Senex Energy Limited (Senex)
EPBC 2015/7469 (Commonwealth)
EA-EPPG-00651513 (State)

Offset Area Management Plan

July 2018

Table of Contents

List of Figures

List of Tables

Introduction

The purpose of this management plan is to identify the management objectives and outcomes, and the actions necessary to fulfil a statutory requirement for the provision of an offset under the *Environment Protection & Biodiversity Conservation Act 1999* (*Cth*) (**EPBC Act**) and the *Queensland Environmental Offsets Policy* (2014) (**QEOP**)

The plan is composed of four components:

Part 1 – Summary information

This section must be completed by all offset proposals and lists all of the following information:

1. Departmental reference details
2. Legislative triggers and impacts requiring an offset
3. Offset area details
4. Ecological Equivalence Assessment
5. Description of the values in the stage 1 impact area and the values located on the offset area

Part 2 – Management plan

This section contains the management plan details that must be completed based on the offsets triggered and requires at a minimum the following information:

1. The offset area management objectives and outcomes
2. Any restrictions imposed on the use of the offset area
3. The activities that will be undertaken to achieve the objectives and outcomes
4. Monitoring requirements
5. An analysis of the risks to achieve the management objectives and outcomes
6. A map that shows spatially the areas subject to the management plan
7. A reporting program
8. Consent between the Landholder and the delegate

Part 3 – Attachment 1 Baseline data

1. Ecological equivalence assessment of the offset area
2. Weed Fact Sheets
3. Flora and fauna present on the offset area or adjacent to offset area

Part 4 – Attachment 2 Land Manager's Monitoring Guide

1. The Land Manager's Monitoring Guide published by the State of Queensland (Department of Environment and Resource Management) 2010 (DERM)

1. Summary information

1.1 Departmental reference details

Departmental Reference Details for application that triggers offset	
Departmental Reference Number and Case Name:	EPBC 2015/7469 (Commonwealth) EA-EPPG-00651513 (State)
Offset reference number (if applicable):	N/A
Tenure: [redacted]	Primary Local Government Area: Maranoa Regional Council

Offset Triggers and Values	
Offset Trigger	**Values requiring to be offset**
☐ Regional Vegetation Management Code ☒ Part P ☐ Part S ☐ Part Xa ☐ Part Xb ☐ Material Change of Use / Reconfiguration of a lot Policies (Table F1) ☒ *Environment Protection & Biodiversity Conservation Act 1999* (Cth)	☒ EPBC TEC and/or Protected Spp. ☐ Assessable vegetation adjacent to a wetland, significant wetland ☒ Assessable vegetation adjacent to a watercourse ☒ Connectivity ☐ Endangered regional ecosystem ☐ Of concern regional ecosystem ☐ Threshold regional ecosystem ☐ Critically limited regional ecosystem ☐ Essential habitat ☐ Essential habitat for koalas in SEQ ☐ Values within a highly-vegetated bioregion ☐ Protected Plant under the *Nature Conservation Act 1992*

1.2 Offset area details

Landholder Details	
Registered Owner/s on Title: [redacted]	
Sub-lessee: Trustee: N/A	
Business/Company name: [redacted]	
ABN/ACN: [redacted]	
Phone number: [redacted]	Mobile phone:
Facsimile number:	Contact person (if required): [redacted]
Email: [redacted]	
Postal Address: [redacted]	

Property Details			
Property name:	[redacted]	**Real property description**	[redacted]
Tenure:	Freeholding Lease	**Primary Local Government Area:**	Maranoa Regional Council
Planning Scheme Zone:	Rural	**Property area (ha):**	[redacted]
		Offset Area (ha):	168.01ha
Landzone / geology	Landzone 3 - Recent Quaternary alluvial systems, including closed depressions, paleo-estuarine deposits currently under freshwater influence. Includes a diverse range of soils, predominantly vertosols and sodosols.		
Soils	Alluvial clay sands		
Pre-clear regional ecosystem	11.3.2		
Existing vegetation	Regrowth: 11.3.2		
Estimated age of vegetation	Regrowth – minimum of 5 years,		
Is there a PMAV currently over all or part of the property, please detail	Yes – PMAV [redacted]		

Legally Binding Mechanism

☒ Voluntary Declaration (*Vegetation Management Act 1999*)

☐ Covenant (*Land Act 1994/Land Title Act 1994*)

☐ Nature Refuge (*Nature Conservation Act 1992*)

☐ Other Reference Number:

