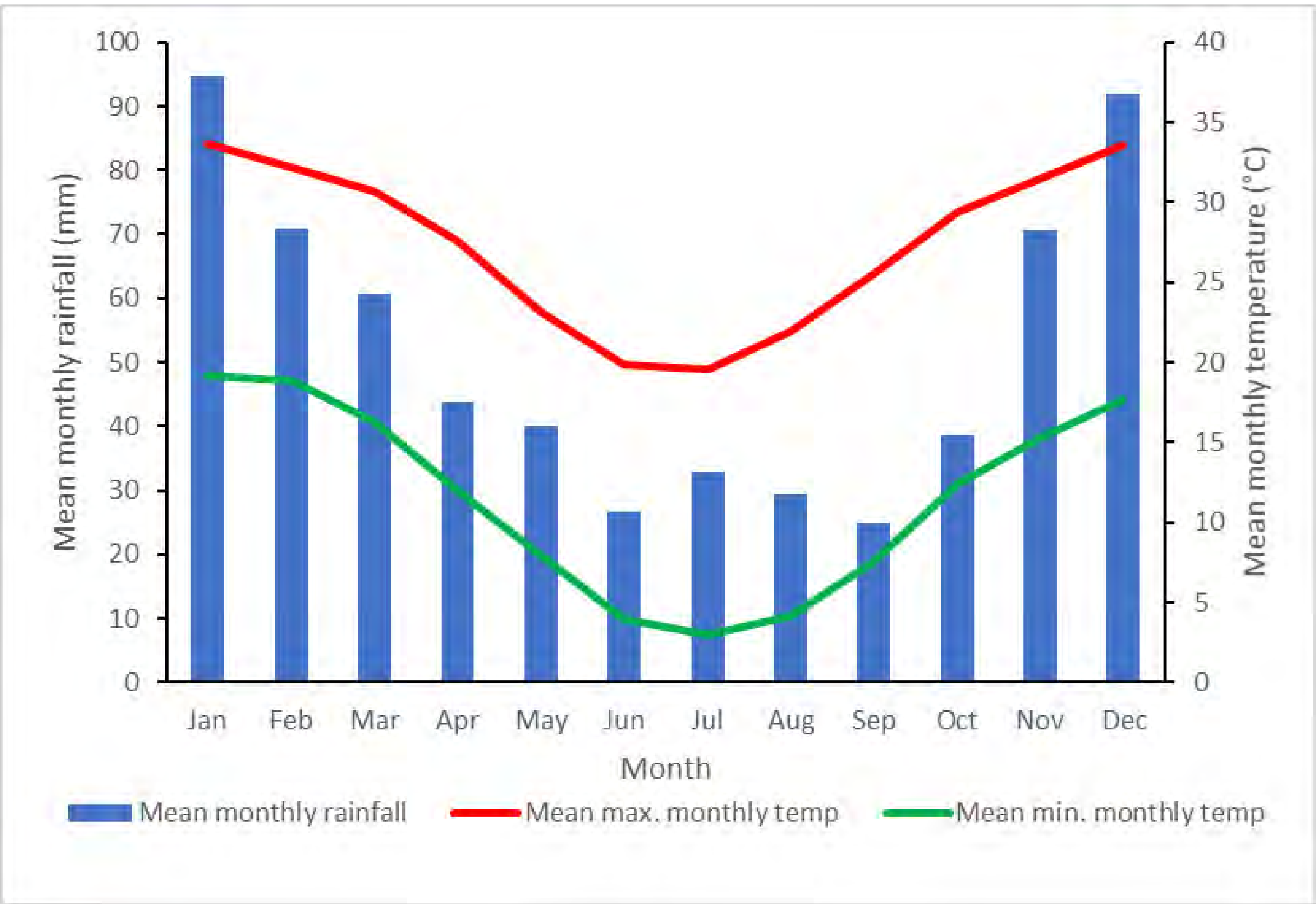
## 2.2. Connectivity

The Kentucky 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 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



## 2.4. On-ground property assessments

Santos has dedicated the majority of the Kentucky property for environmental offsets (4,302.3 ha; herein referred to as the offset area) with the exception of the area excluded for the Santos GLNG pipeline and associated infrastructure (65.6 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<br>Nocturnal active searches | 14 diurnal searches, 2 x 30 min = 14 person/hours<br>11 nocturnal searches, 2 x 1.0-2.5 hr = 29 person/hrs |
| Red Goshawk (*Erythrotriorchis radiatus*) | Scans for soaring birds<br>Nest searches on watercourses<br>Driving traverses | 1 site for 2 person/hrs<br>6 sites for 10 person/hrs<br>Minimum 2hrs/20km per day for 10 days = 20hrs/200km |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | Active/flushing searches of woodland habitat<br>Waterhole searches<br>Driving traverses | 14 diurnal searches, 2 x 30min = 14 person/hours<br>6 x 15 min searches<br>Minimum 2hrs/20km per day for 10 days = 20hrs/200km |
| Northern Quoll (*Dasyurus hallucatus*) | Diurnal searches (on foot) of denning habitat for scats<br>Nocturnal spotlight searches (on foot)<br>Camera traps in rocky habitat (outcrops and cliff lines) | 10 diurnal searches, 2 x 30min = 10 person/hours<br>11 nocturnal searches, 2 x 1.0-2.5 hr = 29 person/hrs<br>47 camera trap-nights |
| Koala (*Phascolarctos cinereus*) | Nocturnal spotlight searches (on foot)<br>Nocturnal spotlight searches (driven)<br>Diurnal searches (on foot) for animals, scats, scratches | 11 nocturnal searches, 2 x 1.0-2.5 hr = 29 person/hrs<br>2 hrs/5 km per night for 3 nights = 6 hrs/15 km<br>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<br>Anabat recording in potential habitat | 20 harp trap-nights<br>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 4,302.3 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

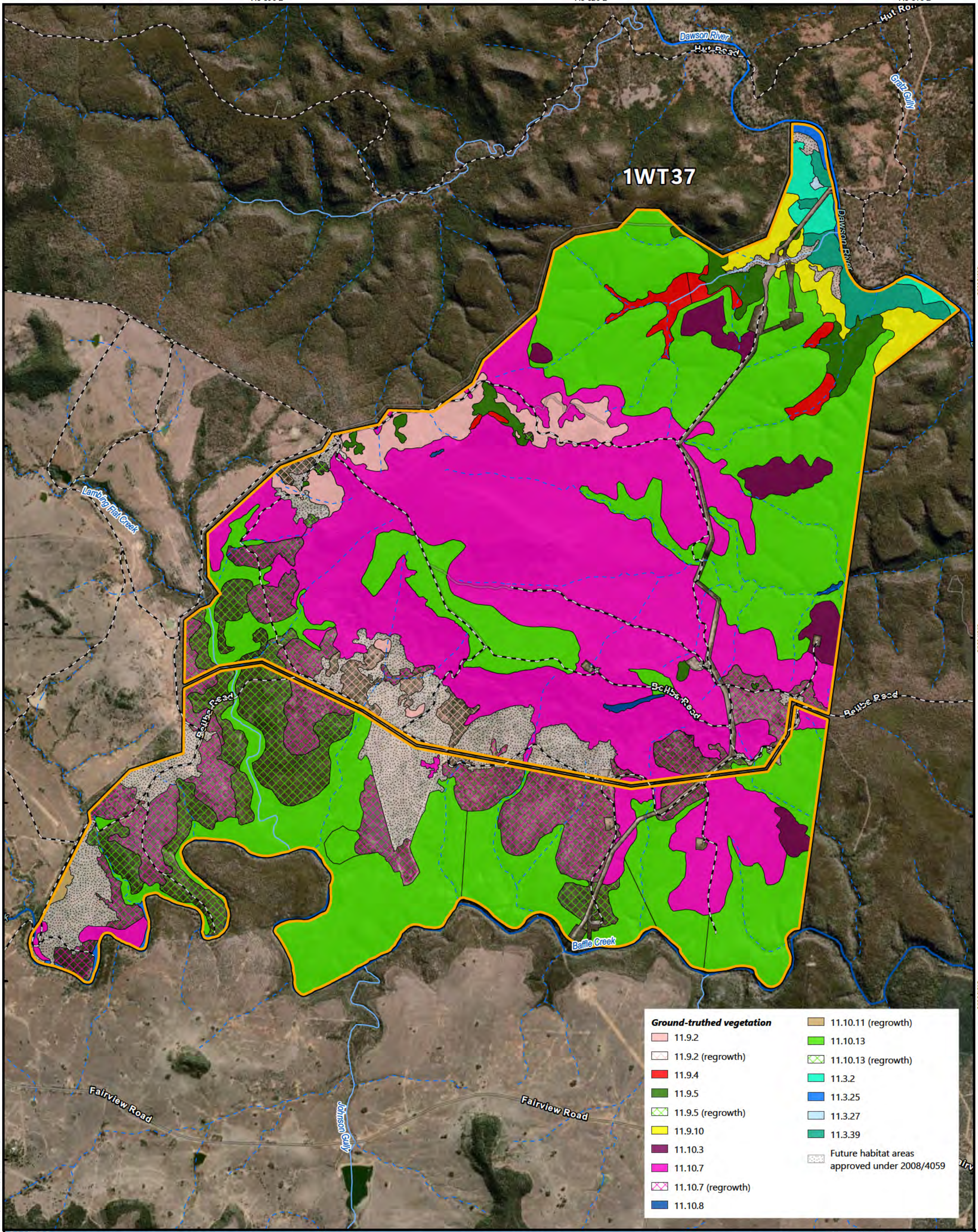
Table 6 provides a summary of the ground-truthed RE mapped on the offset area.

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.




SANTOS

**Figure 4**
**Ground-truthed vegetation**

Kentucky
Offset area
Property access tracks

***Watercourse***
Major watercourse
Creekline
Minor drainage line
Drainage contour

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 19/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:35,000@A3

Location diagram

Queensland
Brisbane

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

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

| RE | Description | Type | Kentucky offset area (ha) | | | | |
|---|---|---|---|---|---|---|---|
| | | | EPBC 2008/4059 Phase 1 and 2 offset area | EPBC 2008/4096 offset area | EPBC 2012/6615 Stage 5 and 6 offset area | EPBC 2012/6615 Stage 7 offset area | 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 | *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks. | Remnant | 67.78 | - | - | - | 67.78 |
| | | 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 |

| RE | Description | Type | Kentucky offset area (ha) | | | | |
|---|---|---|---|---|---|---|---|
| | | | EPBC 2008/4059 Phase 1 and 2 offset area | EPBC 2008/4096 offset area | EPBC 2012/6615 Stage 5 and 6 offset area | EPBC 2012/6615 Stage 7 offset area | Total Area |
| 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 | - | 133.00 | 73.03 | 221.48 |
| Non-remnant | | - | - | - | - | - | 305.35 |
| **Total** | | - | 2,601.77 | 19.79 | 939.50 | 435.86 | 4,302.27 |

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

| Species | Potentially suitable RE | 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 is dominant in the canopy and that the vegetation otherwise met condition criteria (Department of the Environment [DotE], 2013). | 71.1 |
| SEVT TEC | 11.9.4 | Remnant RE 11.9.4, listed as a component RE for this TEC (Threatened Species Scientific Committee [TSSC], 2001). | 42.5 |
| **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 habitat includes all areas of remnant and regrowth vegetation of the nominated RE. | General: 3,784.8 |
| Yakka Skink (*Egernia rugosa*) | Essential Habitat: 11.3.2, 11.3.39, 11.9.2, 11.10.7, 11.10.11<br>General Habitat: 11.9.5, 11.9.10, 11.10.3, 11.10.13 | Mapped habitat is based on known records within the nominated RE and includes all remnant and regrowth vegetation of the nominated RE. This may include sub-optimal habitat. | Essential: 1,965.9<br>General: 1,970.9 |
| 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 habitat includes all remnant and regrowth vegetation of the nominated RE. | General: 3,996.9 |
| 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 | Mapped General Habitat includes all woody vegetation (remnant, mature regrowth, immature regrowth). | General: 3,996.9 |
| 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 vegetation and mature regrowth except REs 11.9.4 and 11.9.5a. | General: 3,797.5 |
| 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 General Habitat includes all remnant and mature regrowth vegetation containing potentially suitable den sites. | Essential: 3,995.9 |

| Species | Potentially suitable RE | Habitat mapping rules | Mapped extent of potential habitat (ha) |
|---|---|---|---|
| Koala<br>(*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: 3,797.5 |
| South-eastern Long-eared Bat<br>(*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 habitat includes all areas of remnant and regrowth vegetation that may be suitable for foraging or shelter. | General: 3,996.9 |
| Large-eared Pied Bat<br>(*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 General Habitat includes all areas of remnant vegetation and mature regrowth that may be suitable for foraging or shelter. | Essential: 3,996.9 |

## 2.6. Offset area

The offset area is 4,302.3 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 65.6 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.
- 2,601.77 ha to acquit offset obligations under EPBC 2008/4059 plus 305.40 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).
- 939.50 ha to acquit offset obligations under Stage 5 and 6 of EPBC 2012/6615.
- 435.86 ha to partially acquit offset obligations under Stage 7 of EPBC 2012/6615.

Table 8 provides a summary of the offset area to acquit the current MNES offset requirements for Stage 7 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 7 of EPBC 2012/6615**

| MNES | Status under EPBC Act[1] | Impact area for Stage 7 of EPBC 2012/6615 (ha) | Area available on Kentucky (after GTP [2008/4096], GLNG [2008/4059], Stage 5 and Stage 6 GFD [2012/6615] acquittals) (ha) | Offset area to be secured under Stage 7 GFD (EPBC 2012/6615) in accordance with the OAG (ha) | % acquittal[2] |
|---|---|---|---|---|---|
| Collared Delma (*Delma torquata*) | V | 313.19 | 384.19 | 384.19 | 13.47 |
| Yakka Skink (*Egernia rugosa*) | V | 313.78 | 435.86 | 435.86 | 17.80 |
| Dunmall's Snake (*Furina dunmalli*) | V | 308.13 | 435.86 | 435.86 | 15.53 |
| Red Goshawk (*Erythrotriorchis radiatus*) | E | 311.78 | 435.86 | 435.86 | 12.59 |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | V | 316.82 | 384.19 | 384.19 | 13.32 |
| Northern Quoll (*Dasyurus hallucatus*) | E | 317.43 | 435.86 | 435.86 | 14.42 |
| Koala (*Phascolarctos cinereus*) | E | 269.57 | 384.19 | 384.19 | 12.83 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | V | 311.78 | 435.86 | 435.86 | 15.35 |
| Large-eared Pied Bat (*Chalinolobus dwyeri*) | E | 257.80 | 435.86 | 435.86 | 17.76 |

[1] E = Endangered; V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties.

## 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 7 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 7 under EPBC 2012/6615 as outlined in Table 8. The remaining will be acquitted elsewhere.<br>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.<br>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 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 2024). |

| 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 value to manage the risk of failing to the achieve the completion criteria and overall environmental outcomes for the offset area.<br>Threats to the offset site are managed through the implementation of the management measures discussed in Section 6, including:<br>• Fire prevention and management<br>• Weed monitoring and control<br>• Clearing protection<br>• Management of grazing<br>• Restricted access.<br>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.<br>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.<br>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.<br>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.<br>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 2024b). 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 2024c). 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 2024f). The species is associated with partly buried rocks and boulders, fallen timber and root cavities for shelter (DCCEEW 2024f). 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 2024e). 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 2024f). 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 2024b). 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 2024i). 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 2024h). 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 2024h). 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 2024a). 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.

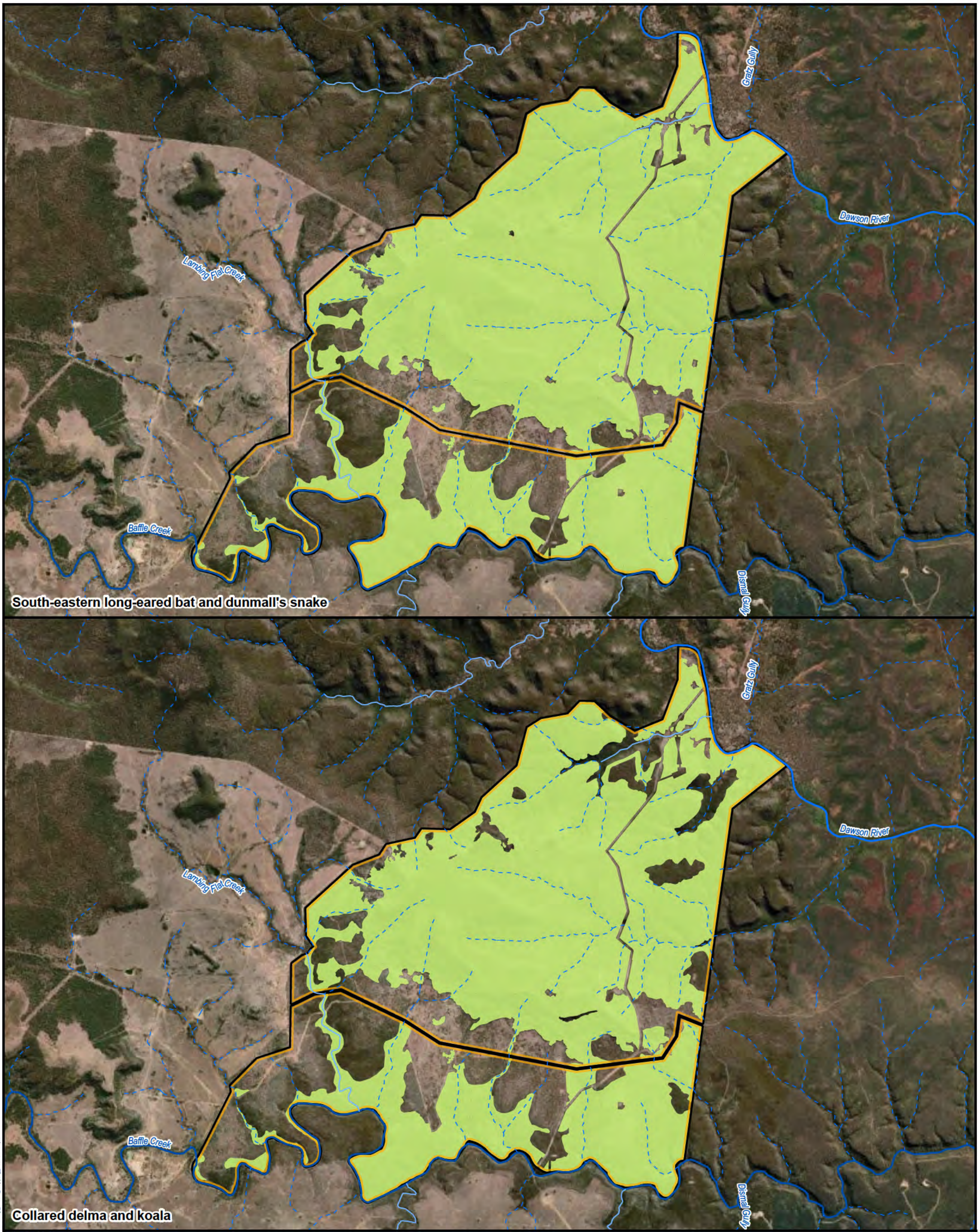



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**Figure 5**
**MNES habitat**

Kentucky - 1WT37
Offset area
MNES offset habitat

*Watercourse*
Major watercourse
Creekline
Minor drainage line
Drainage contour

CO2 AUSTRALIA

N

0 1 2
Kilometres

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

Date: 19/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:55,000@A3

Location diagram

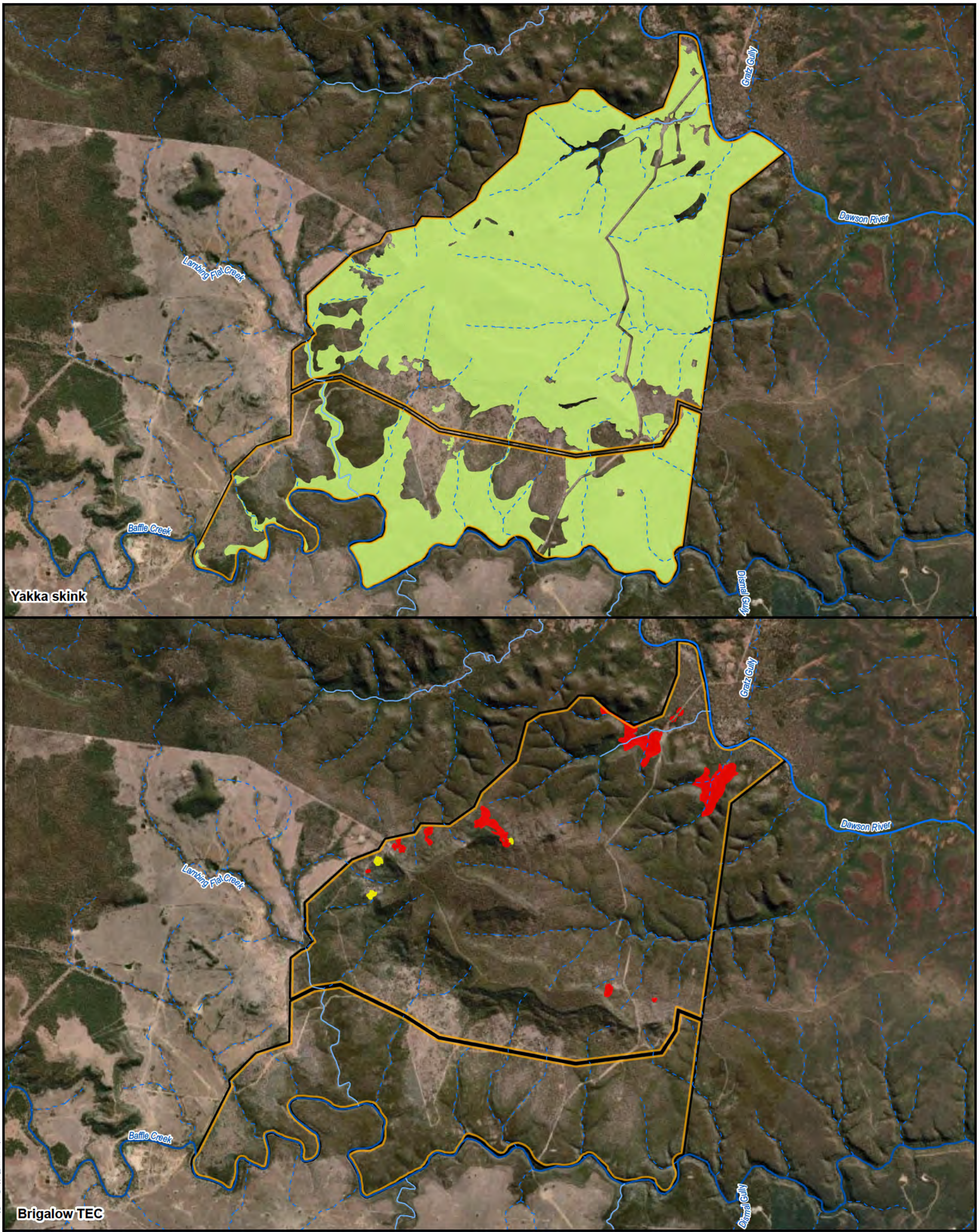


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**Figure 6**
**MNES habitat**

Kentucky - 1WT37
Offset area
MNES offset habitat

***Watercourse***
Major watercourse
Creekline
Minor drainage line
Drainage contour

***Brigalow TEC***
11.9.5
11.9.5 (regrowth)

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

N

0 1 2
Kilometres

Date: 19/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:55,000@A3

Location diagram

# 4. Environmental Outcomes to be Achieved

The outcome of this OAMP will partially acquit the Stage 7 offset obligations for the GFD Project 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 Kentucky will be measured against threat management and the interim performance targets and completion criteria, as detailed in and Table 10 below based on the proposed habitat quality score to be achieved for each MNES in the OAGs (Santos 2024).

**Table 10 – Interim performance targets and completion criteria for the Kentucky offset area**

| MNES | Baseline habitat quality score | Interim performance targets | | | Completion criteria |
|---|---|---|---|---|---|
| | | Year 5 | Year 10 | Year 15 | Year 20 |
| Collared Delma (*Delma torquata)* | 8 (8.1) | 8.3 | 8.6 | 8.8 | 9 |
| Yakka Skink (*Egernia rugosa*) | 7 (7.2) | 7.4 | 7.6 | 7.8 | 8 |
| Dunmall's Snake (*Furina dunmalli)* | 8 (8.2) | 8.4 | 8.6 | 8.8 | 9 |
| Red Goshawk (*Erythrotriorchis radiatus*) | 7 (7.2) | 7.4 | 7.6 | 7.8 | 8 |
| Squatter Pigeon (southern) (*Geophaps scripta scripta*) | 8 (8.1) | 8.3 | 8.6 | 8.8 | 9 |
| Northern Quoll (*Dasyurus hallucatus*) | 8 (7.7) | 8.0 | 8.3 | 8.7 | 9 |
| Koala (*Phascolarctos cinereus*) | 8 (8.0) | 8.2 | 8.5 | 8.8 | 9 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | 8 (7.7) | 8.0 | 8.3 | 8.7 | 9 |
| Large-eared Pied Bat (*Chalinolobus dwyeri*) | 8 (7.8) | 8.1 | 8.4 | 8.7 | 9 |

# 5. Adaptive 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:

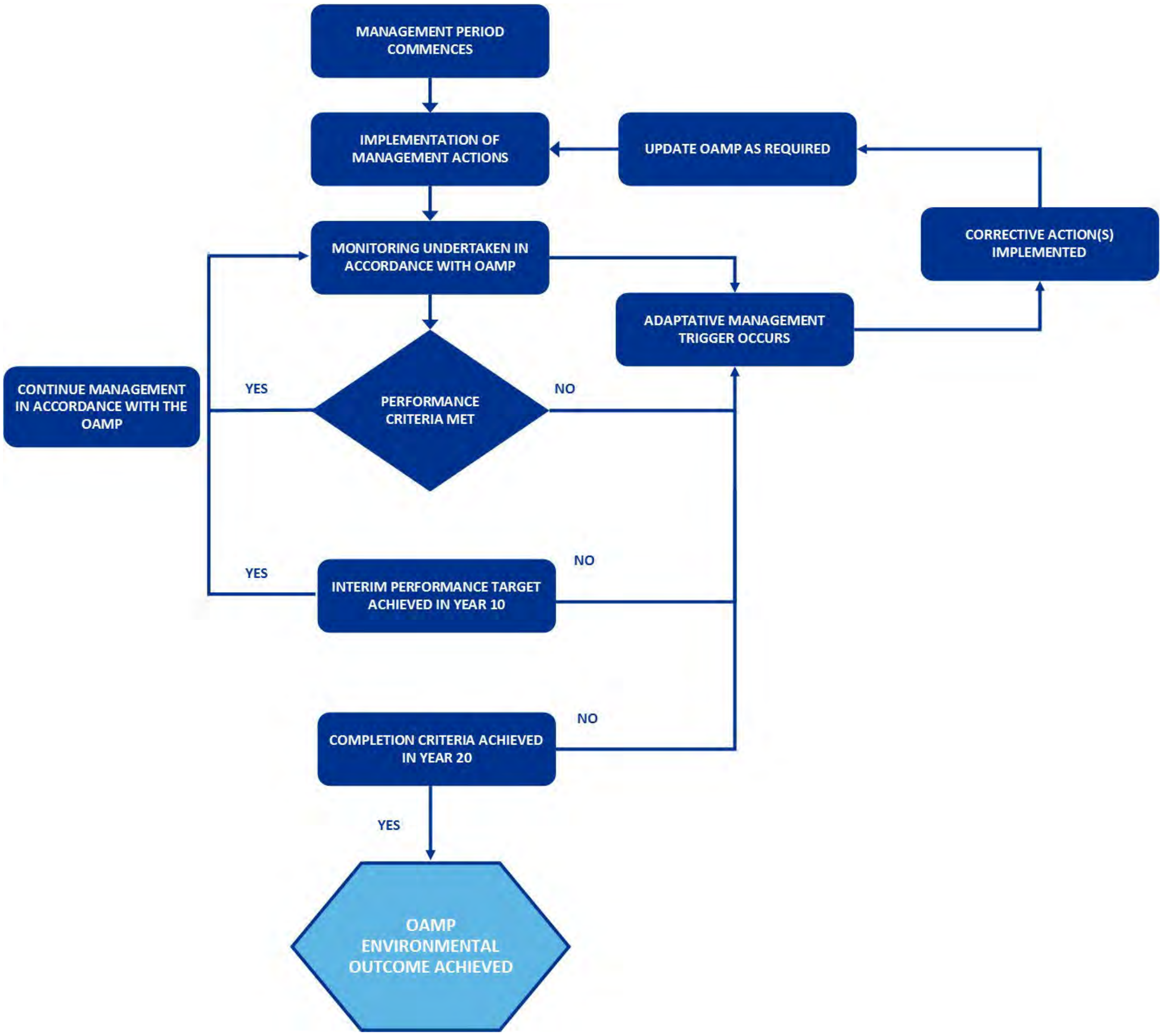
- **identified threats to offset values** – known and potential threats to the offset values have been identified as part of the risk assessment process
- **relevant offset values** – MNES or other offset matter for which the identified threat is relevant have been indicated
- **management objectives** – 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.<br>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. |
| 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.<br>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.<br>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.<br>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**

| MNES | Threats | Recovery/management actions |
|---|---|---|
| Collared Delma (*Delma torquata)* | Threats to the species have been determined based on conservation advice (DCCEEW 2024b):<br>• Alteration of ground cover as a consequence of unsuitable fire regime.<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Predation by feral predators (e.g., cats, foxes, wild dogs).<br>• Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter).<br>• Change in ground layer composition as a consequence of livestock grazing and feral horse browsing.<br>• 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 2024b):<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2).<br>• Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2).<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.4).<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• 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 2024c):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Destruction of potential shelter habitat associated with rabbit warren ripping.<br>• Predation by feral predators (e.g., cats, foxes, pigs).<br>• Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter).<br>• Destruction of potential shelter habitat associated with rabbit warren ripping.<br>• 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 2024c):<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.4).<br>• Weed management and monitoring (see Sections 6.2.5 and 7.3).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2).<br>• Biomass monitoring (see Section 7.2). |

| MNES | Threats | Recovery/management actions |
|---|---|---|
| | • 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 2024f):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Predation by feral predators (e.g., cats, foxes, pigs).<br>• Change in ground layer composition as a consequence of livestock grazing and feral horse browsing.<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.<br>• 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 2024f):<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.4).<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• Weed management and monitoring (see Sections 6.2.5 and 7.3).<br>• 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 2024e):<br>• 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.<br>• Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity.<br>• 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 2024e):<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• Fire management and fuel hazard monitoring (see Sections 6.2.4 and 7.2.2).<br>• Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2). |
| Squatter pigeon (*Geophaps scripta scripta*) | Threats to the species have been determined based on conservation advice and Threat Abatement Plans (DCCEEW 2024g):<br>• Change in ground layer composition as a consequence of grazing and ecosystem engineering actions by rabbits (e.g. burrowing, soil turnover). | The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2024g):<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.4).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2). |

| MNES | Threats | Recovery/management actions |
|---|---|---|
| | • Predation by feral predators (e.g., cats, foxes).<br>• Change in ground layer composition and trampling ground nests as a consequence of livestock grazing and feral horse browsing, especially in grassy, alluvial areas.<br>• Change in ground layer composition, including thickening of understorey structure, as a consequence of unsuitable fire regime. | • Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2).<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• 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 the Recovery Plan and Threat Abatement Plans (Hill and Ward 2010):<br>• Poisoning through ingestion of cane toads (*Rhinella marina*).<br>• Loss of ground cover as a consequence of unsuitable fire, resulting in risk of increased predation and/or reduced food.<br>• Loss of ground cover as a consequence of livestock grazing.<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.<br>• Predation by feral predators (e.g., cats, foxes, wild dogs).<br>• Poisoning through 1080 baiting. | The following recovery actions for the species will be implemented based on conservation advice and recovery objectives outlined in Hill and Ward (2010):<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.4).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2).<br>• Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2).<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• 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 2024i):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Mortality due to vehicle collision.<br>• Predation by feral predators, particularly wild or domesticated dogs. | The following recovery actions for the species will be implemented based on conservation advice (DCCEEW 2024i):<br>• Exclusion of cattle within offset areas (see Section 6.2.3).<br>• 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).<br>• Pest animal management and monitoring (see Section 6.2.6 and 7.4).<br>• Weed management and monitoring (see Sections 6.2.5 and 7.3). |

| MNES | Threats | Recovery/management actions |
| --- | --- | --- |
| | • 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.<br>• Evidence for the presence of disease within the population (i.e., *Chlamydia pecorum*). | • Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2).<br>• 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 2024h):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• 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.<br>• Impacts on understorey habitat as a consequence of livestock grazing, impacting habitat for understorey invertebrate prey.<br>• 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 2024h):<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.4).<br>• Weed management and monitoring (see Sections 6.2.5 and 7.3).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2).<br>• 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 2024e):<br>• Potential of reduced foraging opportunities and flying invertebrate productivity as a consequence of unsuitable fire regime.<br>• 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 2024e):<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.2.2).<br>• Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2).<br>• 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.<br>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:<br>• Offset area inspections (Section 7.1).<br>• Rapid monitoring events (Section 7.5.1).<br>• Habitat quality assessments to determine habitat quality scores (Section 7.5.2).<br>• Targeted fauna surveys (Section 7.5.4).<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• Modifying the strategic grazing regime to better support enhancement of offset values.<br>• 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.<br>• 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 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 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.<br>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**<br>• Investigate reasons why unapproved clearing occurred e.g. unauthorised access<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Addition fencing, signage and/or security for the offset area.<br>• Restoration of the impacted area. |

| Objective | Performance Target | Management Measure | Methodology | Location | Timing or Frequency | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|
| | | 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<br>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**<br>• 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.<br>• Investigate the reason for unapproved or unintentional clearing.<br>• Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks.<br>• 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.<br>• 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:<br>• livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover, and<br>• within the offset area a minimum of 2,500 kg/ha of biomass will be retained at the end of the dry season.<br>See Section 6.2.4 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. 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**<br>• Investigate the reason for the decrease in richness and average % cover of native perennial grasses.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events.<br>• Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime.<br>• 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**<br>• Investigate the reason for biomass being less than 2,500 kg/ha.<br>• 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.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Removal of stock or spelling grazing from the area of the offset in which less than 2,500 kg/ha of biomass was identified.<br>• Review adherence to livestock grazing restrictions in Section 6.2.4. |

| Objective | Performance Target | Management Measure | Methodology | Location | Timing or Frequency | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | • 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<br>• Foot hold traps<br>• 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.<br>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).<br>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**<br>• Investigate potential sources or reasons that may have attributed to an increase in the:<br>– Catling* index for wild dogs, feral cats and/or foxes.<br>– Relative abundance of feral pigs and horses.<br>• Review adherence to pest management control measures as outlined in Section 6.2.6.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency and intensity of pest animal control.<br>• 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.<br>• 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<br>• Trapping<br>• 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<br>• Poisoning<br>• 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 | 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. | |

| Objective | Performance Target | Management Measure | Methodology | Location | Timing or Frequency | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|
| | 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<br>• Shooting<br>• Poisoning | strategically and safely designed, informed by pest animal monitoring results. | | 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.<br>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.<br>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.<br>A new weed species is identified at one or more monitoring sites. | **Step 1: Investigate cause of trigger**<br>• Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds.<br>• Investigate potential sources or reasons for the occurrence of the new weed species.<br>• Review adherence to weed management control measures as outlined in Section 6.2.5.<br>• Review adherence to weed hygiene restrictions as outlined in Section 6.2.1.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Amending weed hygiene restrictions.<br>• Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to.<br>• Revising weed control methods in accordance with the Biosecurity Act 2014 (Qld).<br>• Increasing the frequency and intensity of weed control.<br>• 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.<br>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.<br>Fuel loads will be managed through implementation of the following:<br>• maintained fire breaks, | Fuel load management will be carried out where safe and practicable. Precise location will be determined in collaboration with the | 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.<br>Rapid monitoring events will be | 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 | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores.<br>• Review adherence to the fire management measures as outlined in Section 6.2.4.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s** |

| Objective | Performance Target | Management Measure | Methodology | Location | Timing or Frequency | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|
| | | | • controlled grazing regimes; and,<br>• fuel hazard reduction burns.<br>All management methods will be undertaken in compliance with Section 6.2.4. | landholder and a suitability qualified ecologist to assist the avoidance of sensitive habitats such as SEVT. | | undertaken to assess the general condition of vegetation in accordance with Section 7.5.1. | subsequent monitoring events. | The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency of biomass monitoring.<br>• Increasing the frequency of weed control measures.<br>• Amending the strategic grazing regime.<br>• Reviewing effectiveness of firebreaks, and establishment of additional fire breaks.<br>• 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.<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• 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.<br>• All persons entering the offset area will be required to ensure vehicles and equipment are weed free.<br>• All contractors entering the offset area must hold a current weed hygiene certificate or equivalent for all vehicles and equipment.<br>• 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.<br>• 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.<br>• 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:<br>– maintenance of access tracks and/or fire breaks<br>– fence construction and maintenance, and<br>– ensuring public safety or as directed by emergency management response personnel in the event of unplanned fire or other emergency or associated procedure.<br>• If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be appropriately planned, recorded and monitored.<br>• 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.<br>• The offset area will be demarcated as an exclusion zone in the Santos GIS.<br>• 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.<br>• The property will be suitably fenced to restrict access by unauthorised persons.<br>• 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.<br>• When entering and leaving the property, the land advisor must be advised.<br>• 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

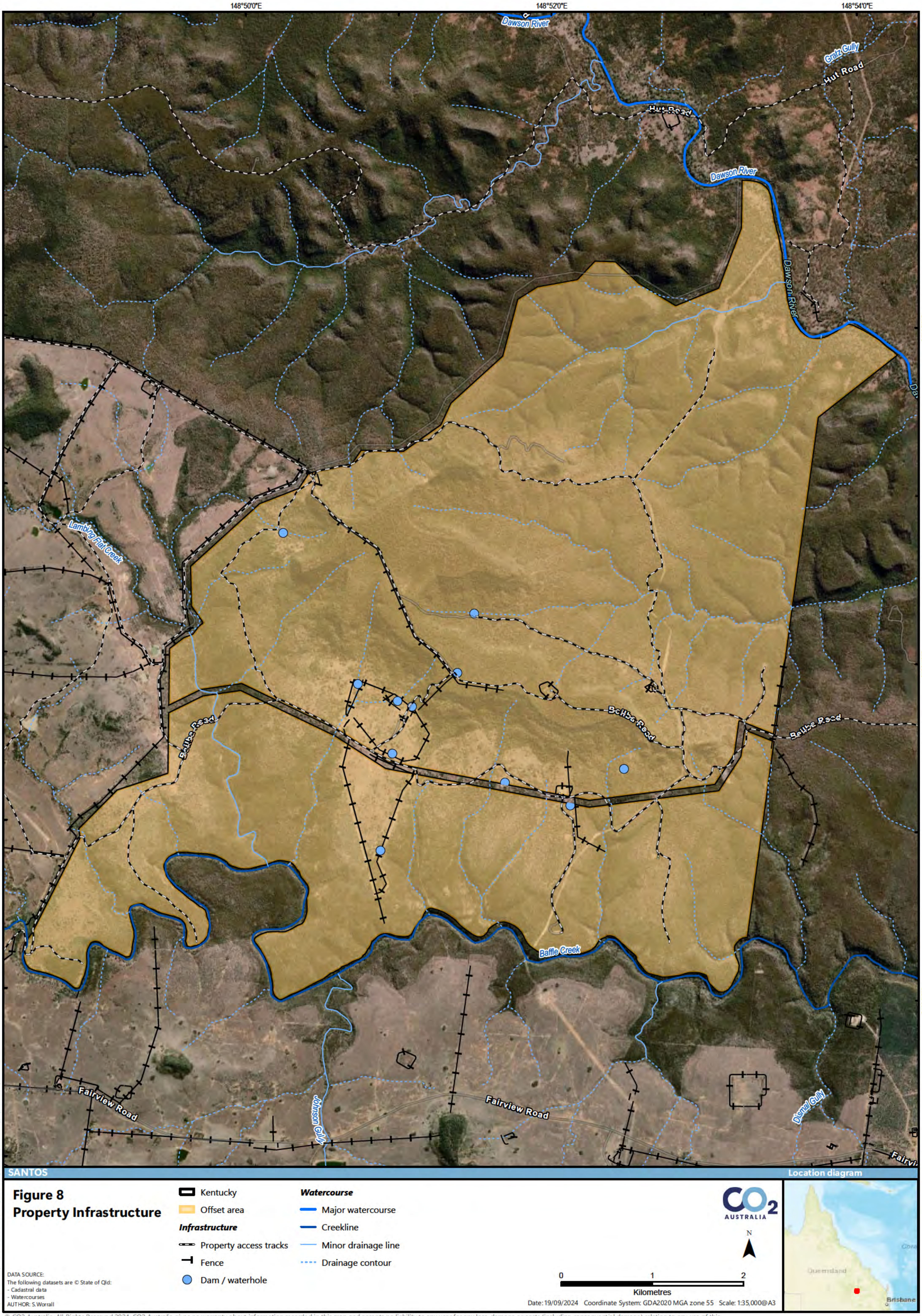
A planned and co-ordinated fire management strategy will be implemented to:

- 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).

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.




# Figure 8
# Property Infrastructure

Kentucky
Offset area

*Infrastructure*

Property access tracks
Fence
Dam / waterhole

*Watercourse*

Major watercourse
Creekline
Minor drainage line
Drainage contour

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 19/09/2024 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

### 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:

- 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 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 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 7.2.2) 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.<br>• 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.<br>• Burn less than 30% of the area in any year.<br>• 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.<br>• 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.<br>• In some situations it may be best not to burn as this RE is often critical habitat for fauna and flora species.<br>• If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants.<br>• 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.<br>• In some situations it may be best not to burn as this RE is often critical habitat for fauna and flora species.<br>• If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants.<br>• 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.<br>• 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.<br>• Restrict to less than 30% in any year.<br>• 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.<br>• Maintain fire management of surrounding country with numerous small fires throughout the year so that fires will be very limited in extent.<br>• Maintenance of fire breaks may be appropriate on flat country, but natural features will be useful as breaks in 'wild' country.<br>• Fuel reduction in the surrounding vegetation under low fire danger conditions and/or revegetation of cleared areas reduce the risk of damaging wildfires.<br>• 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.<br>• High intensity fires will cause damage to overstorey.<br>• 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.<br>• 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.<br>• 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.<br>• Maintain fire management of surrounding country with numerous small fires throughout the year so that fires will be very limited in extent.<br>• 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.<br>• 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.<br>• Burn less than 10-30% of the area in any year.<br>• 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.<br>• 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.<br>• 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.<br>• Burn less than 30% in any year. |
| 11.10.13 | - | Yes | • Protection from fire is necessary.<br>• Burn surrounding country only under conditions of good soil moisture and when plants are actively growing.<br>• 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<br>• Foot hold traps<br>• Shooting | (DAF 2024a) |
| Fox (*Vulpes vulpes*) | Category 3,4,5,6 | • Ground baiting<br>• Trapping<br>• Shooting | (DAF 2024b) |

| Species | Status under *Biosecurity Act 2014* | Example control method | Reference |
|---|---|---|---|
| Feral cat (*Felis catus*) | Category 3,4,6 | • Night shooting<br>• Poisoning<br>• Trapping | (DAF 2023a) |
| Pig (*Sus scrofa*) | Category 3,4,6 | • Trapping<br>• Shooting<br>• 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 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) 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.

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[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, rabbits 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**

<table>
<tr><th>Pest animal</th><th>Methodology to be implemented</th></tr>
<tr><td>Fox</td><td rowspan="3">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.<br>• fauna monitoring cameras will be placed in the offset area,<br>• cameras will be placed along tracks and left in place for a minimum of three consecutive nights, and<br>• 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).</td></tr>
<tr><td>Wild dog</td></tr>
<tr><td>Feral cat</td></tr>
<tr><td>Feral pig</td><td>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:<br>• nominate randomly stratified sites across the offset area in environments that are more regularly impacted (e.g. drainage lines, moist gullies, around swamps etc)<br>• calculate an abundance score for each transect as the percentage of 'present' feral pig signs, and<br>• calculate the mean abundance score (and variance) across all transects in the offset area.</td></tr>
</table>

| 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.<br>[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).