1.3 Description of State impact and offset values

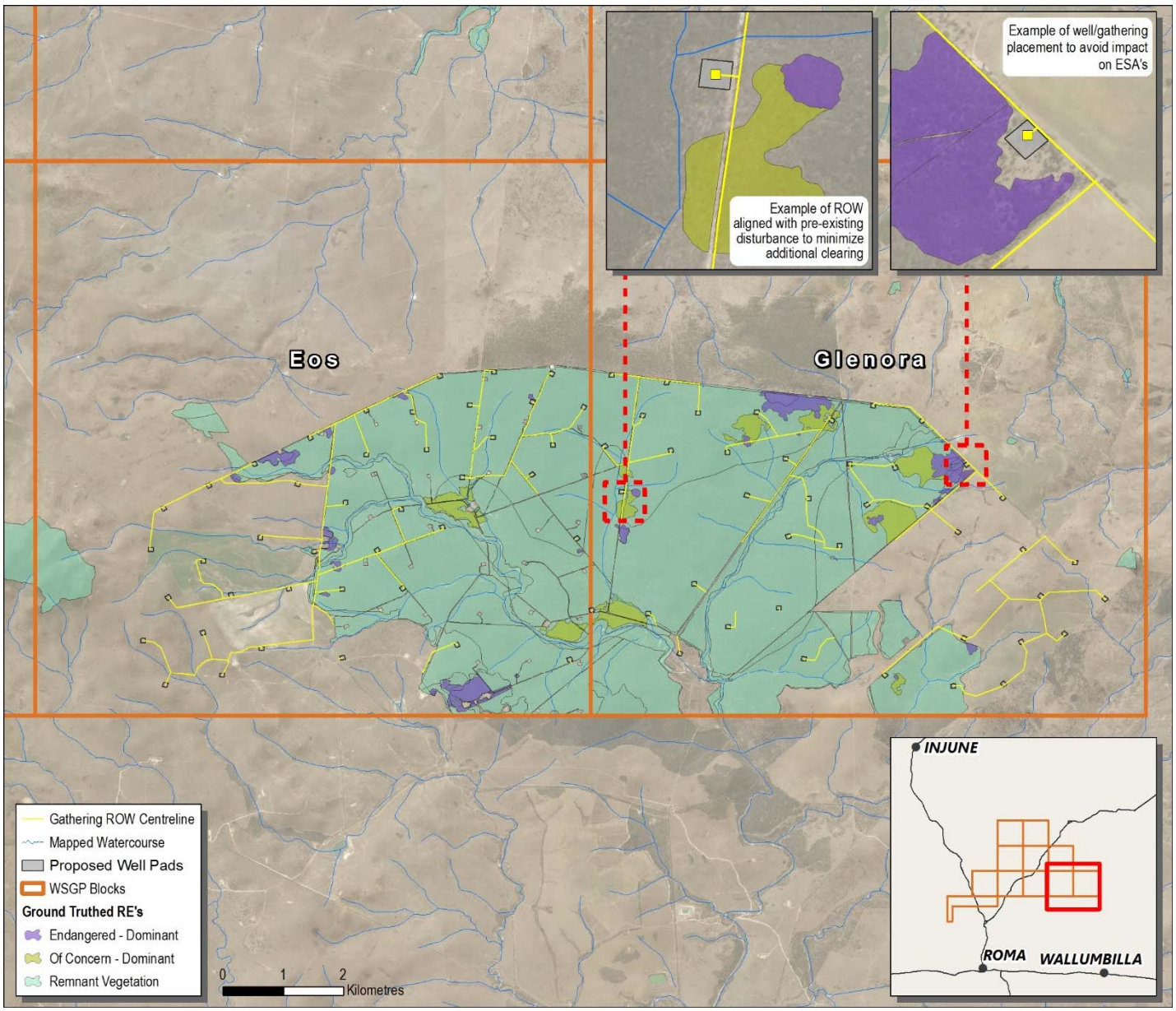
Table 1 identifies the values impacted on and captured under the Queensland *Environmental Protection Act 1994* and Queensland *Nature Conservation Act 1992* (NCA) in the Western Surat Gas Project impact area for which an offset is provided for within the offset areas. The location of remnant regional ecosystems across the Stage 1 impact area is shown in **Figure 1**.

Table 1: Impact area values

Impact area			
Value (as identified in the offset policy)	**VMA* or NCR status**	**Regional ecosystem**	**Area (ha)**
Watercourses	1 or 2	11.10.11 - 11 crossings OLC – BVG - 17a 11.3.39/11.10.11 – 6 crossings OLC – BVG – 17b/17a	1.5
Connectivity			103

***** VMA status refers to the remnant vegetation's classification under the *Vegetation Management Act 1999* (Qld) (**VMA**)

Figure 1: Ground truthed biodiversity values within the WSGP Stage 1 impact area



1.4 Ecological equivalence assessment for State Significant Biodiversity Values under QEOP

Ecological Equivalence Assessment	
Impact area	**Offset area**
Date of Assessment: January 2018	Date of Assessment: January 2018
Ecological Condition assessment score:	Ecological Condition assessment score: see respective tables
Special Features indicators 1-14:	Special Features indicators 1-14: see respective tables
Undertaken using Ecological Equivalence Methodology V 1.1 Yes ☐ No ☒	Undertaken using Ecological Equivalence Methodology V 1.1 Yes ☒ No ☐
Score sheets/assessment attached Yes: ☐ No ☒	Score sheets/assessment attached Yes: ☒ No ☐
Other comments: The Rapid assessment process as detailed in Section 3 of the Guide to determining terrestrial habitat quality, A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy Version 1.1 December 2014	Other comments: Refer to Appendix A for Field Assessment Report (Ecological Condition Scoresheets) for assessment scores for AU6 and AU9.

Table 2: MSES impact site vs offset sites

MSES	BVG	Impact area (ha)	Habitat Quality Score	Offset Area (ha)	Habitat Quality Score	Regional Ecosystem (RE)	BVG	Offset Multiplier from calculator	Comments
Vegetation within the buffers of a stream order 1 or 2	11.10.11 - 11 crossings OLC – BVG - 17a 11.3.39/11.10.11 – 6 crossings OLC – BVG – 17b/17a	Total: 1.5 ha	7	3.69 ha on a stream order 4	3.79 (as per the EEM scores at the *Western Surat Gas Project, Environmental Offset Site Assessment Final Report Ecosure, February 2018* which is at Attachment 2 of the Offset Management Plan)	11.3.2 (OC)	17a	2.46	Regrowth 11.3.2 in AU6
Connectivity		103		103	3.79	11.3.2 (OC)	17a	Ratio 1:1	from offset policy

1.5 Description of Commonwealth impacts and offset values

Table 3 summarises the impacts to Matters of National Environmental Significance (**MNES**) under the EPBC Act in the SENEX ENERGY WSGP project area for which an offset is provided. These values are illustrated in the mapping provided in **Appendix A**. **Table 4A**, **Table 4B** and **Table 4C** show the impact assessments for each MNES. **Table 5A**, **Table 5B** and **Table 5C** provide a description of the input values used for calculation in the EPBC Offset Assessment Calculator.

Table 3: Summary SENEX ENERGY WSGP impact and offset area values – EPBC Act

Protected Matter	Status	Impact Area (ha)	Habitat Quality Score	Offset Area (ha)	Start Habitat Quality Score	Regional Ecosystem (RE)	Offset Property
Threatened Species							
Phascolarctos cinereus (Koala)	Vulnerable	101.83	6	AU6 = 132.63 AU9 =35.38	AU6 = 4 AU9 = 6	RE 11.3.2 *Eucalyptus populnea* woodland to open woodland. *E. melanophloia* may be present and locally dominant. The ground layer is grassy dominated by a range of species depending on soil and management conditions. Occurs on Cainozoic alluvial plains.	[redacted]
Protected animal - *Egernia rugosa* (Yakka Skink)	Vulnerable	101.83	8	AU6 = 132.63 AU9 =35.38	AU6 = 5 AU9 = 4		

Table 4A: Impact assessment for primary habitat for the koala

Attribute	Value	Rationale/assumption
Impact Area	101.83 ha	
Description		
Quality	6/10	Site condition score (4) = 2 A key habitat resource was the presence of both mature and regrowth food trees as either sub-dominant (RE 11.10.9) or dominant trees in the community. REs 11.3.2, 11.3.39, 11.9.2, 11.9.7, 11.9.10, 11.10.7 and 11.10.11 were also present within the Survey Area and were considered suitable habitat for the species. These communities provide breeding and foraging habitat for the species. Skeletal remains of a Koala were located within the Survey Area within remnant vegetation comprising RE 11.10.9. (*Callitris glaucophylla*). The Cypress Pine communities are not considered habitat for or are utilised by Koala These communities are grazed by cattle but apparently at low stocking levels. Some evidence of historical fire disturbance was present in some areas and most Cypress Pine areas showed evidence of selective logging. Weeds were generally rare, with pear cacti (Opuntia stricta, O. tomentosa) being widespread in low densities. Non-native grass cover was low: where present, the most frequently encountered non-native grass species was Buffel Grass (Cenchrus ciliaris). No woody weeds were detected.
		Site context score (3) = 2 The Impact Area is contained within a larger area of predominantly remnant vegetation, the extent of which is approximately 4800ha. The impacts are small in area and linear and a substantial amount of the clearing occurs within the Cyprus Pine community which are not habitat for the Koala. This tract of vegetation is surrounded by extensively cleared lands used for pastoral and cropping purposes. Non-native pastures (Buffel Grass *Cenchrus ciliaris*) predominate on the pastoral lands. Thus this tract represents a significant habitat patch within the Roma district. Further, the patch encompasses the headwaters of Blyth Creek: several records of Koala are known along this creek (DSITI 2018a, BOOBOOK unpublished data) which appears to support an important local population as well as providing a corridor for Koala movement.
		Species stocking rate (3) = 2 No comprehensive assessment of the Koala population has been conducted within the Survey Area. As noted above the habitat patch in which the Survey Area is located is contiguous with a known population of koala, but no data on population size is available. However, it is considered that this population is significant at the local scale, noting that Koala populations in the Brigalow Belt South bioregion have become increasingly fragmented (Martin et al. 2008, DoE 2014).

Table 4B: Impact assessment for yakka skink

Attribute	Value	Rationale/assumption
Impact Area	101.83 ha	
Description		
Quality	8/10	Site condition score (4) = 2 A key habitat resource was the presence of large (>30cm diameter) hollow-bearing logs. This resource was present in varying levels in the vegetation communities but usually 1-5 logs per 50m x50m plot (4-20 logs/ha). Colonies of Yakka Skinks shelter within hollows and/or in burrows excavated under the log. Yakka Skink prefer soil that has a lighter texture that enables burrows to be established. Heavy clay soils are not recognised as habitat for the species due to the difficulty in burrowing (Boobook 2017). Some evidence of historical fire disturbance was present in some areas and most Cypress Pine areas showed evidence of selective logging. Yakka Skink colonies were located within the Survey Area within remnant vegetation comprising REs 11.10.9, 11.9.7 and 11.3.2. REs 11.3.39, 11.9.2, 11.9.10, 11.10.7 and 11.10.11 were also present within the Area and were considered suitable habitat for the species. These vegetation communities were: White Cypress Pine (*Callitris glaucophylla*) dominated woodland to open forest with a variety of myrtaceous species as sub-dominant canopy trees, a sparse shrub layer dominated by Acacia spp. and sparse ground cover dominated by native grasses, particularly Many-headed Wiregrass (*Aristida caput-medusae*), on sandy loams; and Poplar Box or Mountain Coolibah (*Eucalyptus populnea*, *E. orgadophila*) dominated woodlands typically with a well-developed tall shrub layer of Wilga (*Geijera parviflora*), False Sandalwood (*Eremophila mitchellii*) and other species; and a sparse to mid-dense grassy ground cover dominated by wiregrasses (*Aristida spp.*) on alluvium and sandy clay loams; and Ironbark (*Eucalyptus crebra*, *E. melanophloia*) shrubby woodlands with a lower tree layer dominated by White Cypress Pine and a grassy understorey dominated by wiregrasses (*Aristida spp.*) on sandy loams. These communities provide breeding and foraging habitat for the species.
		Site context score (3) = 3 The Impact Area is contained within a larger area of predominantly remnant vegetation, the extent of which is approximately 4800ha. This tract of vegetation is surrounded by extensively cleared lands used for pastoral and cropping purposes. Non-native pastures (Buffel Grass *Cenchrus ciliaris*) predominate on the pastoral lands. Thus this tract represents a significant habitat patch within the Roma district.
		Stocking rate (3) = 3 Species confirmed present within the Survey Area. Field survey has confirmed the presence of significant numbers of colonies within the Survey Area and the surrounding extensive tract of remnant vegetation.

Table 5A: EPBC Act Offset Assessment Guide Inputs – koala AU6

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Koala
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community Clear row	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat Clear row	Yes		Area	101.83	Hectares	
			Quality	6	Scale 0-10	
			Total quantum of impact	61.10	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees Clear row	No					
Condition of habitat Change in habitat condition, but no change in extent Clear row	No					
Threatened species						
Birth rate e.g. Change in nest success Clear row	No					
Mortality rate e.g. Change in number of road kills per year Clear row	No					
Number of individuals e.g. Individual plants/animals Clear row	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	61.10	Adjusted hectares	86.6	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	132.63	Risk of loss (%) without offset Future area without offset (adjusted hectares)	0% 132.6	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0% 132.6	0.00	100%	0.00	0.00	64.99	106.37%	Yes	
					Time until ecological benefit	20	Start quality (scale of 0-10)	4	Future quality without offset (scale of 0-10)	1	Future quality with offset (scale of 0-10)	7	6.00	85%	5.10	4.90				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g. Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Table 5B: EPBC Act Offset Assessment Guide Inputs – koala AU9

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Koala
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community Clear row	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat Clear row	Yes		Area	108	Hectares	
			Quality	8	Scale 0-10	
			Total quantum of impact	86.40	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees Clear row	No					
Condition of habitat Change in habitat condition, but no change in extent Clear row	No					
Threatened species						
Birth rate e.g. Change in nest success Clear row	No					
Mortality rate e.g Change in number of road kills per year Clear row	No					
Number of individuals e.g. Individual plants/animals Clear row	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	86.40	Adjusted hectares	AU9 RE 11.3.2 regrowth	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	35.38	Risk of loss (%) without offset Future area without offset (adjusted hectares)	0% 35.4	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0% 35.4	0.00	100%	0.00	0.00 20.23	23.41%	No		
					Time until ecological benefit	20	Start quality (scale of 0-10)	6	Future quality without offset (scale of 0-10)	1	Future quality with offset (scale of 0-10)	8	7.00	85%	5.95	5.72				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Table 5C: EPBC Act Offset Assessment Guide Inputs – yakka skink AU6