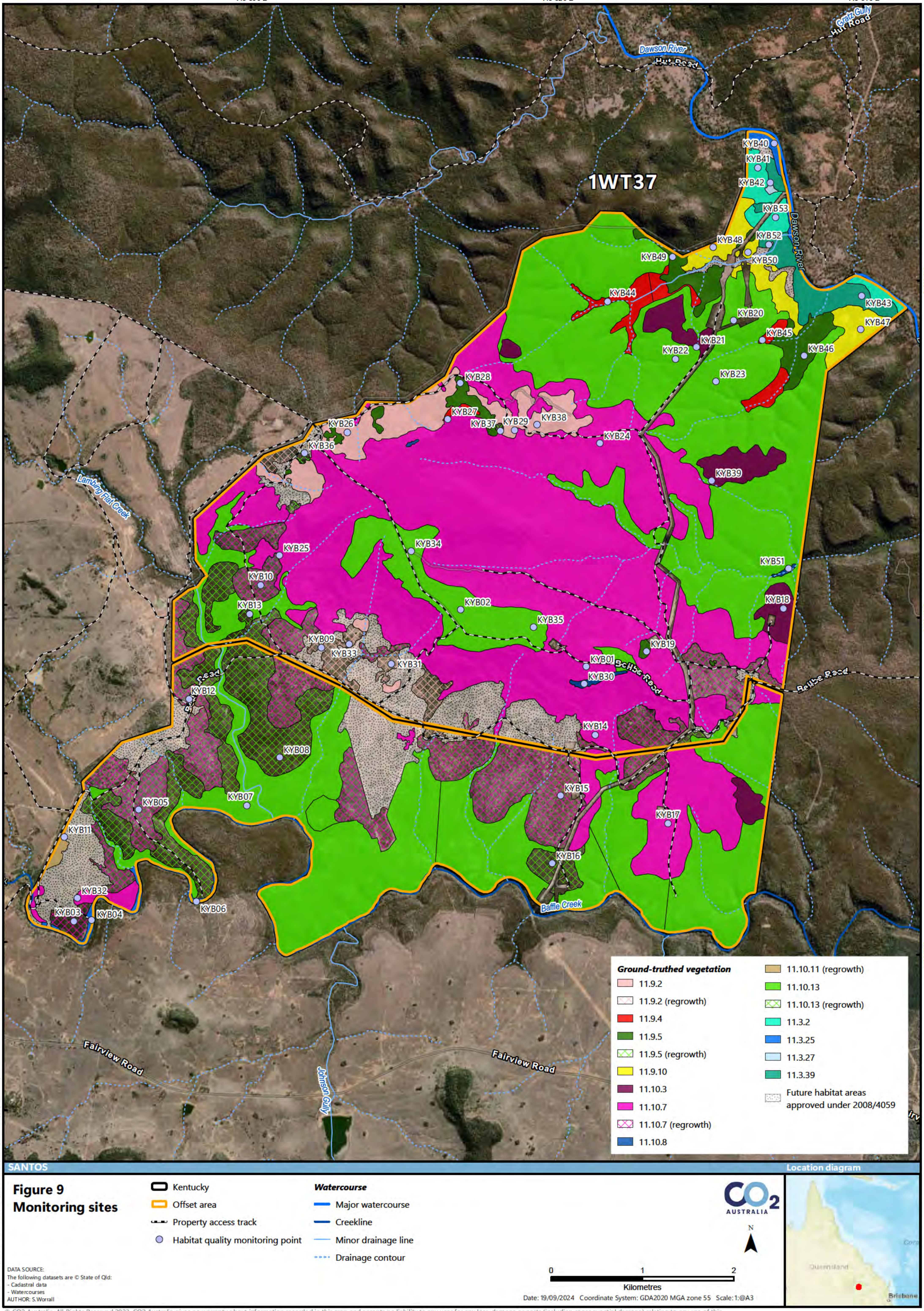



**Figure 9**
**Monitoring sites**

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

Date: 19/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:@A3

### 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). |
| 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<br>✓ Activity required<br>▪ 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)<br>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<br>✓ Activity required<br>▪ 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 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.<br>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. |

| Survey or monitoring objective | Monitoring activity | Management years<br>✓ Activity required<br>▪ 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 | | | | |
| 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 D). | 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).<br>Photo monitoring of selected sites to assess visual changes in weed species and infestations over time.<br>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.<br>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 7.4. | Assessment undertaken generally in accordance with published monitoring techniques developed by the NSW Government. |
| 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 | 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 | See Section 7.5.1 | |

| Survey or monitoring objective | Monitoring activity | Management years<br>✓ Activity required<br>▪ 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 | | | | |
| | | | | | | | | | | | | | | | | | | | | | | survey (Section 7.5.4) | monitoring obligations and traversing the site. | | |
| | 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 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 7.5.4. | Techniques for fauna surveys area based on recommended survey guidelines published by the Queensland and Commonwealth governments. |

# 10. References


Auld, B. (2009). *NSW Guidelines for Monitoring weed Control and recovery of native vegetation*. New South Wales Department of Primary Industries.

Boobook Ecological Consulting (2011). *Report on ground-truthing of environmental offset potential at Kentucky, Fairview gas field, Queensland (Version 2.0)*. Report to Santos, issued 24 Jan 2011.

Boobook Ecological Consulting (2015). *Biodiversity Offset Assessment Report. ''Kentucky' - Lot 1 on Plan WT37* (Rev. 0). Report to Santos, issued 30 March 2015.

Boobook Ecological Consulting (2020a). *Field Survey Report: Ecological Survey of ''Kentucky' (Lot 1 on Plan WT37)* (Rev. 0). Report to Santos, issued 2 July 2020.

Boobook Ecological Consulting (2020b). *Predictive Habitat Mapping Rules for Selected MNES Fauna Species within the Roma, Fairview and Arcadia Gas Fields, Santos GLNG Project Area* (Rev. 0). Report to Santos, issued 06 August 2020.

Brigalow Belt Reptiles Workshop (2010). *Proceedings from the workshop for the nine listed reptiles of the Brigalow Belt bioregions. 18-19 August*. Brisbane: Queensland Herbarium.

Bureau of Meteorology (BoM) (2024). *Climate data online.* Injune weather station (#43015). Available from: http://www.bom.gov.au/climate/data/.

Department of Agriculture and Fisheries (DAF) (2022). *Feral horse*. Queensland Government, Brisbane. Available from: https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/pests/invasive-animals/other/feral-horse.

Department of Agriculture and Fisheries (DAF) (2023a). *Fact Sheet: Feral cat (Felis catus).* Department of Agriculture and Fisheries. Brisbane, QLD. Available at: https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/61987/feral-cat.pdf.

Department of Agriculture and Fisheries (DAF) (2023b). *Fact Sheet: Feral pig (Sus scrofa).* Department of Agriculture and Fisheries. Brisbane, QLD. Available at: https://www.daf.qld.gov.au/__data/assets/pdf_file/0005/70925/feral-pig.pdf.

Department of Agriculture and Fisheries (DAF) (2024a). *Fact Sheet: Wild dog (Canis familiaris)*. Department of Agriculture and Fisheries. Brisbane, QLD. Available at: https://www.daf.qld.gov.au/__data/assets/pdf_file/0003/74487/wild-dog.pdf.

Department of Agriculture and Fisheries (DAF) (2024b). *Fact Sheet: European fox (Vulpes vulpes)*. Department of Agriculture and Fisheries. Brisbane, QLD. Available at: https://www.daf.qld.gov.au/__data/assets/pdf_file/0019/73810/IPA-Fox-PA13.pdf.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024a). *Chalinolobus dwyeri – Large-eared Pied Bat in Species Profile and Threats Database*. Species Profile and Threats Database. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=183.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024b). *Delma torquata — Collared Delma in Species Profile and Threats Database*. Species Profile and Threats Database. Available from: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1656.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024c). *Egernia rugosa — Yakka Skink in Species Profile and Threats Database*. Species Profile and Threats Database. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1420.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024d). Environmental management plan guidelines. Department of Climate Change, Energy, the Environment and Water. Canberra, March CC BY 4.0.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024e). *Erythrotriorchis radiatus – Red Goshawk in Species Profile and Threats Database*. Species Profile and Threats Database. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024f). *Furina dunmalli — Dunmall's Snake in Species Profile and Threats Database*. Species Profile and Threats Database. Available from: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59254.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024g). *Geophaps scripta scripta – Squatter Pigeon (southern) in Species Profile and Threats Database*. Species Profile and Threats Database. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024h). *Nyctophilus corbeni – South-eastern Long-eared Bat in Species Profile and Threats Database*. Species Profile and Threats Database. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83395.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024i). *Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) – Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory in Species Profile and Threats Database*. Species Profile and Threats Database. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104.

Department of Environment and Heritage Protection (DEHP) (2017). *Guide to Determining Terrestrial Habitat Quality (Version 1.2)*. Queensland Government, Brisbane, Queensland.

Ecofund (2010). *Kentucky Property Assessment. Project: GLNG Project*. Unpublished consultancy report prepared for Santos 14 April 2011.

Eyre, T.J., Maron, M., Mathieson, M.T. and Haseler, M. (2009). Impacts of grazing, selective logging and hyper-aggressors on diurnal bird fauna in intact forest landscapes of the Brigalow Belt, Queensland. Austral Ecology, 34: 705-716.

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual.* Version 2.2. Department of Environment and Resource Management, Brisbane.

Eyre, T. J., Ferguson, D. J., Hourigan, C. L., Smith, G. C., Mathieson, M. T., Kelly, A. L., Venz, M. F., Hogan, L. D. and Rowland, J. (2018). *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland*. Department of Environment and Science. Queensland Government, Brisbane.

Fensham, R. J. (1998). The grassy vegetation of the darling downs, south-eastern Queensland, Australia floristics and grazing effects. Biological Conservation, 84: 301-310.

Franks, A. J. (2002). The ecological consequences of Buffel Grass Cenchrus ciliaris establishment within remnant vegetation of Queensland. Pacific Conservation Biology, 8: 99 – 107.

Hines, F., Tolhurst, K. G., Wilson A. AG. and McCarthy, G. J. (2010), *Overall fuel hazard assessment guide*. Department of Sustainability and Environment, Victorian Government, Melbourne.

Hone, J. (1988). Feral pig rooting in a mountain forest and woodland Distribution, abundance and relationships with environmental variables. Australian Journal of Ecology, 13: 393–400.

Hone, J. (1995) Spatial and temporal aspects of vertebrate pest damage with emphasis on feral pigs. *Journal of Applied Ecology* **32:** 311-319.

Meek, P., Fleming, P., Ballard, G., Banks, P., Claridge, A., Sanderson, J., and Swann, D., (2014). *Camera Trapping: Wildlife Management and Research.* CSIRO Publishing, Collingwood, Victoria.

Mitchell, B & Balogh, S (2007a). *Monitoring techniques for vertebrate pests – feral pigs*. Orange, New South Wales.

Mitchell, B & Balogh, S (2007b). *Monitoring techniques for vertebrate pests – wild dogs*. Orange, New South Wales.

Mitchell, B & Balogh, S (2007c). *Monitoring techniques for vertebrate pests – foxes*. Orange, NSW.

National Research Council (2004). *Adaptive Management for Water Resources Project Planning*. The National Academies Press, Washington, DC.

Neldner V.J., Laidlaw M.J., McDonald K.R., Mathieson M.T., Melzer R.I., Seaton R., McDonald W.J. F., Hobson R., and Limpus C.J. (2017). *Scientific review of the impacts of land clearing on threatened species in Queensland*. Queensland Government, Brisbane.

New South Wales National Parks and Wildlife Service (NSW NPWS) (2003). *Threatened species of the New England Tablelands and north west slopes of New South Wales*. NSW Parks and Wildlife Service, Coffs Harbour.

Pennay, M, Ellis, M and Parnaby, H (2011). *The bat fauna of New South Wales and the Australian Capital Territory*. In: B. Law, P. Eby, D. Lunney and L. Lunsdem (eds.) The biology and conservation of Australian bats. Royal Zoological Society of New South Wales, Sydney.

Queensland Herbarium (2019). *BioCondition Benchmarks for Regional Ecosystem Condition Assessment.* Department of Environment and Science, Queensland Government: Brisbane.

Queensland Herbarium (2023). *Regional Ecosystem Description Database (REDD)*. Version 13 (May 2023). Department of the Environment and Science, Brisbane.

Santos (2014). *Methodology for Conducting Ecological Assessments. Rev 2.* Santos internal document, supplied 5/05/2014.

Santos (2024) *Santos GLNG Offset Plan and Acquittal Summary: EPBC Act Approval 2012/6615 (Stage 7).*

Sattler, P. and Williams, R. (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Queensland Government, Brisbane.

South East Queensland Fire and Biodiversity Consortium (2002). *Fire and Biodiversity Monitoring Manual: A Guide for Local Government Field Officers and Land Managers*. South East Queensland Fire and Biodiversity Consortium, Bundall, Queensland.

Turbill, C. & M. Ellis (2006). *Distribution and abundance of the south eastern form of the Greater Long-eared Bat Nyctophilus timoriensis*. Australian Mammalogy 28:1-7.

Turbill, C., L. Lumsden & G. Ford (2008). *South-eastern Long-eared Bat Nyctophilus sp.* In: Van Dyck, S. and R. Strahan, (eds.), eds. The Mammals of Australia. Reed New Holland, Sydney.

Williams, B. (2011). *Adaptive management of natural resources – framework and issues*. Journal of Environmental Management, 92: 1346 – 1353.

Williams, B. & Brown, E. (2016). *Technical challenges in the application of adaptive management*. Biological Conservation, 195: 255–263.

# 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) | 8.0 | 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 | 8.8 | 4 | 8.8 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 6.2 | 4 | 4 | 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 |
| 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 |

* 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 |

* 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 |

* Site type: Rem = remnant; Reg = regrowth.

Santos

# 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**

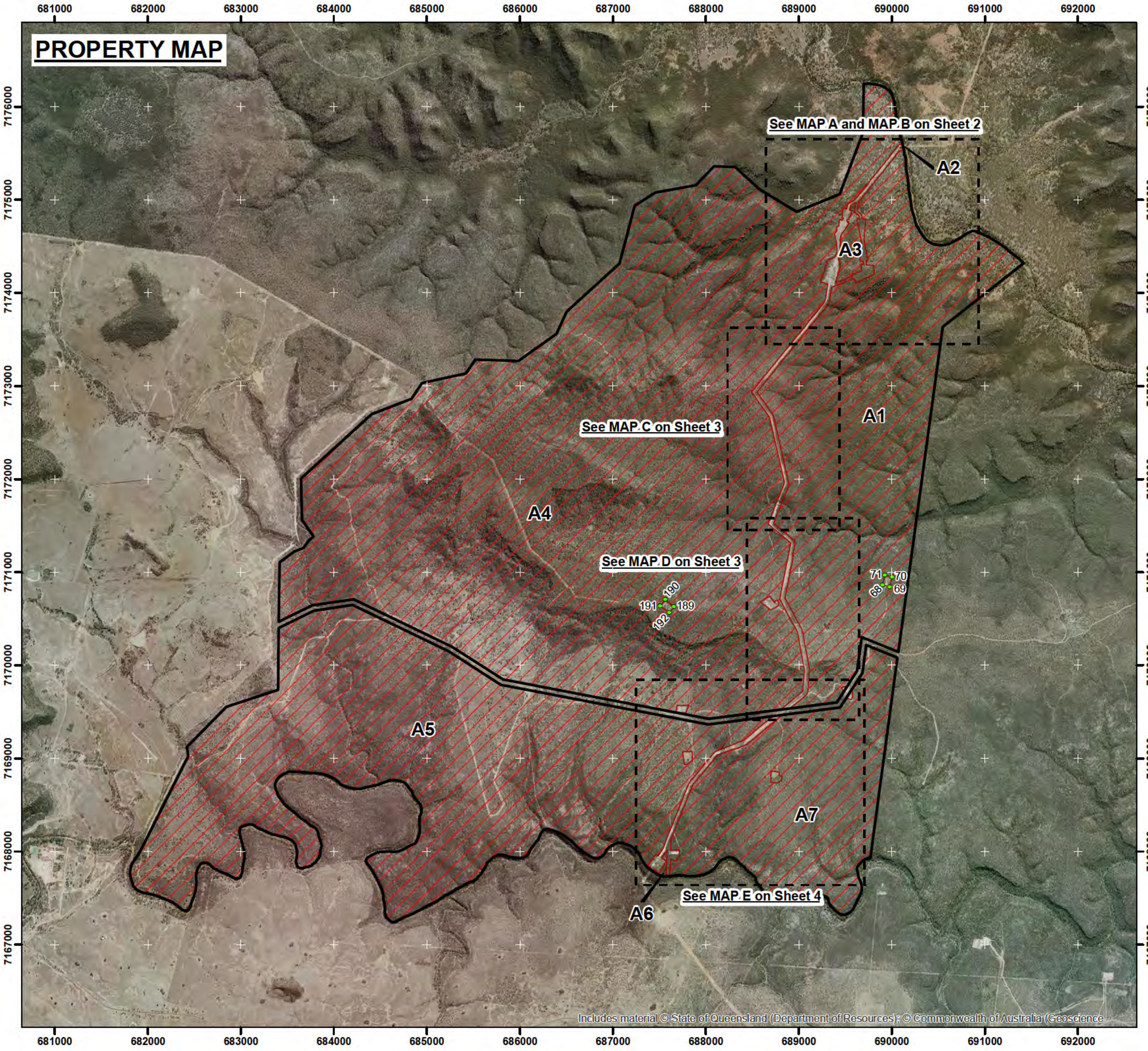
In accordance with s20B(1)(a) of the *Vegetation Management Act 1999*, property map of assessable vegetation PMAV 2022/002029 has been made for the declared area.

2.4. **Date of declaration:** 09 February 2023

## 3. Delegated officer's signature

B. Nicotra

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

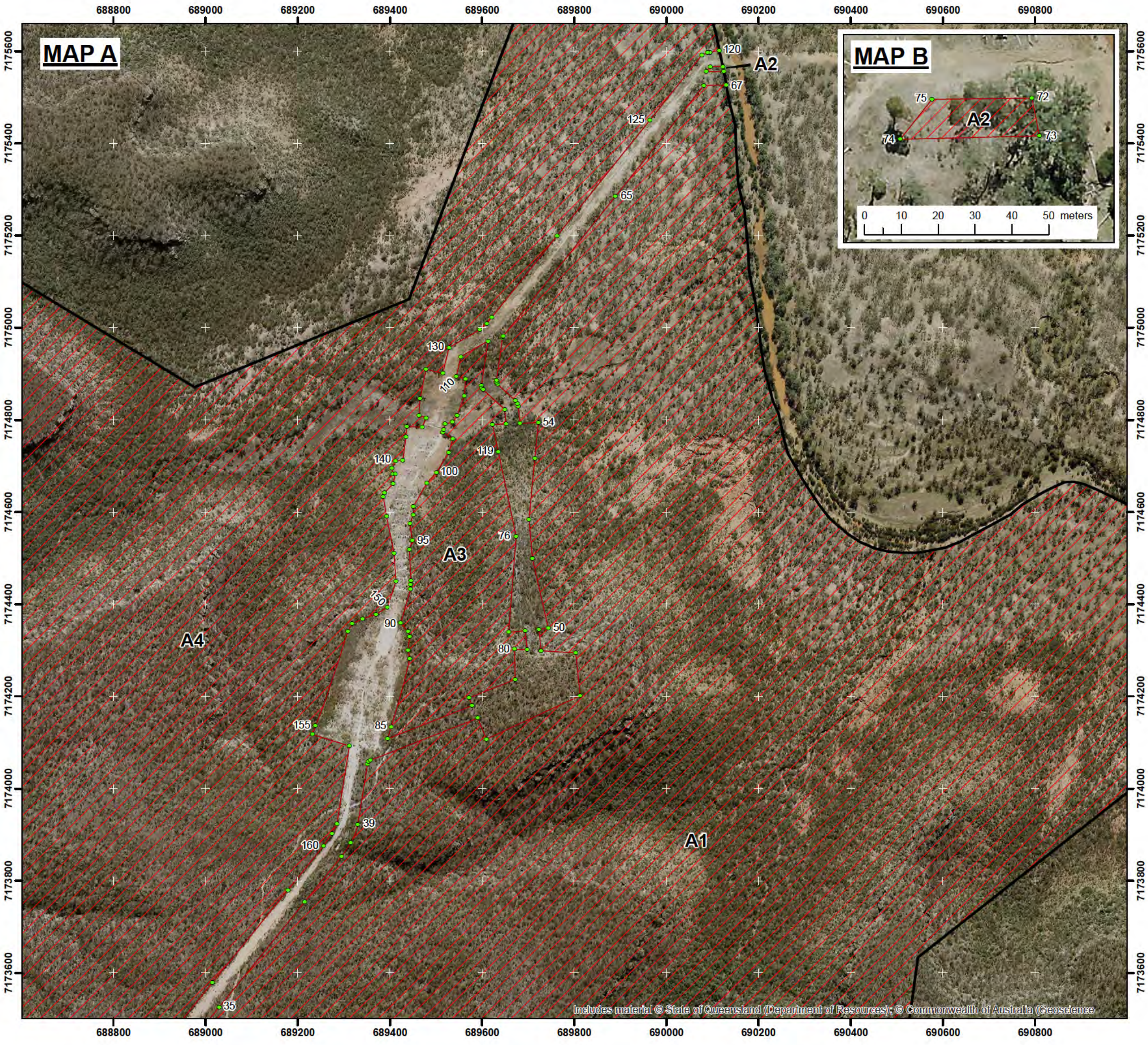
While every care is taken to ensure the accuracy of this product, the Department of Resource makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability, including without limitation, 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.



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

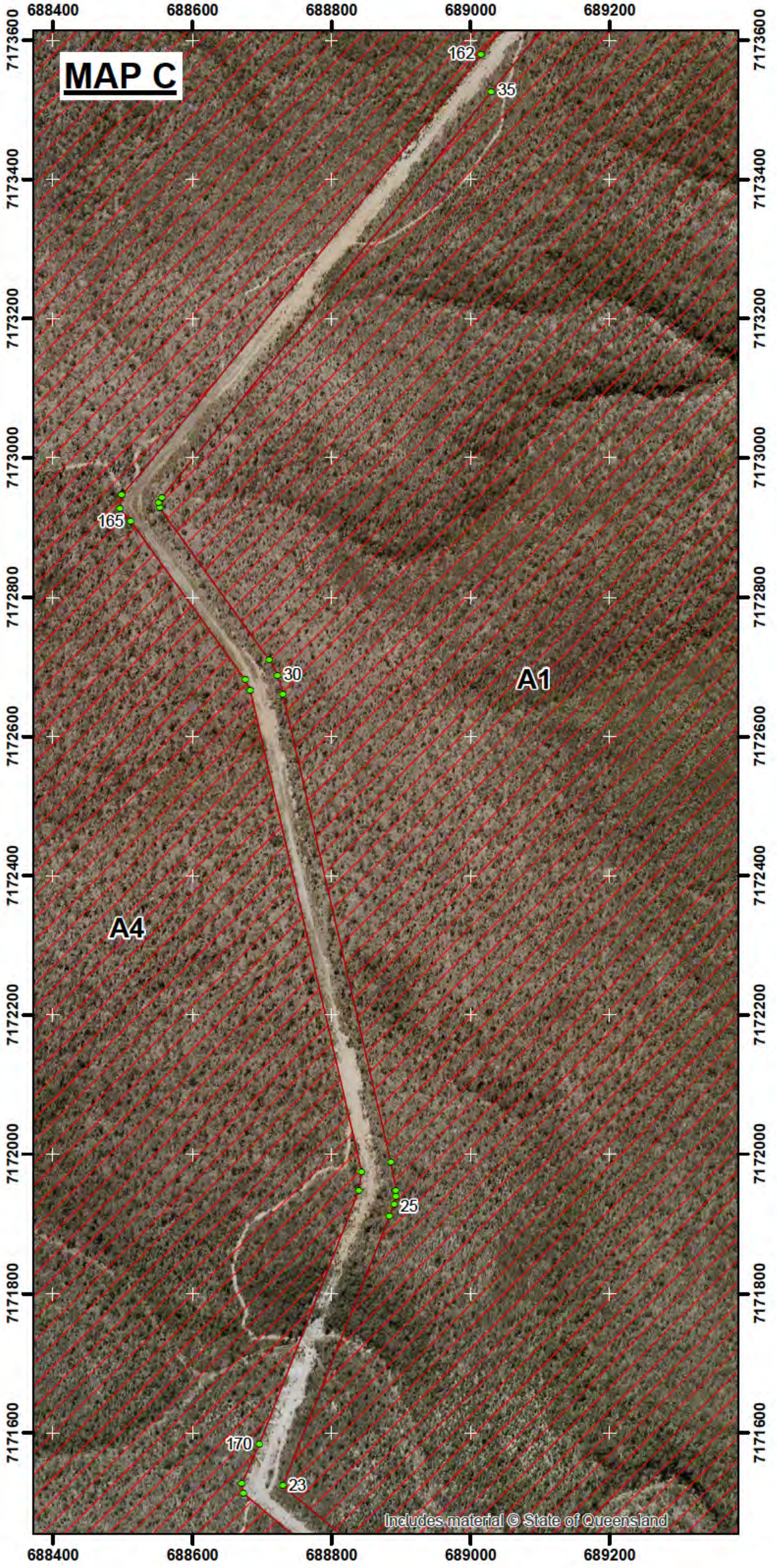
Digital Imagery: Surat_Basin_North_2020_20cm_SISP
Imagery Date: July to October 2020
Imagery Type: Digital Ortho- rectified Satellite

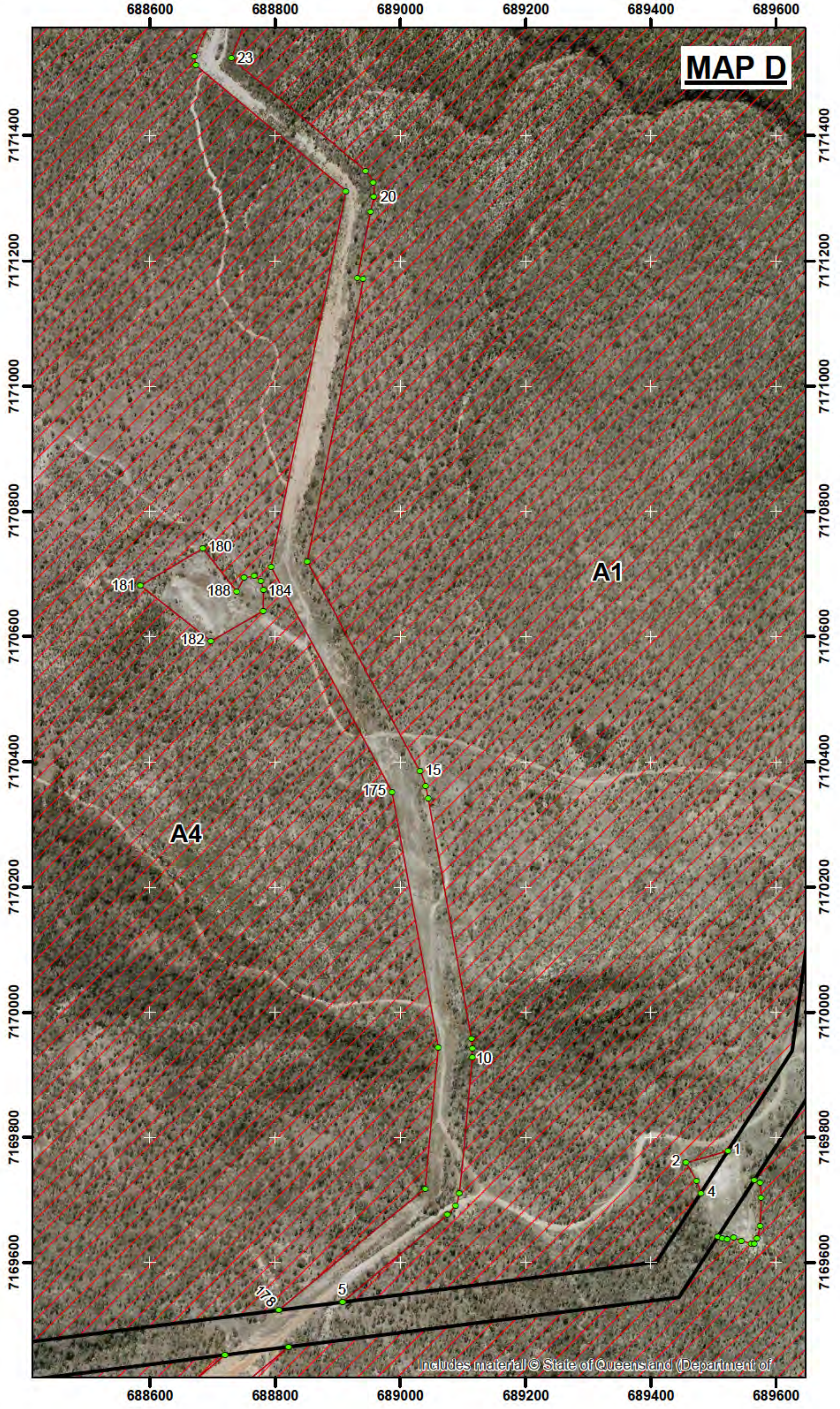


Map Prepared by: LMO

Map Preparation Date: 05/08/2022

This colour map must be reproduced in colour.




Sheet 3 of 4

# Declared Area Map

## 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

This colour map must be reproduced in colour.


# Declared Area Map

| Sheet | of |
| --- | --- |
| 4 | 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



Map Prepared by: LMO

Map Preparation Date: 05/08/2022

This colour map must be reproduced in colour.

# 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 |

| Part ID | Unique ID | Easting | Northing |
|---|---|---|---|
| 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 |
| A3 | 82 | 689571 | 7174197 |
| A3 | 83 | 689579 | 7174180 |
| A3 | 84 | 689395 | 7174108 |
| A3 | 85 | 689403 | 7174133 |
| A3 | 86 | 689443 | 7174281 |
| A3 | 87 | 689440 | 7174300 |
| A3 | 88 | 689443 | 7174330 |
| A3 | 89 | 689439 | 7174341 |
| A3 | 90 | 689423 | 7174359 |
| A3 | 91 | 689445 | 7174432 |
| A3 | 92 | 689445 | 7174442 |
| A3 | 93 | 689445 | 7174451 |
| A3 | 94 | 689442 | 7174519 |
| A3 | 95 | 689449 | 7174538 |
| A3 | 96 | 689443 | 7174575 |
| A3 | 97 | 689451 | 7174594 |
| A3 | 98 | 689451 | 7174612 |
| A3 | 99 | 689480 | 7174663 |
| A3 | 100 | 689501 | 7174686 |
| A3 | 101 | 689528 | 7174729 |
| A3 | 102 | 689536 | 7174759 |
| A3 | 103 | 689515 | 7174773 |
| A3 | 104 | 689516 | 7174779 |
| A3 | 105 | 689520 | 7174791 |
| A3 | 106 | 689536 | 7174795 |
| A3 | 107 | 689546 | 7174809 |
| A3 | 108 | 689561 | 7174852 |
| A3 | 109 | 689564 | 7174889 |
| A3 | 110 | 689544 | 7174894 |
| A3 | 111 | 689554 | 7174937 |
| A3 | 112 | 689613 | 7174971 |
| A3 | 113 | 689599 | 7174874 |
| A3 | 114 | 689599 | 7174869 |
| A3 | 115 | 689602 | 7174865 |
| A3 | 116 | 689649 | 7174822 |
| A3 | 117 | 689652 | 7174791 |
| A3 | 118 | 689623 | 7174790 |
| A3 | 119 | 689635 | 7174730 |
| A4 | 121 | 690094 | 7175597 |

| Part ID | Unique ID | Easting | Northing |
|---|---|---|---|
| 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

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 |
|---|---|---|---|
| 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 |
| 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**<br>+ No bodily damage or minimal harm or impairment (hours to days) | **Minor Harm**<br>+ Short term impairment (days to weeks) | **Moderate Harm**<br>+ Temporary disablement or medium term impairment (weeks to months) | **Severe Harm**<br>+ 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<br>+ Potential surface or groundwater impact. | + Moderate-scale impact to EV(s) of conservation significance<br>+ Localised surface or groundwater impact. | + Large-scale impact to EV(s) of conservation significance<br>+ Moderate-scale surface water impact;<br>+ Localised impact to groundwater with potential or known beneficial use. | + Extensive population or community scale impact to EV(s) of conservation significance<br>+ Extensive impact to other EV(s). | + Irreversible impact to EV(s). |
| **Community & Reputation** | + No actual or potential community criticism<br>+ Details remain within Santos sites and/or offices | + Minor level local community criticism (< week)<br>+ No reputation impact | + Local community criticism (> week) or one-day community protest<br>+ Local company reputation impacted | + State-level community criticism or protest over multiple days/locations<br>+ State-based company reputation impacted<br>+ Very short-term share price impact (< week) | + National community criticism or large scale protest<br>+ Company reputation and approvals impacted<br>+ Shareholder intervention or short-term share price impact (< month) | + Sustained national community criticism or widespread protest<br>+ Industry reputation and approvals impacted<br>+ 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.<br>+ No actual or potential impact to culture | + Will require several days local management time.<br>+ Minor impact to employee engagement and limited staff turnover | + Will require head office staff and take several weeks of site management time.<br>+ Moderate impact to employee engagement and staff turnover above industry average with some key roles | + Will require several weeks of senior management time<br>+ Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession | + Will require several months of senior management time<br>+ 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<br>+ 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<br>+ No regulatory or punitive action | + Minor breach of legislation, instruments or contract<br>+ Notification/report to; request for information by; and/or administrative/ warning notice from the regulator<br>+ LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator | + Limited number of minor breaches of legislation, instruments or contract<br>+ Statutory notice from the regulator<br>+ LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator | + Systemic minor breaches (or one moderate breach) of legislation, instruments or contract<br>+ Company charged with an offence with minor penalty/fine<br>+ LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases | + Systemic moderate breaches (OR single material breach) of legislation, instruments or contract<br>+ Company charged with an offence with moderate penalty/fine | + Material breaches of legislation, instruments or contract<br>+ Company or officers charged with an offence with material penalty/fine, or loss of tenure/operatorship |
| | I | II | III | IV | V | VI |

Likelihood

| | | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| ALMOST CERTAIN **(< 4 monthly)**<br>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)**<br>Occurs in most circumstances OR could occur *within weeks to months* | e | Low | Medium | High | High | Very High | Very High |
| OCCASIONAL **(1 - 3 yearly)**<br>Has occurred before in Santos OR could occur *within months to years* | d | Low | Low | Medium | High | High | Very High |
| POSSIBLE **(3 - 10 yearly)**<br>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)**<br>Has occurred elsewhere OR could occur *within decades* | b | Very Low | Very Low | Low | Low | Medium | High |
| REMOTE **(30 - 100 yearly)**<br>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.<br>Implementation of the adaptive management process outlined in Section 5.<br>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.<br>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.<br>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.<br>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:<br>• Offset area inspections (Section 7.1).<br>• Rapid monitoring events (Section 7.5.1).<br>• Habitat quality assessments to determine habitat quality scores (Section 7.5.2).<br>• Targeted fauna surveys (Section 7.5.4).<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• Modifying the strategic grazing regime to better support enhancement of offset values.<br>• 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.<br>• 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 | 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. | 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**<br>• Investigate reasons why unapproved clearing occurred e.g. unauthorised access<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s** |

| Management Objective | Risk | Event or Circumstance | Risk Rating: Likelihood | Risk Rating: Consequence | Risk Rating: Risk Level | Mitigation Measure | Timing, Frequency or Duration | Residual Risk Rating: Likelihood | Residual Risk Rating: Consequence | Residual Risk Rating: Risk Level | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | threatened species habitat. | | | | | Restrictions outlined in Table 14 will therefore be implemented for the lifetime of the project and OAMP. | | | | | | The appropriate corrective actions will be implemented and may include:<br>• Addition fencing, signage and/or security for the offset area.<br>• Restoration of the impacted area. |
| | | | | | | Comply with the restrictions outlined in Table 14.<br>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.<br>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**<br>• 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.<br>• Investigate the reason for unapproved or unintentional clearing.<br>• Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks.<br>• 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.<br>• 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 | 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.<br>Annual biomass monitoring to inform strategic grazing regimes.<br>Rapid monitoring events and habitat quality assessments will be | Biomass monitoring will be undertaken twice a year, at the end of the wet season and end of the dry season.<br>Offset area inspections and rapid monitoring events will be undertaken once and twice per year, respectively, for the duration of the management | 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 | **Step 1: Investigate cause of trigger**<br>• Investigate the reason for the decrease in richness and average % cover of native perennial grasses.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. |

| 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 | | | |
| offset values and does not result in the degradation of habitat. | | | | | | undertaken in accordance with Section 7.5.1 and 7.5.2 including an assessment of % cover of native perennial grasses. | period and will report on any major or noticeable changes to livestock grazing regimes. | | | | | monitoring events. | • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime.<br>• 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. | 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**<br>• Investigate potential sources or reasons that may have attributed to an increase in the:<br>• Catling* index for wild dogs, feral cats and/or foxes.<br>• Relative abundance of feral pigs and horses.<br>• Review adherence to pest management control measures as outlined in Section 6.2.6.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency and intensity of pest animal control.<br>• Revising methods of pest animal control in accordance with DAF guidelines, and coordinate with neighbouring landowners to ensure a consistent approach.<br>• Updating pest animal control methods in the OAMP and targeted pest animal control programs. |
| | Predation by feral cats. | | | | | | | | | | | | |
| | Predation by foxes. | | | | | | | | | | | | |
| 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 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. | An increase in the observed presence of feral horses across monitoring events. | |
| | 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 | An increase in mean feral pig abundance score from year 1 and subsequent monitoring events. | |

| 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 | | | |
| | | | | | | | | | | | impacted. See Section 7.4. | | |
| 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.<br><br>Adhere to weed hygiene restrictions in accordance with Table 14.<br><br>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). | 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 7.3 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.<br>A new weed species is identified at one or more monitoring sites. | **Step 1: Investigate cause of trigger**<br>• Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds.<br>• Investigate potential sources or reasons for the occurrence of the new weed species.<br>• Review adherence to weed management control measures as outlined in Section 6.2.5.<br>• Review adherence to weed hygiene restrictions as outlined in Section 6.2.1.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Amending weed hygiene restrictions.<br>• Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to.<br>• Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld).<br>• Increasing the frequency and intensity of weed control.<br>• 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 | 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.<br>Firebreaks will be established and maintained around the boundary of the offset area, with green firebreaks established | 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.<br>Rapid monitoring events will be | 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 | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores.<br>• Review adherence to the fire management measures as outlined in Section 6.2.4.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s** |

| 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 | | | |
| | | measures, or an unplanned fire. | | | | 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. | | | | | undertaken to assess the general condition of vegetation in accordance with Section 7.5.1. | and subsequent monitoring events. | The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency of biomass monitoring.<br>• Increasing the frequency of weed control measures.<br>• Amending the strategic grazing regime.<br>• Reviewing effectiveness of firebreaks, and establishment of additional fire breaks.<br>• 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. | 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.<br>Monitoring of the offset area will be undertaken in accordance with Section 7 including:<br>• Offset area inspections (Section 7.1).<br>• Offset value assessments (Section 7.5).<br>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:<br>• Offset area inspections (Section 7.1).<br>• Offset value assessments (Section 7.5).<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values. |

# 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

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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.

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# Contents

# 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

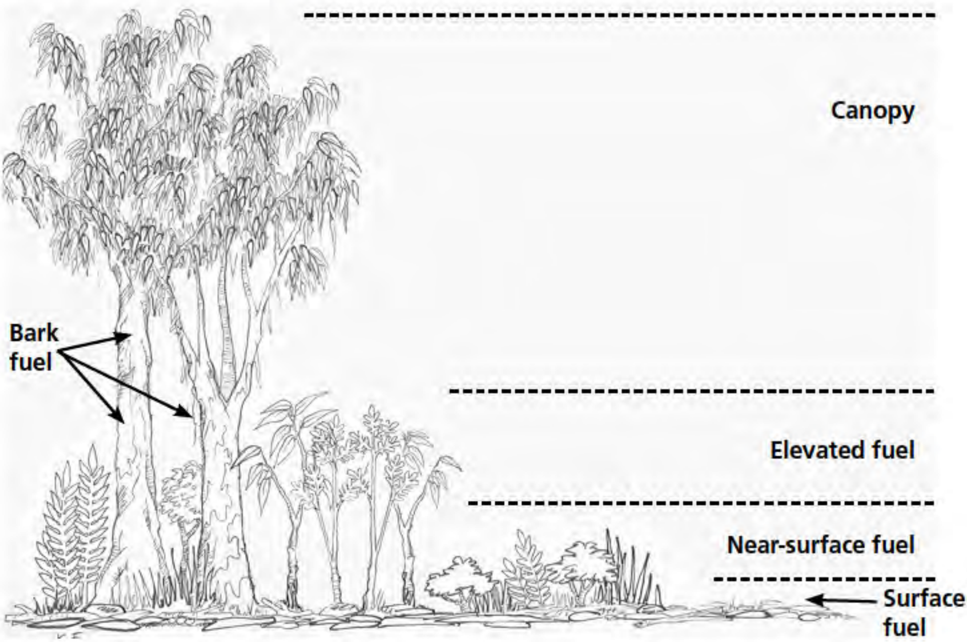
This guide is a tool for rapidly assessing fuel arrangement and its effect on the chances of controlling a bushfire. It may also be used for a range of other fire management purposes, as shown in the table below. Users of this guide should understand the underlying assumptions and limitations before 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.<br><br>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.<br>• 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.<br>• Generally most of the plant material is closer to the top of this fuel layer.<br>• Sometimes contains suspended leaves, bark or twigs.<br>• Fuels that have a clear gap between them and the surface fuels.<br>• Can be highly variable in ground coverage.<br>• 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.<br>• Fuel has a mixture of vertical and horizontal orientation.<br>• 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.<br>• Sometimes contains suspended leaves, bark or twigs.<br>• Coverage may range from continuous to having gaps many times the size of the fuel patch.<br>• Low-intensity fire (flame height of less than 0.5m) will consume most or all of this fuel.<br>• 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.<br>• 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.<br>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.<br>• 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.<br>• Bark fibres resemble the fine fibres that are twisted together to form natural string.<br>• Old bark is retained on the trunk of the tree for decades, forming a relatively spongy fibrous mass with deep vertical fissures.<br>• Outer bark may weather to a greyish colour, while underlying bark retains its original colour.<br>• Bark may form large strands when peeled off.<br>• 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).<br>• Fires will readily climb the tree and branches. |
| **How bark is attached** | • Young or new bark is held tightly to the trunk.<br>• As bark ages it becomes less tightly held.<br>• 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:<br>• Very fine lightweight fibres that will be carried for less than 100m.<br>• Small lightweight wads (about the size of a thumb) that will be carried for less than 300m.<br>• 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.<br>• Small wads of bark that will burn out within 2–3 minutes.<br>• Very large wads of bark that will burn for up to 10 minutes. |
| **Hazard accumulation** | • Bark hazard can reach Extreme.<br>• Bark hazard increases over time as the thickness and looseness of the old bark increases.<br>• 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.<br>Requires substantial effort to break off bark by hand. | Very little combustible bark.<br>Entire trunk almost completely black or charred. | Moderate | Spotting generally does not hinder fire control.<br>Fires will not climb these trees. |
| Bark is mostly tightly held with a few pieces loosely attached. | Limited amount of combustible bark.<br>50–90% of trunk charred.<br>Most of the bark is charred, especially on the lower part of the trunk. | High | Infrequent spotting.<br>Fires will climb some of these trees. |
| Many pieces of bark loosely held.<br>Deep fissures present in bark. | Large amounts of combustible bark.<br>10–50% of trunk charred.<br>Upper parts of the tree may not be charred at all. | Very High | Substantial spotting.<br>Fires will climb most of these trees. |
| Outer bark on trees is weakly attached.<br>Light hand pressure will break off large wads of bark.<br>Deep fissures present in bark. | Huge amounts of combustible bark.<br><10% of trunk charred.<br>Minimal evidence of charring. | Extreme | Quantity of spotting generated makes fire control very difficult or impossible.<br>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

| | | Example |
|---|---|---|
| **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.<br>• Bark is shed in the form of long strips or ribbons of bark.<br>• Long strips of bark curl tightly inwards to form a candle-like shape (see image lower right).<br>• Bark strips 50cm or more in length fall off and often drape around the trunk and over branches and surrounding shrubs.<br>• Strips of bark are usually less than 2mm thick.<br>• 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).<br>• 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.<br>• 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.<br>• Bark hazard tends to increase over the long term as ribbons accumulate on the tree.<br>• A low intensity fire (flame height of less than 0.5m) may not reduce the hazard in this bark type. | |

**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<br>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.<br>Trunk and branches of trees almost entirely smooth. | Moderate | Spotting generally does not hinder fire control.<br>Fires will not climb these trees. |
| Long ribbons of bark present on upper trunk (>4m above ground) and in head of trees.<br>Lower trunk mainly smooth. | High | Infrequent spotting.<br>Fires will climb some of these trees. |
| Long ribbons of bark in the head and upper trunk with:<br>• ribbons hanging down to ground level or,<br>• flammable bark covers trunk. | Very High | Substantial spotting.<br>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.<br>• Bark becomes rough, compacted and furrowed with age<br>• Bark feels very abrasive when rubbed by hand.<br>• Bark pieces tend to be more than 2mm thick when they break off.<br>• There may be little or no evidence of charring on the bark following planned burns. | **Example**  |
| **Hazard accumulation** | • Bark hazard never exceeds Moderate. | |

### 3.5.2 Coarsely fibrous barks

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

### 3.5.3 Papery barks

| | | |
|---|---|---|
| **Physical description** | • Shrubs and trees growing from 2m to 30m tall, often with flaky shedding bark.<br>• Old bark is retained on the trunk and branches and builds up into a thick spongy mass.<br>• Bark layers tend to split allowing sheets of bark to become loose and eventually peel off.<br>• Evidence of charring on the bark may last for up to 10 years. | **Example**<br> |
| **Hazard accumulation** | • Bark hazard never exceeds High.<br>• Bark hazard increases over the long term as the thickness and looseness of the old bark increases. | |

### 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.<br>• Bark shed is often seasonal and often annual.<br>• Species where the old bark tends to peel into large slabs (<50cm in length) or small flakes when shed.<br>• Most of the bark falls off the tree soon after it is shed.<br>• Some small amounts of bark may be retained on the stem or branches for several months before falling off, leading to a mottled effect.<br>• The mottled effect leads to discontinuous bark fuel up the tree. | **Example**<br> |
| **Hazard accumulation** | • Bark hazard never exceeds Moderate.<br>• Bark hazard tends to be seasonal. | |

### 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.

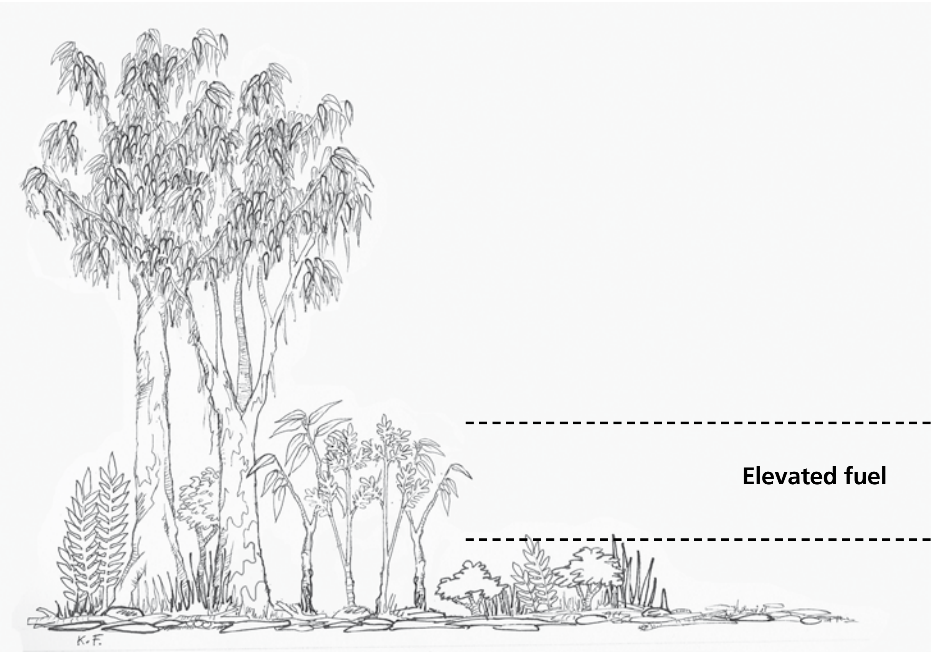
## Table 3.6 Examples of other bark types

| | | | |
|---|---|---|---|
| **Low** | No trees present.<br><br>or<br><br>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.