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Yakka Skink
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community Clear row	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat Clear row	Yes		Area	108	Hectares	
			Quality	8	Scale 0-10	
			Total quantum of impact	86.40	Adjusted hectares	
Number of features e.g. Nest hollows, habitat trees Clear row	No					
Condition of habitat Change in habitat condition, but no change in extent Clear row	No					
Threatened species						
Birth rate e.g. Change in nest success Clear row	No					
Mortality rate e.g Change in number of road kills per year Clear row	No					
Number of individuals e.g. Individual plants/animals Clear row	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	86.40	Adjusted hectares	AU6 RE 11.3.2 regrowth	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	132.63	Risk of loss (%) without offset Future area without offset (adjusted hectares)	0% 132.6	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0% 132.6	0.00	100%	0.00	0.00	75.82	87.76%	No	
					Time until ecological benefit	20	Start quality (scale of 0-10)	5	Future quality without offset (scale of 0-10)	1	Future quality with offset (scale of 0-10)	8	7.00	85%	5.95	5.72				
Offset calculator																				
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start value		Future value without offset		Future value with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Table 5D: EPBC Act Offset Assessment Guide Inputs – yakka skink AU9

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Yakka Skink
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community Clear row	No		Area			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat Clear row	Yes		Area	108	Hectares	
			Quality	8	Scale 0-10	
			Total quantum of impact	86.40	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees Clear row	No					
Condition of habitat Change in habitat condition, but no change in extent Clear row	No					
Threatened species						
Birth rate e.g. Change in nest success Clear row	No					
Mortality rate e.g. Change in number of road kills per year Clear row	No					
Number of individuals e.g. Individual plants/animals Clear row	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				Risk-related time horizon (max 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0								
					Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
Threatened species habitat																				
Area of habitat	Yes	86.40	Adjusted hectares	AUPRE 11.3.2 regrowth	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	35.38	Risk of loss (%) without offset Future area without offset (adjusted hectares)	0% 35.4	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0% 35.4	0.00	100%	0.00	0.00	20.23	23.41%	No	
					Time until ecological benefit	20	Start quality (scale of 0-10)	4	Future quality without offset (scale of 0-10)	1	Future quality with offset (scale of 0-10)	8	7.00	85%	5.95	5.72				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g. Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

2. Management plan

2.1 Management area objectives and outcomes

The management area objectives and outcomes identified below are estimated to be achieved within 20 years, or by 2038. It is recognised that the timeframes are subject to natural conditions and unexpected events, and the risks are identified in section 4, Risk Analysis.

Over time, there will be an improvement on the extent and condition of habitat for the Koala and Yakka Skink within the offset area.

The management area objectives and outcomes for the offset area are for the enhancement of the connectivity along Apple Tree Creek, watercourse vegetation and habitat

The habitat and regional ecosystems are currently in a degraded condition within the offset area (refer to *Section 1*).

2.1.1 Management area objectives

Environment Protection & Biodiversity Conservation Act 1999 (Commonwealth)

The management area objectives are to protect and improve the habitat conditions for the listed threatened species *Phascolarctos cinereus* (Koala) and *Egernia rugosa* (Yakka Skink) under the EPBC Act approval. Management actions in the offset area will enable the natural regeneration of the habitat via the following:

- prevention of broad-scale clearing;
- fire management as per the guidelines provided in the Queensland Herbarium Regional Ecosystems Descriptions Database (REDD) for the respective regional ecosystems;
- livestock management to minimise grazing impacts;
- weed management including control measures; and
- pest animal management measures.

A legally-binding mechanism, in the form of a Voluntary Declaration under the *Vegetation Management Act 1999* will protect this offset area from clearing and require the actions within the management plan to be implemented. The areas will be actively managed until 30 June 2033, or until the outcomes of the management plan are achieved, whichever comes first.

If due to natural conditions and/or unexpected events the offset has not achieved the future quality as detailed in **Tables 5A, 5B**, **5C** and **5D**, then the actions detailed in **Table 6** and **Table 8** will be continued until the outcomes of the management plan are achieved or until 30 June 2036, whichever comes first.

Environmental Offsets Act 2014 (Queensland)

The offset area for impacts to watercourse vegetation and connectivity are managed to maintain and enhance the condition of those regional ecosystems, specifically:

- the ecosystem attains remnant status as defined under the VMA and remains mapped on a Regulated Vegetation Management Map (RVMP), or a map published by the Queensland Government that supersedes the RVMP;
- prevention of broad-scale clearing;
- fire management as per the guidelines provided in the Queensland Herbarium Regional Ecosystems Descriptions Database (REDD) for the respective regional ecosystems;
- livestock management to minimise grazing impacts;
- weed management including control measures; and
- pest animal management including control measures.

2.1.2 Offset area outcomes

(a) **Site Condition**: The offset area is managed to improve the ecological condition of the vegetation through appropriate management actions as detailed in **Table 8**. These actions include the exclusion of any forestry and/or timber harvesting operations which will allow natural regeneration of canopy and sub-canopy species

and protect large hollow bearing trees from being felled, fire management as per the guidelines provided in the Queensland Herbarium Regional Ecosystems Descriptions Database (REDD) for the respective regional ecosystems and weed control.

(b) **Offset Start Condition** scores as shown in **Tables 5A – 5D** align with the scores recorded as the baseline at the monitoring and reporting locations as detailed in **Table 10: Monitoring Sites**. The baseline data is provided in **Attachment 1** of this management plan.

(c) **Site Context**: the offset area is managed to enable the natural regeneration process of the vegetation to occur and to therefore achieve enhanced connectivity along the Apple Tree Creek corridor.

2.2 Detailed offset area mapping

The proximity of the offset area to the Western Surat Gas Project and within the region is illustrated in **Figure 2**Error! Reference source not found.. The explicit location of the offset area [redacted] and the location of offsets under the EPBC Act and EOP are shown in **Figure 2** and **Figure 3**.