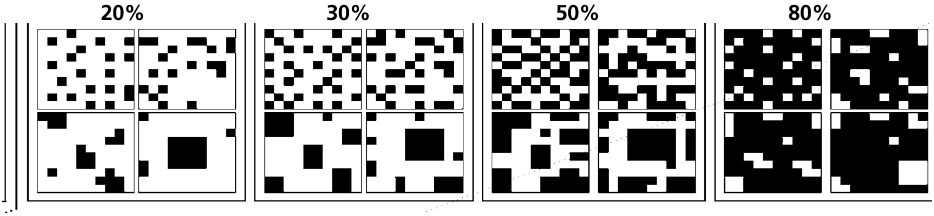
### Table 4.1 Assessing elevated fine fuel hazard

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.

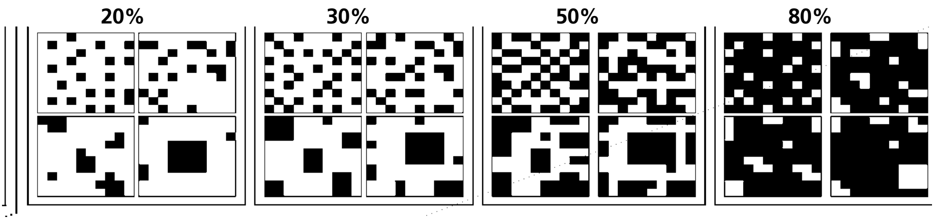
### Table 5.1 Assessing near-surface fine fuel hazard

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.

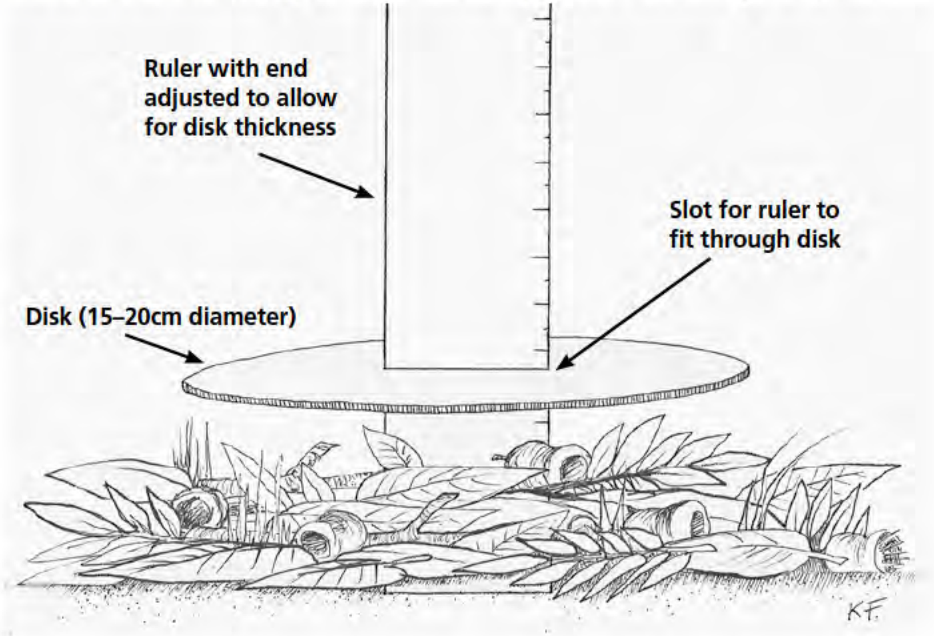

## 6.2 Assessment

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

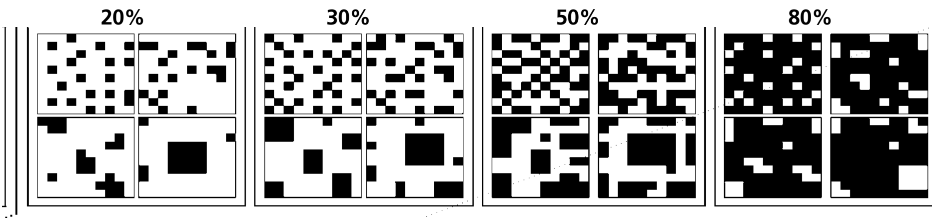
To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

| Key attributes | | | Fuel hazard rating | Effect on fire behaviour (at FFDI 25)[6] |
|---|---|---|---|---|
| **Horizontal connectivity** | **Surface litter cover** | **Litter-bed depth** | | |
| Litter poorly interconnected.<br>Large areas of bare soil or rock. More soil than litter.<br>Soil surface readily visible through litter bed. | <60% | Very thin litter layer<br><10mm | Low | Surface fires will not spread. |
| Litter well connected.<br>Some areas of bare soil or rock.<br>Soil surface occasionally visible through litter bed. | 60–80% | Thin litter layer<br>10–25mm | Moderate | Litter connected well enough to allow fire spread to overcome bare patches. |
| Litter well connected.<br>Little bare soil. | 80–90% | Established litter with layers of leaves ranging from freshly fallen to decomposing.<br>20–30mm | High | Surface fires spread easily with a continuous fire edge. |
| Litter completely connected. | >90% | Thick litter layer<br>25–45mm | Very High | Surface fires spread easily.<br>Increasing flame depth and residence time. |
| Litter completely connected. | >95% | Very thick layer of litter<br>>35mm | Extreme | Surface fires spread easily.<br>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** ①
2. Select the row that corresponds to the **Elevated Fine Fuel Hazard** ②
3. Select the column that corresponds to the assessed level of **Combined Surface and Near-surface Fine Fuel Hazard** ③
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**

| ① Bark Hazard | ② Elevated Fine Fuel Hazard | ③ 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 | green | green | green | green | yellow |
| 3–7 | 6–11 | green | green | green | green | yellow |
| 8–20 | 12–24 | green | green | green | yellow | orange |
| 20–49 | 25–49 | green | green | yellow | orange | orange |
| 50–74 | 50–74 | green | yellow | orange | orange | red |
| 75–99 | 75–99 | green | orange | red | red | red |
| 100+ | 100+ | green | orange | red | red | red |

- (green) Chance of extended first attack success is greater than 95% (almost always succeeds)
- (yellow) Chance of extended first attack success is between 95% and 50% (succeeds most of the time)
- (orange) Chance of extended first attack success is between 49% and 10% (fails most of the time)
- (red) 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.

# References


Department of Environment and Heritage 2006, *Overall fuel hazard guide for South Australia*, 1st edn, Government of South Australia.

Gould, JS McCaw, WL Cheney, NP Ellis, PF Knight, IK & Sullivan, AL 2007a, *Project VESTA. Fire in dry eucalypt forest: fuel structure, fuel dynamics and fire behaviour*, Ensis-CSIRO, Canberra, ACT & Department of Environment and Conservation, Perth, WA.

Gould, JS McCaw, WL Cheney, NP Ellis, PF & Matthews, S 2007b, *Field guide – fuel assessment and fire behaviour prediction in dry eucalypt forest*, Ensis-CSIRO, Canberra, ACT & Department of Environment and Conservation, Perth, WA.

McArthur, AG 1973, *Forest fire danger meter Mk5*, Forestry and Timber Bureau, Forest Research Institute, Commonwealth of Australia.

McCarthy, GJ & Tolhurst, KG 1998a, *Effectiveness of firefighting operations by the Department of Natural Resources and Environment from 1991/2–1994/5*, research report no. 45, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ Tolhurst, KG & Chatto, K 1998b, *Overall fuel hazard guide*, research report no. 47, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ Tolhurst, KG & Chatto, K 1998c, *Overall fuel hazard guide*, 2nd edn, research report no. 47, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ Tolhurst, KG & Chatto, K 1999, *Overall fuel hazard guide*, 3rd edn, research report no. 47, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ & Tolhurst, KG 2001, *Effectiveness of broadscale fuel reduction burning in assisting with wildfire control in parks and forest in Victoria*, research report no. 51, Fire Management, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ 2004, *Surface fine fuel hazard rating – forest fuels in East Gippsland*, research report no. 44, Fire Management Branch, Department of Sustainability and Environment, Victoria.

Plucinski M, Gould, J, McCarthy, G, Hollis J (2007) The effectiveness and efficiency of aerial fire fighting in Australia, Part 1, Bushfire CRC Technical Report Number A0701

Sneeuwjagt, RJ & Peet, GB 1998, *Forest fire behaviour tables for Western Australia*, Department of Conservation and Land Management, Perth, Western Australia.

Wilson, AAG 1992a, *Assessing the fire hazard on public lands in Victoria: fire management needs, and practical research objectives*, research report no. 31, Fire Management Branch, Department of Conservation and Environment, Victoria.

Wilson, AAG 1992b, *Eucalypt bark hazard guide*, research report no. 32, Fire Management Branch, Department of Conservation and Environment, Victoria.

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)<br><br>1 to 2 small 4WD tankers (400l)<br><br>6 firefighters | 5 x 4WD heavy tankers (4000l) each with 5 firefighters | Small dozer (D4) or tractor with scrub roller<br><br>1 to 2 small 4WD tankers (400l)<br><br>6 firefighters | Small dozer (D4)<br><br>1 to 2 small 4WD tankers (400l)<br><br>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 |

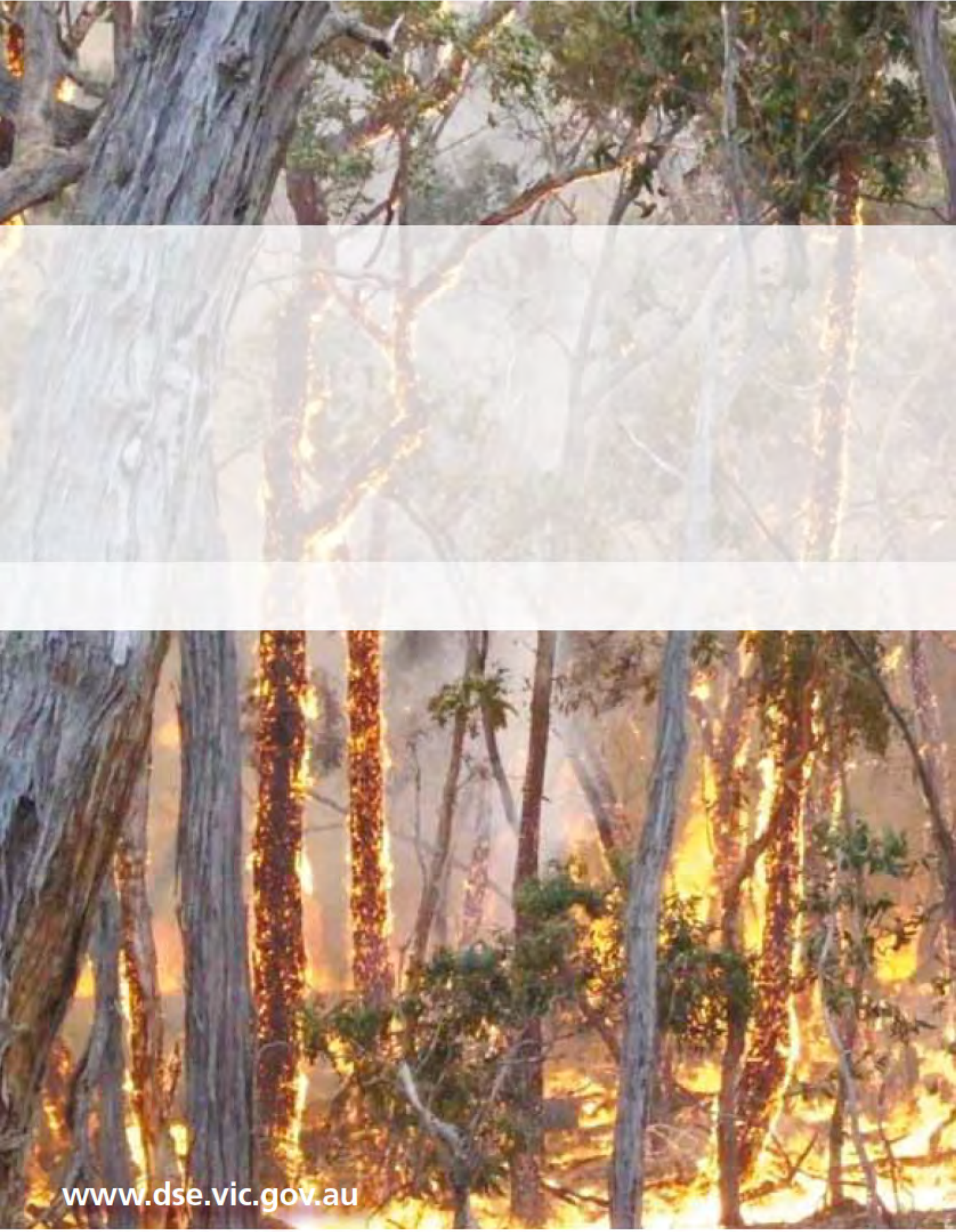
| **Surface fuel layer (Assess over a 10m radius)** | | | |
|---|---|---|---|
| Surface Litter % Cover: | % | % | % |
| Average Litter Depth (mm): | mm | mm | mm |
| Surface Fuel Hazard | L M H VH E | L M H VH E | L M H VH E |

| **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.


www.dse.vic.gov.au

# Appendix E

## 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 E1.
- 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 E1.
- 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 E1.
  - 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 E1. based on whether the site is located within (wholly or partly); shares a common boundary with; or is not within a corridor.

### Table E1 – 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 E2 to Table E10 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 E2 – 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.<br>• Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing).<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• Site is actively managed for conservation purposes to enhance habitat for threatened species.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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<br>• 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:<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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:<br>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<br>• 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<br>• Population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

**Table E3 – 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.<br>• Overgrazing by livestock resulting in irreversible damage to microhabitat including coarse woody debris, dense leaf litter and decorticated bark.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing).<br>• Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing).<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• Site is actively managed for conservation purposes to enhance habitat for threatened species.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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). |

| 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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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<br>• 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<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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<br>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<br>• 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<br>• The population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

**Table E4 – 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.<br>• Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing).<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• Site is actively managed for conservation purposes to enhance habitat for threatened species.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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<br>• 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<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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<br>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<br>• 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<br>• Population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

**Table E5 – 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.<br>• 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.<br>• Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.<br>• 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.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) to allow for recruitment of native species.<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• 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.<br>• 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.<br>• 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.<br>• 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<br>• 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<br>• 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<br>• 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.<br>• 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<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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<br>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<br>• 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<br>• Population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

**Table E6 – 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.<br>• Overgrazing by livestock resulting in irreversible damage to ground layer vegetation that provides foraging and breeding habitat.<br>• No management of invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*).<br>• 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.<br>• 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.<br>• Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.<br>• 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.<br>• Strategic pulse livestock grazing resulting in irreversible damage to ground layer vegetation that provide foraging and breeding habitat.<br>• Some management of invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*).<br>• 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.<br>• 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.<br>• Successful active weed management implemented on site.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for need for fuel load control through strategic grazing, if required).<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• 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%.<br>• 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%.<br>• 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%.<br>• 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%.<br>• 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 grass species richness OR perennial grass cover 40-90%.<br>• 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%.<br>• 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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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<br>• 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<br>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<br>• The site is likely to support only a small or relictual population of the species. |
| | Likely to be critical to species' survival<br>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<br>• The site is likely to support only a small or relictual population of the species. |
| | Known to be critical to species' survival:<br>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<br>• 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<br>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<br>• 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 E7 – 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.<br>• Many cane toads present on site equally a high possibility of death by ingestion and poisoning.<br>• Overgrazing by livestock resulting in irreversible damage to microhabitat such as fallen timber.<br>• 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.<br>• 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.<br>• 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.<br>• Strategic livestock grazing resulting in some damage to critical microhabitat including fallen timber and logs.<br>• Cane toads present on site but not in high numbers.<br>• Foxes and/or feral cats observed on site or on adjacent properties, however pest animal management occurs on site. 1080 not used on site.<br>• 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.<br>• No cane toads present on site or very little activity recorded.<br>• Site is actively managed for conservation purposes to enhance habitat for threatened species.<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing).<br>• 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.<br>• Highly disturbed ground layer.<br>• 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.<br>• 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.<br>• Limited evidence of disturbance to ground layer likely to support known food sources, e.g. reptiles and small mammals.<br>• 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.<br>• 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.<br>• 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.<br>• 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). |

| 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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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<br>• 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:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Likely to be critical to species' survival:<br>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<br>• The site is likely to support only a small or relictual population of the species. |
| | Known to be critical to species' survival:<br>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<br>• 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:<br>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<br>• 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 E8 – 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.<br>• Public vehicle access to site, with evidence of death through vehicle strike observed or likely.<br>• 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.<br>• 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.<br>• 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.<br>• Restricted access to the site by authorised personnel only, with no public vehicle access.<br>• Habitat is not protected through legislation and is unlikely to be cleared for development or agricultural land use.<br>• 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.<br>• 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.<br>• 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.<br>• Active fire management, with controlled burns on site and low risk of uncontrolled fire on site, including from adjacent properties.<br>• 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<br>• >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<br>• >70% of the RE benchmark for attributes number of large trees, OR<br>• 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<br>• >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 |

| Component | Level | Score | Description |
|---|---|---|---|
| | | | for Koalas, AND<br>• >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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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<br>• 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:<br>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<br>• The site is likely to support only a small or relictual population of the species. |
| | Likely to be critical to species' survival:<br>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<br>• The site is likely to support only a small or relictual population of the species. |
| | Known to be critical to species' survival:<br>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<br>• 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:<br>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<br>• 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 E9 – 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.<br>• 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.<br>• Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.<br>• 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.<br>• Strategic livestock grazing resulting in some degradation to the understory habitat that supports invertebrate prey however, patches of habitat occur on site.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) allowing for recruitment of native saplings.<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• 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<br>• <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<br>• >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<br>• >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.<br>• 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.<br>• 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.<br>• 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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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. |

| Component | Level | Score | Description |
|---|---|---|---|
| | 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<br>• 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:<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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:<br>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<br>• 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<br>• The population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

**Table E10 – 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.<br>• 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.<br>• Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.<br>• 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.<br>• Strategic livestock grazing resulting in some degradation to the understory habitat that supports invertebrate prey however, patches of habitat occur on site.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) allowing for recruitment of native saplings.<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• 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.<br>• 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.<br>• 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.<br>• 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<br>• 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<br>• 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<br>• 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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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, OR<br>• 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:<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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:<br>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<br>• 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<br>• Population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

# Appendix B

## Mt Tabor Offset Area Management Plan

# SANTOS GLNG MT TABOR OFFSET AREA MANAGEMENT PLAN

EPBC Act Approval 2012/6615 (Stage 7)

Document Number: 0007-650-EMP-0020

4 October 2024

Santos

| Date | Rev | Reason For Issue | Reviewed | Endorsed | Approved |
|---|---|---|---|---|---|
| 4 October 2024 | 0 | For DCCEEW submission | AB | AB | DG |

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# Tables



# Figures

# Abbreviations

| Acronym | Description |
|---|---|
| BPA | Biodiversity Planning Assessment |
| CSG | Coal Seam Gas |
| DAF | Department of Agriculture and Fisheries (Qld) |
| DCCEEW | Department of Climate Change, Energy, the Environment and Water (formerly the Department of Agriculture, Water and the Environment) |
| DESI | Department of Environment, Science and Innovation (formerly the Department of Environment and Science [DES]) |
| EMP | Environmental Management Plan Guidelines (DCCEEW 2024a) |
| 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) |
| GTP | Gas Transmission Pipeline |
| 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) was originally prepared to address the offset requirements for matters of national environmental significance (MNES) associated with Stage 4 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 has since been updated (this document) 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 predicted offset requirements for MNES associated with Stage 7 of the GFD Project in accordance with the staged approach to offsets under EPBC 2012/6615.

A consolidated offset area of 7,473 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 7 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 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 approval of the OAMP in November 2022. As presented in Table ES1, offset area 1 will partially acquit offset requirements for Stage 7 of the GFD Project.
- Offset area 2 (2,349 ha) – this additional offset area has been included, as part of this 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 will partially acquit offset requirements for Stage 7 of the GFD Project and include surplus to be drawn down on by Santos to acquit future offset requirements (Table ES1). Following approval of this OAMP, Santos will include 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 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 7 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 begun 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 04 January 2023 and will remain in place for the life of EPBC 2012/6615. Within 12 months following approval of this OAMP, Santos will apply to have Offset area 2 protected via a Voluntary Declaration under Section 19E and 19F of the VM Act.

**Table ES1 – Summary of Stage 7 MNES offset requirements acquitted on the Mt Tabor offset area**

| MNES | Status under EPBC Act[1] | Impact area (ha) | Offset area 1 | | Offset area 2 | | | Total % acquittal[2] |
|---|---|---|---|---|---|---|---|---|
| | | | Offset area to be secured under OAG (ha) | % acquittal | Offset area to be secured under OAG (ha) | % acquittal | Surplus area available (ha) | |
| **Listed threatened ecological communities (TEC)** | | | | | | | | |
| Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community | E | 0.6 | - | - | - | - | - | - |
| **Listed threatened species** | | | | | | | | |
| Collared delma (*Delma torquata*) | V | 313.2 | 951.6 | 33.36% | 2,036.5 | 71.40% | 312.3 | 104.76% |
| Yakka skink (*Egernia rugosa*) | V | 313.8 | 66.0 | 2.69% | 1,908.2 | 77.91% | - | 80.60% |
| Dunmall's snake (*Furina dunmalli*) | V | 308.1 | 951.6 | 33.91% | 2,036.5 | 72.58% | 312.3 | 106.49% |
| Red goshawk (*Erythrotriorchis radiatus*) | E | 311.8 | 951.6 | 27.48% | 2,036.5 | 58.81% | 312.3 | 86.29% |
| Squatter pigeon (southern) (*Geophaps scripta scripta*) | V | 316.8 | 951.6 | 32.98% | 2,036.5 | 70.58% | 312.3 | 103.56% |
| Northern quoll (*Dasyurus hallucatus*) | E | 317.4 | 951.6 | 31.49% | 2,036.5 | 67.38% | 312.3 | 98.87% |
| Koala (*Phascolarctos cinereus*) | E | 269.6 | 951.6 | 31.78% | 2,036.5 | 68.01% | 312.3 | 99.79% |
| South-eastern long-eared bat (*Nyctophilus corbeni*) | V | 311.8 | 951.6 | 33.51% | 2,036.5 | 71.73% | 312.3 | 105.24% |
| Large-eared pied bat (*Chalinolobus dwyeri*) | E | 257.8 | 951.6 | 38.77% | 2,036.5 | 82.97% | 312.3 | 121.74% |

[1] Status: E = Endangered and V = Vulnerable (DCCEEW 2024a-k).
[2] Remaining offset requirement satisfied on other properties for MNES with less than 100% acquittal.

### Table ES2 – Interim performance targets and completion criteria

| 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 |
| 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 | 8 | No decrease in overall habitat quality score from previous monitoring event | 9 | 9 |
| Northern quoll (*Dasyurus hallucatus)* | 7 | 8 | No decrease in overall habitat quality score from previous monitoring event | 8 | 9 |
| Koala (*Phascolarctos cinereus*) | 8 | 8 | No decrease in overall habitat quality score from previous monitoring event | 9 | 9 |
| 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 |

# 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 *Environment Protection and Biodiversity Conservation Act 1999* (Cth; EPBC Act).

This offset area management plan (OAMP) was originally prepared to address the offset requirements for MNES associated with Stage 4 of the Gas Fields Development Project (GFD Project) in accordance with EPBC 2012/6615 (Mt Tabor Offset Area Management Plan, [0007-650-EMP-0020]; [Santos 2022]). 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.

This version of the OAMP has been updated from the November 2022 approved version, in accordance with the staged approach to offsets under EPBC 2012/6615, to address predicted impacts (Table 1) and offset acquittal associated with Stage 7 of the GFD Project as presented in the Santos *GLNG Offset Plan and Acquittal Summary: EPBC Act Approval 2012/6615 (Stage 7; 0007-650-EMP-0041)*.

**Table 1 – Impacted MNES required to be offset for Stage 7 of the GFD Project under EPBC 2012/6615**

| MNES | Status* | Stage 7 impacts (ha) |
|---|---|---|
| **Threatened ecological communities** | | |
| Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC) | E | 0.6 |
| **Threatened fauna species** | | |
| Collared delma (*Delma torquata)* | V | 313.2 |
| Yakka skink (*Egernia rugosa*) | V | 313.8 |
| Dunmall's snake (*Furina dunmalli)* | V | 308.1 |
| Red goshawk (*Erythrotriorchis radiatus*) | V | 311.8 |
| Squatter pigeon (southern) (*Geophaps scripta scripta*) | V | 316.8 |
| Northern quoll (*Dasyurus hallucatus)* | E | 317.4 |
| Koala (*Phascolarctos cinereus*) | E | 269.6 |
| South-eastern long-eared bat (*Nyctophilus corbeni*) | V | 311.8 |
| Large-eared pied bat (*Chalinolobus dwyeri)* | V | 257.8 |

*Status: E = Endangered and V = Vulnerable (DCCEEW 2024a-k).

A consolidated offset area of 7,473 ha will be secured, managed and monitored on the Mt Tabor property (Lot 6 CHS25) in accordance with this OAMP (Figure 1). While the consolidated offset will be managed as one area, for the purposes of reconciling offset requirements for Stage 7 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 – a 5,329.4 ha 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 approval of the OAMP in November 2022 and as part of management the offset area has been fenced to restrict access by livestock (see Sections 2.2 and 6.2.3). This resulted in a variation to the extent of offset area 1 managed as part of this OAMP, now totalling 5,124.5 ha. Section 2.6 provides a summary of the updated available habitat for MNES within offset area 1. As presented in Section 2.7, offset area 1 will partially acquit offset requirements for Stage 7 of the GFD Project.
- Offset area 2 – this version of the OAMP includes an additional 2,348.8 ha area, located adjacent to offset area 1, increasing the extent of protected MNES habitat on the Mt Tabor property. Offset area 2 has been secured to acquit offset requirements for Stage 7 of the GFD Project and provide surplus areas to be drawn down on by Santos to acquit future offset requirements (Section 2.7). Following approval of this OAMP, Santos will include 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 in conjunction with the Environmental Management Plan (EMP) Guidelines (DCCEEW 2024c) 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 (2024c).

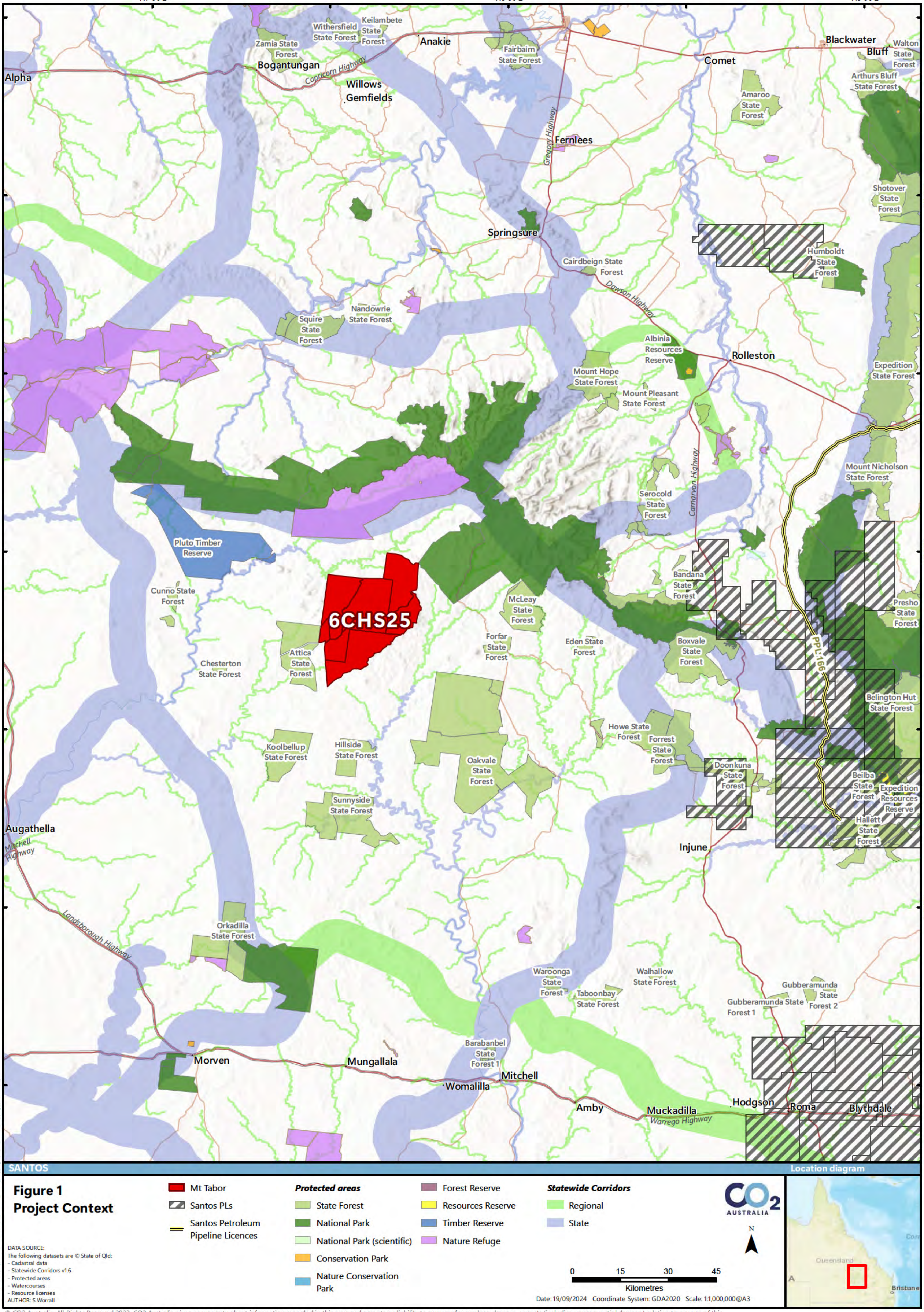
**Table 2 – Approval conditions satisfied through this OAMP**

| 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 7 of the GFD Project will be delivered in accordance with the principles of the EPBC Act *Environmental Offsets Policy*.<br>An offset area will be secured on Mt Tabor to partially acquit offset obligations for the MNES matters outlined in Table 1.<br>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 7 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 7 of the GFD Project. This OAMP for the Mt Tabor offset area is submitted as part of the offset plan to address Stage 7 of the GFD Project.<br>A reconciliation of impacts for Stage 1-6 of the GFD Project is included in the Stage 7 offset plan. |
| 14 | The Offset Management Plan must include:<br>a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities;<br>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;<br>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;<br>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;<br>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;<br>f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary);<br>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;<br>h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria;<br>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;<br>j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and<br>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 7 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.<br>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.<br>b. Details of the relevant field assessments within the Stage 7 GFD Project development areas are provided in the offset plan, submitted in conjunction with this OAMP.<br>c. Summaries of the significant residual impacts associated with Stage 7 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 7 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 7 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.<br>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.<br>e. Details on the connectivity and the landscape context are provided in Section 2.3.<br>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.<br>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.<br>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.<br>i. Risks to the successful implementation of this plan are included in the risk assessment presented in Appendix C.<br>j. The timing for implementation of the management and monitoring program are provided in Section 9.<br>k. Details on how the Mt Tabor offset area for Stage 7 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 7 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 7 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:<br>a. include the information required for the Offset Management Plan at condition 14 for the next project phase;<br>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 and may be subtracted from the obligations required for the 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<br>c. demonstrate how the offset builds on offsets already secured for previous project stages 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 |



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26°0'0"S
Alpha
Zamia State Forest
Withersfield State Forest
Keilambete State Forest
Anakie
Bogantungan
Capricorn Highway
Willows
Gemfields
Fairbairn State Forest
Blackwater
Walton State Forest
Bluff
Comet
Arthurs Bluff State Forest
Amaroo State Forest
Gregory Highway
Fernlees
Shotover State Forest
Springsure
Humboldt State Forest
Cairdbeign State Forest
Dawson Highway
Squire State Forest
Nandowrie State Forest
Albinia Resources Reserve
Rolleston
Mount Hope State Forest
Mount Pleasant State Forest
Expedition State Forest
Mount Nicholson State Forest
Carnarvon Highway
Serocold State Forest
Pluto Timber Reserve
Bandana State Forest
Presho State Forest
Cunno State Forest
McLeay State Forest
6CHS25
Attica State Forest
Forfar State Forest
Eden State Forest
Boxvale State Forest
PPL 166
Chesterton State Forest
Belington Hut State Forest
Howe State Forest
Forrest State Forest
Koolbellup State Forest
Hillside State Forest
Oakvale State Forest
Doonkuna State Forest
Beilba State Forest
Expedition Resources Reserve
Sunnyside State Forest
Hallett State Forest
Augathella
Mitchell Highway
Injune
Landsborough Highway
Orkadilla State Forest
Waroonga State Forest
Walhallow State Forest
Taboonbay State Forest
Gubberamunda State Forest 1
Gubberamunda State Forest 2
Barabanbel State Forest 1
Morven
Mungallala
Mitchell
Womalilla
Amby
Muckadilla
Warrego Highway
Hodgson
Roma
Blythdale
SANTOS
Location diagram
Figure 1
Project Context
Mt Tabor
Santos PLs
Santos Petroleum Pipeline Licences
Protected areas
State Forest
National Park
National Park (scientific)
Conservation Park
Nature Conservation Park
Forest Reserve
Resources Reserve
Timber Reserve
Nature Refuge
Statewide Corridors
Regional
State
CO2 AUSTRALIA
N
0 15 30 45
Kilometres
Date: 19/09/2024 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
- Watercourses
- Resource licenses
AUTHOR: S.Worrall
Queensland
Brisbane

# 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 |

## 2.2. Offset area boundary realignment

Following approval of the original *Santos GLNG Mt Tabor Offset Area Management Plan* (Santos 2022) 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 has decreased from 5,329.4 ha to 5,124.5 ha.

This version of the OAMP has been updated to present the actual on-ground extent of MNES habitat within offset area 1.

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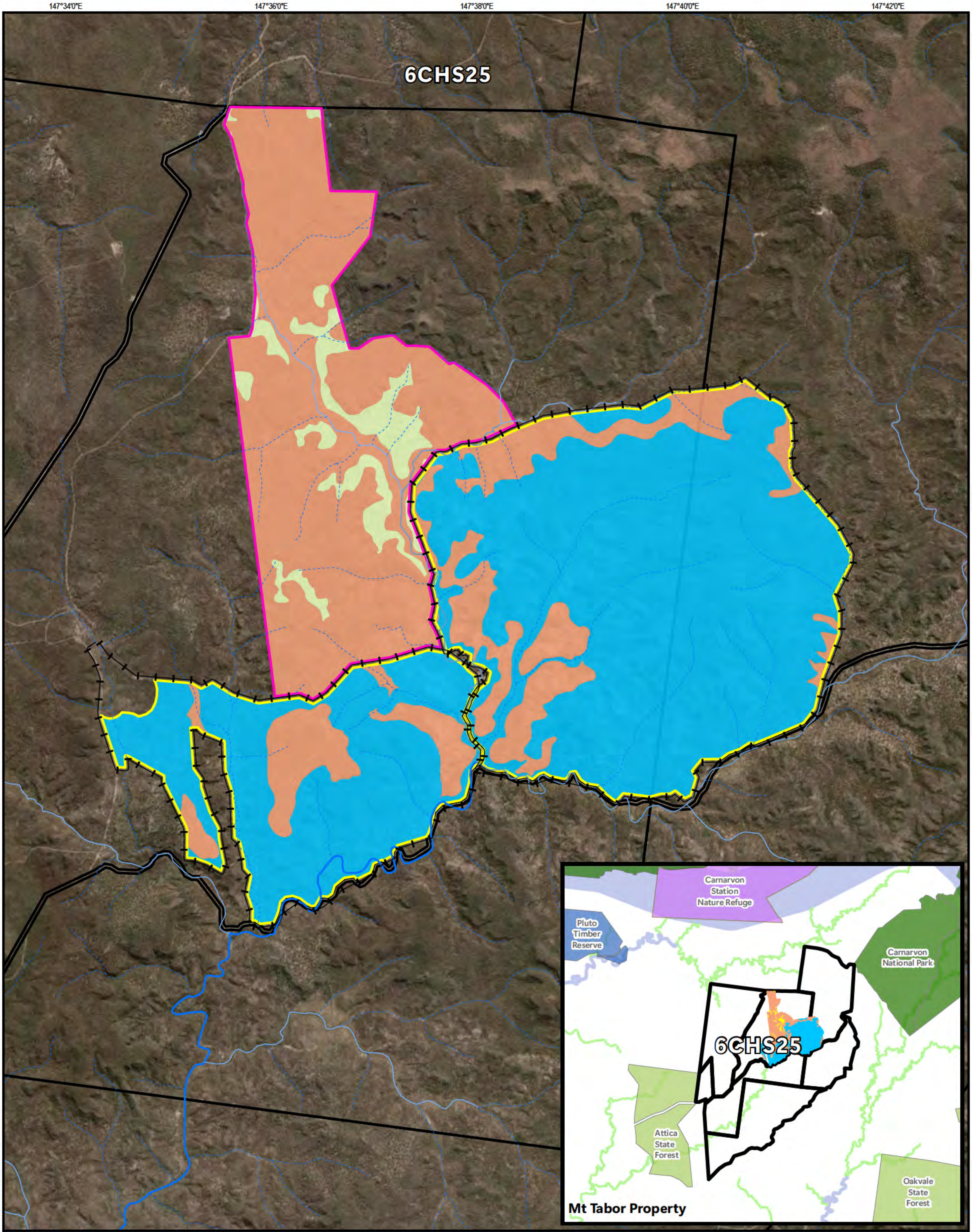



**Figure 2**
**Property overview**

Mt Tabor
Fence line

***Watercourse***
Major watercourse
Creekline
Minor drainage line
Drainage contour

***Offset area***
Area 1
Area 2

***Offset stage***
Stage 4 under 2012/6615
Stage 7 under 2012/6615
Surplus

***Protected areas***
State Forest
National Park
Timber Reserve
Nature Refuge

***Statewide Corridors***
Regional
State

CO2 AUSTRALIA

N

0 2 4
Kilometres

Date: 19/09/2024 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\20240821_MtTabor_OAMP_mapping\MtTabor_OAMP_mapping_20240918.aprx

## 2.3. Connectivity

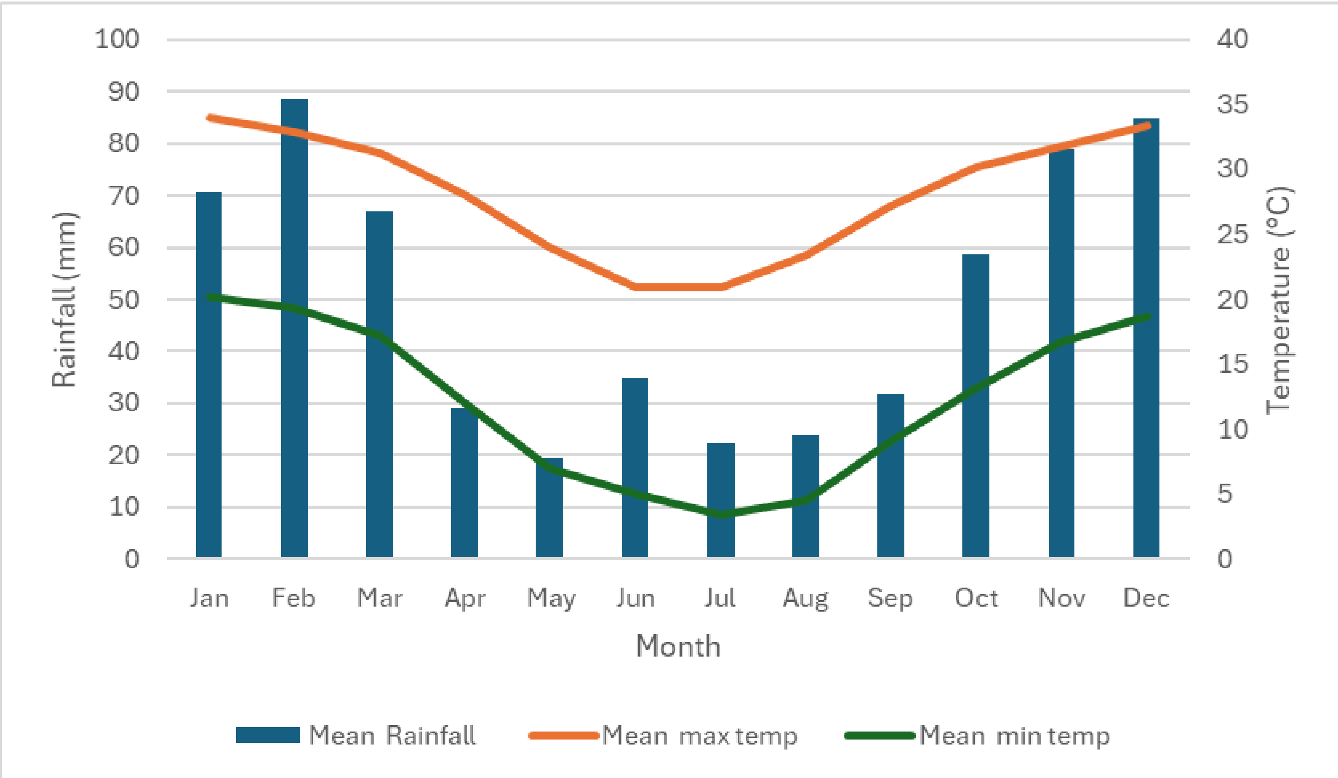
The Mt Tabor property is part of a vast area of remnant vegetation covering the Carnarvon and Chesterton Ranges. This is an area considered of national significance on account of the extent of remnant vegetation, one which includes the headwaters of all major rivers of inland central Queensland (Boobook 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

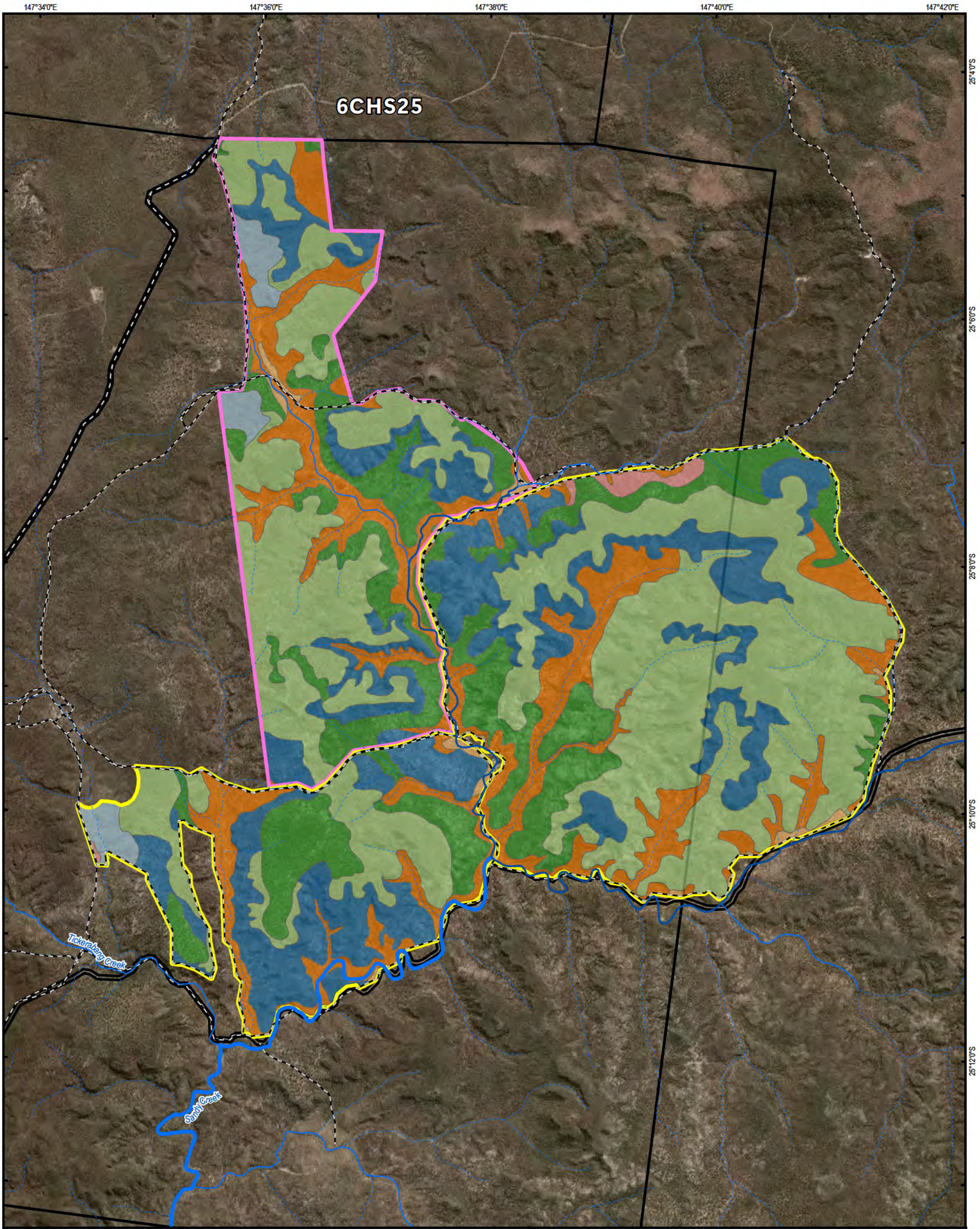
Within the Mt Tabor property, Santos has identified a 7,473.3 ha area for environmental offsets, comprising offset area 1 (5,124.5 ha) and Offset area 2 (2,348.8 ha). A combination of desktop and detailed on-ground assessments of the offset area have been undertaken within the offset areas and broader 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 assessment 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).