Figure 2: West Surat Gas Project [redacted] location map

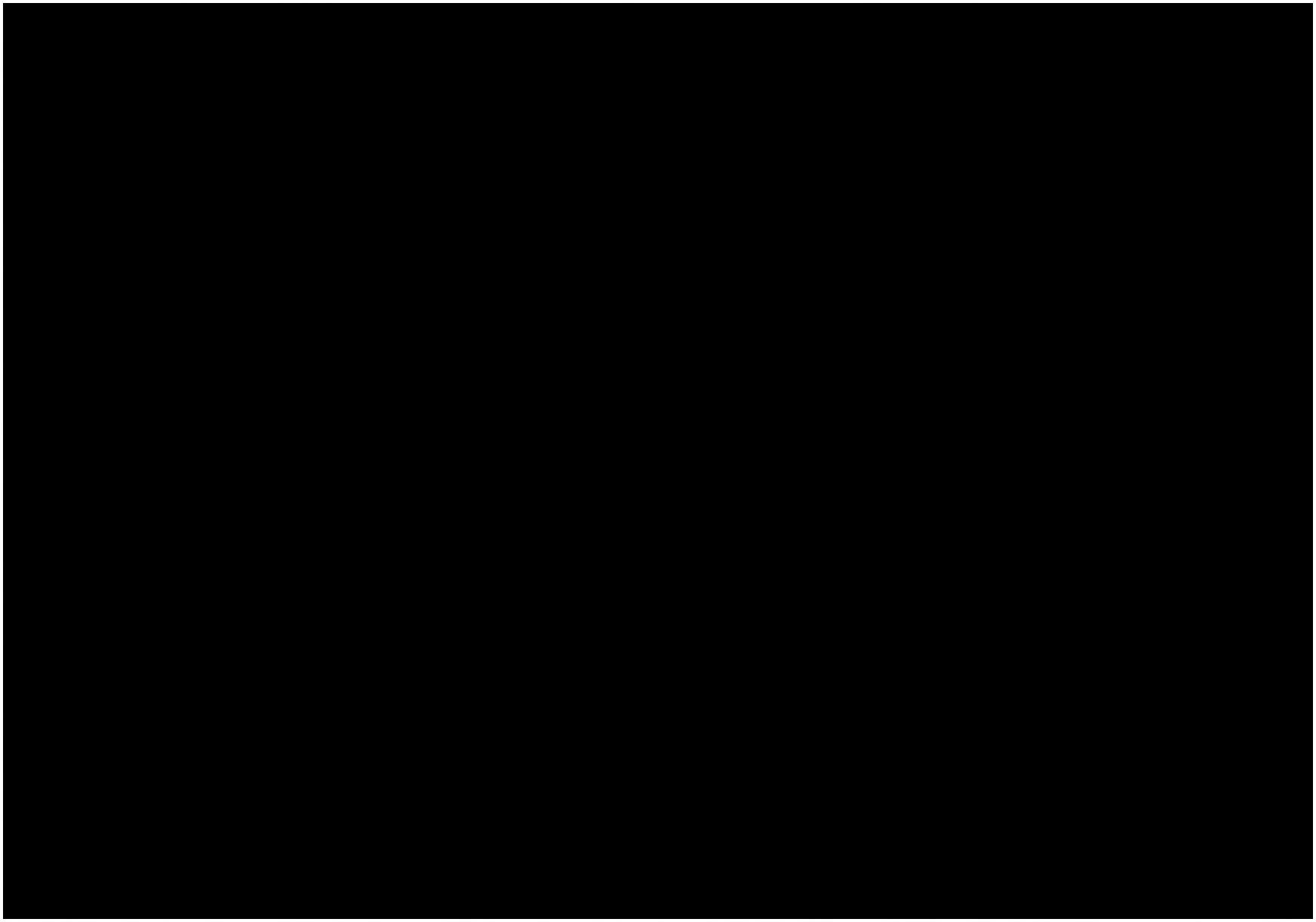


Figure 3: MNES and MSES Offset area [redacted]

3. Restrictions imposed on the use of the offset area

The restrictions below (**Table 6**) will be implemented as actions within the Offset Area Management Plan (**OAMP**), for the offset site, as shown in **Figure 3**.

Table 6: Offset area restrictions

Restriction	Details
Vegetation clearing is restricted and to be undertaken only by the exemptions in the *Vegetation Management Act 1999* for point 1 **Any new fences are to be established outside of the offset area** **The fencing associated with the offset area is at Figure 3.**	1. Vegetation clearing on the offset area is restricted to: a) that necessary for the removal of non-native weeds or declared pests b) ensure public safety c) maintenance of existing roads, fence lines, water pipelines and firebreaks; and d) that necessary to establish and maintain access to Ecological Equivalence assessment and photo point monitoring sites. Where vegetation clearing is sought for any other purpose, the Landholder must contact the relevant department administering the *Vegetation Management Act 1999 (Qld).* 2. Native forest practice (harvesting of timber for forestry purposes) is not allowed under this Offset Area Management Plan. 3. Clearing for new fencing will be on the outside of the offset area boundary or along the property boundary. Note: Any vegetation clearing must be undertaken in accordance with: • best practice management methods; and • any applicable legislative requirements. For example, the clearing of endangered, vulnerable or near-threatened plant species or the tampering with animal breeding places under *Nature Conservation Act 1992 (Qld)* Under the *Vegetation Management Act 1999*, clearing in Least Concern regional ecosystems for fences, roads or tracks is exempt clearing if it is less than 10m in width. Any new fences, roads or tracks will be less than 10m in width for each piece of infrastructure. Clearing to establish or maintain a necessary firebreak to protect infrastructure (other than fences, roads and tracks) to a maximum width of 20m or 1.5 times the height of the tallest adjacent tree, whichever is the greater.
Grazing	Grazing of domestic livestock (cattle) will occur in the offset area under the following arrangements: 1. for fuel reduction purposes only during the dry season; and 2. noting that there are no set stocking rates or times throughout the year where stock are to be permitted to graze. The Landholder, at their discretion, is to graze stock at rates and times necessary to reduce the fuel load in the offset area without lowering the total grass cover to below 40% at the end of the dry season. The ground cover is to be a Level 1 assessment as described on page 9 of the *Land Manager's Monitoring Guide* published by the State of Queensland (DERM) 2010 (***Attachment 2***), or any subsequent published version of this document; 3. the grazing regime should allow native grasses to flower and set seed at least every two years (6-8 week period during the wet/summer season); and 4. cattle are excluded from the offset area during the wet season and during the early dry season (April to August).
Fire	1. Fire is excluded from the offset area by: a) maintaining firebreaks relative to the offset areas; and b) firebreaks are to be co-located with roads and fence lines on the property where possible. Note: Fire is not to be used as a tool for regrowth management on the offset areas.

Restriction	Details
Pest animals and weeds	**Animal** Minimise the introduction of pest animals and control of existing populations of pest animals within the offset area in accordance with the *Biosecurity Act 2014* (Qld). 1. Monitor and manage pest animal populations and subsequently adapt control effort with populations with regards to wild pigs and wild dogs. **Weeds** 1. Keep the introduction, establishment and spread of non-native weeds including Prohibited or Restricted Pest Plants listed under the *Biosecurity Act 2014* (Qld) to no more than 5% weed cover over the offset area. 2. Control any existing infestations of non-native weeds including Prohibited or Restricted Pest Plants under the *Biosecurity Act 2014* (Qld) to ensure that the non-native weeds do not cover more than 5% of the offset areas, e.g., Parthenium. 3. Minimise the spread of any non-native pasture species within the offset area in accordance with **Table 8: Management Actions**. **Note:** Any weed control required will be undertaken as early as practicable within the natural regeneration process throughout the offset area and then periodically as required to treat the weeds at the optimum time in their life cycles to control and minimise the spread of the existing weed species.

4. Analysis of risks to achieving management objectives and outcomes

The following risk assessment (**Table 7)** has considered:

- any real or potential risks associated with achieving the management objectives and outcomes;
- the actions taken to minimise those risks; and
- remedial action that will be undertaken if any of the risks occur.

The risks to the offset failing has been assessed in Table 7 for Fire, Forestry, grazing, erosion and drought and the risk is assessed as low for each risk factor. Table 8 has trigger levels and corrective actions for each risk factor and hence the risk of the offset failing is considered extremely low.

Table 7: Risk analysis

Number	Risk	Level of Risk (Extreme, High, Moderate or Low)	Actions to Minimise Risk	Remedial Actions if Risk Occurs
1	Fire	**Low** The offset area contains regrowth (>5 years old) in a degraded condition with a ground layer dominated by native grasses. Inappropriate fire events will delay the development of more mature trees and affect woody debris accumulation and groundcover however will not destroy the site entirely.	Maintaining firebreaks at appropriate widths to enable fires in adjoining areas to be prevented from impacting on the offset area. Manage fuel loads through controlled grazing during the dry season noting that razing is excluded between December and March (wet season). *Force majeure* events are acknowledged being separate from general fire use practices. Fire control lines to be checked monthly for condition and	**Remedial action:** Destock the offset area within 5 days, re-establish fencing, fire breaks and control lines and if appropriate, widen fire control lines and reassess fuel load reduction practices.

Number	Risk	Level of Risk (Extreme, High, Moderate or Low)	Actions to Minimise Risk	Remedial Actions if Risk Occurs
			adequacy, and maintenance work is to be undertaken at a minimum once every two years.	
2	Forestry	**Low** Standard forestry and native timber harvesting practices remove large trees that contain hollows and deadwood from the environment and are hence considered a potential threat to the quality of the vegetation community, habitat and to the accumulation of groundcover.	Forestry and native timber harvesting are **excluded** from the offset area.	**Remedial action**: Reassess access protocols.
3	Grazing	**Low** High density grazing destroys shrubs and native grass cover and slows the regeneration of the habitat and increases the likelihood of the introduction of weeds. The benchmark native ground cover in this regional ecosystem is circa 37% and hence any grazing undertaken is to be enable the retention of a minimum of 40% grass cover at the end of the dry season.	Grazing of domestic livestock will occur in the offset area during the dry season for fuel reduction purposes with a minimum grass cover to be present at the end of the dry season as follows of 40%. For clarity, grazing is excluded in the offset area between December and March (wet season). Offset area boundary fencing is to be inspected monthly when stock are not in the area and weekly when stock are grazing the offset area. Fencing must be maintained in a stock proof condition.	Grazing is determined by the amount of dry matter available and is used conservatively for that necessary for fuel reduction purposes only. **Remedial action**: If stock are noted within the offset area between December and March then the fence is to be repaired to a stock proof condition and stock removed within 5 days. When stock are not grazing in the offset area, fencing breaks are to be repaired to a stock proof condition as soon as possible and within 10 days.
4	Erosion	**Low**	Maintain grass cover at levels specified in (3) above at the end of the dry season. This will ensure groundcover is high due to the presence of fallen woody debris, organic matter etc. thus minimising the risk of sheet erosion.	**Remedial action**: Further reduction of grazing levels and inspections to identify the cause of any point source erosion (such as illegal vehicle access), and rectifying accessibility as required.
5	Drought	**Low** The risk posed by drought would also increase the likelihood of fire due to the dry conditions and accumulated fuel loads.	Maintain fire control lines and manage grazing levels according to the amount of dry matter available for grazing.	**Remedial action**: Allow offset area to recover post drought/fire, particularly through the removal of stock and control of weeds. Maintaining grass cover at levels specified in (3) above at the end of the dry season.

5. Management actions

The following table (**Table 8**) identifies the actions which will be undertaken for the offset area, by whom, when and more specific information relating to the action. It is noted that all costs and responsibilities associated with the implementation of the management plan rests with the landholder. The cost of monitoring and reporting (section 6) lies wholly with Senex Energy.

Table 8: Schedule of management actions

Management action	How the action will be carried out	Where the action will be carried out	When the action will be carried out	Who will be carrying out the action	Progress/ measurable outcomes	Comments/ corrective actions
Forestry Operations, Native Timber Harvesting and general vegetation impacts Consistent with the risk of clearing as identified in the Conservation Advice for Reptiles of the Brigalow Belt and Conservation Advice for the Koala	1. Vegetation clearing on the offset area is restricted to: a) that necessary for the removal of non-native weeds or declared pests b) ensure public safety; and c) maintenance of existing roads, fence lines, and firebreaks; Where vegetation clearing is sought for any other purpose, the Landholder must contact the relevant department administering the *Vegetation Management Act 1999 (Qld).* 2. Native forest practice (harvesting of timber for forestry purposes) <u>is not</u> allowed under this Offset Area Management Plan. 3. Clearing for new fencing will be on the outside of the offset area	Only in those areas subject to non-native weed control, fire control lines and fences.	Vegetation clearing for approved purposes may occur as required.	Landholder or suitable qualified person appointed by the Landholder.	No evidence of recent forestry or timber harvesting activities are evident during the term of the offset area management plan. Vegetation clearing for any purpose to be recorded as part of the quarterly inspection conducted by the Landholder. Trigger for remedial action and reassessment of the management actions detailed: detection of illegal clearing	Upon being notified or becoming aware of prohibited vegetation harvesting/clearing in the offset area, the Landholder is to reassess and repair access points within one fortnight. The Offset Area Report will document any prohibited vegetation clearing/damage (such as that incurred by vehicles traversing the are off designated roads/tracks and/or illegal camping that has occurred during the reporting period and the correlating responsive actions. Residual Risk: Low