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# Figure 4 Ground-truthed vegetation

Mt Tabor
Property access tracks

*Watercourse*

Major watercourse
Creekline
Minor drainage line
Drainage contour

*Offset area*

Area 1
Area 2

*Regional ecosystem*

11.10.11
11.10.13
11.10.4
11.10.6
11.10.7
11.10.9
11.3.2
11.3.39
11.8.4
11.8.5

N

0 1 2
Kilometres

Date: 17/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:50,000@A3

Location diagram


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

Path: P:\GISData\Projects\Santos\20240821_MtTabor_OAMP_mapping\MtTabor_OAMP_mapping_20240910.aprx

### 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 inophloa* 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 areas**

| RE | Description | Offset area 1 (ha) | Offset area 2 (ha) |
|---|---|---|---|
| 11.3.2 | *Eucalyptus populnea* woodland on alluvial plains | 34.8 | 22.9 |
| 11.3.39 | *Eucalyptus melanophloia* +/- *E. chloroclada* open woodland on undulating plains and valleys with sandy soils. | 828.0 | 440.9 |
| 11.10.4 | *Eucalyptus decorticans, Lysicarpus angustifolius* +/- *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp. woodland on coarse-grained sedimentary rocks | 2,109.2 | 972.6 |
| 11.10.6 | *Angophora leiocarpa*, *Callitris glaucophylla* open woodland on coarse-grained sedimentary rocks. Broad valleys. | 885.6 | 440.6 |
| 11.10.7 | *Eucalyptus crebra* woodland on coarse-grained sedimentary rocks | 43.2 | - |
| 11.10.11 | *Eucalyptus populnea, E. melanophloia* +/- *Callitris glaucophylla* woodland on coarse-grained sedimentary rocks | 48.2 | 97.9 |
| 11.10.13 | *Eucalyptus* spp. and/or *Corymbia* spp. open forest on scarps and sandstone tablelands. | 1,175.6 | 374.0 |
| **Total** | | **5,124.5** | **2,348.8** |

### 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 predicted suitable habitat mapped for MNES associated with disturbance under EPBC 2012/6615 on Mt Tabor**

| Species | Suitable REs | Habitat Mapping Rules | Offset area 1 | | Offset area 2 | |
|---|---|---|---|---|---|---|
| | | | Essential Habitat (ha) | General Habitat (ha) | Essential habitat (ha) | General Habitat (ha) |
| 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 | - | **2,348.8** |
| Yakka skink | Essential Habitat: 11.3.2, 11.3.39, 11.10.7, 11.10.11<br>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.<br>*General habitat* includes all remnant and regrowth vegetation of the nominated RE. This may include sub-optimal habitat. | 954.2 | 3,284.8 | 561.7 | **1,346.5** |
| 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 | - | **2,348.8** |
| 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 thenominated RE. This species requires tall treesclose to permanent water for nest sites but may forage at adistance from this habitat. | - | 5,124.5 | - | **2,348.8** |
| 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 thenominated RE. | - | 5,124.5 | - | **2,348.8** |
| 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).<br>*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 | **463.7** |
| 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 REdominated by Myrtaceae species. | 5,124.5 | - | - | **2,348.8** |
| 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 | - | **2,348.8** |
| 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 | - | **2,348.8** |

## 2.7. Offset area

The total consolidated offset area to be secured on Mt Tabor is 7,473.3 ha, which includes 5,124.5 ha in offset area 1 and 2,348.8 ha in offset area 2 as illustrated in Figure 4. The Mt Tabor offset area includes:

- 4,173.0 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 (951.5 ha) and offset area 2 (2,036.5 ha). The 951.5 ha within offset area 1 draws down on the surplus areas identified as part of the approved version of this OAMP in November 2022.
- 312.3 ha, within offset area 2, identified as surplus areas, to be managed and monitored as part of this OAMP, comprising habitat for MNES that will be used by Santos to acquit future project offset requirements.

Table 7 provides a summary of the Mt Tabor offset area, including the offset areas to be secured under Stage 7 of EPBC 2012/6615 and the area of surplus habitat. 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 7* (Santos 2024).

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 7 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 Stage 7 Mt Tabor offset area and acquittal**

| MNES | Status under EPBC Act[1] | Impact area (ha) | Offset area 1 | | Offset area 2 | | | Total % acquittal[2] |
|---|---|---|---|---|---|---|---|---|
| | | | Offset area to be secured under OAG (ha) | % acquittal | Offset area to be secured under OAG (ha) | % acquittal | Surplus area available (ha) | |
| **Threatened ecological communities** | | | | | | | | |
| Brigalow TEC | E | 0.6 | - | - | - | - | - | - |
| **Threatened fauna species** | | | | | | | | |
| Collared delma (*Delma torquata*) | V | 313.2 | 951.6 | 33.36% | 2,036.5 | 71.40% | 312.3 | 104.76% |
| Yakka skink (*Egernia rugosa*) | V | 313.8 | 66.0 | 2.69% | 1,908.2 | 77.91% | - | 80.60% |
| Dunmall's snake (*Furina dunmalli*) | V | 308.1 | 951.6 | 33.91% | 2,036.5 | 72.58% | 312.3 | 106.49% |
| Red goshawk (*Erythrotriorchis radiatus*) | E | 311.8 | 951.6 | 27.48% | 2,036.5 | 58.81% | 312.3 | 86.29% |
| Squatter pigeon (southern) (*Geophaps scripta scripta*) | V | 316.8 | 951.6 | 32.98% | 2,036.5 | 70.58% | 312.3 | 103.56% |
| Northern quoll (*Dasyurus hallucatus*) | E | 317.4 | 951.6 | 31.49% | 2,036.5 | 67.38% | 312.3 | 98.87% |
| Koala (*Phascolarctos cinereus*) | E | 269.6 | 951.6 | 31.78% | 2,036.5 | 68.01% | 312.3 | 99.79% |
| South-eastern long-eared bat (*Nyctophilus corbeni*) | V | 311.8 | 951.6 | 33.51% | 2,036.5 | 71.73% | 312.3 | 105.24% |
| Large-eared pied bat (*Chalinolobus dwyeri*) | E | 257.8 | 951.6 | 38.77% | 2,036.5 | 82.97% | 312.3 | 121.74% |

[1]Status: E = Endangered and V = Vulnerable (DCCEEW 2024a-k).
[2] For MNES with acquittal less than 100%, the remaining offset requirement is satisfied on other properties.

## 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 1 boundary and to have offset area 2 secured under a Voluntary Declaration 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, Mines and Energy considers it necessary.

The Voluntary Declaration for the original offset area and offset area coordinates for the current 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 7 GFD Project offset obligations partially acquitted on the Mt Tabor offset areas 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 7 of the GFD Project under EPBC 2012/6615 as outlined in Table 7. The remaining will be acquitted elsewhere.<br>The Mt Tabor offset areas will be managed and monitored to improve the quality and viability of habitat for threatened fauna species.<br>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 7 of the GFD Project under EPBC 2012/6615 will be acquitted through the delivery of direct land-based offsets on the Mt Tabor offset areas 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 7*) |

| 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 areas.<br>Threats to the offset site are managed through the implementation of the management measures discussed in Section 6, including:<br>• Fire prevention and management<br>• Weed and pest animal monitoring and control<br>• Clearing protection<br>• Management of grazing<br>• Restricted access<br>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.<br>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.<br>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.<br>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.<br>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. |

| Principle | How the principle is met in this offset proposal |
|---|---|
| 9. 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.<br>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.<br>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.<br>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 habitat for each MNES offset value. Figure 5 illustrates the location of suitable habitat for MNES within 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 2024b), 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 2024b). 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 2024d). The species is commonly found under partly buried rocks, logs, root cavities or in abandoned animal burrows (DCCEEW 2024d). 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 2024d). Rare observations have been made on the edge of dry vine scrub and in hard ironstone country (DCCEEW 2024d). 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 2024f). 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 2024g). 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 (Hill and Ward 2010). 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 2024h). Koalas predominantly feed on *Eucalyptus* spp.; however, they are also known to consume other Myrtaceae species (DCCEEW 2024h). 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.

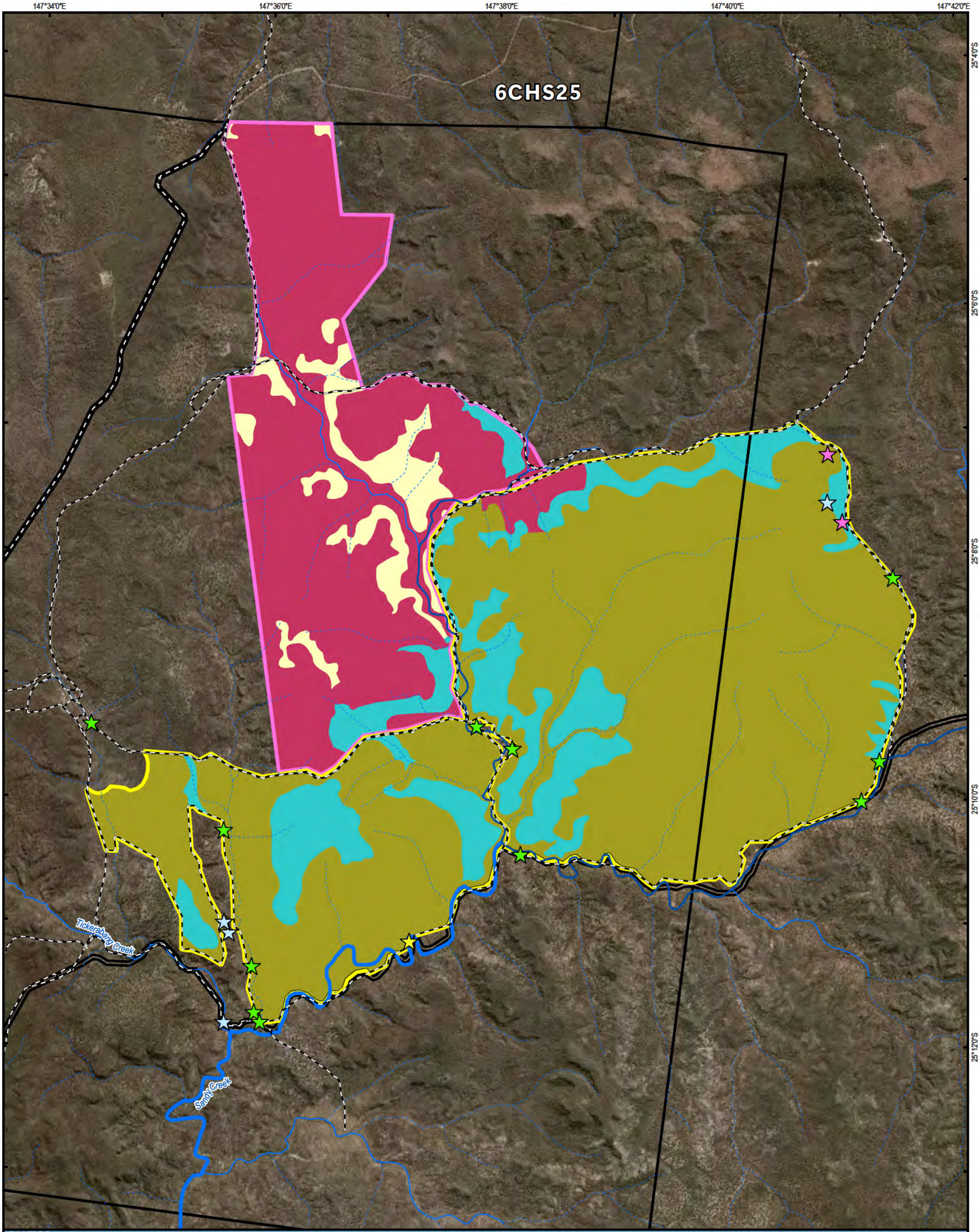
The species is known to occur in a variety of dry forest habitats including those dominated by river red gum, open woodland, mallee, brigalow and other arid and semi-arid habitats, although the preferred habitat is mallee and *Callitris* woodlands (Pennay *et al*. 2011), and habitats that have a distinct canopy with a dense, cluttered understorey (Turbill and Ellis 2006). The species roosts in tree hollows or under bark (NSW NPWS 2003). Surveys suggest the species requires large tracts of forest to occur (Turbill *et al*. 2008).

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 (TSSC 2012; DCCEEW 2024e). 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).




SANTOS

# Figure 5
# MNES habitat

Mt Tabor
Property access tracks

**Watercourse**

Major watercourse
Creekline
Minor drainage line
Drainage contour

**Offset area**

Area 1
Area 2

**MNES habitat**

Stage 4 Offset area for all MNES
Stage 7 Offset area for all MNES (exc. yakka skink)
Stage 7 Offset area for all MNES
Surplus

**MNES fauna observation**

Glossy black cockatoo
Greater glider
Koala
Squatter pigeon

CO2 AUSTRALIA

N

0 1 2
Kilometres

Date: 17/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:50,000@A3

Location diagram

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

Path: P:\GIS\Data\Projects\Santos\20240821_MtTabor_OAMP_mapping\MtTabor_OAMP_mapping_20240910.aprx

# 4. Environmental Outcomes to be Achieved

The outcome of this OAMP is to partially acquit the offset obligations for Stage 7 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 2024).

**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 |
| 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

## 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), 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:

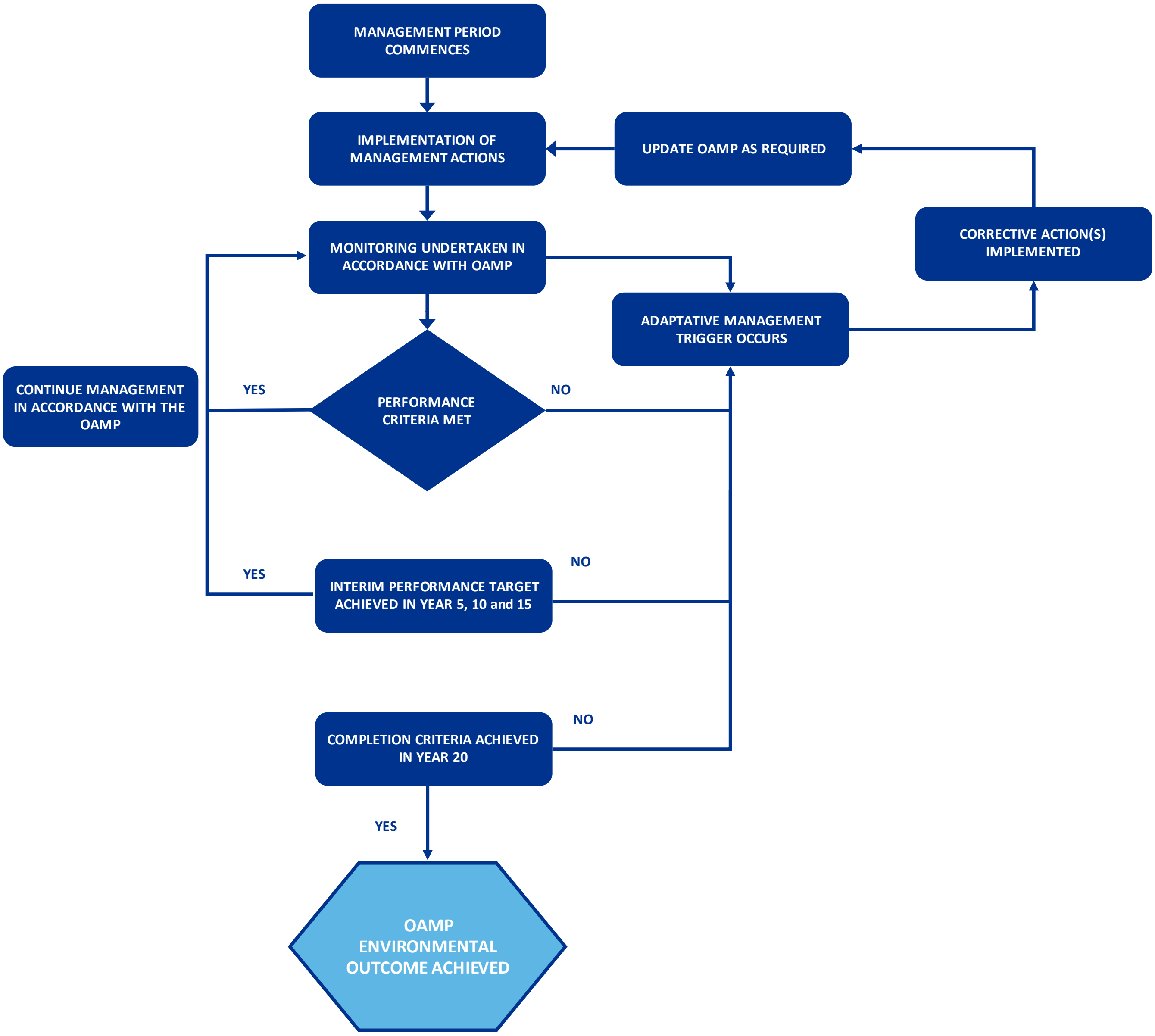
- **identified threats to offset values** – known and potential threats to the offset values have been identified as part of the risk assessment process
- **relevant offset values** – MNES or other offset matter for which the identified threat is relevant have been indicated
- **management objectives** – 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.<br>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.<br>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 |
|---|---|---|
| Collared Delma (*Delma torquata*) | Threats to the species have been determined based on conservation advice (DCCEEW 2024a):<br>• Alteration of ground cover as a consequence of unsuitable fire regime.<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Predation by feral predators (e.g., cats, foxes, wild dogs).<br>• Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter).<br>• Change in ground layer composition as a consequence of livestock grazing and feral horse browsing.<br>• 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 2024a):<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).<br>• Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2).<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.5).<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• 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 2024d):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Destruction of potential shelter habitat associated with rabbit warren ripping.<br>• Predation by feral predators (e.g., cats, foxes, pigs).<br>• Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter).<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.<br>• 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 2024d):<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.5).<br>• Weed management and monitoring (see Sections 6.2.5 and 7.4).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).<br>• Biomass monitoring (see Section 7.2). |

| MNES | Threats | Recovery/management actions |
|---|---|---|
| Dunmall's snake (*Furina dunmalli*) | Threats to the species have been determined based on conservation advice (DCCEEW 2024c):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Predation by feral predators (e.g., cats, foxes, pigs).<br>• Change in ground layer composition as a consequence of livestock grazing and feral horse browsing.<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.<br>• 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 2024c):<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.5).<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• Weed management and monitoring (see Sections 6.2.5 and 7.4).<br>• 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 and the Recovery Plan (DCCEEW 2024f):<br>• 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.<br>• Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity.<br>• 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 2024f):<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).<br>• Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2). |
| Squatter pigeon (*Geophaps scripta scripta*) | Threats to the species have been determined based on conservation advice and Threat Abatement Plans (DCCEEW 2024g):<br>• Change in ground layer composition as a consequence of grazing and ecosystem engineering actions by rabbits (e.g. burrowing, soil turnover).<br>• Predation by feral predators (e.g., cats, foxes). | The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2024g):<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.5).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).<br>• Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2).<br>• Exclusion of cattle from the offset area (see Section 6.2.3). |

| MNES | Threats | Recovery/management actions |
|---|---|---|
| | • Change in ground layer composition and trampling ground nests as a consequence of livestock grazing and feral horse browsing, especially in grassy, alluvial areas.<br>• Change in ground layer composition, including thickening of understorey structure, as a consequence of unsuitable fire regime.<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.<br>Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. | • Weed management and monitoring (see Sections 6.2.5 and 7.4). |
| Northern Quoll (*Dasyurus hallucatus)* | Threats to the species have been determined based on the Recovery Plan (Hill and Ward 2010):<br>• Poisoning through ingestion of cane toads (*Rhinella marina*).<br>• Loss of ground cover as a consequence of unsuitable fire, resulting in risk of increased predation and/or reduced food.<br>• Loss of ground cover as a consequence of livestock grazing.<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.<br>• Predation by feral predators (e.g., cats, foxes, wild dogs).<br>Poisoning through 1080 baiting. | The following recovery actions for the species will be implemented based on conservation advice and recovery objectives outlined in Hill and Ward (2010):<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.5).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).<br>• Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2).<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• 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 2024h):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Mortality due to vehicle collision. | The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2024h):<br>• Exclusion of cattle within offset areas (see Section 6.2.3).<br>• Management of unauthorised access and vehicles within the offset area (see Sections 6.2.1 and 6.2.2).<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.5). |

| MNES | Threats | Recovery/management actions |
|---|---|---|
| | • Predation by feral predators, particularly wild or domesticated dogs.<br>• 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.<br>Evidence for the presence of disease within the population (i.e., *Chlamydia pecorum*). | • Weed management and monitoring (see Sections 6.2.5 and 7.4).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).<br>• 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 2024i):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• 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.<br>• Impacts on understorey habitat as a consequence of livestock grazing, impacting habitat for understorey invertebrate prey.<br>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 2024i):<br>• Exclusion of cattle from the offset area (see Section 6.2.3).<br>• Pest animal management and monitoring (see Sections 6.2.6 and 7.5).<br>• Weed management and monitoring (see Sections 6.2.5 and 7.4).<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).<br>• 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 2024e):<br>• Potential of reduced foraging opportunities and flying invertebrate productivity as a consequence of unsuitable fire regime.<br>• 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 2024e):<br>• Fuel hazard management and monitoring (see Sections 6.2.4 and 7.3).<br>• Strategic grazing for fuel load management (see Section 6.2.4).<br>• Biomass monitoring (see Section 7.2).<br>• 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.<br>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:<br>• Offset area inspections (Section 7.1).<br>• Rapid monitoring events (Section 7.6.1).<br>• Habitat quality assessments to determine habitat quality scores (Section 7.6.2).<br>• Targeted fauna surveys (Section 7.6.4).<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• Modifying the strategic grazing regime to better support enhancement of offset values.<br>• 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.<br>• 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 | 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 | 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. | Any activities in contravention of the Voluntary Declaration and this OAMP. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why unapproved clearing occurred e.g. unauthorised access<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s** |

| Objective | Performance Target | Management Measure | Methodology | Location | Timing or Frequency | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|
| | public safety as outlined in Table 13. | | nature conservation value. See Section 2.8. | | | Reporting to the Commonwealth Government consistent with EPBC approval. | | The appropriate corrective actions will be implemented and may include:<br>• Addition fencing, signage and/or security for the offset area.<br>• 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.<br>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**<br>• 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.<br>• Investigate the reason for unapproved or unintentional clearing.<br>• Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks.<br>• 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.<br>• 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:<br>livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover<br>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**<br>• Investigate the reason for the decrease in richness and average % cover of native perennial grasses.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events.<br>• Constructing additional fencing should the current fencing be considered |

| Objective | Performance Target | Management Measure | Methodology | Location | Timing or Frequency | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|
| | | | See Section 6.2.4. for more detail. | | | | | insufficient to manage livestock in accordance with the grazing regime.<br>• Installing additional watering points for livestock to manage livestock in accordance with |
| | 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**<br>• Investigate the reason for biomass being less than 2,500 kg/ha.<br>• 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.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Removal of stock or spelling grazing from the area of the offset in which less than 2,500 kg/ha of biomass was identified.<br>• Review adherence to livestock grazing restrictions in Section 6.2.5.1.<br>• 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<br>• Foot hold traps<br>• 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 | An increase in Catling* Index for wild dogs from year 1 and subsequent monitoring events. | **Step 1: Investigate cause of trigger**<br>• Investigate potential sources or reasons that may have attributed to an increase in the:<br>– Catling* index for wild dogs, feral cats and/or foxes. |

| Objective | Performance Target | Management Measure | Methodology | Location | Timing or Frequency | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|
| | 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<br>• Trapping<br>• Shooting | | | minimum of three consecutive nights.<br>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).<br>Monitoring methods are detailed in Section 7.5. | An increase in Catling* Index for feral cats from year 1 and subsequent monitoring events. | – relative abundance of feral pigs and horses.<br>• Review adherence to pest management control measures as outlined in Section 6.2.6.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency and intensity of pest animal control.<br>• Revising methods of pest animal control in accordance with DAF guidelines, and coordinate with neighbouring landowners to ensure a consistent approach.<br>• Updating pest animal control methods in the OAMP and targeted pest animal control programs. |
| | 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<br>• Poisoning<br>• 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 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<br>• Shooting<br>• 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 | Implement weed control actions in accordance with Section 6.2.5.<br>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. | 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. | **Step 1: Investigate cause of trigger**<br>• Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds. |

| Objective | Performance Target | Management Measure | Methodology | Location | Timing or Frequency | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|
| | monitoring events.<br>No new weed species are identified at any monitoring site (based on year 1 and subsequent monitoring data). | | | | | See Section 7.4 for more detail. | A new weed species is identified at one or more monitoring sites. | • Investigate potential sources or reasons for the occurrence of the new weed species.<br>• Review adherence to weed management control measures as outlined in Section 6.2.5.<br>• Review adherence to weed hygiene restrictions as outlined in Section 6.2.1.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Amending weed hygiene restrictions.<br>• Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to.<br>• Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld).<br>• Increasing the frequency and intensity of weed control.<br>• 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.<br>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.<br>Fuel loads will be managed through implementation of the following:<br>• maintained fire breaks,<br>• controlled grazing regimes; and,<br>• fuel hazard reduction burns.<br>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.<br>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**<br>• Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores.<br>• Review adherence to the fire management measures as outlined in Section 6.2.4.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency of biomass monitoring.<br>• Increasing the frequency of weed control measures.<br>• Amending the strategic grazing regime. |

| Objective | Performance Target | Management Measure | Methodology | Location | Timing or Frequency | Monitoring Activity | Management Trigger | Corrective Action |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | • Reviewing effectiveness of firebreaks, and establishment of additional fire breaks.<br>• 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.<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• 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.<br>• All persons entering the offset area will be required to ensure vehicles and equipment are weed free.<br>• All contractors entering the offset area must hold a current weed hygiene certificate or equivalent for all vehicles and equipment.<br>• 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.<br>• 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.<br>• 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:<br>– maintenance of access tracks and/or fire breaks,<br>– fence construction and maintenance, and<br>– ensuring public safety or as directed by emergency management response personnel in the event of unplanned fire or other emergency or associated procedure.<br>• If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be appropriately planned, recorded and monitored.<br>• 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.<br>• 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<br>• The property will be suitably fenced to restrict access by unauthorised persons.<br>• 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.<br>• When entering and leaving the property, the Land Advisor must be advised.<br>  • 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 to assist with management of livestock control for weed and fuel load management (Figure 7). Following approval of this OAMP the final location for fencing around offset area 2 will be scouted with the Traditional Owners as part of on-ground cultural heritage surveys and will be provided to the Commonwealth Government following completion.

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 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 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.

### 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

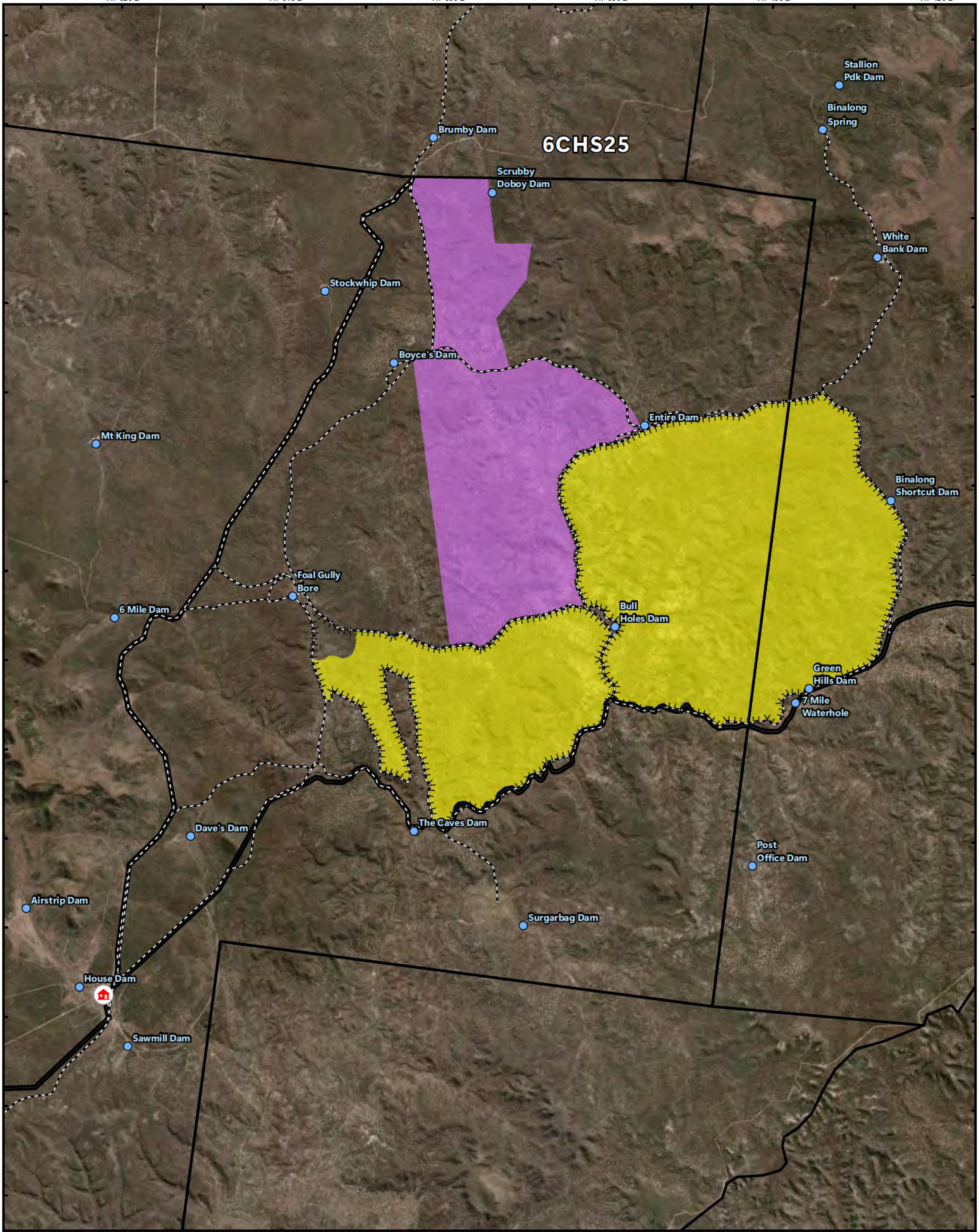
- improve habitat quality through:
  - controlling weeds, biomass levels and fuel loads,
  - supporting development of structural components of habitat for offset values (e.g. recruitment of native plants, establishment of fire sensitive native herbs and groundcover, important microhabitat including 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.

SANTOS




Location diagram

# Figure 7
## Property Infrastructure

- Mt Tabor
- Offset area 1
- Offset area 2
- Property access track
- Fence line
- Homestead
- Property dam

CO2 AUSTRALIA

N

0 1 2
Kilometres

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

Date: 17/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:70,000@A3

Path: P:\GIS\Data\Projects\Santos\20240821_MtTabor_OAMP_mapping\MtTabor_OAMP_mapping_20240910.aprx

### 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
- 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 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 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
- when plants approach a more active growing phase.

**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.<br>• 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.<br>• Burn less than 30% of the area in any year.<br>• 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.<br>• 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:<br>– maintaining a fire mosaic,<br>– control invasive shrubs,<br>– low to moderate intensity burns with good soil moisture to minimise loss of hollow trees, and<br>– avoiding riparian communities where appropriate. |
| 11.3.39 | • Conduct a low to moderate burn every 6-10 years.<br>• 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.<br>• Burn less than 30% in any year.<br>• 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.<br>• 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:<br>– maintaining a fire mosaic,<br>– control invasive shrubs,<br>– low to moderate intensity burns with good soil moisture are necessary to minimise loss of hollow trees, and<br>– avoid riparian communities where appropriate. |
| 11.10.4 | • Maintain fire management of surrounding country. |

| RE | Fire Management Guidelines |
|---|---|
| | • Burn surrounding country only under conditions of good soil moisture and when plants are actively growing.<br>• 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.<br>• 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.<br>• Burn less than 10-30% in any year to achieve a mosaic.<br>• Burn under conditions of good soil moisture and when plants are actively growing.<br>• 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.<br>• 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.<br>• Burn less than 10-30% of the area in any year.<br>• 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.<br>• 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.<br>• 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.<br>• Burn less than 30% in any year.<br>• Burn under conditions of good soil moisture and when plants are actively growing. |
| 11.10.13 | • Manage surrounding country.<br>• Burn surrounding country only under conditions of good soil moisture and when plants are actively growing.<br>• 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 | Example control method | Reference |
|---|---|---|---|
| Wild dog (*Canis familiaris*) | Category 3,4,6 | • Exclusion fencing<br>• Trapping (e.g. foot hold traps)<br>• Baiting<br>• Shooting | (DAF 2024a) |
| Fox (*Vulpes vulpes*) | Category 3,4,5,6 | • Exclusion fencing<br>• Trapping<br>• Shooting<br>• Poisoning | (DAF 2024b) |
| Feral cat (*Felis catus*) | Category 3,4,6 | • Exclusion fencing<br>• Night shooting<br>• Poisoning<br>• Trapping | (DAF 2023b) |
| Pig (*Sus scrofa*) | Category 3,4,6 | • Exclusion fencing<br>• Trapping<br>• Shooting<br>• Poisoning | (DAF 2023c) |

| Species | Status under Biosecurity Act 2014 | Example control method | Reference |
|---|---|---|---|
| Rabbits (*Oryctolagus cuniculus*) | Category 3, 4, 5, 6 | • Manual control (i.e. harbour destruction)<br>• Mechanical control (i.e. warren ripping)<br>• Trapping<br>• Exclusion fencing<br>• Biological control<br>• Poison baiting<br>• Fumigation<br>• 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.<br>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, 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 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, 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, 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.<br>• fauna monitoring cameras will be placed in the offset area,<br>• cameras will be placed along tracks and left in place for a minimum of three consecutive nights, and<br>• 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:<br>• nominate randomly stratified sites across the offset area in environments that are more regularly impacted (e.g. drainage lines, moist gullies, around swamps etc),<br>• calculate an abundance score for each transect as the percentage of 'present' feral pig signs, and<br>• calculate the mean abundance score (and variance) across all transects in the offset area.<br>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.<br>[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:<br>• 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.<br>• 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.<br>• 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.<br>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]).<br>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 OEHDPC (2013):<br>• 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,<br>• 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,<br>• 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,<br>• 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<br>• 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.<br>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).

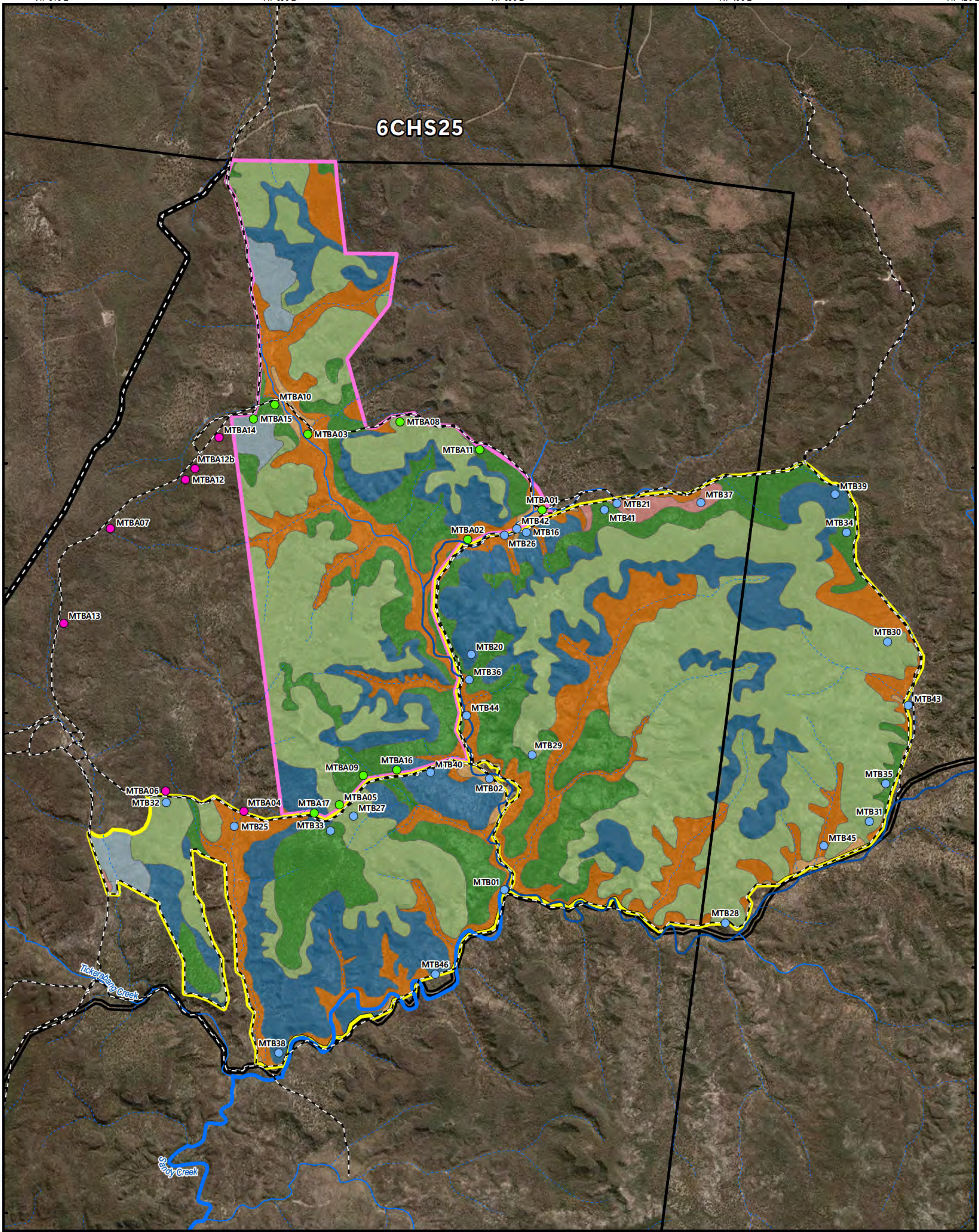
BioCondition assessments will be undertaken at each of the transects in year one and then every two years for the first six years, and then every three years thereafter. As part of year one monitoring activities, monitoring points will be marked with a capped stake and a GPS location will be recorded.

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).




SANTOS

# Figure 8
## Monitoring sites

Mt Tabor
Property access track

*Watercourse*
Major watercourse
Creekline
Minor drainage line
Drainage contour

*Offset area*
Area 1
Area 2

*Regional Ecosystem*
11.10.11
11.10.13
11.10.4
11.10.6
11.10.7
11.10.9
11.3.2
11.3.39
11.8.4
11.8.5

*Habitat quality monitoring site*
Offset area 1
Offset area 2
Outside offset area

CO2 AUSTRALIA

N

0 1 2
Kilometres

Location diagram
Queensland
Brisbane

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

Date: 18/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:50,000@A3

### 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. |
| 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, 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, 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<br>✓ Activity required<br>▪ 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)<br>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.<br>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<br>✓ Activity required<br>▪ 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.<br>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).<br>Photo monitoring of selected sites to assess visual changes in weed species and infestations over time.<br>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. | 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 | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | 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. | | |
| 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.* |

| Survey or monitoring objective | Monitoring activity | Management years<br>✓ Activity required<br>▪ 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 | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | *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. |

# 10. References


Aurecon (2014). *Santos GLNG Gas Field Development Project.* Terrestrial Ecology Assessment Report. Report to Santos GLNG Rev. 0, 26 August 2014.

Boobook (2021a). *Field Survey Report, Ecological survey of investigation area on 'Mt Tabor' (Lot 6 on Plan CHS25).* (Rev 0) report to Santos GLNG Pty Ltd, issued 18th March 2021.

Boobook (2021b). *Broad-scale Ecological Assessment Report Fairview Optimisation and Electrification project.* (Rev A) report to Santos GLNG Pty Ltd, issued. 7th March 2021

Bureau of Meteorology (BoM) (2024a). *Monthly mean maximum temperature Injune Post Office,* viewed 21 August 2024, http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=36&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=043015.

Bureau of Meteorology (BoM) (2024b). *Monthly mean minimum temperature Injune Post Office,* viewed 21 August 2024, http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=38&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=043015.

Bureau of Meteorology (BoM) (2024c). *Monthly rainfall Injune Post Office*, viewed 21 August 2024, http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=044223.

CO2 Australia (2024). *Mt Tabor Additional Biodiversity Offset Assessment*. A report prepared for Santos Ltd. CO2 Australia, Brisbane.

Cooke B., McPhee S., and Hart Q. (2014). *Rabbits: A threat to conservation and natural resources management. How to rapidly assess a rabbit problem and take action*. Bureau of Rural Sciences, Canberra. Available from: https://www.wool.com/globalassets/wool/sheep/pest-animals/rabbits/rabbits_booklet_lr_final.pdf.

Department of Agriculture and Fisheries (DAF) (2022). *Feral horse Fact Sheet*, viewed 21 August 2024, https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/pests/invasive-animals/other/feral-horse.

Department of Agriculture and Fisheries (DAF) (2023a). *Cane Toad Fact Sheet*, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0005/77360/cane-toad.pdf.

Department of Agriculture and Fisheries (DAF) (2023b). *Feral Cat Fact Sheet*, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/61987/feral-cat.pdf.

Department of Agriculture and Fisheries (DAF) (2023c). *Feral Pig Fact Sheet*, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0005/70925/feral-pig.pdf.

Department of Agriculture and Fisheries (DAF) (2023d). *Rabbit Fact Sheet*, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0015/62700/rabbit.pdf.

Department of Agriculture and Fisheries (DAF) (2024a). *Wild Dog Fact Sheet*, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0003/74487/wild-dog.pdf.

Department of Agriculture and Fisheries (DAF) (2024b). *Fox Fact Sheet*, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0019/73810/european-red-fox.pdf.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024a). *Delma torquata.* Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1656.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024b), *Environmental Management Plan Guidelines*, Department of Climate Change, Energy, the Environment and Water, Canberra, March. CC BY 4.0

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024c). *Furina dunmalli – Dunmall's Snake.* Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59254.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024d). *Egernia rugosa — Yakka Skink.* Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1420.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024e). *Chalinolobus dwyeri — Large-eared Pied Bat, Large Pied Bat.* Species Profile and Threats Database, viewed 21 August 2021, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=183.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024f). *Erythrotriorchis radiatus — Red Goshawk.* Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024g). *Geophaps scripta scripta — Squatter Pigeon (southern).* Species Profile and Threats Database, viewed 21 August 2021, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024h). *Phascolarctos cinereus (combined populations of Qld, NSW and the ACT).* Species Profile and Threats Database, viewed 21 August 2021, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024i). *Nyctophilus corbeni — Corben's Long-eared Bat, South-eastern Long-eared Bat.* Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83395.

Department of Environment and Science (DES) (2020). *Guide to Determining Terrestrial Habitat Quality (Version 1.3)*. Department of Environment and Science (State of Queensland), Brisbane, QLD.

Department of Environment and Science (DES) (2021). *Biodiversity and Conservation Values: Biodiversity Planning Assessments and Aquatic Conservation Assessments for the selected area of interest Lot: 6 Plan: CHS25.* Department of Environment and Science (State of Queensland), Brisbane, QLD.

Department of the Environment, Water Heritage and the Arts (DEWHA) (2010). *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999.* Australian Government, Canberra, ACT.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011). *Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act.* Australian Government, Canberra, ACT.

Eyre, T.J., Ferguson, D., Hourigan, C., Smith, G. C., Mathieson, M., Kelly, A. L., Venz, M. F., Hogan, L. D. and Rowland, J. (2014). *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. Version 2.* Department of Science, Information Technology, Innovation and the Arts, Brisbane, QLD.

Eyre, T.J., Kelly, A.L., Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J., and Franks, A.J. (2015). *BioCondition: Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2*. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts, Brisbane, QLD.

Eyre, T. J., Ferguson, D. J., Hourigan, C. L., Smith, G. C., Mathieson, M. T., Kelly, A. L., Venz, M. F., Hogan, L. D. and Rowland, J. (2018). *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland*. Department of Environment and Science, Brisbane, QLD.

Franks, A. J. (2002). The ecological consequences of Buffel Grass Cenchrus ciliaris establishment within remnant vegetation of Queensland. *Pacific Conservation Biology* 8: 99 – 107.

Hines, F., Tolhurst, K. G., Wilson A. AG. and McCarthy, G. J. (2010), *Overall fuel hazard assessment guide*. Department of Sustainability and Environment (State of Victoria), Melbourne, VIC.

Hill B.M. and Ward S.J. (2010). *National Recovery Plan for the Northern Quoll Dasyurus hallucatus*. Department of Natural Resources, Environment, The Arts and Sport, Darwin.

Hone, J. (1988). Feral pig rooting in a mountain forest and woodland Distribution, abundance and relationships with environmental variables. *Australian Journal of Ecology*, vol. 13, pp. 393–400.

Hone J (1995). Spatial and temporal aspects of vertebrate pest damage with emphasis on feral hogs. *Journal of Applied Ecology*, 32: 311–319.

Meek, P., Fleming, P., Ballard, G., Banks, P., Claridge, A., Sanderson, J., and Swann, D., (2014). *Camera Trapping: Wildlife Management and Research.* CSIRO Publishing, Collingwood, VIC.

Mitchell, B and Balogh, S (2007a). *Monitoring techniques for vertebrate pests – feral pigs*. Orange, NSW.

Mitchell, B and Balogh, S (2007b). *Monitoring techniques for vertebrate pests – wild dogs*. Orange, NSW.

Mitchell, B and Balogh, S (2007c). *Monitoring techniques for vertebrate pests – foxes*. Orange, NSW.

National Research Council (2004). *Adaptive Management for Water Resources Project Planning*. Washington, DC: The National Academies Press. https://doi.org/10.17226/10972.

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F, Richter, D., Addicott, E.P. and Appelman, C.N. (2023) *Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland*. Version 7.0. Updated December 2023. Queensland Herbarium, Queensland Department of Environment, Science and Innovation, Brisbane.

NSW NPWS (2003). *Threatened species of the New England Tablelands and north west slopes of New South Wales.* NSW Parks and Wildlife Service, Coffs Harbour, NSW.

Office of Environment and Heritage, Department of Premier and Cabinet NSW (OEHDPC) (2013). *Eradicating cane toads in New South Wales outside their current range of distribution: Best practice guideline.* Office of the Environment and Heritage, Sydney, NSW. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Pests-and-weeds/eradicating-cane-toads-in-nsw-guidelines-130118.pdf.

Pennay, M, Ellis, M and Parnaby, H (2011). *The bat fauna of New South Wales and the Australian Capital Territory*. In: B. Law, P. Eby, D. Lunney and L. Lunsdem (eds.) The biology and conservation of Australian bats, Royal Zoological Society of New South Wales, Sydney, NSW.

Queensland Herbarium (2021) *Regional Ecosystem Fire Guidelines (March 2021)*. Queensland Department of Science, Brisbane, QLD.

Santos Limited (Santos) (2022). *Santos GLNG Mt Tabor Offset Area Management Plan*. Santos Limited, Brisbane.

Santos Limited (Santos) (2024). *Santos GLNG Offset Plan and Acquittal Summary: EPBC Act Approval 2012/6615, Stage 7*. Santos Limited, Brisbane.

Sattler, P. and Williams, R. (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency (State of Queensland), Brisbane, QLD.

South East Queensland Fire and Biodiversity Consortium (2002). *Fire and Biodiversity Monitoring Manual*. Brisbane, QLD.

Threatened Species Scientific Committee (TSSC) (2012). *Commonwealth Listing Advice on Chalinolobus dwyeri (Large-eared Pied Bat)*. Department of Sustainability, Environment, Water, Population and Communities, Canberra. Viewed 9 July 2021, http://www.environment.gov.au/biodiversity/threatened/species/pubs/183-listing-advice.pdf.

Threatened Species Scientific Committee (TSSC) (2015a). *Conservation Advice Geophaps scripta scripta squatter pigeon (southern)*. Department of the Environment, Canberra. Viewed 9 July 2021, http://www.environment.gov.au/biodiversity/threatened/species/pubs/64440-conservation-advice-31102015.pdf.

Threatened Species Scientific Committee (TSSC) (2015b). *Conservation Advice Nyctophilus corbeni south-eastern long-eared bat*. Department of the Environment, Canberra. Viewed 9 July 2021, http://www.environment.gov.au/biodiversity/threatened/species/pubs/64440-conservation-advice-31102015.pdf.

Turbill, C. and Ellis, M. (2006). Distribution and abundance of the south eastern form of the Greater Long-eared Bat Nyctophilus timoriensis. *Australian Mammalogy*, vol. 28, pp. 1-7.

Turbill, C., Lumsden, L. F. and Ford, G. I. (2008). South-eastern and Tasmanian Long-eared Bats. In S van Dyck and R Strahan (eds.). *The mammals of Australia*, Reed New Holland, Sydney.

Wilson, S. (2015). *A Field Guide to Reptiles of Queensland.* Second edition. New Holland, Sydney.

Williams, B. (2011). Adaptive management of natural resources – framework and issues. *Journal of Environmental Management*. 92: 1346 – 1353.

Williams, B. and Brown, E. (2016). Technical challenges in the application of adaptive management. *Biological Conservation*, 195: 255–263.

Queensland Herbarium (2024). *Regional Ecosystem Description Database (REDD)*. Version 13.1 (May 2024) (DESI: Brisbane).

# 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 | 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% | 9 | 9 | 9 | 9 | 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 | 30.6 | 30.6 | 30.6 | 30.6 |
| Species habitat index | Quality as foraging habitat | 5 | 17% | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 3 |
| | Quality as shelter, breeding habitat | 5 | 17% | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 3 | 1 | 2 | 2 | 2 | 2 |
| | Quality as mobility habitat | 5 | 17% | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 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% | 13.3 | 13.3 | 12.7 | 12.7 | 12.7 | 13.3 | 12.0 | 12.0 | 12.7 | 12.7 | 13.3 | 13.3 | 12.7 | 12.7 | 11.3 | 11.3 | 10.7 | 12.7 | 13.3 | 10.7 | 12.0 | 12.7 | 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% | 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 | 30.6 | 30.6 | 30.6 | 30.6 |
| | Species habitat index | 20 | 40% | 13.3 | 13.3 | 12.7 | 12.7 | 12.7 | 13.3 | 12.0 | 12.0 | 12.7 | 12.7 | 13.3 | 13.3 | 12.7 | 12.7 | 11.3 | 11.3 | 10.7 | 12.7 | 13.3 | 10.7 | 12.0 | 12.7 | 12.0 | 12.0 |
| | Total /10 | 145 | 100% | 6.6 | 7.2 | 6.7 | 7.3 | 7.0 | 7.4 | 7.0 | 6.6 | 7.0 | 7.0 | 7.4 | 7.4 | 7.1 | 7.3 | 6.6 | 6.5 | 6.4 | 7.0 | 6.6 | 6.1 | 7.0 | 7.4 | 7.0 | 7.0 |
| | **Total /10 (rounded)** | | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 6 | 7 | 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 |

*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 |
| Site context | Connectivity (fragmented bioregions) | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Site context | Context (fragmented bioregions) | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Site context | 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 | 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 |
| Species habitat index | 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 |
| Species habitat index | 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 |
| Species habitat index | 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 |
| Species habitat index | 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 |
| Habitat quality score | 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 |
| Habitat quality score | 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 |
| Habitat quality score | 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 |
| Habitat quality score | **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 |
| Site context | 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 |
| Site context | 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 |
| Site context | 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 | 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 |
| Species habitat index | 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 |
| Species habitat index | 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 |
| Species habitat index | 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 |
| Species habitat index | 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 |
| Habitat quality score | 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 |
| Habitat quality score | 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 |
| Habitat quality score | 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 |
| Habitat quality score | **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 |
| Site context | Connectivity (fragmented bioregions) | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Site context | Context (fragmented bioregions) | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Site context | 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 | 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 |
| Species habitat index | 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 |
| Species habitat index | 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 |
| Species habitat index | 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 |
| Species habitat index | 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 |
| Habitat quality score | 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 |
| Habitat quality score | 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 |
| Habitat quality score | 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 |
| Habitat quality score | 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 |

**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 | 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 | 7.0 | 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 |

### 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 |

**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 | 22.9 | 6.9 | 6.9 | 7.2 | 7.2 | 7.1 | 7.0 | 7.7 | 7.1 | 7.0 |
| 11.3.39 | 440.6 | 7.5 | 7.4 | 7.7 | 7.4 | 7.8 | 6.9 | 6.6 | 7.9 | 7.6 |
| 11.10.4 | 972.6 | 8.0 | 7.9 | 8.2 | 7.5 | 7.6 | 7.2 | 7.5 | 8.1 | 7.5 |
| 11.10.6 | 440.9 | 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 | 97.9 | 6.9 | 7.2 | 7.4 | 7.0 | 7.2 | 7.1 | 6.9 | 7.2 | 7.5 |
| 11.10.13 | 374.0 | 7.4 | 7.5 | 7.7 | 7.2 | 6.6 | 7.4 | 7.1 | 7.6 | 7.5 |

**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 | 22.9 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 11.3.39 | 440.6 | 1.4 | 1.7 | 1.4 | 1.4 | 1.5 | 1.3 | 1.2 | 1.5 | 1.4 |
| 11.10.4 | 972.6 | 3.3 | 4.0 | 3.4 | 3.1 | 3.1 | 3.0 | 3.1 | 3.3 | 3.1 |
| 11.10.6 | 440.9 | 1.5 | - | 1.5 | 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 | 97.9 | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 11.10.13 | 374.0 | 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 | 7 | 7 |

# 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

# DAM 2022/003111

LOT on PLAN

6CHS25

Queensland Government

0 1 2 3 4

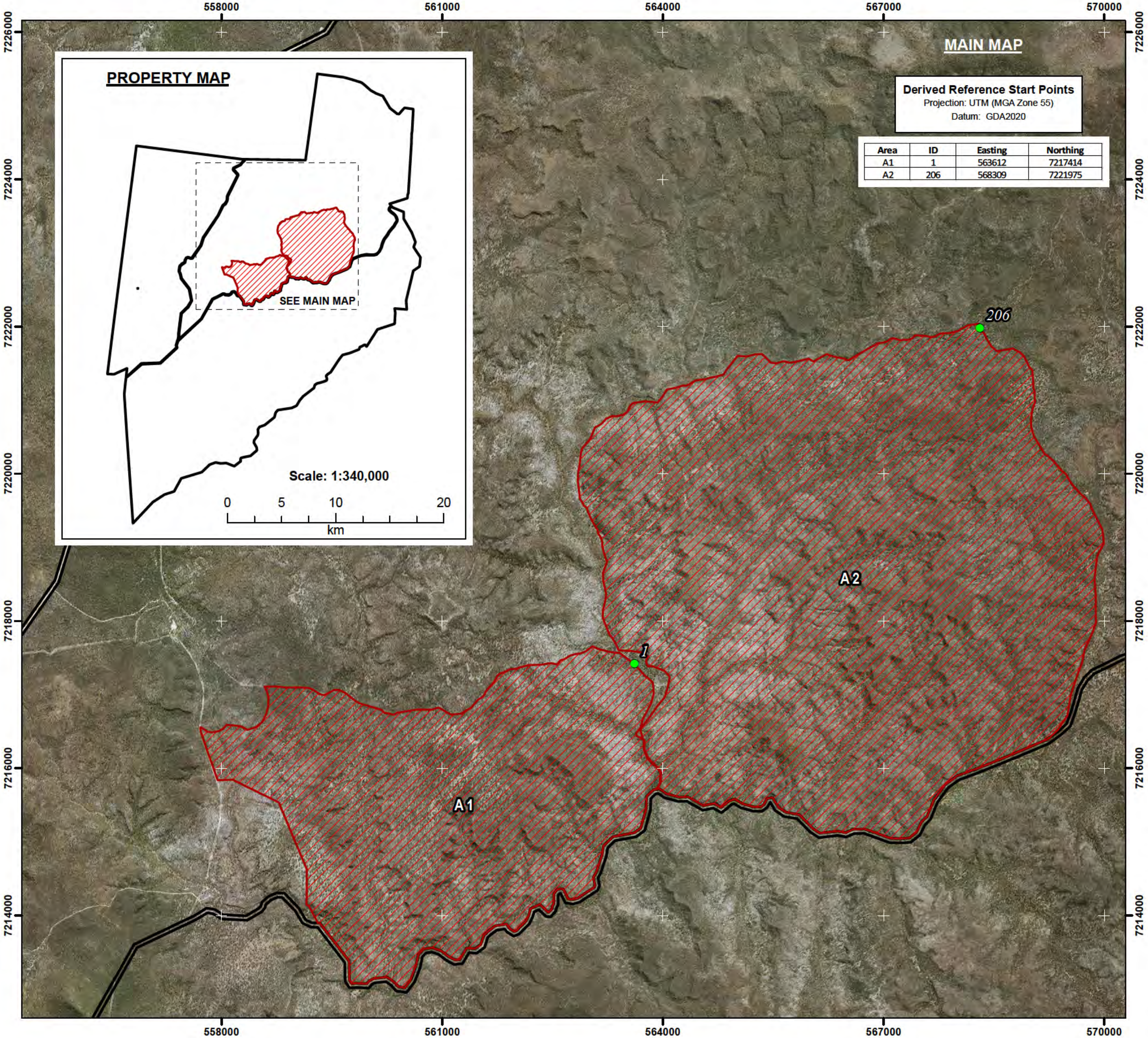
km

MAIN MAP

**Scale: 1:50000**

(original size A3)

N




| Area | ID | Easting | Northing |
|---|---|---|---|
| A1 | 1 | 563612 | 7217414 |
| A2 | 206 | 568309 | 7221975 |

**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



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

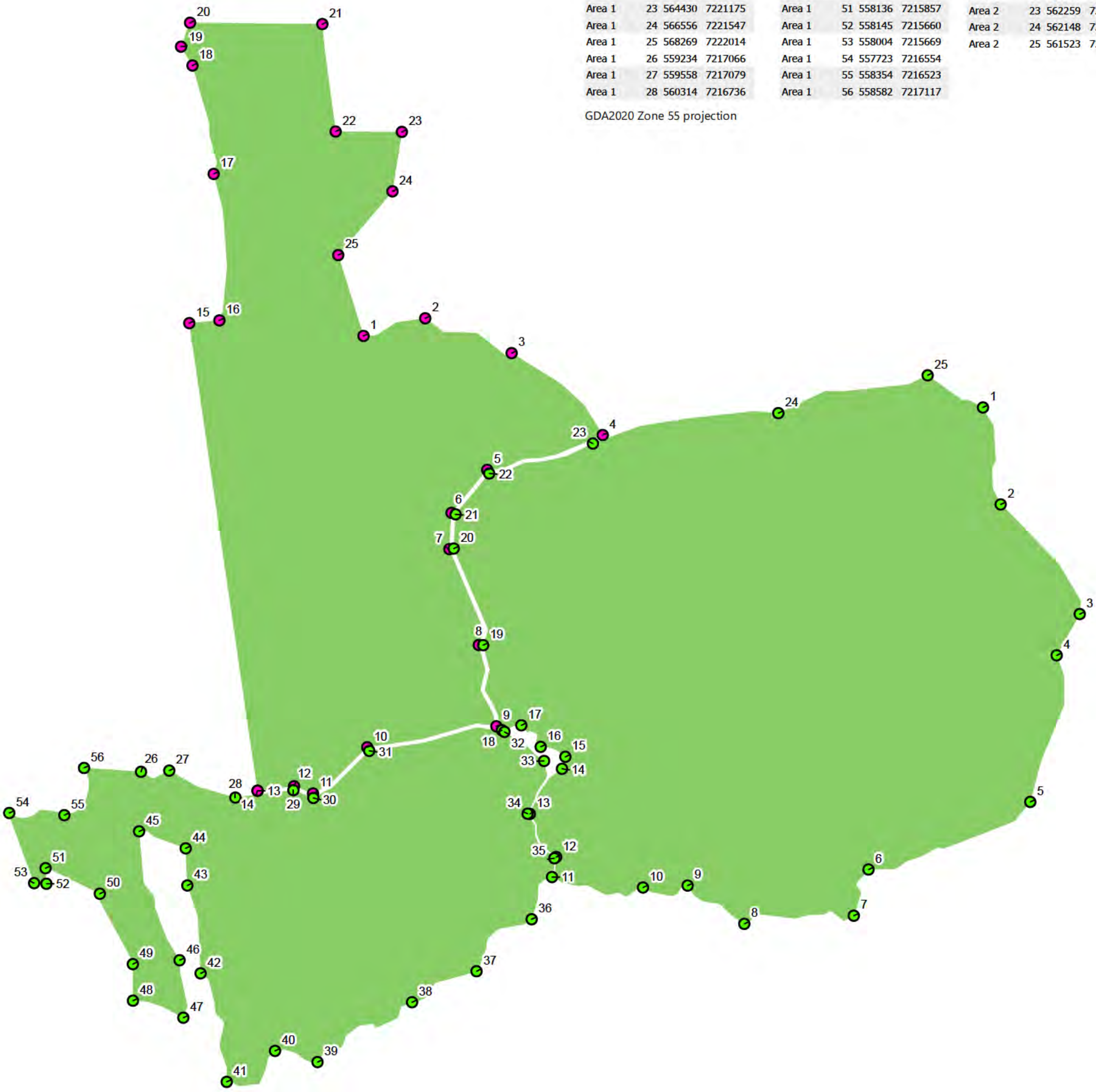
147°34'0"E 147°36'0"E 147°38'0"E 147°40'0"E 147°42'0"E

| 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 | 561808 | 7222541 |
| Area 2 | 2 | 562516 | 7222760 |
| Area 2 | 3 | 563504 | 7222317 |
| Area 2 | 4 | 564543 | 7221281 |
| 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 | 561500 | 7225116 |
| Area 2 | 23 | 562259 | 7225108 |
| Area 2 | 24 | 562148 | 7224360 |
| Area 2 | 25 | 561523 | 7223560 |

GDA2020 Zone 55 projection



25°2'0"S 25°4'0"S 25°6'0"S 25°8'0"S 25°10'0"S 25°12'0"S

SANTOS

**Figure B1**
**Offset area boundary**

Offset area

***Offset area coordinate***

Area 1

Area 2

CO2 AUSTRALIA

N

0 2 4
Kilometres

Date: 17/09/2024 Coordinate System: GDA2020 Scale: 1:52,849@A3

AUTHOR: S.Worrall

Location diagram

# 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**<br>+ No bodily damage or minimal harm or impairment (hours to days) | **Minor Harm**<br>+ Short term impairment (days to weeks) | **Moderate Harm**<br>+ Temporary disablement or medium term impairment (weeks to months) | **Severe Harm**<br>+ 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<br>+ Potential surface or groundwater impact. | + Moderate-scale impact to EV(s) of conservation significance<br>+ Localised surface or groundwater impact. | + Large-scale impact to EV(s) of conservation significance<br>+ Moderate-scale surface water impact;<br>+ Localised impact to groundwater with potential or known beneficial use. | + Extensive population or community scale impact to EV(s) of conservation significance<br>+ Extensive impact to other EV(s). | + Irreversible impact to EV(s). |
| **Community & Reputation** | + No actual or potential community criticism<br>+ Details remain within Santos sites and/or offices | + Minor level local community criticism (< week)<br>+ No reputation impact | + Local community criticism (> week) or one-day community protest<br>+ Local company reputation impacted | + State-level community criticism or protest over multiple days/locations<br>+ State-based company reputation impacted<br>+ Very short-term share price impact (< week) | + National community criticism or large scale protest<br>+ Company reputation and approvals impacted<br>+ Shareholder intervention or short-term share price impact (< month) | + Sustained national community criticism or widespread protest<br>+ Industry reputation and approvals impacted<br>+ 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.<br>+ No actual or potential impact to culture | + Will require several days local management time.<br>+ Minor impact to employee engagement and limited staff turnover | + Will require head office staff and take several weeks of site management time.<br>+ Moderate impact to employee engagement and staff turnover above industry average with some key roles | + Will require several weeks of senior management time<br>+ Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession | + Will require several months of senior management time<br>+ 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<br>+ 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<br>+ No regulatory or punitive action | + Minor breach of legislation, instruments or contract<br>+ Notification/report to; request for information by; and/or administrative/ warning notice from the regulator<br>+ LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator | + Limited number of minor breaches of legislation, instruments or contract<br>+ Statutory notice from the regulator<br>+ LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator | + Systemic minor breaches (or one moderate breach) of legislation, instruments or contract<br>+ Company charged with an offence with minor penalty/fine<br>+ LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases | + Systemic moderate breaches (OR single material breach) of legislation, instruments or contract<br>+ Company charged with an offence with moderate penalty/fine | + Material breaches of legislation, instruments or contract<br>+ Company or officers charged with an offence with material penalty/fine, or loss of tenure/operatorship |
| | I | II | III | IV | V | VI |

| Likelihood | | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| ALMOST CERTAIN **(< 4 monthly)**<br>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)**<br>Occurs in most circumstances OR could occur *within weeks to months* | e | Low | Medium | High | High | Very High | Very High |
| OCCASIONAL **(1 - 3 yearly)**<br>Has occurred before in Santos OR could occur *within months to years* | d | Low | Low | Medium | High | High | Very High |
| POSSIBLE **(3 - 10 yearly)**<br>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)**<br>Has occurred elsewhere OR could occur *within decades* | b | Very Low | Very Low | Low | Low | Medium | High |
| REMOTE **(30 - 100 yearly)**<br>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: Likelihood | Risk Rating: Consequence | Risk Rating: Risk Level | Mitigation Measure | Timing, Frequency or Duration | Residual Risk Rating: Likelihood | Residual Risk Rating: Consequence | Residual Risk Rating: Risk Level | 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. | 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.<br>Implementation of the adaptive management process outlined in Section 5.<br>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.<br>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.<br>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.<br>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:<br>Offset area inspections (Section 7.1).<br>Rapid monitoring events (Section 7.6.1).<br>Habitat quality assessments to determine habitat quality scores (Section 7.6.2).<br>Targeted fauna surveys (Section 7.6.4).<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• Increasing the frequency and intensity of pest animal and weed control measures or revising the type of measures to be implemented.<br>• Modifying the strategic grazing regime to better support enhancement of offset values.<br>• 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. |

| 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 | | | |
| | | | | | | | | | | | | | • 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 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**<br>• Investigate reasons why unapproved clearing occurred e.g. unauthorised access.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Addition fencing, signage and/or security for the offset area.<br>• Restoration of the impacted area. |
| | | | | | | Comply with the restrictions outlined in Table 13.<br>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.<br>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<br>• 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.<br>• Investigate the reason for unapproved or unintentional clearing.<br>• Following clearing, the area is to be assessed by a |

| 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 | | | |
| | | | | | | | | | | | | | suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks.<br>• 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.<br>• 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.<br>Annual biomass monitoring to inform strategic grazing regimes.<br>Rapid monitoring events and habitat quality assessments will be undertaken in accordance with Section 6.2.4 including an assessment of % cover | Biomass monitoring will be undertaken twice a year, at the end of the wet season and end of the dry season.<br>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**<br>• Investigate the reason for the decrease in richness and average % cover of native perennial grasses.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events. |

| 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 | | | |
| | | | | | | of native perennial grasses. | | | | | | | • Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime.<br>• 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.<br>Predation by feral cats.<br>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**<br>• Investigate potential sources or reasons that may have attributed to an increase in the:<br>– Catling* index for wild dogs, feral cats and/or foxes.<br>– relative abundance of feral pigs and horses.<br>• Review adherence to pest management control measures as outlined in Section 6.2.6.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency and intensity of pest animal control.<br>• Revising methods of pest animal control in accordance with DAF guidelines, and coordinate with neighbouring landowners to ensure a consistent approach. |
| Minimise degradation of offset value habitat by feral horse and feral pig. | Degradation of habitat by feral horses.<br>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 7.5 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 | The presence of, or signs of horses will be documented during offset area inspections, twice yearly.<br>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 | An increase in the observed presence of feral horses across monitoring events.<br>An increase in mean feral pig abundance score from year 1 and subsequent monitoring events. | |

| 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 | | | |
| | | | | | | | | | | | impacted. See Section 7.5. | | • 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 | Implement weed control actions in accordance with Section 6.2.5.<br><br>Adhere to weed hygiene restrictions in accordance with Table 13.<br><br>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.<br>A new weed species is identified at one or more monitoring sites. | **Step 1: Investigate cause of trigger**<br>• Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds.<br>• Investigate potential sources or reasons for the occurrence of the new weed species.<br>• Review adherence to weed management control measures as outlined in Section 6.2.5.<br>• Review adherence to weed hygiene restrictions as outlined in Section 6.2.1.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Amending weed hygiene restrictions.<br>• Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to.<br>• Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld). |

| 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 | | | |
| | | | | | | | | | | | | | • Increasing the frequency and intensity of weed control.<br>• 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.<br>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.<br>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**<br>• Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores.<br>• Review adherence to the fire management measures as outlined in Section 6.2.4.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency of biomass monitoring.<br>• Increasing the frequency of weed control measures.<br>• Amending the strategic grazing regime.<br>• Reviewing effectiveness of firebreaks, and establishment of additional fire breaks.<br>• 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.<br>Monitoring of the offset area will be undertaken in accordance with Section 7 including:<br>• Offset area inspections (Section 7.1).<br>• Offset value assessments (Section 7.6).<br>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.<br>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:<br>• Offset area inspections (Section 7.1).<br>• Offset value assessments (Section 7.6).<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• 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

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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.

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# Contents

# 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

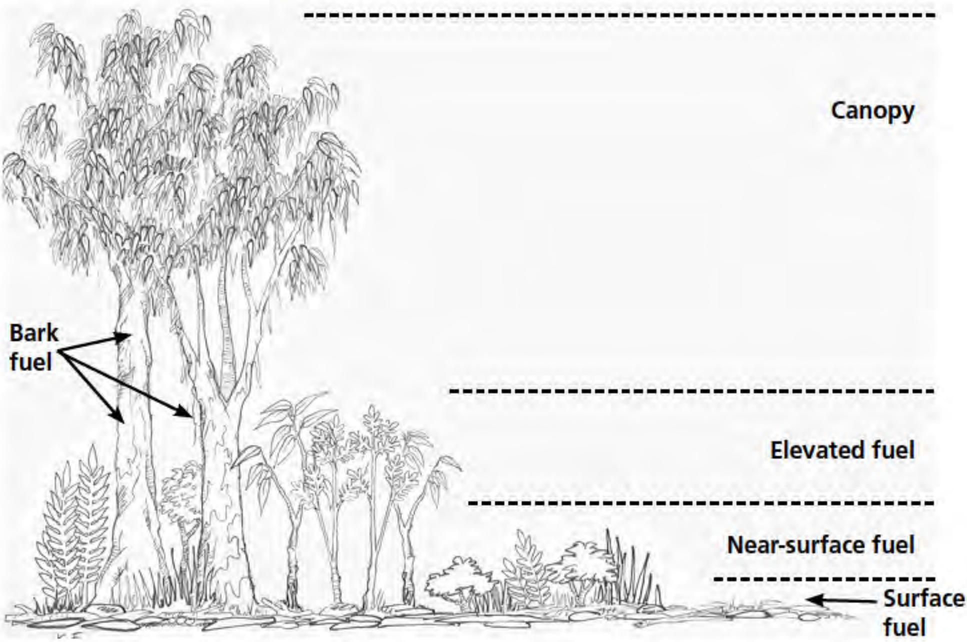
This guide is a tool for rapidly assessing fuel arrangement and its effect on the chances of controlling a bushfire. It may also be used for a range of other fire management purposes, as shown in the table below. Users of this guide should understand the underlying assumptions and limitations before 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.<br><br>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.<br>• 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.<br>• Generally most of the plant material is closer to the top of this fuel layer.<br>• Sometimes contains suspended leaves, bark or twigs.<br>• Fuels that have a clear gap between them and the surface fuels.<br>• Can be highly variable in ground coverage.<br>• 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.<br>• Fuel has a mixture of vertical and horizontal orientation.<br>• 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.<br>• Sometimes contains suspended leaves, bark or twigs.<br>• Coverage may range from continuous to having gaps many times the size of the fuel patch.<br>• Low-intensity fire (flame height of less than 0.5m) will consume most or all of this fuel.<br>• 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.<br>• 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.<br>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.<br>• 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.<br>• Bark fibres resemble the fine fibres that are twisted together to form natural string.<br>• Old bark is retained on the trunk of the tree for decades, forming a relatively spongy fibrous mass with deep vertical fissures.<br>• Outer bark may weather to a greyish colour, while underlying bark retains its original colour.<br>• Bark may form large strands when peeled off.<br>• 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).<br>• Fires will readily climb the tree and branches. |
| **How bark is attached** | • Young or new bark is held tightly to the trunk.<br>• As bark ages it becomes less tightly held.<br>• 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:<br>• Very fine lightweight fibres that will be carried for less than 100m.<br>• Small lightweight wads (about the size of a thumb) that will be carried for less than 300m.<br>• 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.<br>• Small wads of bark that will burn out within 2–3 minutes.<br>• Very large wads of bark that will burn for up to 10 minutes. |
| **Hazard accumulation** | • Bark hazard can reach Extreme.<br>• Bark hazard increases over time as the thickness and looseness of the old bark increases.<br>• 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 | | | |
|---|---|---|---|
| **How bark is attached** | **Quantity of combustible bark** | **Hazard rating** | **Effect on fire behaviour (at FFDI 25)[1]** |
| This hazard rating cannot occur when only this bark type is present. | | Low | |
| Bark tightly held.<br>Requires substantial effort to break off bark by hand. | Very little combustible bark.<br>Entire trunk almost completely black or charred. | Moderate | Spotting generally does not hinder fire control.<br>Fires will not climb these trees. |
| Bark is mostly tightly held with a few pieces loosely attached. | Limited amount of combustible bark.<br>50–90% of trunk charred.<br>Most of the bark is charred, especially on the lower part of the trunk. | High | Infrequent spotting.<br>Fires will climb some of these trees. |
| Many pieces of bark loosely held.<br>Deep fissures present in bark. | Large amounts of combustible bark.<br>10–50% of trunk charred.<br>Upper parts of the tree may not be charred at all. | Very High | Substantial spotting.<br>Fires will climb most of these trees. |
| Outer bark on trees is weakly attached.<br>Light hand pressure will break off large wads of bark.<br>Deep fissures present in bark. | Huge amounts of combustible bark.<br><10% of trunk charred.<br>Minimal evidence of charring. | Extreme | Quantity of spotting generated makes fire control very difficult or impossible.<br>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.

## 3.4 Identifying ribbon or candle bark types

| | | Example |
|---|---|---|
| **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.<br>• Bark is shed in the form of long strips or ribbons of bark.<br>• Long strips of bark curl tightly inwards to form a candle-like shape (see image lower right).<br>• Bark strips 50cm or more in length fall off and often drape around the trunk and over branches and surrounding shrubs.<br>• Strips of bark are usually less than 2mm thick.<br>• 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).<br>• 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.<br>• 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.<br>• Bark hazard tends to increase over the long term as ribbons accumulate on the tree.<br>• A low intensity fire (flame height of less than 0.5m) may not reduce the hazard in this bark type. | |

**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<br>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.<br>Trunk and branches of trees almost entirely smooth. | Moderate | Spotting generally does not hinder fire control.<br>Fires will not climb these trees. |
| Long ribbons of bark present on upper trunk (>4m above ground) and in head of trees.<br>Lower trunk mainly smooth. | High | Infrequent spotting.<br>Fires will climb some of these trees. |
| Long ribbons of bark in the head and upper trunk with:<br>• ribbons hanging down to ground level or,<br>• flammable bark covers trunk. | Very High | Substantial spotting.<br>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.<br>• Bark becomes rough, compacted and furrowed with age<br>• Bark feels very abrasive when rubbed by hand.<br>• Bark pieces tend to be more than 2mm thick when they break off.<br>• There may be little or no evidence of charring on the bark following planned burns. | **Example**  |
| **Hazard accumulation** | • Bark hazard never exceeds Moderate. | |

### 3.5.2 Coarsely fibrous barks

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

## 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.

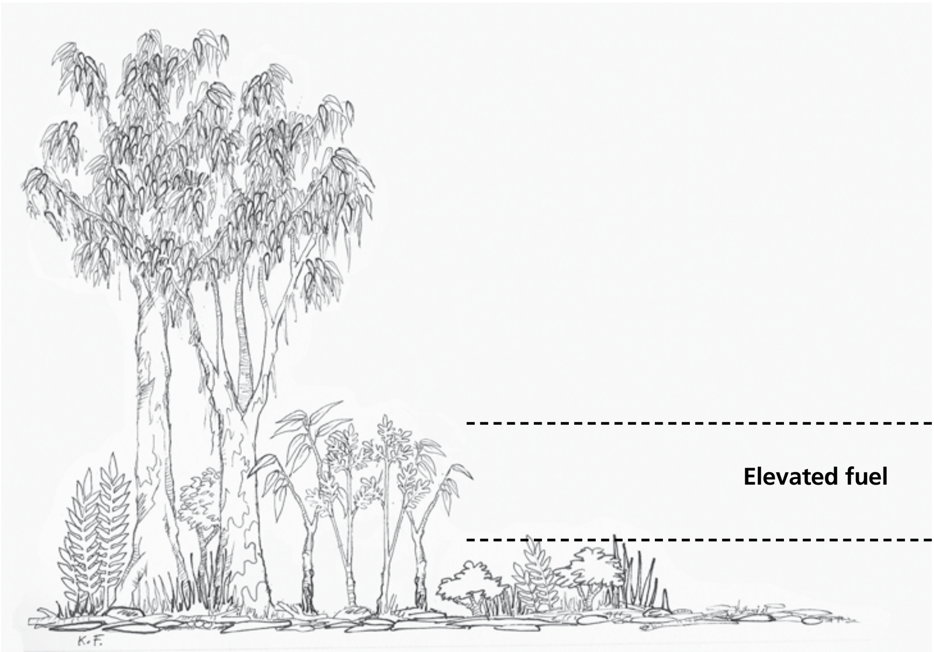
**Table 3.6 Examples of other bark types**

| | | | |
|---|---|---|---|
| **Low** | No trees present.<br>or<br>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.

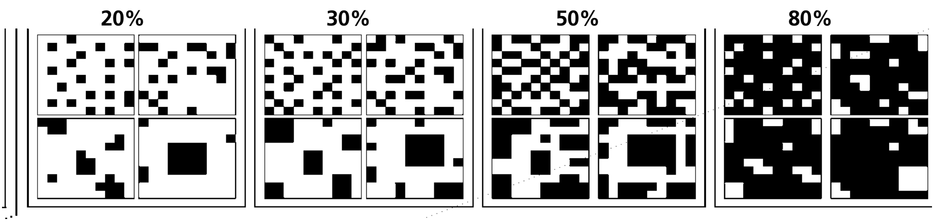
### Table 4.1 Assessing elevated fine fuel hazard

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.

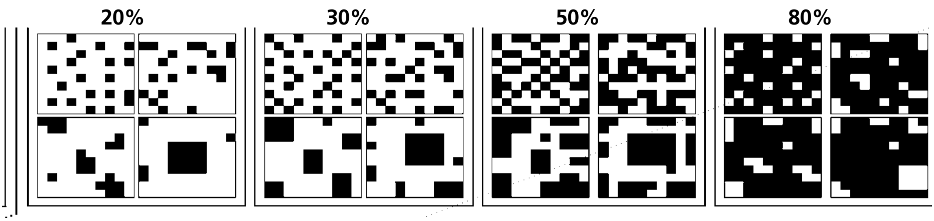
### Table 5.1 Assessing near-surface fine fuel hazard

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.

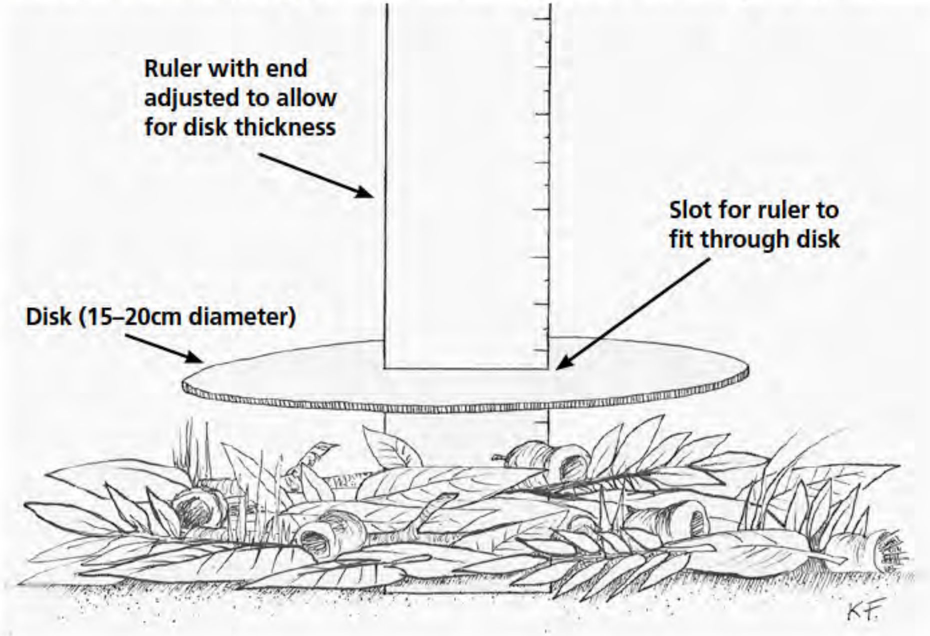

## 6.2 Assessment

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

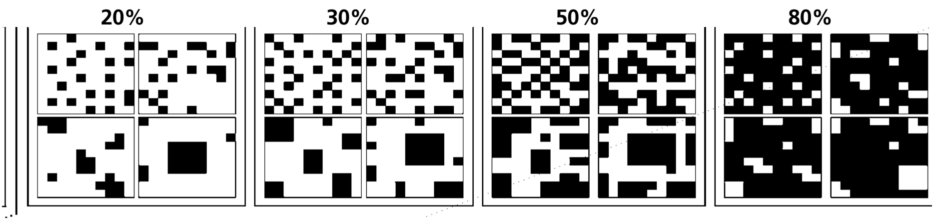
To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

| Key attributes | | | Fuel hazard rating | Effect on fire behaviour (at FFDI 25)[6] |
|---|---|---|---|---|
| **Horizontal connectivity** | **Surface litter cover** | **Litter-bed depth** | | |
| Litter poorly interconnected.<br>Large areas of bare soil or rock. More soil than litter.<br>Soil surface readily visible through litter bed. | <60% | Very thin litter layer<br><10mm | Low | Surface fires will not spread. |
| Litter well connected.<br>Some areas of bare soil or rock.<br>Soil surface occasionally visible through litter bed. | 60–80% | Thin litter layer<br>10–25mm | Moderate | Litter connected well enough to allow fire spread to overcome bare patches. |
| Litter well connected.<br>Little bare soil. | 80–90% | Established litter with layers of leaves ranging from freshly fallen to decomposing.<br>20–30mm | High | Surface fires spread easily with a continuous fire edge. |
| Litter completely connected. | >90% | Thick litter layer<br>25–45mm | Very High | Surface fires spread easily.<br>Increasing flame depth and residence time. |
| Litter completely connected. | >95% | Very thick layer of litter<br>>35mm | Extreme | Surface fires spread easily.<br>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** 1
2. Select the row that corresponds to the **Elevated Fine Fuel Hazard** 2
3. Select the column that corresponds to the assessed level of **Combined Surface and Near-surface Fine Fuel Hazard** 3
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**

| 1 Bark Hazard | 2 Elevated Fine Fuel Hazard | 3 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 | Green | Green | Green | Green | Yellow |
| 3–7 | 6–11 | Green | Green | Green | Green | Yellow |
| 8–20 | 12–24 | Green | Green | Green | Yellow | Orange |
| 20–49 | 25–49 | Green | Green | Yellow | Orange | Orange |
| 50–74 | 50–74 | Green | Yellow | Orange | Orange | Red |
| 75–99 | 75–99 | Green | Orange | Red | Red | Red |
| 100+ | 100+ | Green | Orange | Red | Red | Red |

- Green: Chance of extended first attack success is greater than 95% (almost always succeeds)
- Yellow: Chance of extended first attack success is between 95% and 50% (succeeds most of the time)
- Orange: Chance of extended first attack success is between 49% and 10% (fails most of the time)
- Red: 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.