Management action	How the action will be carried out	Where the action will be carried out	When the action will be carried out	Who will be carrying out the action	Progress/ measurable outcomes	Comments/ corrective actions
	boundary. See the fencing plan at Figure 3. **Note:** Any vegetation clearing must be undertaken in accordance with: • best practice management methods; and • any applicable legislative requirements. For example, the clearing of endangered, vulnerable or near-threatened plant species or the tampering with animal breeding places under *Nature Conservation Act 1992 (Qld)* Under the *Vegetation Management Act 1999*, clearing in Least Concern regional ecosystems for fences, roads or tracks is exempt clearing if it is less than 10 m in width. Any new fences, roads or tracks will be less than 10 m in width for each piece of infrastructure. Clearing to establish or maintain a necessary firebreak to protect infrastructure (other than fences, roads and tracks) to a maximum width of 20 m or 1.5 times the height of the tallest adjacent tree, whichever is the greater.					

Management action	How the action will be carried out	Where the action will be carried out	When the action will be carried out	Who will be carrying out the action	Progress/ measurable outcomes	Comments/ corrective actions
Fire Consistent with the risk of clearing as identified in the Conservation Advice for Reptiles of the Brigalow Belt and Conservation Advice for the Koala	2. Fire is to be excluded from the offset area by: a) maintaining firebreaks relative to the offset areas; and b) firebreaks are to be co-located with roads and fence lines on the property where possible. **Note:** Fire is not to be used as a tool for regrowth management on the offset areas.	Along fire breaks.	Fire control lines must be inspected monthly. Maintenance must be undertaken as required and at least every two years.	Landholder or suitable qualified person appointed by the Landholder.	Evidence of fire is not observed during the term of the offset area management plan. Any observed incidence of prohibited burning or force majeure events will be recorded during quarterly inspections conducted by the Landholder. Trigger for remedial action and reassessment of the management actions detailed: destruction of regrowth, fallen timber and the occurrence of deliberately lit hot fires	Upon being notified or becoming aware of prohibited fire in the offset area, the Landholder is to reassess access within two weeks. After any occurrence of fire in the offset area, the Landholder or suitable qualified person appointed by the Landholder will: 1. inspect and repair, and widen if necessary, all firebreaks; 2. inspect and repair fences to a stock proof condition; 3. reassess fuel load reduction practices; and 4. exclude grazing until the grass cover present at the end of the dry season is a minimum 60% groundcover or 850kg/ha pasture biomass. (See **Plate 1**). 5. Weed monitoring and control will be at fortnightly intervals post a fire event to maintain low levels of weed cover as the natural grass cover reestablishes. *Note that groundcover is used to accommodate the change in the structure of the community over*

Management action	How the action will be carried out	Where the action will be carried out	When the action will be carried out	Who will be carrying out the action	Progress/ measurable outcomes	Comments/ corrective actions
						time from pasture to a reginal ecosystem Grass cover measurements must be in accordance with the Level 1 methodology stated in the *Land Manager's Monitoring Guide* (Department of Environment and Resource Management, 2010) (DERM)[i] (or any subsequent published version of this document) as attached to the OAMP, or any subsequent published version of this document. The Offset Area Report will document any known incidences of fire that have occurred during the reporting period and the correlating responsive actions. Residual Risk: Low
Fencing Consistent with the risk of clearing as identified in the Conservation Advice for Reptiles of the Brigalow Belt and Conservation Advice Koala	Routinely inspect fencing to secure the offset area to prevent stock entry during exclusion times and unauthorised access.	All external boundaries of the offset area. Where the offset boundary coincides with the property boundary, the fence may align with the property boundary. A	If cattle are grazing the offset area, fencing must be inspected weekly. During non-grazing periods, fencing must be inspected fortnightly.	Landholder or suitable qualified person appointed by the Landholder.	Fortnightly inspections will identify if fences are preventing cattle and unauthorised people from accessing the offset area. These inspections may be conducted by the Landholder or suitable qualified person appointed by the Landholder.	Upon being notified or becoming aware of an unsecure offset area (ie allows the entry of stock or illegal access), the Landholder or a suitably qualified person is to undertake fence maintenance and repairs as soon as possible and within 10 days. Fencing is to be inspected and if required repaired, within 10 days

[i] *Land Manager's Monitoring Guide: Ground cover indicator*, Department of Environment and Resource Management, 2010, Queensland Government, Brisbane, available at http://qldgov.softlinkhosting.com.au/liberty/opac/search.do#

Management action	How the action will be carried out	Where the action will be carried out	When the action will be carried out	Who will be carrying out the action	Progress/ measurable outcomes	Comments/ corrective actions
		fenced area may include non-offset areas.			Trigger for remedial action and reassessment of the management actions detailed: detection of illegal access, cattle grazing during exclusion times and grass cover reducing below threshold levels.	of any *Force Majure* events such as storms, fire etc. The Offset Area Report will document the maintenance and repair of fences during the reporting period. Residual Risk: Low
Following extreme weather conditions of drought or flood Drought is defined as being when the Queensland Government declares the property and/or district to be in drought via a Drought Declaration Consistent with the risk of clearing as identified in the Conservation Advice for Reptiles of the Brigalow Belt and Koala	Determine the extent of damage to the offset area and fencing caused by the event.	Throughout the offset area with attention paid to boundary fencing.	As soon as safely possible post a flood event. For a drought event, inspections must be fortnightly.	Landholder or suitable qualified person appointed by the Landholder.	Within one fortnight after the cessation of a flood, an inspection conducted by the Landholder or suitable qualified person appointed by the Landholder will determine if the offset area is secure from stock and illegal access. During drought events, fortnightly inspections will be conducted by the Landholder or suitable qualified person appointed by the Landholder to record the ground cover levels in the offset area.	Upon being notified or becoming aware of flood event occurring in offset area, the Landholder is to undertake fence maintenance and repairs within one month. Upon being notified or becoming aware of a drought event occurring in the offset area, the Landholder is to remove cattle from the offset area within 5 days. The Offset Area Report will document the repair of fences and removal of cattle from offset areas, because of extreme weather conditions, during the reporting period. **Residual Risk: Low**