# References


Department of Environment and Heritage 2006, *Overall fuel hazard guide for South Australia*, 1st edn, Government of South Australia.

Gould, JS McCaw, WL Cheney, NP Ellis, PF Knight, IK & Sullivan, AL 2007a, *Project VESTA. Fire in dry eucalypt forest: fuel structure, fuel dynamics and fire behaviour*, Ensis-CSIRO, Canberra, ACT & Department of Environment and Conservation, Perth, WA.

Gould, JS McCaw, WL Cheney, NP Ellis, PF & Matthews, S 2007b, *Field guide – fuel assessment and fire behaviour prediction in dry eucalypt forest*, Ensis-CSIRO, Canberra, ACT & Department of Environment and Conservation, Perth, WA.

McArthur, AG 1973, *Forest fire danger meter Mk5*, Forestry and Timber Bureau, Forest Research Institute, Commonwealth of Australia.

McCarthy, GJ & Tolhurst, KG 1998a, *Effectiveness of firefighting operations by the Department of Natural Resources and Environment from 1991/2–1994/5*, research report no. 45, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ Tolhurst, KG & Chatto, K 1998b, *Overall fuel hazard guide*, research report no. 47, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ Tolhurst, KG & Chatto, K 1998c, *Overall fuel hazard guide*, 2nd edn, research report no. 47, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ Tolhurst, KG & Chatto, K 1999, *Overall fuel hazard guide*, 3rd edn, research report no. 47, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ & Tolhurst, KG 2001, *Effectiveness of broadscale fuel reduction burning in assisting with wildfire control in parks and forest in Victoria*, research report no. 51, Fire Management, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ 2004, *Surface fine fuel hazard rating – forest fuels in East Gippsland*, research report no. 44, Fire Management Branch, Department of Sustainability and Environment, Victoria.

Plucinski M, Gould, J, McCarthy, G, Hollis J (2007) The effectiveness and efficiency of aerial fire fighting in Australia, Part 1, Bushfire CRC Technical Report Number A0701

Sneeuwjagt, RJ & Peet, GB 1998, *Forest fire behaviour tables for Western Australia*, Department of Conservation and Land Management, Perth, Western Australia.

Wilson, AAG 1992a, *Assessing the fire hazard on public lands in Victoria: fire management needs, and practical research objectives*, research report no. 31, Fire Management Branch, Department of Conservation and Environment, Victoria.

Wilson, AAG 1992b, *Eucalypt bark hazard guide*, research report no. 32, Fire Management Branch, Department of Conservation and Environment, Victoria.

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)<br><br>1 to 2 small 4WD tankers (400l)<br><br>6 firefighters | 5 x 4WD heavy tankers (4000l) each with 5 firefighters | Small dozer (D4) or tractor with scrub roller<br><br>1 to 2 small 4WD tankers (400l)<br><br>6 firefighters | Small dozer (D4)<br><br>1 to 2 small 4WD tankers (400l)<br><br>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 |

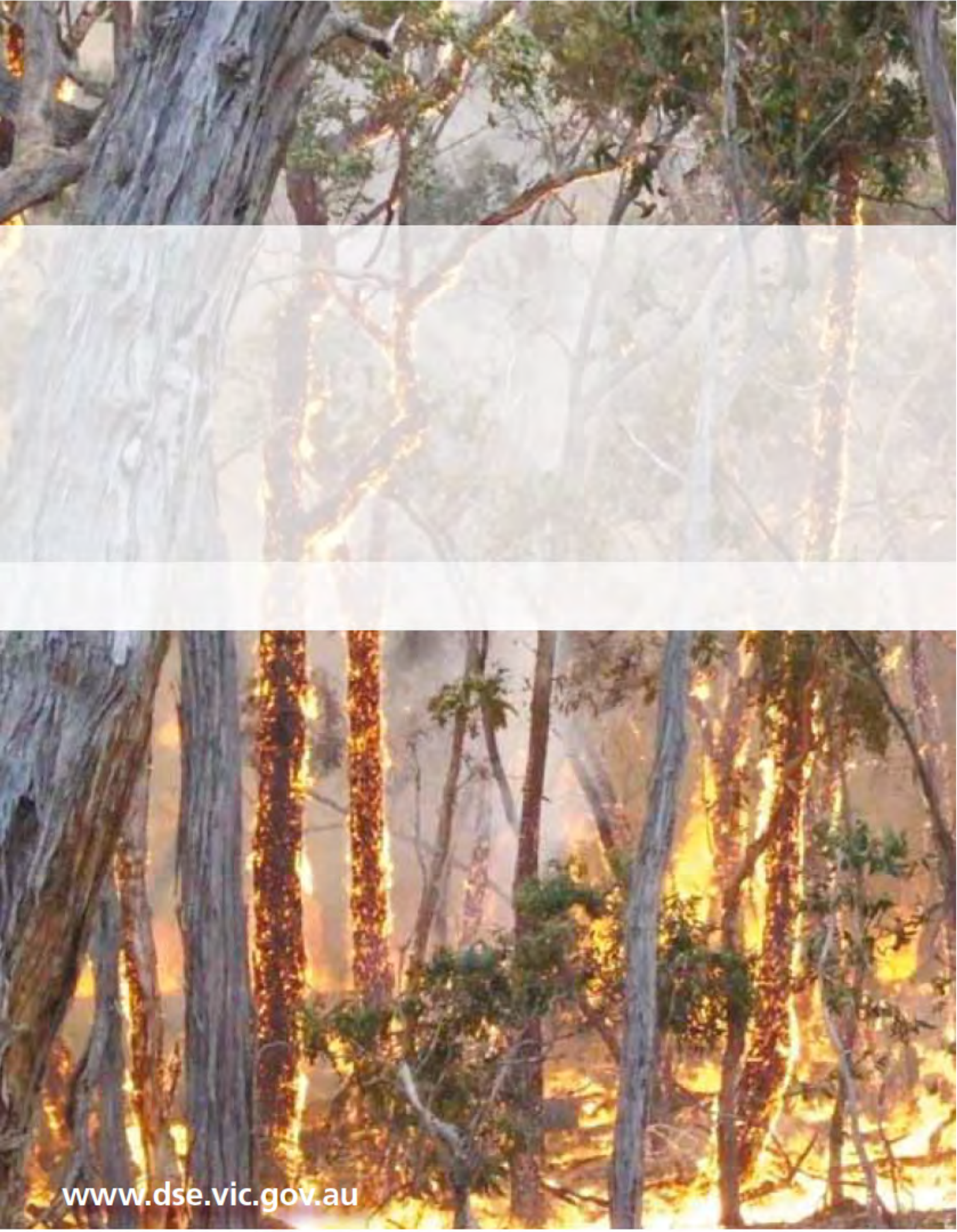
| Surface fuel layer (Assess over a 10m radius) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Litter % Cover: | | | | | % | | | | | % | | | | | % |
| Average Litter Depth (mm): | | | | | mm | | | | | mm | | | | | mm |
| Surface Fuel Hazard | 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.


www.dse.vic.gov.au

# 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).<br>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.<br>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.<br>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:<br>• Patch size – measuring the size of the patch of remnant vegetation being assessed and any directly connecting remnant vegetation.<br>• 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.<br>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:<br>• 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<br>• 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:<br>• 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<br>• 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:<br>• 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)<br>• 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 |
| | 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' | 1 |

| Component | Sub-component/scoring | Score |
| --- | --- | --- |
| Role of site location to species overall population | geographical range. The site contains low quality food, foraging and shelter habitat, with limited mobility capacity to other areas of suitable habitat. | |
| | 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.<br>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 DSITIA 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<br>• Alteration of ground cover as a consequence of unsuitable fire regime<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds<br>• Predation by feral predators (e.g., cats, foxes, wild dogs)<br>• Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter)<br>• 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<br>• 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<br>• 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<br>• Predation by feral predators (e.g., cats, foxes, pigs)<br>• Alteration of ground cover as a consequence of unsuitable fire regime<br>• Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter)<br>• 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<br>• 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<br>• 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<br>• Change in ground layer composition as a consequence of livestock grazing and feral horse browsing<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat<br>• Predation by feral predators (e.g., cats, foxes, pigs)<br>• 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<br>• Potential of reduced prey (e.g., medium sized birds) as a consequence of unsuitable fire regime<br>• Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity<br>• 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<br>• 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,<br>• Presence of an intact, contiguous canopy cover<br>• 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<br>• Change in ground layer composition as a consequence of grazing and ecosystem engineering actions by rabbits (e.g. burrowing, soil turnover)<br>• 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<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds<br>• 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<br>• Proximity to water<br>• 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<br>• Poisoning through ingestion of cane toads (*Rhinella marina*)<br>• Loss of ground cover as a consequence of unsuitable fire, resulting in risk of increased predation and/or reduced food<br>• Loss of ground cover as a consequence of livestock grazing<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds<br>• Predation by feral predators (e.g., cats, foxes, wild dogs)<br>• 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.<br>• 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<br>• Presence and quality of grass and shrub layers<br>• Presence of temporary shelter such as boulders, logs.<br>• Presence of known or potential predators (e.g., cats, dogs)<br>• 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<br>• Mortality due to vehicle collision<br>• Predation by feral predators, particularly wild or domesticated dogs<br>• 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<br>• 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*)<br>• 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*)<br>• 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<br>• 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<br>• Impacts on understorey habitat suitability as a consequence of livestock grazing and feral horse browsing, impacting habitat for flying invertebrate prey in the understorey<br>• 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<br>• 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<br>• 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<br>• Loss of sandstone roosting/maternity sites, whether through occupation by pest animal species (e.g., goats) or impacts to structural integrity from uncontrolled wildfire<br>• 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<br>• 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 C

## Bottle Tree Offset Area Management Plan

Santos

# SANTOS GLNG BOTTLE TREE OFFSET AREA MANAGEMENT PLAN

## EPBC Act Approval 2012/6615 (Stage 7)

Document Number: 0007-650-EMP-0018

4 October 2024

| Date | Rev | Reason For Issue | Reviewed | Endorsed | Approved |
|---|---|---|---|---|---|
| 4 October 2024 | 0 | For DCCEEW submission | AB | AB | DG |

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# Tables



# Figures

# 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, 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 7 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 19.7 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 7 of the GFD Project under EPBC 2012/6615 (Table ES 1). The remaining 2,748.8 ha of offset area on Bottle Tree is currently being used to acquit offset obligations for the Gas Transmission Pipeline Project (EPBC 2008/4096) and GLNG Project (EPBC 2008/4059) and includes 153.42 ha of surplus areas of suitable MNES habitat for Santos to drawdown on for future project offset acquittals. This OAMP relates to the 19.7 ha offset area required to partially acquit Stage 7 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 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 7 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 *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 Bottle Tree offset area and Stage 7 acquittal for EPBC 2012/6615**

| MNES | Status under EPBC Act[1] | Impact area (ha) | Surplus area remaining on Bottle Tree following acquittal of EPBC 2008/4059 and 2008/4096 (ha) | Offset area to be secured under Stage 7 of EPBC 2012/6615 in accordance with the OAG (ha) | % acquittal[2] | Surplus area available (ha) |
|---|---|---|---|---|---|---|
| **Threatened ecological communities** | | | | | | |
| Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (Brigalow TEC) | E | 0.59 | 172.63 | 19.70 | 599.41 | 152.93 |
| **Threatened fauna species** | | | | | | |
| Collared Delma (*Delma torquata*) | V | 313.19 | 172.63 | 19.70 | 1.38 | 152.93 |
| Yakka Skink (*Egernia rugosa*) | V | 313.78 | 172.63 | 19.70 | 1.61 | 152.93 |
| Dunmall's Snake (*Furina dunmalli*) | V | 308.13 | 173.12 | 19.70 | 1.40 | 153.42 |
| Red Goshawk (*Erythrotriorchis radiatus*) | E | 311.78 | 173.12 | 19.70 | 1.14 | 153.42 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | V | 311.78 | 173.12 | 19.70 | 1.39 | 153.42 |

[1] E = Endangered; V = Vulnerable.
[2] Remaining offset requirement satisfied on other properties for MNES with less than 100% acquittal.

**Table ES 2: Interim performance targets and completion criteria for the EPBC 2012/6615 Bottle Tree offset area**

| MNES | Baseline score | Interim performance targets | | | Completion criteria |
|---|---|---|---|---|---|
| | | Year 5 | Year 10 | Year 15 | Year 20 |
| Brigalow TEC | 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 |
| Collared Delma (*Delma torquata*) | 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 (*Egernia rugosa*) | 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 (*Furina dunmalli*) | 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 (*Erythrotriorchis radiatus*) | 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 (*Nyctophilus corbeni*) | 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 (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 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Bottle Tree offset area was approved by the Department of Agriculture, Water and the Environment (DAWE) in December 2021 to acquit MNES offset requirements under EPBC 2008/4059 and 2008/4096, 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 7 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 7 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 | 0.59 |
| **Threatened fauna species** | | |
| Collared Delma (*Delma torquata*) | Vulnerable | 313.19 |
| Yakka Skink (*Egernia rugosa*) | Vulnerable | 313.78 |
| Dunmall's Snake (*Furina dunmalli*) | Vulnerable | 308.13 |
| Red Goshawk (*Erythrotriorchis radiatus*) | Endangered | 311.78 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | Vulnerable | 311.78 |

## 1.1. Purpose

This OAMP provides a detailed management and monitoring framework for the Bottle Tree offset area in accordance with the requirements 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 7 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 7 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 7 of the GFD Project. This OAMP for the Bottle Tree offset area is submitted as part of the offset plan to address Stage 7 of the GFD Project.<br>A reconciliation of impacts for Stage 1-6 of the GFD Project is included in the offset plan. |
| 14 | The Offset Management Plan must include:<br>a. a method for assessing residual significant impacts to EPBC threatened species, EPBC migratory species and EPBC communities;<br>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;<br>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;<br>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;<br>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;<br>f. performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action (if necessary);<br>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;<br>h. a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria;<br>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;<br>j. a timeline for when actions identified in the Offset Management Plan will be implemented for each offset area; and<br>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 7 of the GFD Project. A 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.<br>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.<br>b. Details of the relevant field assessments within the Stage 7 GFD Project development area are provided in the offset plan, submitted in conjunction with this OAMP.<br>c. A summary of the significant residual impacts associated with Stage 7 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 7 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 7 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 as described in Section 1.1.<br>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.<br>e. Details on the connectivity and the landscape context are provided in Section 2.2.<br>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.<br>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.<br>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.<br>i. Risks to the successful implementation of this plan are included in the risk assessment presented in Appendix C.<br>j. The timing for implementation of the management and monitoring program are provided in Section 9.<br>k. Details on how the Bottle Tree offset area for Stage 7 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 7 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 7 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:<br>a. include the information required for the Offset Management Plan at condition 14 for the next project phase;<br>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 and may be subtracted from the obligations required for the 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<br>c. demonstrate how the offset builds on offsets already secured for previous project stages 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.<br>Stage 7 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 |

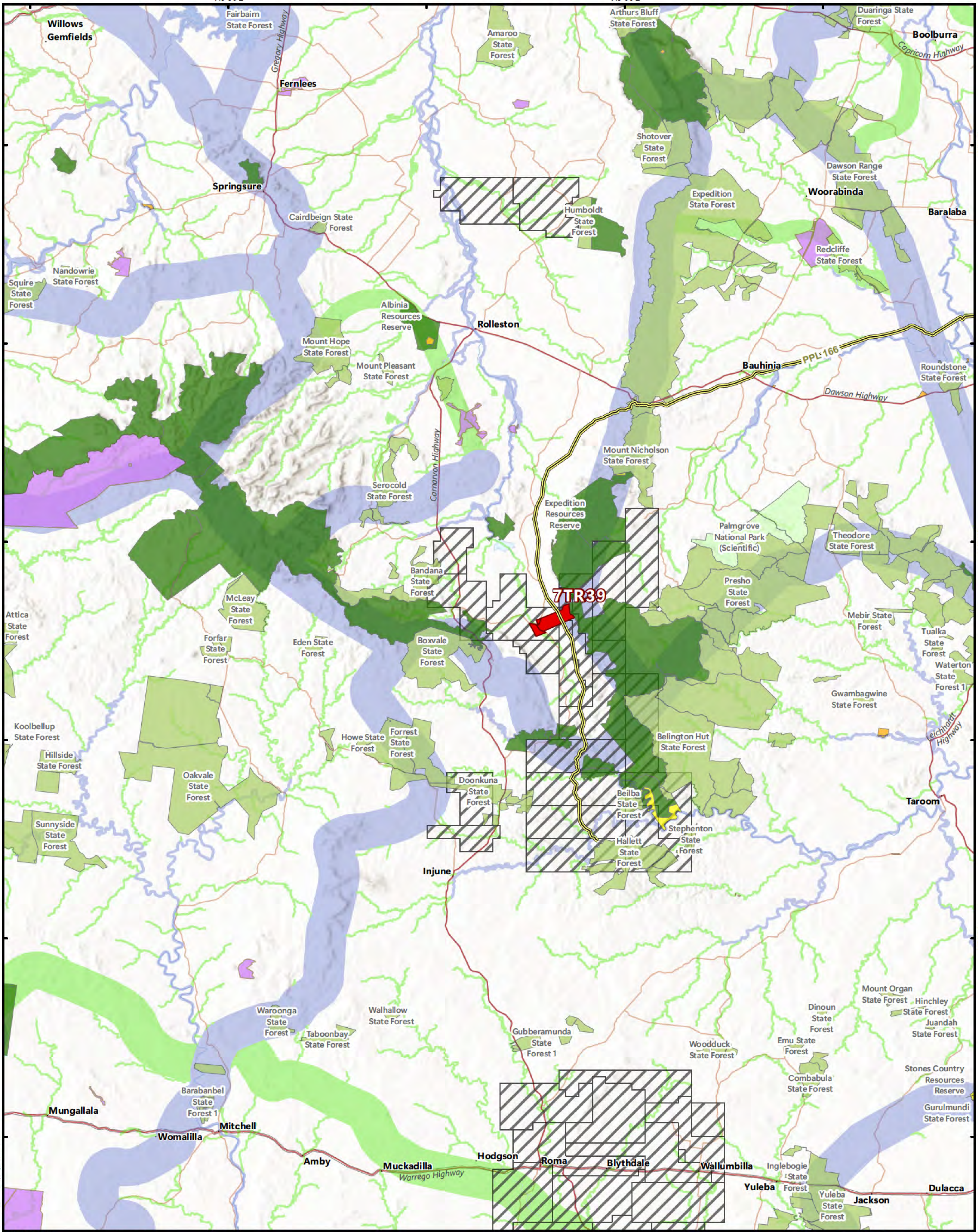


**Figure 1**
**Project Context**

Bottle Tree
Santos Petroleum Licence
Santos Petroleum Pipeline Licence

*Statewide Corridor*
Regional
State

*Protected areas*
State forest
National Park
National Park (scientific)

Conservation Park
Nature Conservation Park
Forest Reserve
Resources Reserve
Timber Reserve
Nature Refuge

CO2 AUSTRALIA

0 20 40
Kilometres

Date: 18/09/2024 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
- Watercourses
- Resource licenses
AUTHOR: S.Worrall

# 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. 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.

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)<br>Total GNG Australia<br>PAPL (Downstream) Pty Ltd<br>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 |
| Petroleum and gas exploration permit | ATP1191 SANTOS QNT Pty Ltd. |
| Petroleum and gas production permit | PL1062 SANTOS QNT Pty. Ltd (application)<br>PL420 and PL421 Santos Toga Pty Ltd |
| Infrastructure permit | PPL166 Santos GLNG Pty Ltd |

## 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. Existing threatened flora offsets

Santos has satisfied offset obligations for Ooline (*Cadellia pentastylis*) and *Xerothamnella herbacea* under EPBC 2008/4096 through the propagation and translocation of individuals on two planting sites (existing offset area) on the Bottle Tree offset area (see Figure 2).

Two individual offset areas for Ooline and *Xerothamnella herbacea,* respectively, have been legally secured through a Voluntary Declaration under the Queensland *Vegetation Management Act 1999* (VM Act). These offset areas are currently being managed, monitored and reported on in accordance with dedicated management plans for the sites, also attached to the Voluntary Declarations.

The offset area to be secured as part of this OAMP exclude areas already legally secured for the Ooline and *Xerothamnella herbacea.* This OAMP has been prepared to align with the management actions detailed in the individual management plans for the Ooline and *Xerothamnella herbacea* offset areas and will be implemented concurrently.

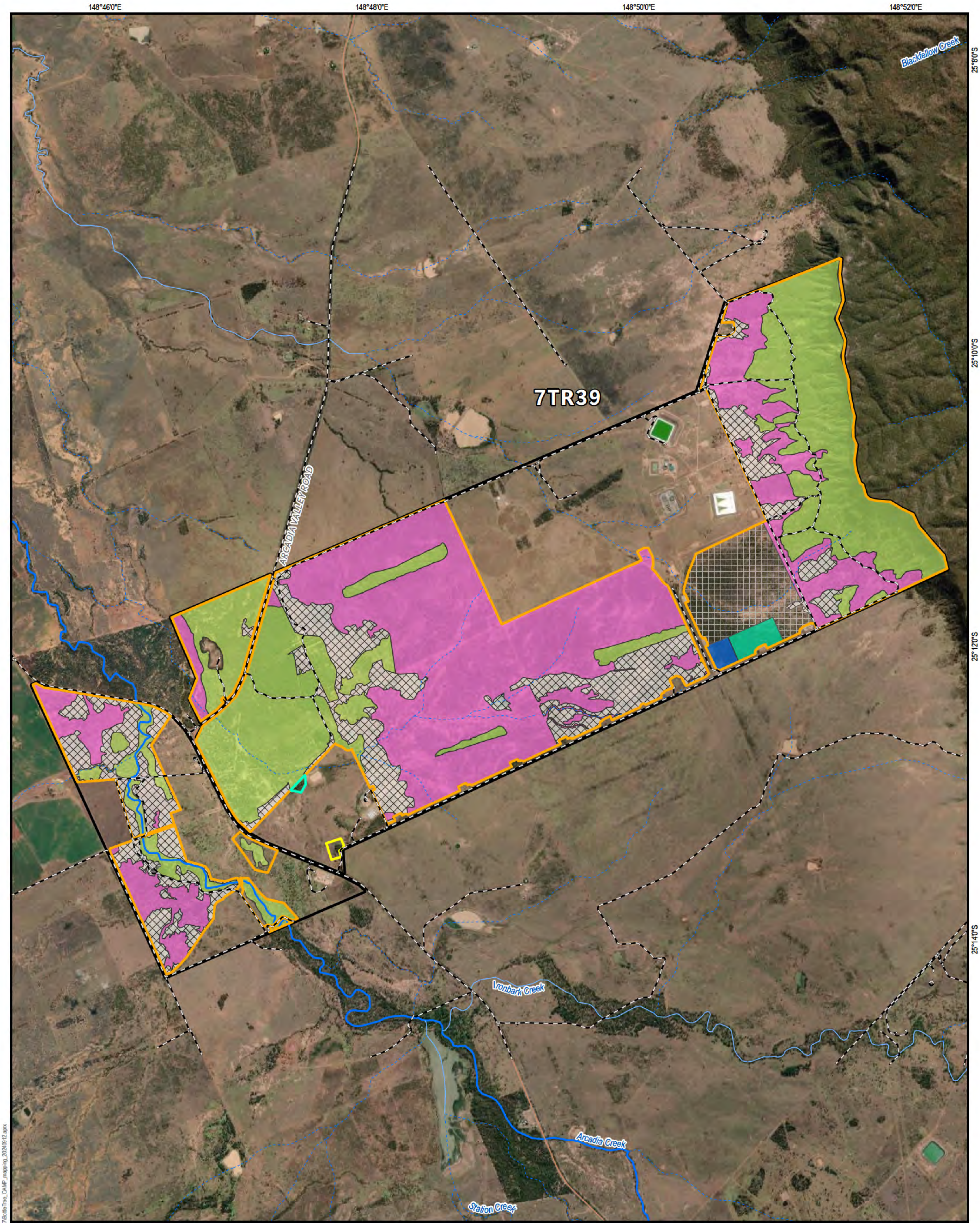


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**Figure 2**
**Property Overview**

Bottle tree
Offset area boundary
Property access track
Major road

***Watercourse***
Major watercourse
Minor drainage line
Drainage contour

***Offset area EPBC 2008/4059***
Phase 1
Phase 2
Future habitat area

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

Offset area EPBC 2012/6615 - stage 7
Surplus offset area

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

CO2 AUSTRALIA

N

0 1 2
Kilometres

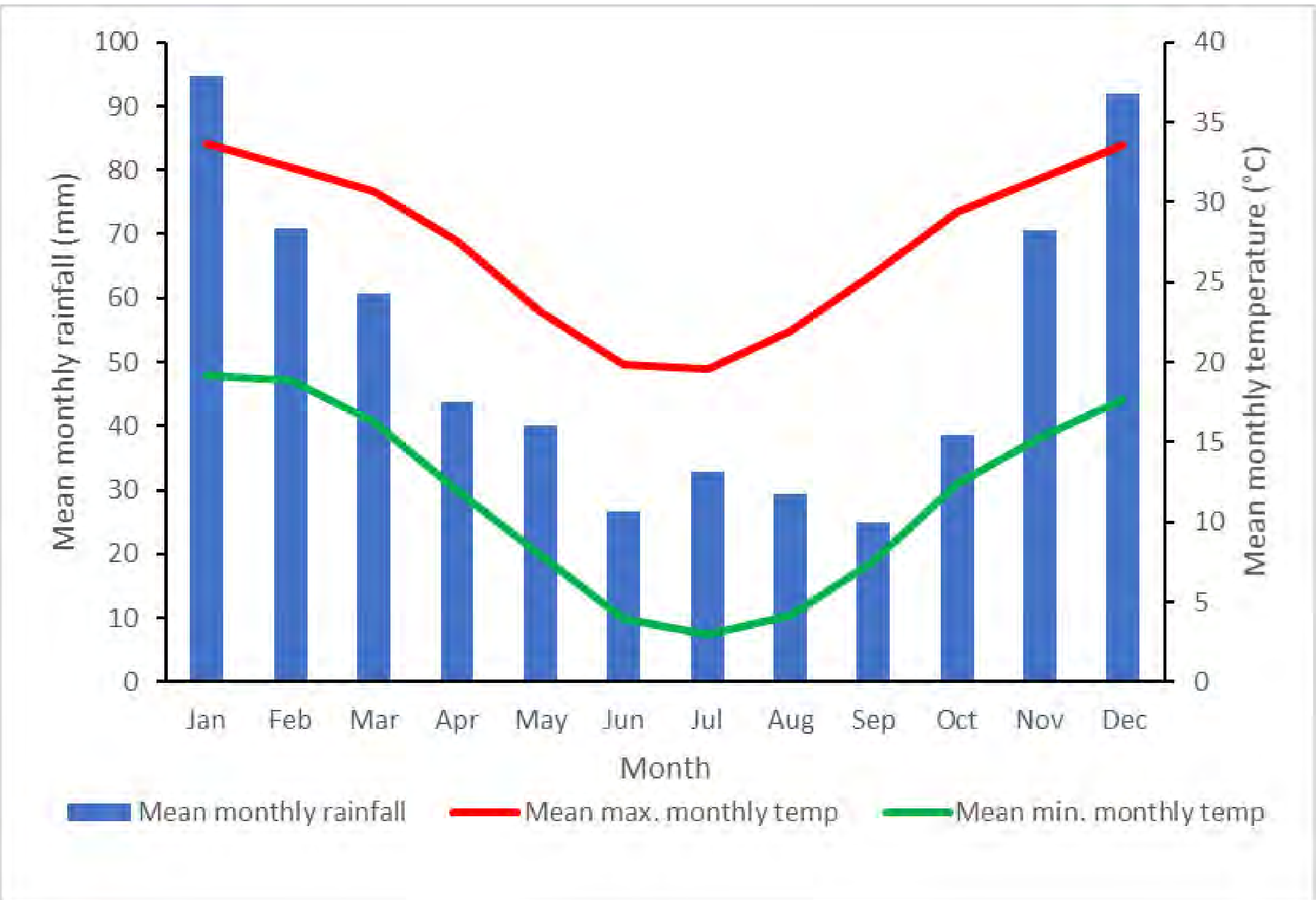
Date: 18/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:42,000@A3

Location diagram

## 2.4. 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 3 – Mean monthly temperature and rainfall records




## 2.5. 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, 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](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 (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, and
    - 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.

## 2.6. 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 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.

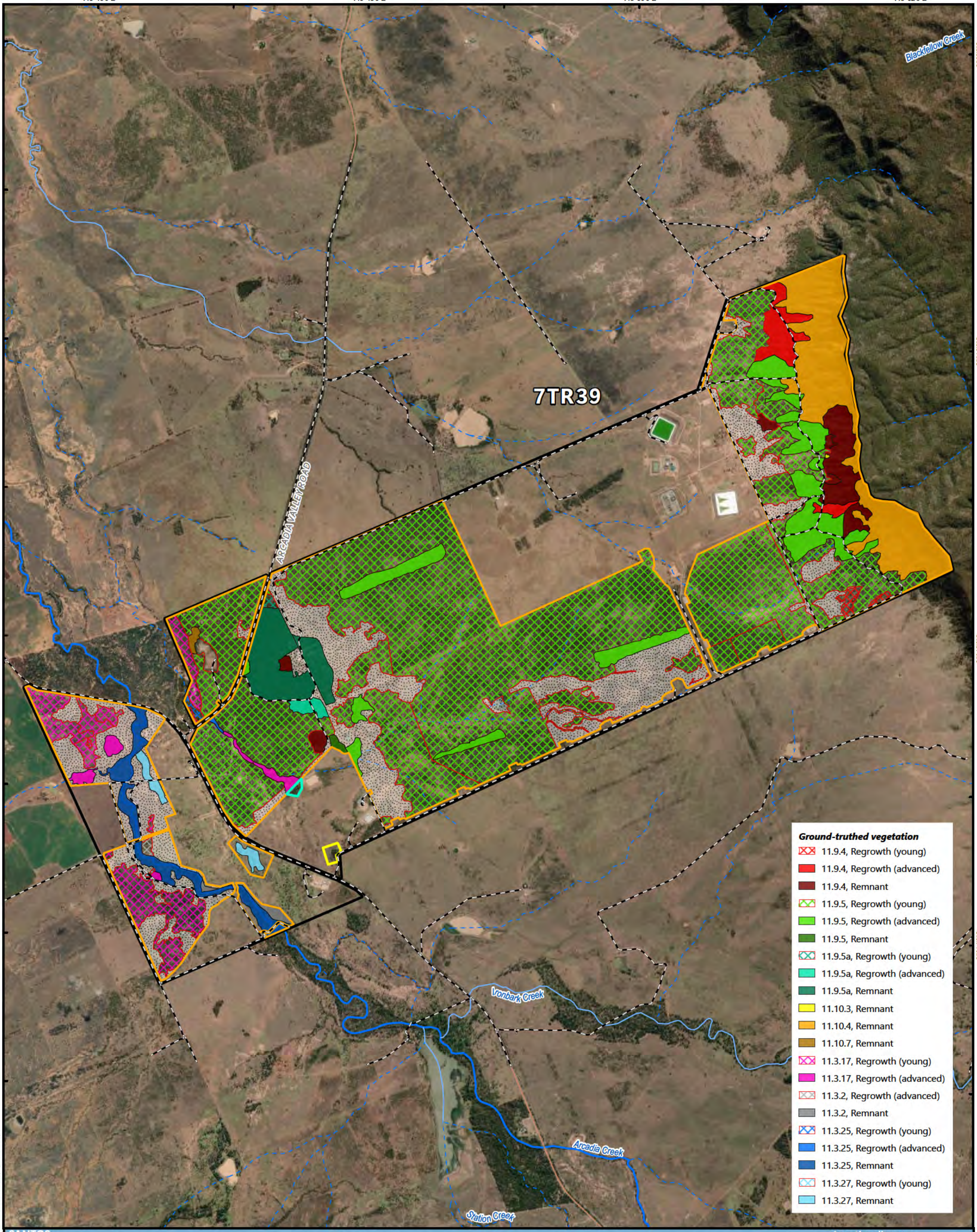
The results of detailed field assessments were subsequently used to confirm the suitability of the mapped ground-truthed RE on the offset area to support habitat for the Project's MNES offset requirements also taking into account the habitat mapping rules for the Santos GLNG Project area outlined in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

### 2.6.1. 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.

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Location diagram


**Figure 4**
**Ground-truthed vegetation**

Bottle Tree
Offset area boundary
EPBC 2008/4059 Future habitat area

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

Property access track
Major road

***Watercourse***
Major watercourse
Minor drainage line
Drainage contour

CO2 AUSTRALIA

N

0 1 2
Kilometres

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

Date: 18/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:42,000@A3

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.

### 2.6.2. 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 | Proposed offset area for Stage 7 of EPBC 2012/6615 | 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 |
| 11.9.5 | *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks | Remnant | 2.60 | - | - | - | 2.60 |
| | | Regrowth (advanced) | 154.33 | - | - | - | 154.33 |
| | | Regrowth (young) | 282.15 | 1,017.14 | 19.70 | 152.93 | 1,471.91 |
| 11.9.5a | | Remnant | 79.89 | - | - | - | 79.89 |

| RE | Description | Type | Bottle Tree offset area (ha) | | | | |
|---|---|---|---|---|---|---|---|
| | | | **EPBC 2008/4059 Phase 1 and Phase 2 offset area** | **EPBC 2008/4096 offset area** | **Proposed offset area for Stage 7 of EPBC 2012/6615** | **Surplus offset** | **Total area** |
| | | 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** | **153.42** | **2,768.49** |

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

| Fauna species | Potentially suitable REs | Habitat mapping rules | High quality habitat (ha) | Moderate quality habitat (ha)* |
|---|---|---|---|---|
| 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).<br>*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).<br>*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).<br>*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.<br>*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.<br>*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.

## 2.7. 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 Phase 1 and 2 of the 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 EPBC 2012/6615.
- 153.4 ha of the remaining surplus offset value comprising moderate quality habitat for MNES and will 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 7 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.

## 2.8. 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, and
- Bottle Tree house and workshop.

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

| MNES | Disturbance area (ha) | Bottle Tree offset area approved under Phase 1 and 2 of EPBC 2008/4059 | Bottle Tree offset area approved under EPBC 2008/4096 | Offset area to be secured for Stage 7 under EPBC 2012/6615 (ha) | Offset requirement satisfied on Bottle Tree?[1] | Surplus area remaining on Bottle Tree following acquittal of EPBC 2008/4059, 2008/4096 and 2012/6615 (ha) |
|---|---|---|---|---|---|---|
| Brigalow TEC | 0.59 | 355.10 | 1,019.47 | 19.70 | Yes | 152.93 |
| Collared Delma (*Delma torquata*) | 313.19 | 579.80 | 1,140.89 | 19.70 | Partially | 152.93 |
| Yakka Skink (*Egernia rugosa*) | 313.78 | 480.10 | 1,140.89 | 19.70 | Partially | 152.93 |
| Dunmall's Snake (*Furina dunmalli*) | 308.13 | 480.10 | 1,140.89 | 19.70 | Partially | 153.42 |
| Red Goshawk (*Erythrotriorchis radiatus*) | 311.78 | 647.50 | 1,143.63 | 19.70 | Partially | 153.42 |
| South-eastern Long-eared Bat (*Nyctophilus corbeni*) | 311.78 | 647.50 | 1,143.63 | 19.70 | Partially | 153.42 |

[1] Where partially satisfied, the remaining offset requirement is satisfied on other properties.

## 2.9. 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 the Queensland Department of Natural Resources, Mines and Energy 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.

## 2.10. EPBC Act Environmental Offset Policy

Table 8 outlines how the Stage 7 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 7Table 7. The remaining will be acquitted elsewhere.<br>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.<br>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 2024). |

| 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.<br>Threats to the offset site are managed by through the implementation of the management measures discussed in Section 6, including:<br>• Fire prevention and management<br>• Weed monitoring and control<br>• Clearing protection<br>• Management of grazing<br>• Restricted access<br>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* 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.<br>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.<br>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.<br>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.<br>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 2024b). The species appears to require rocks, timber, bark or other surface debris for shelter (DCCEEW 2024b). 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.

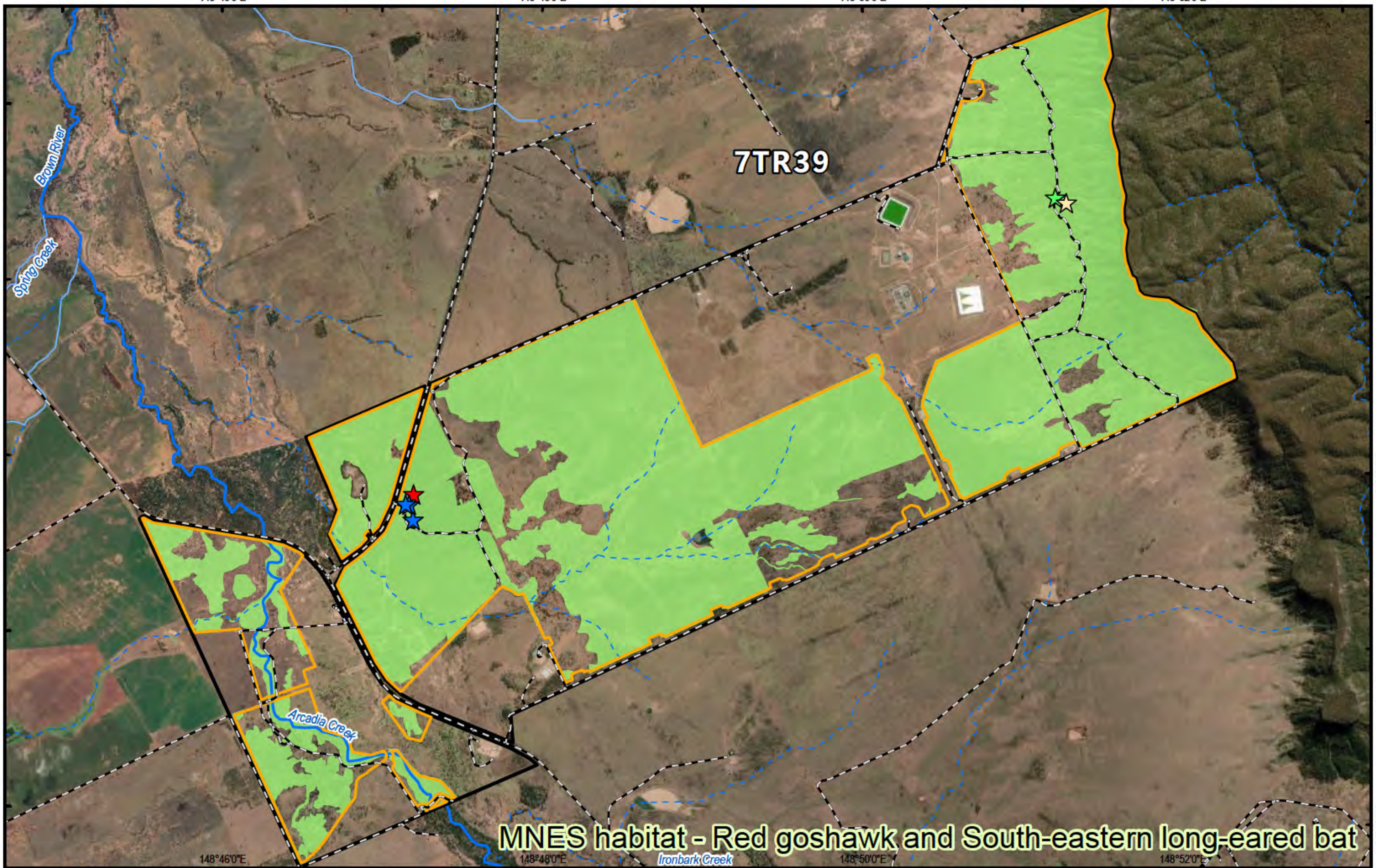
Suitable habitat for red goshawk includes vegetation along and adjacent to the steep cliffs of the Expedition range combined with tall open forests of Brown's Creek and tall ironbark woodlands at the base of the escarpment. Red goshawk is a highly mobile species with a large home range. Breeding habitat is in intact tall forest associated with major drainage lines; however, the species may often forage much further away from these areas (DCCEEW 2024f).

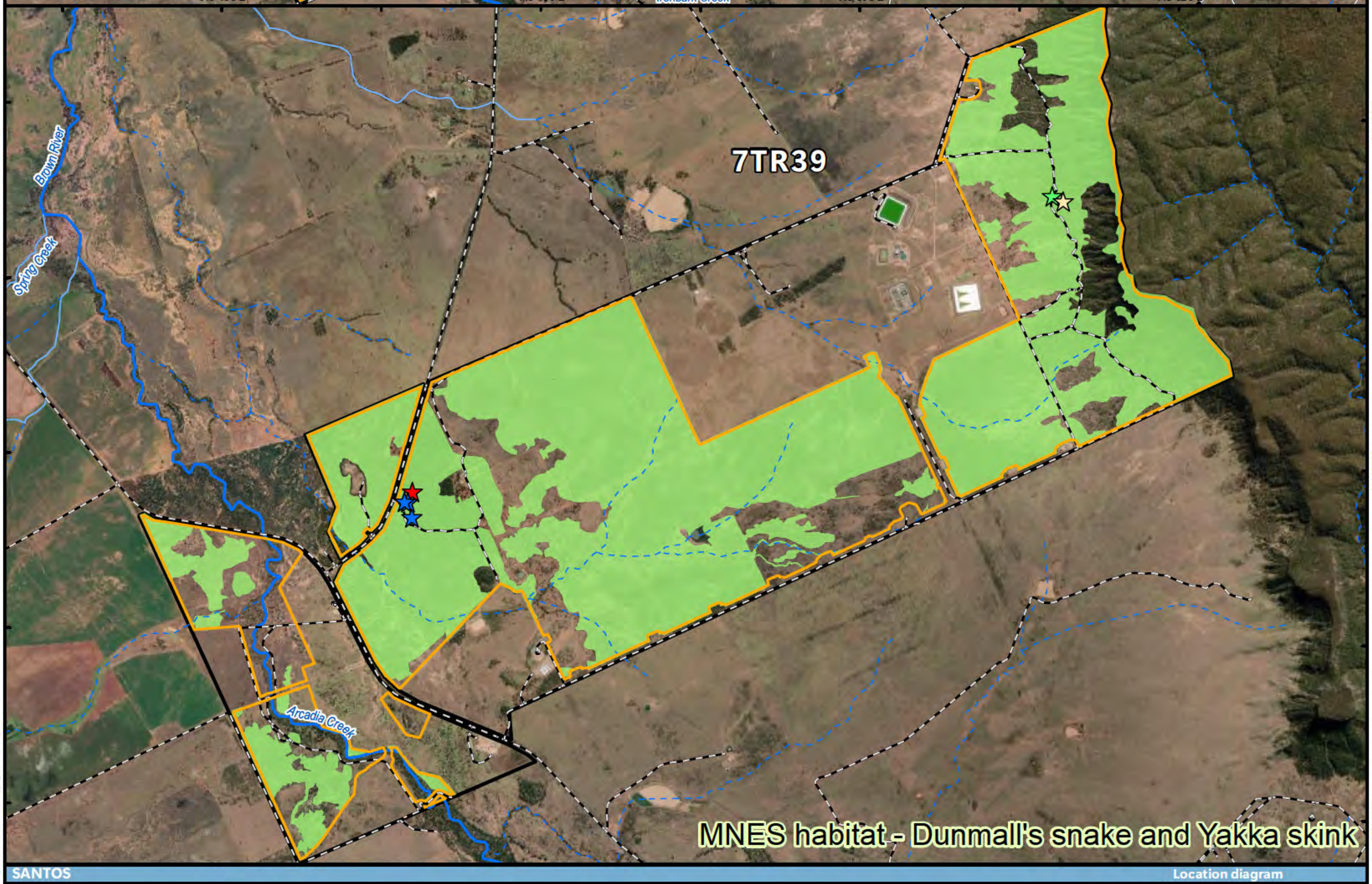
## 3.6. South-eastern Long-eared Bat

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 (NSW NPWS 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).




SANTOS

**Figure 5**
**MNES habitat**

Bottle Tree
Offset area boundary
Property access tracks

***Watercourse***
Major watercourse
Minor drainage line
Drainage contour

MNES habitat

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

CO2 AUSTRALIA

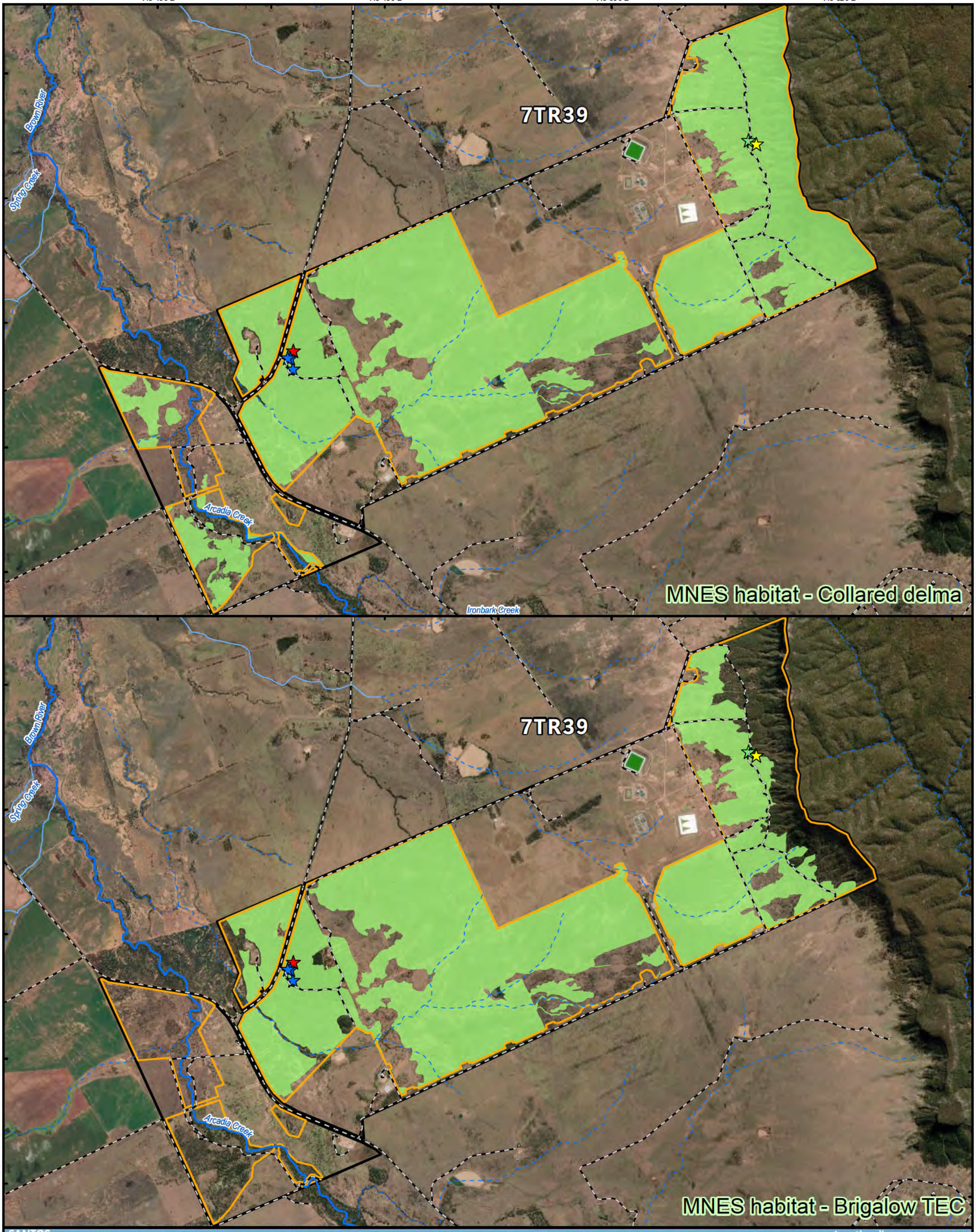
N

0 1 2
Kilometres

Location diagram


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

Date: 18/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:50,000@A3




SANTOS

**Figure 6**
**MNES habitat**

Bottle Tree
Offset area boundary
Property access tracks

***Watercourse***
Major watercourse
Minor drainage line
Drainage contour

MNES habitat

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

DATA SOURCE:
The following datasets are © State of Qld:
- Cadastral data
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0 1 2
Kilometres

Date: 18/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:@A3

Location diagram

# 4. Environmental Outcomes to be Achieved

The outcome of this OAMP will partially acquit the Stage 7 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 (Santos 2024).

**Table 9 – Interim performance targets and completion criteria for the Bottle Tree offset area**

| MNES | Baseline[1] | Interim performance targets | | | Completion criteria |
|---|---|---|---|---|---|
| | | Year 5 | Year 10 | Year 15 | Year 20 |
| Brigalow TEC | 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<br>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:<br>• covering more than 50% of the undisturbed predominant canopy; and<br>• averaging more than 70% of the vegetation's undisturbed height; and<br>• composed of species characteristic of the vegetation's undisturbed predominant canopy. |
| Collared Delma (*Delma torquata*) | 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 (*Egernia rugosa*) | 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 (*Furina dunmalli*) | 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 (*Erythrotriorchis radiatus*) | 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 (*Nyctophilus corbeni*) | 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]Corresponding to moderate quality habitat used for Stage 7 under EPBC 2012/6615.

# 5. Adaptive 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), 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:

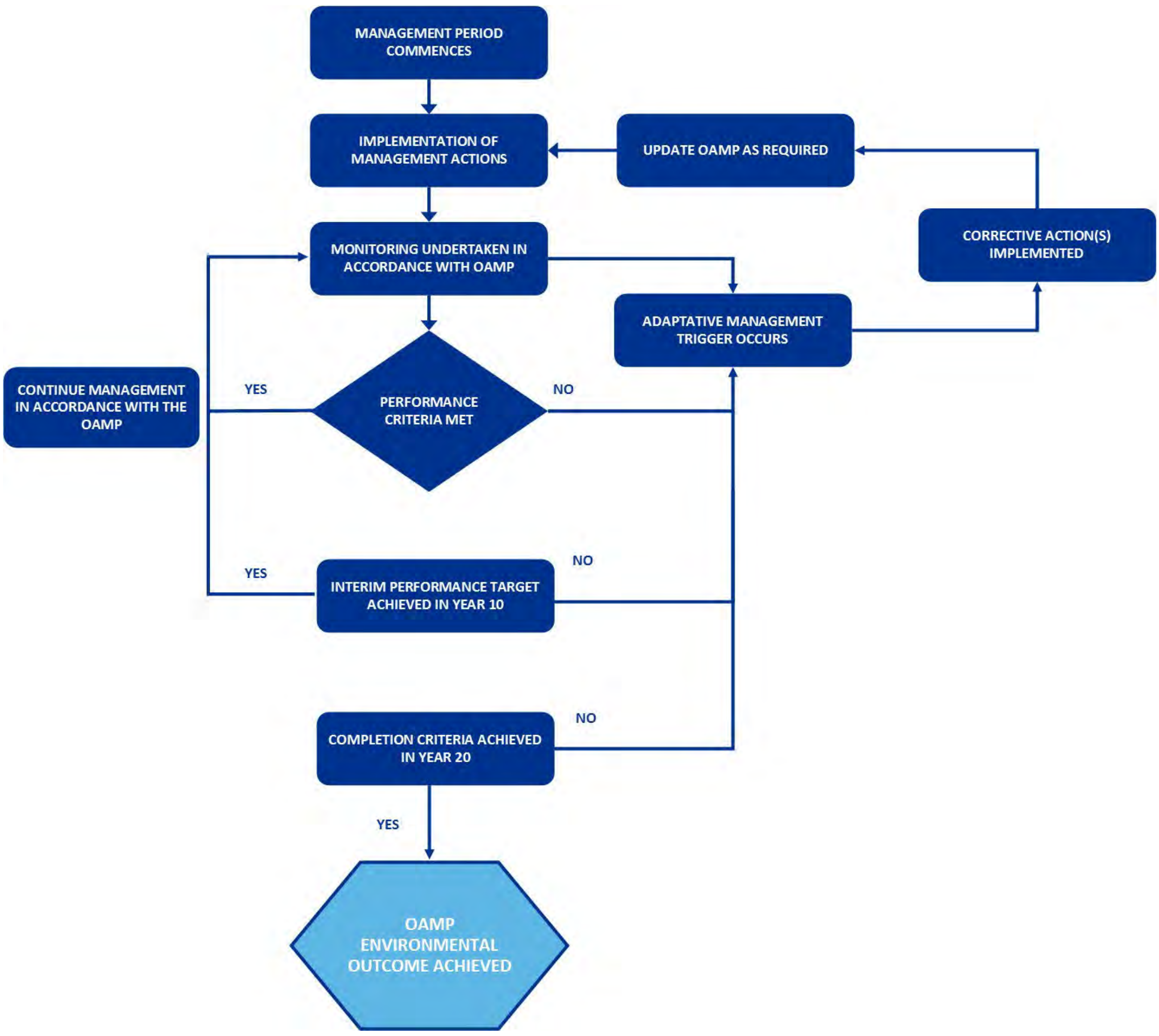
- **identified threats to offset values** – known and potential threats to the offset values have been identified as part of the risk assessment process
- **relevant offset values** – MNES or other offset matter for which the identified threat is relevant have been indicated
- **management objectives** – 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.<br>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 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.<br>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<br>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<br>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 |
|---|---|---|
| Brigalow TEC | Threats to the TEC have been determined based on conservation advice and the Threat Abatement Plan (DCCEEW 2024a):<br>• Clearing of regrowth vegetation.<br>• Inappropriate fire regimes and management.<br>• Pest plant infestation.<br>• Potential knowledge gaps.<br>• Increased grazing by livestock. | The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2024a):<br>• Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2).<br>• Strategic grazing for fuel load management (see Section 6.2.5).<br>• Exclusion of cattle from the offset area (see Section 6.2.4).<br>• Pest animal management and monitoring (see Sections 6.2.7 and 7.4). |
| Collared Delma (*Delma torquata*) | Threats to the species have been determined based on conservation advice (DCCEEW 2024c):<br>• Alteration of ground cover as a consequence of unsuitable fire regime.<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Predation by feral predators (e.g., cats, foxes, wild dogs).<br>• Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter).<br>• Change in ground layer composition as a consequence of livestock grazing and feral horse browsing.<br>• 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 2024b):<br>• Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2).<br>• Strategic grazing for fuel load management (see Section 6.2.5).<br>• Biomass monitoring (see Section 7.2).<br>• Pest animal management and monitoring (see Sections 6.2.7 and 7.4).<br>• Exclusion of cattle from the offset area (see Section 6.2.4).<br>• Weed management and monitoring (see Sections 6.2.6 and 7.3). |
| Yakka Skink (*Egernia rugosa*) | Threats to the species have been determined based on conservation advice (DCCEEW 2024e):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Destruction of potential shelter habitat associated with rabbit warren ripping.<br>• Predation by feral predators (e.g., cats, foxes, pigs).<br>• Removal of foraging and shelter habitat (e.g., rocks, coarse woody debris, ground litter). | The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2024e):<br>• Exclusion of cattle from the offset area (see Section 6.2.4).<br>• Pest animal management and monitoring (see Sections 6.2.7 and 7.4).<br>• Weed management and monitoring (see Sections 6.2.6 and 7.3).<br>• Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2).<br>• Biomass monitoring (see Section 7.2). |

| MNES | Threats | Recovery/management actions |
|---|---|---|
| | • Destruction of potential shelter habitat associated with rabbit warren ripping.<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.<br>• 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 2024e):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat.<br>• Predation by feral predators (e.g., cats, foxes, pigs).<br>• Change in ground layer composition as a consequence of livestock grazing and feral horse browsing.<br>• Alteration of habitat suitability through the presence and extent of non-native, invasive weeds.<br>• 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 2024d):<br>• Pest animal management and monitoring (see Sections 6.2.7 and 7.4).<br>• Exclusion of cattle from the offset area (see Section 6.2.4).<br>• Weed management and monitoring (see Sections 6.2.6 and 7.3).<br>• Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2). |
| Red Goshawk (*Erythrotriorchis radiatus*) | Threats to the species have been determined based on conservation advice (DCCEEW 2024f):<br>• 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.<br>• Potential of reduced prey as a consequence of impacts such as grazing, reducing productivity.<br>• 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 2024f):<br>• Exclusion of cattle from the offset area (see Section 6.2.4).<br>• Fuel hazard management and monitoring (see Section 6.2.5 and 7.2.2).<br>• Strategic grazing for fuel load management (see Section 6.2.5).<br>• 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 2024g):<br>• Loss of suitable habitat through land clearing and effects associated with fragmentation of habitat. | The following recovery actions for the species have been implemented based on conservation advice (DCCEEW 2024g):<br>• Exclusion of cattle from the offset area (see Section 6.2.4).<br>• Pest animal management and monitoring (see Sections 6.2.7 and 7.4).<br>• Weed management and monitoring (see Sections 6.2.6 and 7.3). |

| 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.<br>• Impacts on understorey habitat as a consequence of livestock grazing, impacting habitat for understorey invertebrate prey.<br>• 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. | • Fuel hazard management and monitoring (see Sections 6.2.5 and 7.2.2).<br>• 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.<br>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:<br>• Offset area inspections (Section 7.1).<br>• Rapid monitoring events (Section 7.5.1).<br>• Habitat quality assessments to determine habitat quality scores (Section 7.5.2).<br>• Targeted fauna surveys (Section 7.5.4).<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• Modifying the strategic grazing regime to better support enhancement of offset values.<br>• 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.<br>• 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.<br>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**<br>• Investigate reasons why unapproved clearing occurred e.g. unauthorised access<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Addition fencing, signage and/or security for the offset area.<br>• 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**<br>• 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.<br>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.<br>• Following clearing, the area is to be assessed by a suitably qualified ecologist/expert to determine the total clearing extent of offset value habitat.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks.<br>• 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.<br>• 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:<br>• livestock will only be permitted in the offset area to reduce fuel loads, avoid weed seed set and reduce weed cover, and<br>• within the offset area a minimum of 2,500 kg/ha of biomass will be retained at the end of the dry season.<br>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**<br>• Investigate the reason for the decrease in richness and average % cover of native perennial grasses<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>– Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events.<br>– Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime.<br>– 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**<br>• Investigate the reason for biomass being less than 2,500 kg/ha.<br>• 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.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Removal of stock or spelling grazing from the area of the offset in which less than 2,500 kg/ha of biomass was identified.<br>• Review adherence to livestock grazing restrictions in Section 6.2.5.<br>• 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<br>• Foot hold traps<br>• 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**<br>• Investigate potential sources or reasons that may have attributed to an increase in the:<br>– Catling* index for wild dogs, feral cats and/or foxes<br>– relative abundance of feral pigs and horses.<br>• Review adherence to pest management control measures as outlined in Section 6.2.7<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency and intensity of pest animal control.<br>• Revising methods of pest animal control in accordance with Queensland Department of Agriculture and Fisheries (DAF) guidelines, and coordinate with neighbouring land owners to ensure a consistent approach.<br>• 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<br>• Trapping<br>• 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<br>• Poisoning<br>• 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<br>• Shooting<br>• 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.<br>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.<br>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.<br>A new weed species is identified at one or more monitoring sites. | **Step 1: Investigate cause of trigger**<br>• Investigate potential sources or reasons that may have attributed to an increase in species richness and/or relative abundance of weeds.<br>• Investigate potential sources or reasons for the occurrence of the new weed species.<br>• Review adherence to weed management control measures as outlined in Section 6.2.6<br>• Review adherence to weed hygiene restrictions as outlined in Section 6.2.1<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Amending weed hygiene restrictions.<br>• Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to.<br>• Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld).<br>• Increasing the frequency and intensity of weed control.<br>• 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<br>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.<br>Fuel loads will be managed through implementation of the following:<br>• maintained fire breaks,<br>• controlled grazing regimes; and,<br>• fuel hazard reduction burns.<br>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.<br>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**<br>• Investigate reasons why the fire management measures have resulted in a decrease in habitat quality scores.<br>• Review adherence to the fire management measures as outlined in Section 6.2.5.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency of biomass monitoring.<br>• Increasing the frequency of weed control measures.<br>• Amending the strategic grazing regime.<br>• Reviewing effectiveness of firebreaks, and establishment of additional fire breaks.<br>• 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).<br>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**<br>• Investigate the reasons why stem density is >10,000 stems/ha and whether management intervention is required.<br>• Mechanical thinning is effective and appropriate.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency thinning activities.<br>• 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.<br>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:<br>• Offset area inspections (Section 7.1).<br>• Offset value assessments (Section 7.5).<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• 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.<br>• All persons entering the offset area will be required to ensure vehicles and equipment are weed free.<br>• All contractors entering the offset area must hold a current weed hygiene certificate or equivalent for all vehicles and equipment.<br>• 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.<br>• 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.<br>• 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:<br>– maintenance of access tracks and/or fire breaks,<br>– fence construction and maintenance, and<br>– ensuring public safety or as directed by emergency management response personnel in the event of unplanned fire or other emergency or associated procedure.<br>• If vegetation clearing is required for fencing, access, firebreaks or public safety, all activities will be appropriately planned, recorded and monitored.<br>• 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.<br>• The offset area will be demarcated as an exclusion zone in the Santos GIS.<br>• 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.<br>• The property will be suitably fenced to restrict access by unauthorised persons.<br>• 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.<br>• When entering and leaving the property, the Land Advisor must be advised.<br>• 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, and
- 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).

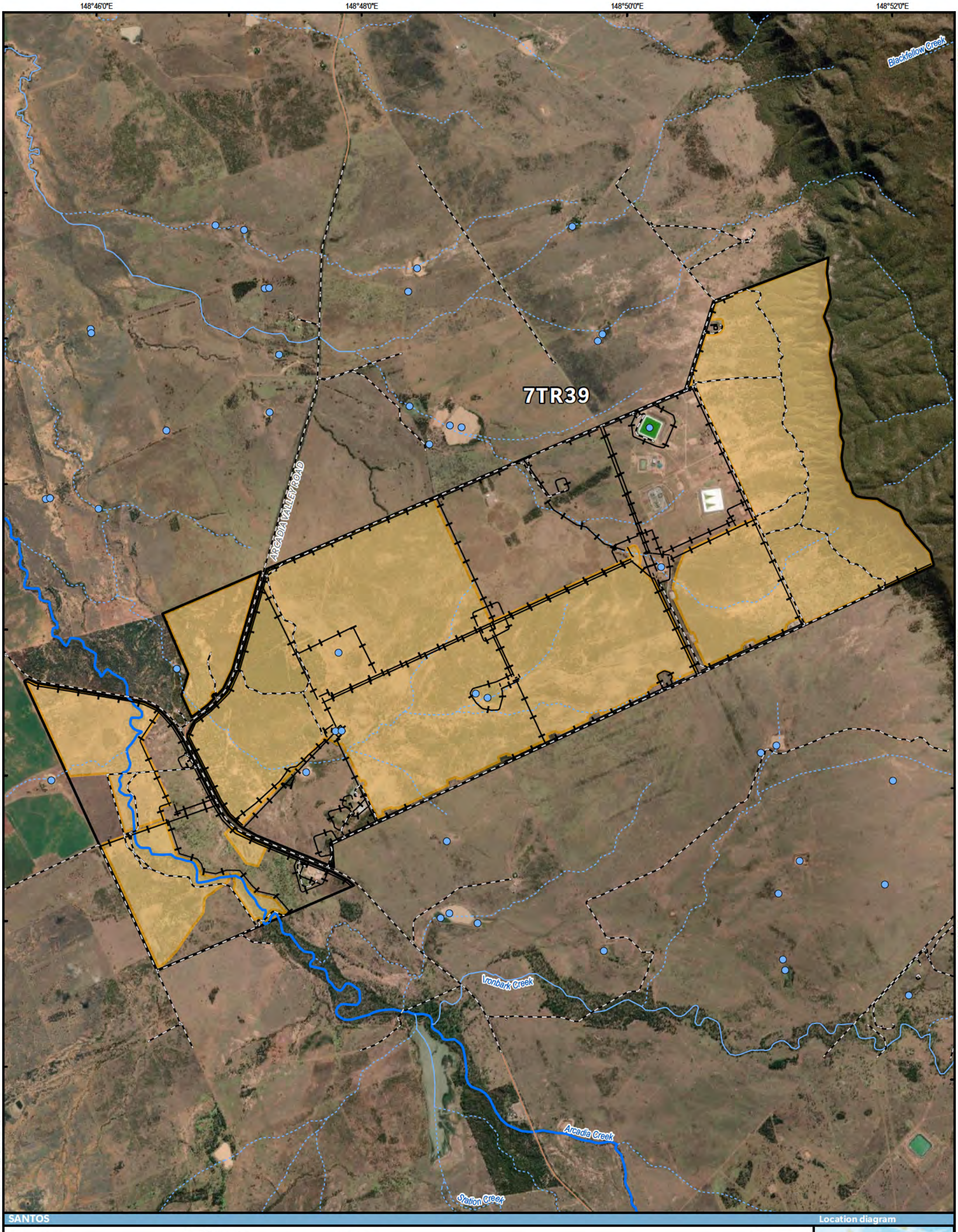
### 6.2.4. Fencing

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.




SANTOS

Location diagram

**Figure 8**
**Property Infrastructure**

Bottle Tree
Offset area
Property access tracks
Fence
Dam
Major road
*Watercourse*
Major watercourse
Minor drainage line
Drainage contour

CO2 AUSTRALIA

N

0 1 2
Kilometres

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

Date:18/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:42,000@A3

### 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 Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions Threatened Ecological Community (SEVT TEC), 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), 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 6.2.5), and
- 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 Regional Ecosystem Description Database (REDD; Queensland Herbarium 2021), which provides recommendations for fire management for each of the component RE (Table 14), 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.

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 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 7.2.2) 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, and
- 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 component RE**

| RE | Associated TEC | Fire Exclusion? | Fire Management |
|---|---|---|---|
| 11.10.3 | - | Yes | • Protection from fire is necessary.<br>• Maintain fire management of surrounding country with numerous small fires throughout the year so that fires will be very limited in extent.<br>• There is typically not enough ground vegetation within this RE to carry a fire. |
| 11.10.4 | - | No | • Maintain fire management of surrounding country.<br>• Burn surrounding country only under conditions of good soil moisture and when plants are actively growing.<br>• 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.<br>• 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.<br>• Burn less than 10-30% of the area in any year.<br>• 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.<br>• 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.<br>• 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.<br>• Burn less than 30% of the area in any year.<br>• 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.<br>• 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:<br>– maintaining a fire mosaic,<br>– control invasive shrubs,<br>– low to moderate intensity burns with good soil moisture to minimise loss of hollow trees, and<br>– avoiding riparian communities where appropriate. |
| 11.3.17 | - | No | • Conduct a burn every 6-10 years, avoiding hottest and driest time of the year.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• In some situations it may be best not to burn as this RE is often critical habitat for fauna and flora species.<br>• If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants.<br>• 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.<br>• In some situations it may be best not to burn as this RE is often critical habitat for fauna and flora species.<br>• If burning is to occur then implement when water level is deep enough to protect the bases of aquatic plants.<br>• 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.<br>• Maintain fire management of surrounding country with numerous small fires throughout the year so that fires will be very limited in extent.<br>• Maintenance of fire breaks may be appropriate on flat country, but natural features will be useful as breaks in 'wild' country.<br>• Fuel reduction in the surrounding vegetation under low fire danger conditions and/or revegetation of cleared areas reduce the risk of damaging wildfires.<br>• 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.<br>• High intensity fires will cause damage to overstorey.<br>• 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.<br>• 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<br>• Foot hold traps<br>• Shooting | (DAF 2024a) |
| Fox (*Vulpes vulpes*) | Category 3,4,5,6 | • Ground baiting<br>• Trapping<br>• Shooting | (DAF 2024b) |
| Feral cat (*Felis catus*) | Category 3,4,6 | • Night shooting<br>• Poisoning<br>• Trapping | (DAF 2023a) |

| Species | Status under *Biosecurity Act 2014* | Example control method | Reference |
|---|---|---|---|
| Pig (Sus scrofa) | Category 3,4,6 | • Trapping<br>• Shooting<br>• 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), and
- 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, 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 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 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.

[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 6.2.6).

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**

<table>
<tr><th>Pest animal</th><th>Methodology to be implemented</th></tr>
<tr><td>Fox</td><td rowspan="3">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.<br>• fauna monitoring cameras will be placed in the offset area,<br>• cameras will be placed along tracks and left in place for a minimum of three consecutive nights, and<br>• 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).</td></tr>
<tr><td>Wild dog</td></tr>
<tr><td>Feral cat</td></tr>
<tr><td>Feral pig</td><td>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:<br>• nominate randomly stratified sites across the offset area in environments that are more regularly impacted (e.g. drainage lines, moist gullies, around swamps etc),<br>• calculate an abundance score for each transect as the percentage of 'present' feral pig signs, and<br>• calculate the mean abundance score (and variance) across all transects in the offset area.</td></tr>
</table>

| 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.<br>[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 Guide to Determining Terrestrial Habitat Quality 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).

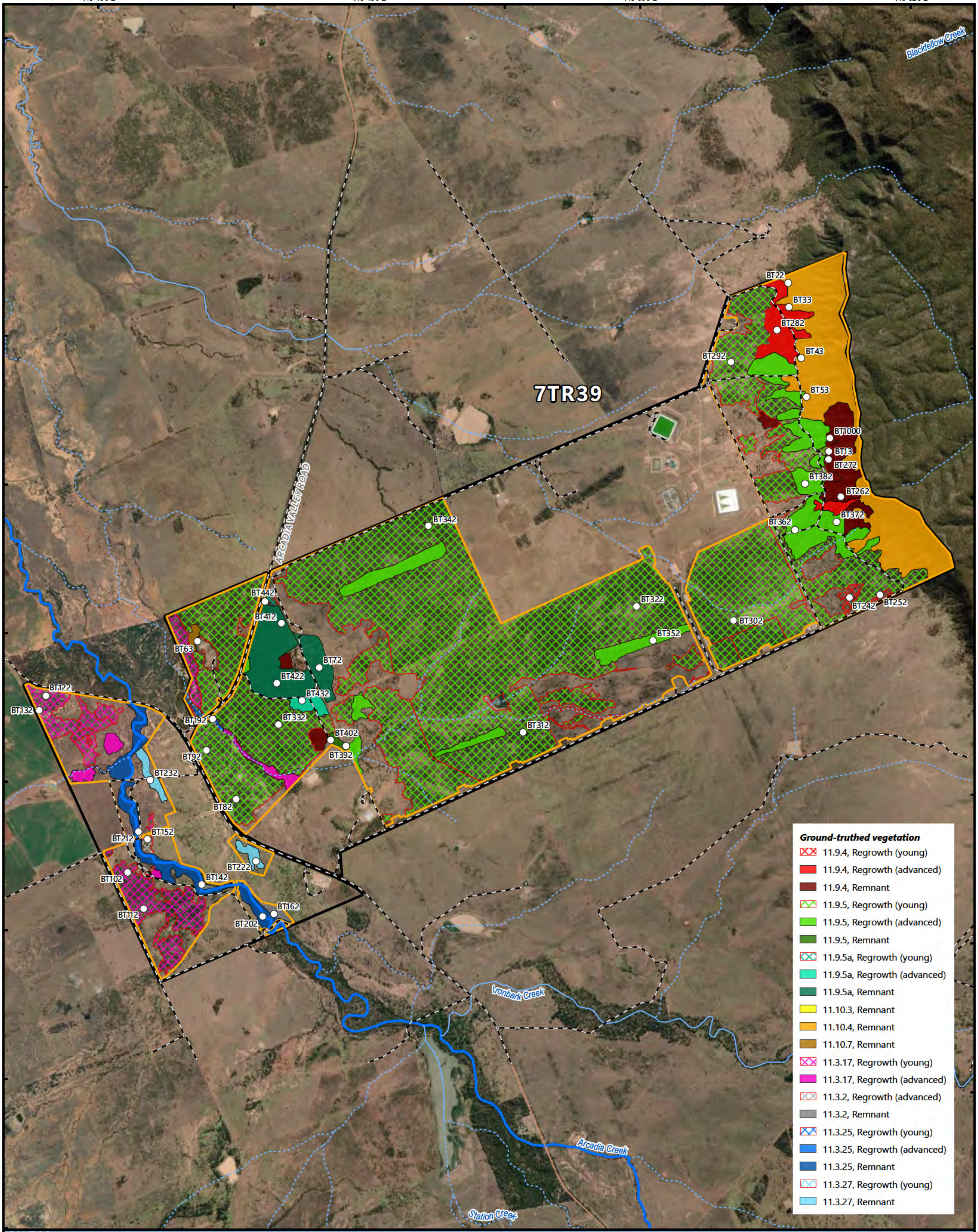



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**Figure 9**
**Monitoring sites**

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

*Watercourse*
- Major watercourse
- Minor drainage line
- Drainage contour

- Habitat quality monitoring point

CO2 AUSTRALIA

Location diagram


N

0 1 2
Kilometres

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

Date: 18/09/2024 Coordinate System: GDA2020 MGA zone 55 Scale: 1:42,000@A3

### 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 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. |
| 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 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 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<br>✓ Activity required<br>■ 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)<br>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. | Reporting (Section 8) |
| | Update OAMP | | | | | ■ | | | | | ■ | | | | | ■ | | | | | ■ | The OAMP will be reviewed, audited and updated every 5 years. | |

**Table 19 – Implementation of monitoring events**

| Survey or monitoring objective | Monitoring activity | Management years<br>✓ Activity required<br>▪ 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.<br>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 D). | 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)<br>Photo monitoring of selected sites to assess visual changes in weed species and infestations over time.<br>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<br>✓ Activity required<br>▪ 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). |

# References


Auld, B. (2009). *NSW Guidelines for Monitoring weed Control and recovery of native vegetation*. NSW Department of Primary Industries, Orange.

Boobook (2011). *Report on ground truthing of Biodiversity Offset Potential at 'Bottle Tree', Queensland (Rev. 1)* report to Santos, issued 30 August 2011.

Boobook (2015). *Biodiversity Offset Assessment Report. 'Bottle Tree' - Lot 7 on Plan TR39. (Rev. 0)* report to Santos, issued 30 March 2015.

Boobook (2020). *Predictive Habitat Mapping Rules for Selected MNES Fauna Species within the Roma, Fairview and Arcadia Gas Fields, Santos GLNG Project Area*. Unpublished consultancy report to Santos GLNG Pty Ltd.

Bureau of Meteorology (BOM) (2024) Climate data online. Injune Post Office. Bureau of Meteorology. Viewed 28 July 2021. http://www.bom.gov.au/climate/data/.

Department of Agriculture and Fisheries (DAF) (2023a). Feral Cat Fact Sheet, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/61987/feral-cat.pdf.

Department of Agriculture and Fisheries (DAF) (2023b). Feral Pig Fact Sheet, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0005/70925/feral-pig.pdf.

Department of Agriculture and Fisheries (DAF) (2022). Feral horse Fact Sheet, viewed 21 August 2024, https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/pests/invasive-animals/other/feral-horse.

Department of Agriculture and Fisheries (DAF) (20240a). Wild Dog Fact Sheet, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0003/74487/wild-dog.pdf.

Department of Agriculture and Fisheries (DAF) (20240b). Fox Fact Sheet, viewed 21 August 2024, https://www.daf.qld.gov.au/__data/assets/pdf_file/0019/73810/european-red-fox.pdf.

Department of Agriculture, Water and the Environment (DCCEEW) (2024a). Brigalow (Acacia harpophylla dominant and co-dominant). Species Profile and Threats Database. Viewed 2 April 2020. http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=28.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024b). Delma torquata. Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1656.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024c), Environmental Management Plan Guidelines, Department of Climate Change, Energy, the Environment and Water, Canberra, March. CC BY 4.0.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024d). Furina dunmalli – Dunmall's Snake. Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59254.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024e). Egernia rugosa — Yakka Skink. Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1420.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024f). Erythrotriorchis radiatus — Red Goshawk. Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024g). Nyctophilus corbeni — Corben's Long-eared Bat, South-eastern Long-eared Bat. Species Profile and Threats Database, viewed 21 August 2024, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83395.

Department of Environment and Heritage Protection (DEHP). (2017). Guide to Determining Terrestrial Habitat Quality (Version 1.2). QLD Government, Brisbane, QLD.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012). Environment Protection and Biodiversity Conservation Act 1999 Environmental Offset Policy. Commonwealth of Australia, Canberra.

Dwyer, J.M. and Mason, R. (2017). Plant community responses to thinning in densely regenerating Acacia harpophylla forest. *Restoration Ecology*, 26: 97-105.

Ecofund (2011). *Bottle Tree Property Assessment. Project: GLNG Project*. Unpublished consultancy report prepared for Santos 14 April 2011.

Eyre, T.J., Kelly, A.L., Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J., and Franks, A.J. (2015). *BioCondition: Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2*. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Eyre, T. J., Ferguson, D. J., Hourigan, C. L., Smith, G. C., Mathieson, M. T., Kelly, A. L., Venz, M. F., Hogan, L. D. and Rowland, J. (2018). *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland*. Department of Environment and Science, Queensland Government, Brisbane.

Fensham, R. J. (1998). The grassy vegetation of the darling downs, south-eastern Queensland, Australia floristics and grazing effects. *Biological Conservation*, 84: 301-310.

Fleming, P., Meek, P., Ballard, G., Banks, P., Claridge, A., Sanderson, J. & Swann, D. (2104). *Camera trapping: Wildlife management and research.* CSIRO Publishing, Collingwood.

Franks, A. J. (2002). The ecological consequences of Buffel Grass Cenchrus ciliaris establishment within remnant vegetation of Queensland. Pacific *Conservation Biology*, 8: 99 – 107.

Hines, F., Tolhurst, K. G., Wilson A. AG. and McCarthy, G. J. (2010). *Overall fuel hazard assessment guide*. Department of Sustainability and Environment, Victorian Government, Melbourne.

Hone, J. (1988). Feral pig rooting in a mountain forest and woodland Distribution, abundance and relationships with environmental variables. *Australian Journal of Ecology*, 13: 393–400.

Hone, J. (1995) Spatial and temporal aspects of vertebrate pest damage with emphasis on feral pigs. *Journal of Applied Ecology*, 32: 311-319

Mitchell, B & Balogh, S (2007a). *Monitoring techniques for vertebrate pests – feral pigs*. Orange, NSW.

Mitchell, B & Balogh, S (2007b). *Monitoring techniques for vertebrate pests – wild dogs*. Orange, NSW.

Mitchell, B & Balogh, S (2007c). *Monitoring techniques for vertebrate pests – foxes*. Orange, NSW.

National Research Council (2004), *Adaptive Management for Water Resources Project Planning*. The National Academies Press, Washington, DC.

Neldner, V.J., Wilson, B.A., Thompson, E.J. and Dillewaard H.A. (2012). *Methodology for Survey And Mapping of Regional Ecosystems and Vegetation Communities in Queensland. Version 3.2.* Updated August 2012. Queensland Herbarium, Queensland Department of Science, Information Technology, Innovation and the Arts, Brisbane.

NSW National Parks and Wildlife Service (NSW NPWS) (2003). *Threatened species of the New England Tablelands and north west slopes of New South Wales*. NSW Parks and Wildlife Service, Coffs Harbour.

Peeters P.J. and Butler D.W. (2014) *Brigalow: regrowth benefits management guideline*. Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Pennay, M, Ellis, M and Parnaby, H (2011). *The bat fauna of New South Wales and the Australian Capital Territory*. In: B. Law, P. Eby, D. Lunney and L. Lunsdem (eds.) The biology and conservation of Australian bats, Royal Zoological Society of New South Wales, Sydney.

Queensland Herbarium (2021) Regional Ecosystem Description Database (REDD). Version 12. Updated March 2021. Department of Environment and Science, Brisbane.

Santos (2024). *Santos GLNG Offset Plan and Acquittal Summary: EPBC Act Approval 2012/6615 (Stage 7).* A report prepared for Santos Ltd. Document number 0007-650-EMP-0039.

Sattler, P. and Williams, R. (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency. Queensland Government, Brisbane.

Terrestria Pty Ltd (2020), *Bottle Tree Offset Area: 2019 Baseline Ecological Monitoring and Assessment*. Prepared for Santos GLNG.

Threatened Species Scientific Committee (TSSC) (2012). Commonwealth Listing Advice on Chalinolobus dwyeri (Large-eared Pied Bat). Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT. Viewed 3 July 2020. http://www.environment.gov.au/biodiversity/threatened/species/pubs/183-listing-advice.pdf.

Threatened Species Scientific Committee (TSSC) (2015a). Conservation Advice Geophaps scripta scripta squatter pigeon (southern). Department of Environment, Canberra, ACT. Viewed 3 July 2020. http://www.environment.gov.au/biodiversity/threatened/species/pubs/64440-conservation-advice-31102015.pdf.

Threatened Species Scientific Committee (TSSC) (2015b) Conservation Advice Nyctophilus corbeni south-eastern long-eared bat. Department of the Environment, Canberra, ACT. Viewed 3 July 2020. http://www.environment.gov.au/biodiversity/threatened/species/pubs/83395-conservation_advice-01102015.pdf.

Turbill, C and Ellis, M (2006). Distribution and abundance of the south eastern form of the Greater Long-eared Bat Nyctophilus timoriensis. *Australian Mammalogy*, 28: 1-7.

Turbill, C, Lumsden, LF and Ford, GI (2008). South-eastern and Tasmanian Long-eared Bats. In S van Dyck and R Strahan (eds.). *The mammals of Australia*, Reed New Holland, Sydney.

Williams, B. (2011). Adaptive management of natural resources – framework and issues. *Journal of Environmental Management*, 92: 1346 – 1353.

Williams, B. & Brown, E. (2016). Technical challenges in the application of adaptive management. *Biological Conservation*, 195: 255–263.

# 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) | 4.875 | 6.25 | 5.5 | 6.1875 | 6.5625 | 4.375 | 5.75 | 4.3125 | 5.4375 | 2.75 | 2.875 | 2.125 | 3.0625 | 3.875 | 5 | 4.875 | 7.125 | 5.75 | 6.125 | 6.875 | 6.25 | 1.625 |
| Site context (/10) | 7 | 8 | 9 | 9 | 9 | 5.5 | 7 | 5 | 6 | 3.5 | 3.5 | 3.5 | 3.5 | 6.5 | 5.5 | 5.5 | 6 | 5.5 | 5.5 | 2 | 4.5 | 6 |
| **Habitat quality score /10 (site condition 60%, site context 40%)** | | | | | | | | | | | | | | | | | | | | | | |
| Brigalow TEC | 5.725 | - | - | - | - | - | 6.25 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Species habitat index /10** | | | | | | | | | | | | | | | | | | | | | | |
| Collared delma | 5.6 | 6.6 | 6.6 | 6.6 | 6.6 | 5.4 | 5 | 5 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 4.2 | 4.2 | 4.2 | - | - | - | - | - | 2.8 |
| Yakka skink | 5.6 | 7.6 | 7.6 | 7.6 | 7.6 | 7 | 5 | 3.4 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 7.6 | 7.6 | 7.6 | - | - | - | - | - | - |
| Dunmall's snake | 7.2 | 8.2 | 8.2 | 8.2 | 6.6 | 6 | 6 | 5 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 6 | 6 | 6 | - | - | - | - | - | - |
| Red goshawk | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 5.6 | 5.6 | 4.8 | 4 | 4 | 4 | 4 | 4 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 | 4 |
| South-eastern long-eared bat | 4.8 | 7.2 | 7.2 | 7.2 | 7.2 | 5.6 | 5.6 | 4.8 | 4 | 4 | 4 | 4 | 4 | 9.2 | 9.2 | 9.2 | 8.2 | 9.2 | 9.2 | 5.6 | 5.6 | 4 |
| **Habitat quality score fauna species /10 (site condition 30%, site context 30%, species habitat index 40%)** | | | | | | | | | | | | | | | | | | | | | | |
| Collared delma | 5.80 | 6.92 | 6.99 | 7.20 | 7.31 | 5.12 | 5.83 | 4.79 | 4.31 | 2.76 | 2.79 | 2.57 | 2.85 | 4.79 | 4.83 | 4.79 | - | - | - | - | - | 3.41 |
| Yakka skink | 5.80 | 7.32 | 7.39 | 7.60 | 7.71 | 5.76 | 5.83 | 4.15 | 4.31 | 2.76 | 2.79 | 2.57 | 2.85 | 6.15 | 6.19 | 6.15 | - | - | - | - | - | - |
| Dunmall's snake | 6.44 | 7.56 | 7.63 | 7.84 | 7.31 | 5.36 | 6.23 | 4.79 | 4.79 | 3.24 | 3.27 | 3.05 | 3.33 | 5.51 | 5.55 | 5.51 | - | - | - | - | - | - |
| Red goshawk | 6.44 | 7.16 | 7.23 | 7.44 | 7.55 | 5.20 | 6.07 | 4.71 | 5.03 | 3.48 | 3.51 | 3.29 | 3.57 | 6.79 | 6.83 | 6.79 | 7.62 | 7.06 | 7.17 | 6.34 | 6.91 | 3.89 |
| South-eastern long-eared bat | 5.48 | 7.16 | 7.23 | 7.44 | 7.55 | 5.20 | 6.07 | 4.71 | 5.03 | 3.48 | 3.51 | 3.29 | 3.57 | 6.79 | 6.83 | 6.79 | 7.22 | 7.06 | 7.17 | 4.90 | 5.47 | 3.89 |

* 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) | 2.25 | 6.0625 | 5.8125 | 6.125 | 3.125 | 2.625 | 2.625 | 1.0625 | 3.5625 | 2.375 | 3.375 | 3.125 | 4.1875 | 2.9375 | 6.25 | 5.625 | 7.1875 | 7.25 | 6.125 | 6.9375 | 5.3125 |
| Site context (/10) | 6 | 9 | 9 | 9 | 6 | 6 | 5 | 5 | 7 | 5 | 5 | 7 | 8 | 8 | 6 | 6 | 6 | 7 | 8 | 7 | 9 |
| **Habitat quality score /10 (site condition 60%, site context 40%)** | | | | | | | | | | | | | | | | | | | | | |
| Brigalow TEC | - | - | - | - | 3.975 | 3.575 | 2.6375 | 4.9375 | 3.425 | 4.025 | 4.675 | 5.7125 | 4.9625 | 6.15 | 5.775 | 6.7125 | 7.15 | 6.875 | 6.9625 | 3.975 | - |
| **Species habitat index /10** | | | | | | | | | | | | | | | | | | | | | |
| Collared delma | 2.8 | 6.6 | 6.6 | 6.6 | 2.8 | 2.2 | 2.2 | 2.2 | 3 | 2.2 | 5 | 5.6 | 5.6 | 5.6 | 5 | 5 | 5 | 5 | 5 | 5 | 6.6 |
| Yakka skink | - | - | - | - | 2.8 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 3.8 | 4.8 | 5.6 | 5.6 | 5 | 5 | 4.2 | 4.2 | 3.4 | 3.4 | - |
| Dunmall's snake | - | - | - | - | 5.6 | 3.4 | 3.4 | 3.4 | 4.2 | 3.4 | 5 | 6.4 | 7.2 | 7.2 | 5.6 | 5 | 5.6 | 5.6 | 5 | 5.6 | - |
| Red goshawk | 4 | 5.6 | 5.6 | 5.6 | 4 | 4 | 4 | 4 | 4 | 4 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 |
| South-eastern long-eared bat | 4 | 5.6 | 5.6 | 5.6 | 4 | 4 | 4 | 4 | 4 | 4 | 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 | 3.60 | 7.16 | 7.08 | 7.18 | 3.86 | 3.47 | 3.17 | 2.70 | 4.37 | 3.09 | 4.51 | 5.28 | 5.90 | 5.52 | 5.68 | 5.49 | 5.96 | 6.28 | 6.24 | 6.18 | 6.93 |
| Yakka skink | - | - | - | - | 3.86 | 3.47 | 3.17 | 2.70 | 4.05 | 3.09 | 4.03 | 4.96 | 5.90 | 5.52 | 5.68 | 5.49 | 5.64 | 5.96 | 5.60 | 5.54 | - |
| Dunmall's snake | - | - | - | - | 4.98 | 3.95 | 3.65 | 3.18 | 4.85 | 3.57 | 4.51 | 5.60 | 6.54 | 6.16 | 5.92 | 5.49 | 6.20 | 6.52 | 6.24 | 6.42 | - |
| Red goshawk | 4.08 | 6.76 | 6.68 | 6.78 | 4.34 | 4.19 | 3.89 | 3.42 | 4.77 | 3.81 | 4.75 | 5.28 | 5.90 | 5.52 | 5.92 | 5.73 | 6.20 | 6.52 | 6.48 | 6.42 | 6.53 |
| South-eastern long-eared bat | 4.08 | 6.76 | 6.68 | 6.78 | 4.34 | 4.19 | 3.89 | 3.42 | 4.77 | 3.81 | 4.43 | 4.96 | 5.58 | 5.20 | 5.92 | 5.41 | 6.20 | 6.52 | 6.48 | 6.42 | 6.53 |

* 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

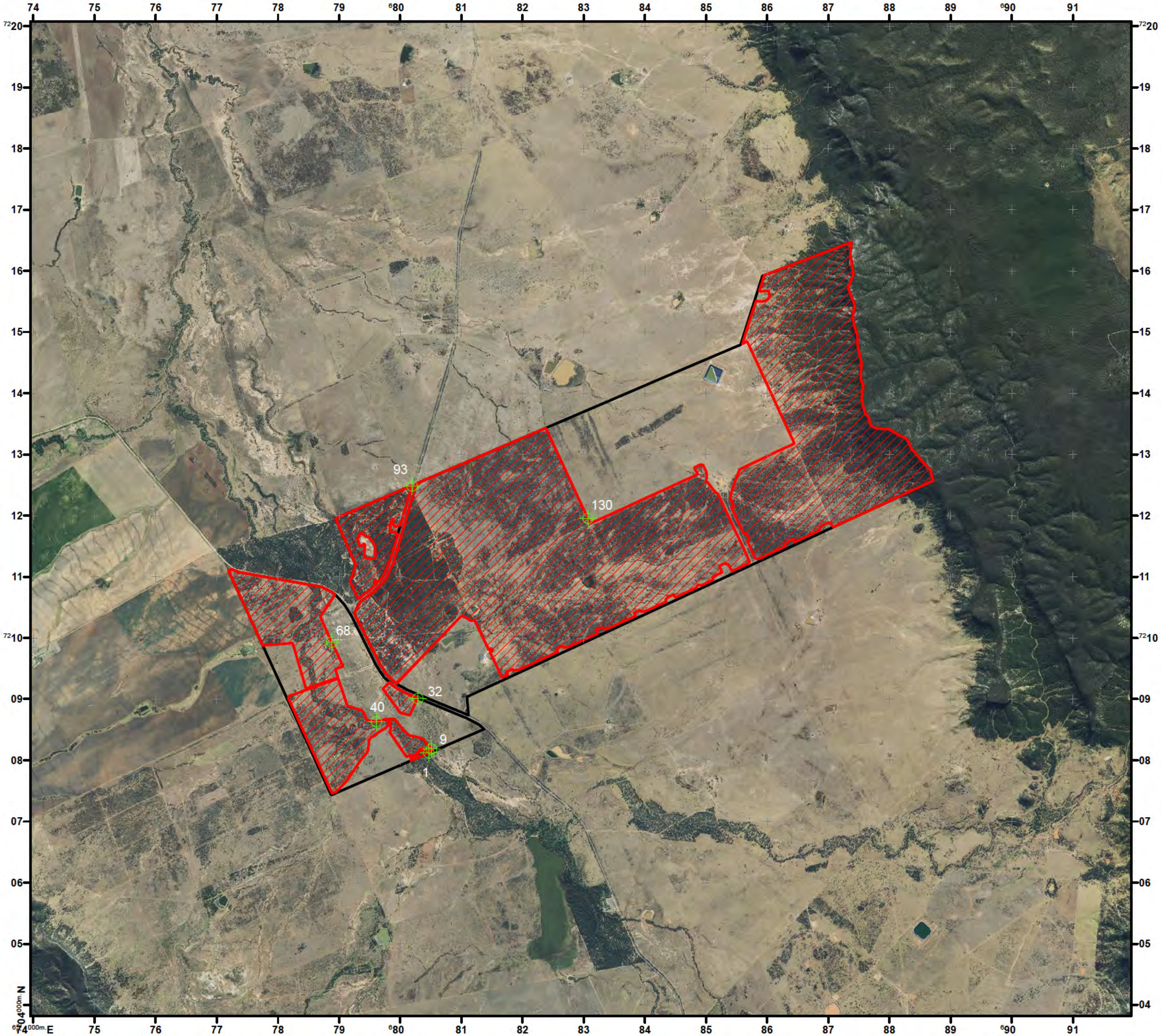
### 2.3. Property Map of Assessable Vegetation

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



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**

| | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|
| **Safety** | **Negligible Harm**<br>+ No bodily damage or minimal harm or impairment (hours to days) | **Minor Harm**<br>+ Short term impairment (days to weeks) | **Moderate Harm**<br>+ Temporary disablement or medium term impairment (weeks to months) | **Severe Harm**<br>+ 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<br>+ Potential surface or groundwater impact. | + Moderate-scale impact to EV(s) of conservation significance<br>+ Localised surface or groundwater impact. | + Large-scale impact to EV(s) of conservation significance<br>+ Moderate-scale surface water impact;<br>+ Localised impact to groundwater with potential or known beneficial use. | + Extensive population or community scale impact to EV(s) of conservation significance<br>+ Extensive impact to other EV(s). | + Irreversible impact to EV(s). |
| **Community & Reputation** | + No actual or potential community criticism<br>+ Details remain within Santos sites and/or offices | + Minor level local community criticism (< week)<br>+ No reputation impact | + Local community criticism (> week) or one-day community protest<br>+ Local company reputation impacted | + State-level community criticism or protest over multiple days/locations<br>+ State-based company reputation impacted<br>+ Very short-term share price impact (< week) | + National community criticism or large scale protest<br>+ Company reputation and approvals impacted<br>+ Shareholder intervention or short-term share price impact (< month) | + Sustained national community criticism or widespread protest<br>+ Industry reputation and approvals impacted<br>+ 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.<br>+ No actual or potential impact to culture | + Will require several days local management time.<br>+ Minor impact to employee engagement and limited staff turnover | + Will require head office staff and take several weeks of site management time.<br>+ Moderate impact to employee engagement and staff turnover above industry average with some key roles | + Will require several weeks of senior management time<br>+ Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession | + Will require several months of senior management time<br>+ 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<br>+ 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<br>+ No regulatory or punitive action | + Minor breach of legislation, instruments or contract<br>+ Notification/report to; request for information by; and/or administrative/ warning notice from the regulator<br>+ LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator | + Limited number of minor breaches of legislation, instruments or contract<br>+ Statutory notice from the regulator<br>+ LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator | + Systemic minor breaches (or one moderate breach) of legislation, instruments or contract<br>+ Company charged with an offence with minor penalty/fine<br>+ LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases | + Systemic moderate breaches (OR single material breach) of legislation, instruments or contract<br>+ Company charged with an offence with moderate penalty/fine | + Material breaches of legislation, instruments or contract<br>+ 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)**<br>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)**<br>Occurs in most circumstances OR could occur *within weeks to months* | e | Low | Medium | High | High | Very High | Very High |
| OCCASIONAL **(1 - 3 yearly)**<br>Has occurred before in Santos OR could occur *within months to years* | d | Low | Low | Medium | High | High | Very High |
| POSSIBLE **(3 - 10 yearly)**<br>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)**<br>Has occurred elsewhere OR could occur *within decades* | b | Very Low | Very Low | Low | Low | Medium | High |
| REMOTE **(30 - 100 yearly)**<br>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.<br>• Implementation of the adaptive management process outlined in Section 5.<br>• 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.<br>• 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.<br>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.<br>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:<br>• Offset area inspections (Section 7.1).<br>• Rapid monitoring events (Section 7.5.1).<br>• Habitat quality assessments to determine habitat quality scores (Section 7.5.2).<br>• Targeted fauna surveys (Section 7.5.4).<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• Modifying the strategic grazing regime to better support enhancement of offset values.<br>• 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.<br>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**<br>• Investigate reasons why unapproved clearing occurred e.g. unauthorised access<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Addition fencing, signage and/or security for the offset area<br>• Restoration of the impacted area |
| | | | | | | • Comply with the restrictions outlined in Table 13.<br>• 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.<br>• 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**<br>• 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.<br>• Investigate the reason for unapproved or unintentional clearing.<br>• 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.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Reviewing and modifying protocols for the establishment of fences, access tracks, and firebreaks.<br>• 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.<br>• 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.<br>• Annual biomass monitoring to inform strategic grazing regimes.<br>• 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.<br>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**<br>• Investigate the reason for the decrease in richness and average % cover of native perennial grasses<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Modifying the strategic grazing regime including modifying the frequency, intensity and/or duration of grazing events.<br>• Constructing additional fencing should the current fencing be considered insufficient to manage livestock in accordance with the grazing regime.<br>• 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**<br>• Investigate potential sources or reasons that may have attributed to an increase in the:<br>– Catling* index for wild dogs, feral cats and/or foxes<br>– relative abundance of feral pigs and horses.<br>• Review adherence to pest management control measures as outlined in Section 6.2.7<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency and intensity of pest animal control.<br>• 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.<br>• 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 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. | |
| 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**<br>• 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.<br>A new weed species is identified at one or more monitoring sites. | increase in species richness and/or relative abundance of weeds.<br>• Investigate potential sources or reasons for the occurrence of the new weed species.<br>• Review adherence to weed management control measures as outlined in Section 6.2.6<br>• Review adherence to weed hygiene restrictions as outlined in Section 6.2.1<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Amending weed hygiene restrictions.<br>• Providing additional educational awareness training for all staff and contractors to ensure weed hygiene restrictions are adhered to.<br>• Revising weed control methods in accordance with the *Biosecurity Act 2014* (Qld).<br>• Increasing the frequency and intensity of weed control.<br>• 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 | 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 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**<br>• 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. | | | | • 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.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Increasing the frequency of biomass monitoring.<br>• Increasing the frequency of weed control measures.<br>• Amending the strategic grazing regime.<br>• Reviewing effectiveness of firebreaks, and establishment of additional fire breaks.<br>• 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).<br>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**<br>• Investigate the reasons why stem density is >10,000 stems/ha and whether management intervention is required. mechanical thinning is effective and appropriate<br>**Step 2: Implementation of corrective action/s**<br>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<br>• 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.<br>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:<br>• Offset area inspections (Section 7.1).<br>• Offset value assessments (Section 7.5).<br>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.<br>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:<br>• Offset area inspections (Section 7.1).<br>• Offset value assessments (Section 7.5)<br>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.<br>Completion criteria are not achieved for one or more offset values by year 20. | **Step 1: Investigate cause of trigger**<br>• Investigate reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes.<br>• Re-evaluate the suitability of the relevant management measures in the OAMP.<br>• Identify appropriate corrective actions.<br>**Step 2: Implementation of corrective action/s**<br>The appropriate corrective actions will be implemented and may include:<br>• Third party review of the OAMP to provide input on the effectiveness of the management actions.<br>• Increasing the frequency and intensity of pest animal and weed control measures, or revising the type of measures to be implemented.<br>• Modifying the strategic grazing regime, or fire management measures, to better support enhancement of offset values. |

# 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

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**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.

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# Contents

# 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

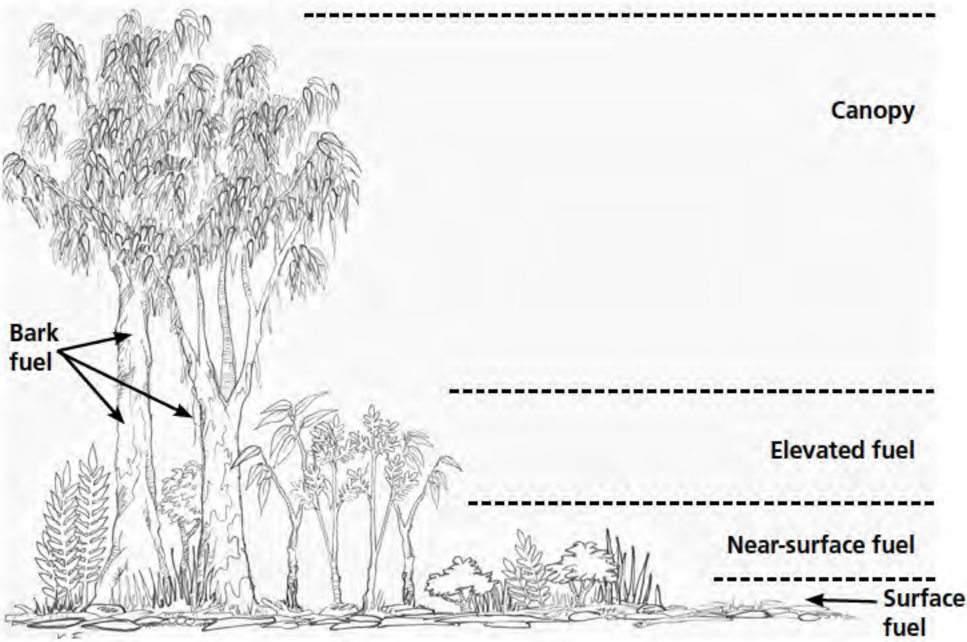
This guide is a tool for rapidly assessing fuel arrangement and its effect on the chances of controlling a bushfire. It may also be used for a range of other fire management purposes, as shown in the table below. Users of this guide should understand the underlying assumptions and limitations before 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.<br><br>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.<br>• 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.<br>• Generally most of the plant material is closer to the top of this fuel layer.<br>• Sometimes contains suspended leaves, bark or twigs.<br>• Fuels that have a clear gap between them and the surface fuels.<br>• Can be highly variable in ground coverage.<br>• 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.<br>• Fuel has a mixture of vertical and horizontal orientation.<br>• 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.<br>• Sometimes contains suspended leaves, bark or twigs.<br>• Coverage may range from continuous to having gaps many times the size of the fuel patch.<br>• Low-intensity fire (flame height of less than 0.5m) will consume most or all of this fuel.<br>• 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.<br>• 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.<br>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.<br>• 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.<br>• Bark fibres resemble the fine fibres that are twisted together to form natural string.<br>• Old bark is retained on the trunk of the tree for decades, forming a relatively spongy fibrous mass with deep vertical fissures.<br>• Outer bark may weather to a greyish colour, while underlying bark retains its original colour.<br>• Bark may form large strands when peeled off.<br>• 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).<br>• Fires will readily climb the tree and branches. |
| **How bark is attached** | • Young or new bark is held tightly to the trunk.<br>• As bark ages it becomes less tightly held.<br>• 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:<br>• Very fine lightweight fibres that will be carried for less than 100m.<br>• Small lightweight wads (about the size of a thumb) that will be carried for less than 300m.<br>• 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.<br>• Small wads of bark that will burn out within 2–3 minutes.<br>• Very large wads of bark that will burn for up to 10 minutes. |
| **Hazard accumulation** | • Bark hazard can reach Extreme.<br>• Bark hazard increases over time as the thickness and looseness of the old bark increases.<br>• 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.<br>Requires substantial effort to break off bark by hand. | Very little combustible bark.<br>Entire trunk almost completely black or charred. | Moderate | Spotting generally does not hinder fire control.<br>Fires will not climb these trees. |
| Bark is mostly tightly held with a few pieces loosely attached. | Limited amount of combustible bark.<br>50–90% of trunk charred.<br>Most of the bark is charred, especially on the lower part of the trunk. | High | Infrequent spotting.<br>Fires will climb some of these trees. |
| Many pieces of bark loosely held.<br>Deep fissures present in bark. | Large amounts of combustible bark.<br>10–50% of trunk charred.<br>Upper parts of the tree may not be charred at all. | Very High | Substantial spotting.<br>Fires will climb most of these trees. |
| Outer bark on trees is weakly attached.<br>Light hand pressure will break off large wads of bark.<br>Deep fissures present in bark. | Huge amounts of combustible bark.<br><10% of trunk charred.<br>Minimal evidence of charring. | Extreme | Quantity of spotting generated makes fire control very difficult or impossible.<br>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

| | | Example |
|---|---|---|
| **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.<br>• Bark is shed in the form of long strips or ribbons of bark.<br>• Long strips of bark curl tightly inwards to form a candle-like shape (see image lower right).<br>• Bark strips 50cm or more in length fall off and often drape around the trunk and over branches and surrounding shrubs.<br>• Strips of bark are usually less than 2mm thick.<br>• 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).<br>• 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.<br>• 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.<br>• Bark hazard tends to increase over the long term as ribbons accumulate on the tree.<br>• A low intensity fire (flame height of less than 0.5m) may not reduce the hazard in this bark type. | |

**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<br>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.<br>Trunk and branches of trees almost entirely smooth. | Moderate | Spotting generally does not hinder fire control.<br>Fires will not climb these trees. |
| Long ribbons of bark present on upper trunk (>4m above ground) and in head of trees.<br>Lower trunk mainly smooth. | High | Infrequent spotting.<br>Fires will climb some of these trees. |
| Long ribbons of bark in the head and upper trunk with:<br>• ribbons hanging down to ground level or,<br>• flammable bark covers trunk. | Very High | Substantial spotting.<br>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

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

### 3.5.2 Coarsely fibrous barks

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

## 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.

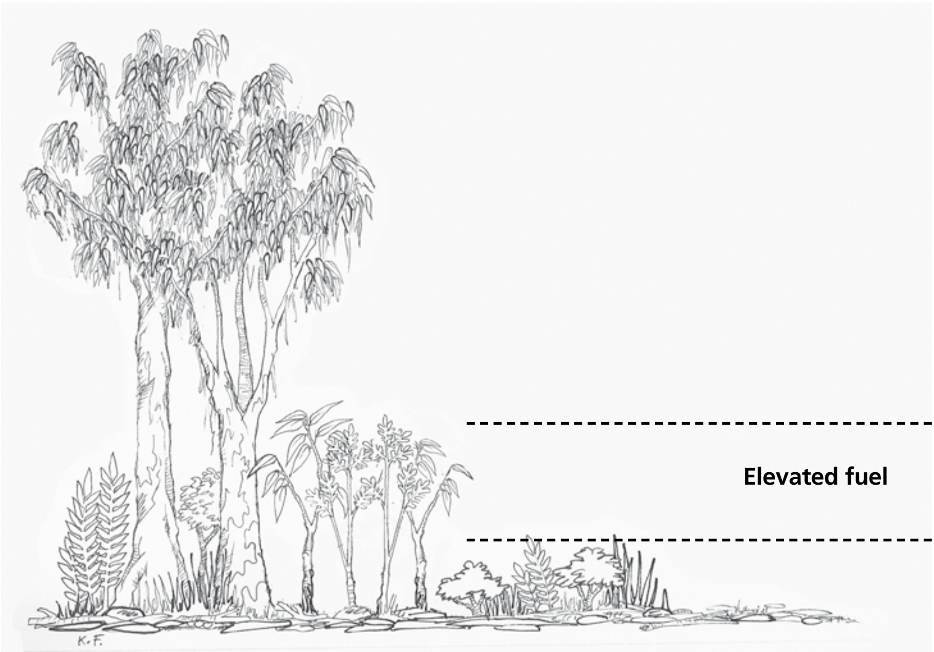
## Table 3.6 Examples of other bark types

| | | | |
|---|---|---|---|
| **Low** | No trees present.<br><br>or<br><br>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.

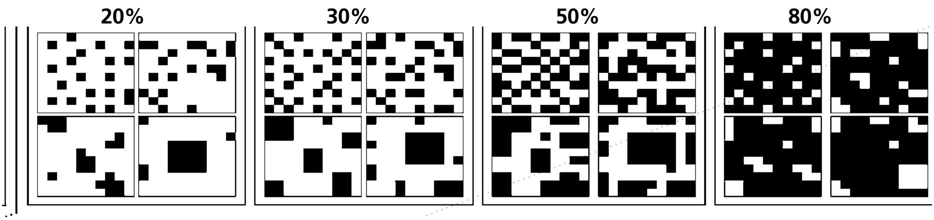
### Table 4.1 Assessing elevated fine fuel hazard

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.

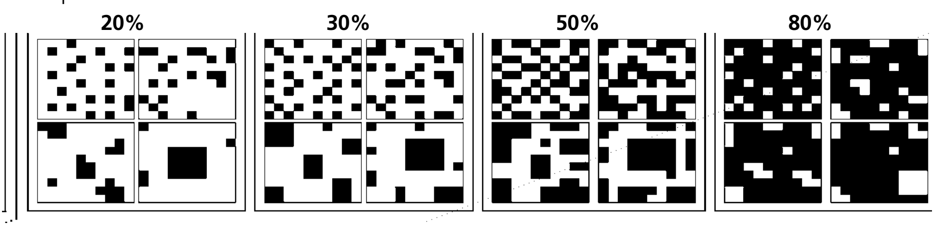
### Table 5.1 Assessing near-surface fine fuel hazard

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.<br>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.<br>A fire will spread readily in this layer without having to consume the surface layer. |
| >60% | >50% | Very small gaps between fuel patches.<br>Logs and rocks obscured. | Extreme | Contributes significantly to fire spread and flame height.<br>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.

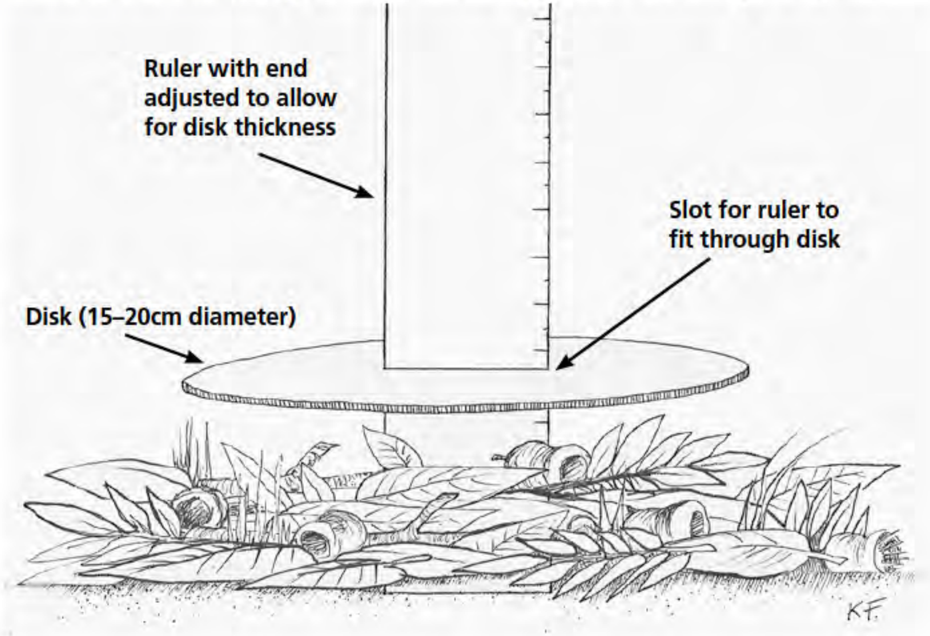

## 6.2 Assessment

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

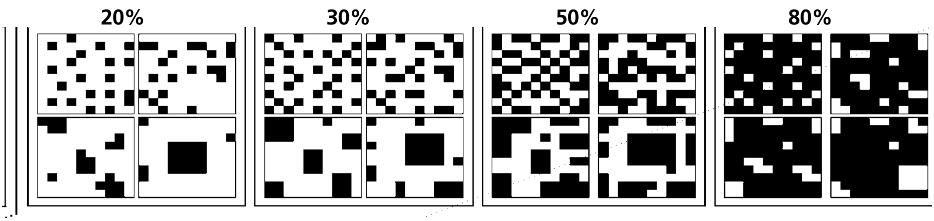
To achieve a given hazard rating a best fit of all key attributes should be sought. Choices for the hazard rating of fuels that fit across several descriptions may be informed by the effect that different levels of key attributes have on fire behaviour.

| Key attributes | | | Fuel hazard rating | Effect on fire behaviour (at FFDI 25)[6] |
|---|---|---|---|---|
| **Horizontal connectivity** | **Surface litter cover** | **Litter-bed depth** | | |
| Litter poorly interconnected.<br>Large areas of bare soil or rock. More soil than litter.<br>Soil surface readily visible through litter bed. | <60% | Very thin litter layer<br><10mm | Low | Surface fires will not spread. |
| Litter well connected.<br>Some areas of bare soil or rock.<br>Soil surface occasionally visible through litter bed. | 60–80% | Thin litter layer<br>10–25mm | Moderate | Litter connected well enough to allow fire spread to overcome bare patches. |
| Litter well connected.<br>Little bare soil. | 80–90% | Established litter with layers of leaves ranging from freshly fallen to decomposing.<br>20–30mm | High | Surface fires spread easily with a continuous fire edge. |
| Litter completely connected. | >90% | Thick litter layer<br>25–45mm | Very High | Surface fires spread easily.<br>Increasing flame depth and residence time. |
| Litter completely connected. | >95% | Very thick layer of litter<br>>35mm | Extreme | Surface fires spread easily.<br>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** 1
2. Select the row that corresponds to the **Elevated Fine Fuel Hazard** 2
3. Select the column that corresponds to the assessed level of **Combined Surface and Near-surface Fine Fuel Hazard** 3
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**

| 1 Bark Hazard | 2 Elevated Fine Fuel Hazard | 3 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.

# References

Department of Environment and Heritage 2006, *Overall fuel hazard guide for South Australia*, 1st edn, Government of South Australia.

Gould, JS McCaw, WL Cheney, NP Ellis, PF Knight, IK & Sullivan, AL 2007a, *Project VESTA. Fire in dry eucalypt forest: fuel structure, fuel dynamics and fire behaviour*, Ensis-CSIRO, Canberra, ACT & Department of Environment and Conservation, Perth, WA.

Gould, JS McCaw, WL Cheney, NP Ellis, PF & Matthews, S 2007b, *Field guide – fuel assessment and fire behaviour prediction in dry eucalypt forest*, Ensis-CSIRO, Canberra, ACT & Department of Environment and Conservation, Perth, WA.

McArthur, AG 1973, *Forest fire danger meter Mk5*, Forestry and Timber Bureau, Forest Research Institute, Commonwealth of Australia.

McCarthy, GJ & Tolhurst, KG 1998a, *Effectiveness of firefighting operations by the Department of Natural Resources and Environment from 1991/2–1994/5*, research report no. 45, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ Tolhurst, KG & Chatto, K 1998b, *Overall fuel hazard guide*, research report no. 47, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ Tolhurst, KG & Chatto, K 1998c, *Overall fuel hazard guide*, 2nd edn, research report no. 47, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ Tolhurst, KG & Chatto, K 1999, *Overall fuel hazard guide*, 3rd edn, research report no. 47, Fire Management Branch, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ & Tolhurst, KG 2001, *Effectiveness of broadscale fuel reduction burning in assisting with wildfire control in parks and forest in Victoria*, research report no. 51, Fire Management, Department of Natural Resources and Environment, Victoria.

McCarthy, GJ 2004, *Surface fine fuel hazard rating – forest fuels in East Gippsland*, research report no. 44, Fire Management Branch, Department of Sustainability and Environment, Victoria.

Plucinski M, Gould, J, McCarthy, G, Hollis J (2007) The effectiveness and efficiency of aerial fire fighting in Australia, Part 1, Bushfire CRC Technical Report Number A0701

Sneeuwjagt, RJ & Peet, GB 1998, *Forest fire behaviour tables for Western Australia*, Department of Conservation and Land Management, Perth, Western Australia.

Wilson, AAG 1992a, *Assessing the fire hazard on public lands in Victoria: fire management needs, and practical research objectives*, research report no. 31, Fire Management Branch, Department of Conservation and Environment, Victoria.

Wilson, AAG 1992b, *Eucalypt bark hazard guide*, research report no. 32, Fire Management Branch, Department of Conservation and Environment, Victoria.

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)<br><br>1 to 2 small 4WD tankers (400l)<br><br>6 firefighters | 5 x 4WD heavy tankers (4000l) each with 5 firefighters | Small dozer (D4) or tractor with scrub roller<br><br>1 to 2 small 4WD tankers (400l)<br><br>6 firefighters | Small dozer (D4)<br><br>1 to 2 small 4WD tankers (400l)<br><br>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 |

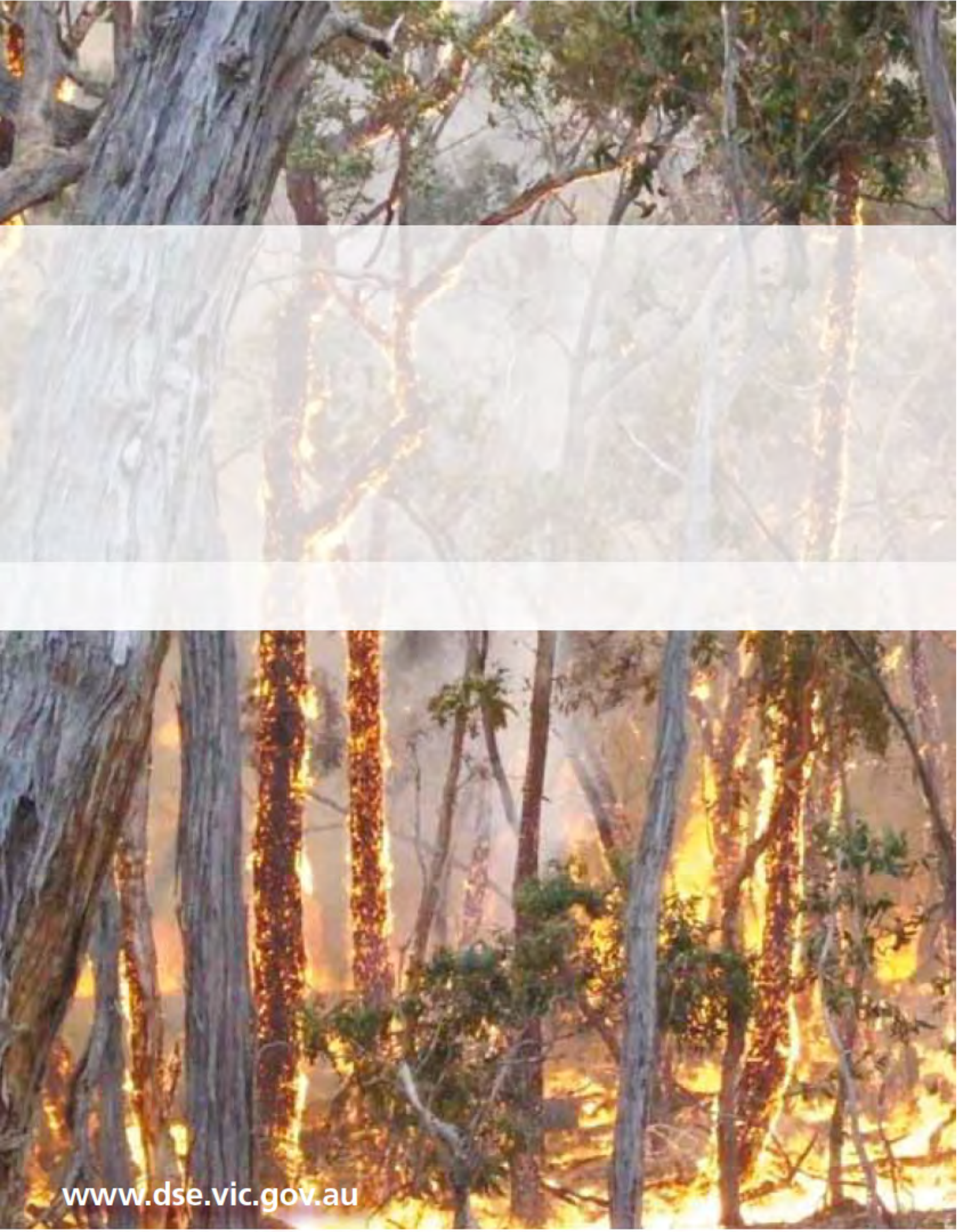
| **Surface fuel layer (Assess over a 10m radius)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Litter % Cover: | | | | | % | | | | | % | | | | | % |
| Average Litter Depth (mm): | | | | | mm | | | | | mm | | | | | mm |
| Surface Fuel Hazard | 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

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 E1.
- 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 E1.
- 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 E1.
  - 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 E1 based on whether the site is located within (wholly or partly); shares a common boundary with; or is not within a corridor.

### Table E1: 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 E2 to Table E6 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 E2: 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.<br>• Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing).<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• Site is actively managed for conservation purposes to enhance habitat for threatened species.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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<br>• 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:<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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:<br>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<br>• 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<br>• Population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

**Table E3: 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.<br>• Overgrazing by livestock resulting in irreversible damage to microhabitat including coarse woody debris, dense leaf litter and decorticated bark.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing).<br>• Active fire management and/or low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing).<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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<br>• 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<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival<br>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<br>• 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<br>• 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<br>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<br>• 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<br>• The population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

**Table E4: 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.<br>• Overgrazing by livestock resulting in irreversible damage to microhabitat including loss of deep cracks in clay soils, fallen timber and logs.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing).<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• Site is actively managed for conservation purposes to enhance habitat for threatened species.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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<br>• 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<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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<br>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<br>• 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<br>• Population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

**Table E5: 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.<br>• 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.<br>• Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.<br>• 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.<br>• 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.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) to allow for recruitment of native species.<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• 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.<br>• 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.<br>• 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.<br>• 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<br>• 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<br>• 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<br>• 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.<br>• 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<br>• 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<br>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<br>• 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:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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<br>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<br>• 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<br>• Population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

**Table E6: 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.<br>• 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.<br>• Site is not actively managed for conservation purposes and lack of landholder awareness of threatened species habitat and conservation.<br>• 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.<br>• Strategic livestock grazing resulting in some degradation to the understory habitat that supports invertebrate prey however, patches of habitat occur on site.<br>• 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.<br>• Livestock grazing excluded from habitat at all times (except for fuel load control through strategic grazing) allowing for recruitment of native saplings.<br>• Active fire management, with controlled burns on site and low risk of uncontrolled wildfire on site, including from adjacent properties.<br>• 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<br>• <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<br>• >10% - <50% tree canopy cover. |

| 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, OR<br>• >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.<br>• 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.<br>• 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.<br>• 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.<br>• The site is small compared with the known habitat known or likely to support the species.<br>• 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<br>• 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:<br>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<br>• 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<br>• Site has very few records for migratory species. |
| | Likely to be critical to species' survival:<br>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<br>• 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<br>• Site is an important stopover habitat for migratory species. |
| | Known to be critical to species' survival:<br>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<br>• 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:<br>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<br>• 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<br>• The population is outside or near the geographical limit of the species/community range, OR<br>• Site is critical stopover habitat for migratory species at the national or state scale. |

# Appendix D

## Offsets Assessment Guides for the Kentucky, Mt Tabor and Bottle Tree offset areas

Table D1 summarises the OAG inputs for the MNES to be offset on Kentucky, Mt Tabor and Bottle Tree. 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 7 development area (AECOM 2020; Boobook 2021; Boobook 2023a,b,c,d,e; Boobook 2024). 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 7 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.

Appendix E presents a summary of the area weighted MNES impact quality scores used to inform the OAG input. The quality of Brigalow TEC within the impact area for each MNES was assumed to be 7, based on the rapid assessment process allowed under the GTDTHQ (version 1.3; DES 2020).

### 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 2017 [Kentucky and Bottle Tree] and version 1.3; DES 2020 [Mt Tabor]) based on the results of the detailed field assessments of the offset area:

- Kentucky OAMP: Section 2.4, Appendix A.
- Mt Tabor OAMP: Section 2.5, Appendix A.
- Bottle Tree OAMP: Section 2.5, Appendix A.

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:

- Kentucky OAMP: Section 2.5.
- Mt Tabor OAMP: Section 2.6.
- Bottle Tree OAMP: Section 2.6.

### Future quality without offset management

**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.

#### Mt Tabor

Based on a business-as-usual scenario without offset management, habitat quality scores on Mt Tabor are not expected to change.

#### 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.

### Future quality with offset management

Santos has committed to excluding all development activities from the offset areas.

The Kentucky, Mt Tabor and Bottle Tree 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 Kentucky, Mt Tabor and Bottle Tree 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 D1 – Summary of *Offsets Assessment Guide* inputs for each Stage 7 MNES on Kentucky, Mt Tabor and Bottle Tree**

| Inputs | | | Brigalow TEC | Collared Delma | Yakka Skink | Dunmall's Snake | Red Goshawk | Squatter Pigeon (southern) | Northern Quoll | Koala | South-eastern Long-eared Bat | Large-eared Pied Bat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Impact | | Area (ha) | 0.6 | 313.2 | 313.8 | 308.1 | 311.8 | 316.8 | 317.4 | 269.6 | 311.8 | 257.8 |
| | | Quality | 7 | 7 | 6 | 7 | 7 | 7 | 6 | 7 | 7 | 6 |
| Offset | Kentucky | Area (ha) | - | 384.2 | 435.9 | 435.9 | 435.9 | 384.2 | 435.9 | 384.2 | 435.9 | 435.9 |
| | | Start quality | - | 8 | 7 | 8 | 7 | 8 | 8 | 8 | 8 | 8 |
| | | Future quality without offset | - | 8 | 7 | 8 | 7 | 8 | 8 | 8 | 8 | 8 |
| | | Future quality with offset | - | 9 | 8 | 9 | 8 | 9 | 9 | 9 | 9 | 9 |
| | Mt Tabor Offset area 1 | Area (ha) | - | 951.6 | 66.0 | 951.6 | 951.6 | 951.6 | 951.6 | 951.6 | 951.6 | 951.6 |
| | | Start quality | - | 7 | 7 | 7 | 8 | 8 | 7 | 8 | 8 | 8 |
| | | Future quality without offset | - | 7 | 7 | 7 | 8 | 8 | 7 | 8 | 8 | 8 |
| | | Future quality with offset | - | 8 | 8 | 8 | 9 | 9 | 8 | 9 | 9 | 9 |
| | Mt Tabor Offset area 2 | Area (ha) | - | 2,348.8 | 1,908.2 | 2,348.8 | 2,348.8 | 2,348.8 | 2,348.8 | 2,348.8 | 2,348.8 | 2,348.8 |
| | | Start quality | - | 8 | 7 | 8 | 7 | 8 | 8 | 8 | 8 | 8 |
| | | Future quality without offset | - | 8 | 7 | 8 | 7 | 8 | 8 | 8 | 8 | 8 |
| | | Future quality with offset | - | 9 | 8 | 9 | 8 | 9 | 9 | 9 | 9 | 9 |
| | Bottle Tree | Area (ha) | 19.7 | 19.7 | 19.7 | 19.7 | 19.7 | - | - | - | 19.7 | - |
| | | 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% | 80% | 80% | 80% | 80% |
| Risk of loss | | Without offset | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| | | With offset | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| | | Confidence in result | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% | 90% |
| Risk related time horizon/time over which loss is averted (max. 20 years) | | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Time until ecological benefit | | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |

# Appendix E

## 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 7 development area (AECOM 2020; Boobook 2021; Boobook 2023a,b,c,d,e; Boobook 2024). 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 7 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 listed reports were used:

- *Santos Scotia Ecology Report* (AECOM 2020).
- *Ecological Assessment Report: Ecological Assessment of Fairview Eastern Expedition Project* (Boobook 2023b).
- *Broad-scale Ecological Assessment Report: Parts of Expedition Resources Reserve (Lot 5 on Plan TR839674), Lot 8 on Plan SP261936, Lot 1 on Plan AB81 and Lot 2 on Plan AB247 within tenements PL100 and PL232* (Boobook 2023a).
- *Ecological Assessment Report: Ecological Assessment of Fairview Eastern Gas Expansion Project* (Boobook 2024).
- *Broad-scale Ecological Assessment Report: Fairview Infield Wells Project* (Boobook 2023c).

Whilst other studies within the Stage 7 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 2021, 2023d,e). In the absence of detailed habitat quality assessments within particular development areas or for some MNES offset requirements (including Brigalow TEC), 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 E1 – Summary of impact area weighted habitat quality scores for each MNES**

| MNES | Santos Scotia Ecology Report (AECOM 2020) | | | Ecological Assessment of Fairview Eastern Expedition Project (Boobook 2023b) | | | Parts of Expedition Resources Reserve (Boobook 2023a) | | | Fairview Eastern Gas Expansion Project (Boobook 2024) | | | Fairview Infield Wells project (Boobook 2023c) | | | Arcadia Hill crossing | | | CO2 to Hub 5 | | | Final area weighted HQ score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | |
| Collared Delma | 5 | 4.6 | 0.1 | 5.9 | 102.5 | 1.9 | 8 | 145.5 | 3.7 | 4.5 | 45.5 | 0.7 | 1.5 | 6.0 | 0.0 | 7* | 0.12 | 0.00 | 7* | 8.9 | 0.2 | 6.6 |
| Yakka Skink | 5 | 4.6 | 0.1 | 5.7 | 102.9 | 1.9 | 7 | 145.6 | 3.2 | 5.4 | 45.5 | 0.8 | 1.1 | 6.0 | 0.0 | 7* | 0.12 | 0.00 | 7* | 8.9 | 0.2 | 6.2 |
| Dunmall's Snake | 5 | 4.6 | 0.1 | 5.7 | 102.9 | 1.9 | 8 | 145.6 | 3.8 | 5.0 | 45.5 | 0.7 | 1.0 | 6.0 | 0.0 | 7* | 0.12 | 0.00 | 7* | 3.2 | 0.1 | 6.6 |
| Red Goshawk | 7* | 5.5 | 0.1 | 7.0* | 103.9 | 2.3 | 8 | 147.3 | 3.8 | 7.0* | 45.5 | 1.0 | 1.6 | 6.0 | 0.0 | 7* | 0.27 | 0.01 | 7* | 3.2 | 0.1 | 7.4 |
| Squatter Pigeon (southern) | 7* | 5.5 | 0.1 | 7.0 | 103.4 | 2.3 | 7 | 147.2 | 3.3 | 6.3 | 45.5 | 0.9 | 4.7 | 6.0 | 0.1 | 7* | 0.27 | 0.01 | 7* | 8.9 | 0.2 | 6.9 |
| Northern Quoll | 7* | 5.5 | 0.1 | 5.3 | 103.9 | 1.7 | 7 | 147.3 | 3.2 | 7.0* | 45.5 | 1.0 | 0.9 | 6.0 | 0.0 | 7* | 0.27 | 0.01 | 7* | 8.9 | 0.2 | 6.3 |
| Koala | 6 | 4.9 | 0.1 | 7.0 | 103.4 | 2.7 | 8 | 134.1 | 4.0 | 5.0 | 19.7 | 0.4 | 1.3 | 4.0 | 0.0 | 7* | 0.27 | 0.01 | 7* | 3.2 | 0.1 | 7.3 |
| South-eastern Long-eared Bat | 5 | 5.5 | 0.1 | 6.0 | 103.9 | 2.0 | 8 | 147.3 | 3.8 | 6.7 | 45.5 | 1.0 | 5.3 | 6.0 | 0.1 | 7* | 0.27 | 0.01 | 7* | 3.2 | 0.1 | 7.0 |
| Large-eared Pied Bat | 7* | 4.9 | 0.1 | 5.5 | 155.5 | 3.3 | 8 | 80.8 | 2.5 | 4.5 | 12.9 | 0.2 | 0.7 | 3.4 | 0.0 | 7* | 0.27 | 0.01 | 7* | 0.0 | 0.0 | 6.2 |

* MNES 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.