Management action	How the action will be carried out	Where the action will be carried out	When the action will be carried out	Who will be carrying out the action	Progress/ measurable outcomes	Comments/ corrective actions
Grazing Consistent with the risk of clearing as identified in the Conservation Advice for Reptiles of the Brigalow Belt and Conservation Advice for the Koala	Stocking rates are not fixed as this region is subject to significant changes in grass cover with seasonal conditions. Throughout the offset area, management actions for fire, drought and grazing are interlinked due to the necessity to manage increased fuel loads that will establish as a consequence of reduced grazing intensity. As Eucalypt trees in the offset area establish and mature, their resulting canopy cover will naturally diminish the fuel load as grass cover will decline in extent as the canopy cover increases. Until such time, intervention in the form of both low intensity grazing will achieve this outcome.	Stock will be grazed in the offset areas for fuel reduction purposes only during the dry season which is usually between April and December.	As required when grasscover exceeds 60% during the dry season. The dry season is normally between April and December; however, if unseasonal rainfall should occur, then grazing is to be allowed.	Landholder or suitable qualified person appointed by the Landholder.	During grazing periods, weekly inspections will be conducted by the Landholder or a suitable qualified person appointed by the Landholder, to record the minimum grass cover of the offset area. Graze stock during the dry season, at rates and times necessary to reduce the fuel load in the offset areas with a minimum grass cover to be present at the end of the dry season of 40%. Trigger for remedial action and reassessment of the management actions detailed: detection of cattle grazing out of allowed times and grass cover thresholds. *Note that groundcover is to be used to be used as the measure when the grass cover is reduced to the regional ecosystems benchmark in later years due to increased canopy cover and competition from trees and shrubs. This is to accommodate the*	Upon being notified or becoming aware of grass cover falling below 40%, the Landholder is to remove cattle from the offset area within 7 days. Grazing period may recommence when the grass cover has increased to 60%. Upon being notified or becoming aware of an unsecure offset area, the Landholder is to undertake fence maintenance and repairs to resecure the offset area within 10 days. If overgrazing occurs, weed monitoring and control is to be increased to fortnightly inspections to ensure weed cover does not increase in low cover conditions. Weed cover is to be estimated using the Level 1 methodology stated in the Land Manager's Monitoring Guide (Department of Environment and Resource Management, 2010) (DERM) (or any subsequent published version of this document) as attached to the OAMP, or any subsequent published version of this document. The Offset Area Report will document the grazing periods

Management action	How the action will be carried out	Where the action will be carried out	When the action will be carried out	Who will be carrying out the action	Progress/ measurable outcomes	Comments/ corrective actions
					change in the structure of the community over time from pasture to a regional ecosystem	that occurred in the offset areas during the reporting period and the correlating responsive actions that occurred as part of grazing management. Residual Risk: Low
Pest animals Consistent with the risk of clearing as identified in the Conservation Advice for Reptiles of the Brigalow Belt and Conservation Advice for the Koala	Minimise the introduction of pest animals and control of existing populations of pest animals (wild dogs and pigs) within the offset areas in accordance with the *Biosecurity Act 2014* (Qld). Wild pig and dog populations are generally small and highly transient, and therefore the scale of impact is small. Major damage to the environment/habitat occurs when large numbers of animals congregate in the area. Current control of pigs and wild dogs is undertaken via a baiting program on the property. Additional to this measure, the Landholder, during monthly inspections of the offset area may remove any wild pigs or wild dogs that are seen. If an increase in pig or dog activity is noted, an additional trapping, baiting and/or control program is to be instigated until the increased activity has ceased.	All offset areas.	Preferably in the autumn and spring months. When a group of animals is observed, a control program will be implemented.	Landholder or suitable qualified person appointed by the Landholder.	Monthly inspections to record the presence of wallow holes, tracks and visual incidents in the offset area. These inspections may be conducted by the Landholder or suitable qualified person appointed by the Landholder. Monitoring is to be undertaken by checking for, and taking note of dog prints, that traverse roads and fire control lines associated with the offset area during the monthly inspections. Observations are to be made for pigs and pig wallows along 500m of Apple Tree Creek when traversing the fence lines during the monthly inspections. Trigger for remedial action and reassessment of the management actions	Upon being notified or becoming aware of pest animals causing damage to the offset area, the Landholder is to implement pest control measures within one month. If twelve or more half grown and/or mature wild pigs or dogs are noted during the monthly inspections, then a control program will be initiated. The Landholder may approach neighbouring landowners to discuss the increased pest animal presence and an integrated control program may be developed. The Offset Area Report will document the indications or sightings of pest animals during the reporting period and the correlating responsive actions. Residual Risk: Low

Management action	How the action will be carried out	Where the action will be carried out	When the action will be carried out	Who will be carrying out the action	Progress/ measurable outcomes	Comments/ corrective actions
					detailed: detection of large numbers of feral animals	
Pest plants (i.e. weeds) Consistent with the risk of clearing as identified in the Conservation Advice for Reptiles of the Brigalow Belt and Conservation Advice for the Koala.	Keep the introduction, establishment and spread of non-native weeds including Declared Pest Plants listed under the *Biosecurity Act 20014* (Qld) to less than 5% weed cover in the entire offset area. Control existing infestations of non-native weeds including declared pest plants under the *Biosecurity Act 2014* (Qld) to ensure that the non-native weeds cover less than 5% of the offset area (e.g., Parthenium). Spot spraying of patches of Parthenium is permitted.	Throughout the offset area	Weed control will be undertaken as early as practicable within the natural regeneration process throughout the offset areas and then periodically as required to treat the weeds at the optimum time in their life cycles to control and minimise the spread of the existing weed species.	Landholder or suitable qualified person appointed by the Landholder. Trigger for remedial action and reassessment of the management actions detailed: pest plants are present/cover more than 10% of the offset area	Quarterly inspections will be conducted by the Landholder or suitable qualified person appointed by the Landholder to observe and record the presence of weeds and success of previously applied weed control measures. Weed monitoring and control is to be increased to fortnightly inspections to ensure weed cover does not increase in low cover conditions. Weed cover is to be estimated using the Level 1 methodology stated in the Land Manager's Monitoring Guide (Department of Environment and Resource Management, 2010) (DERM) (or any subsequent published version of this document) as attached to the OAMP, or any subsequent published version of this document.	Upon being notified or becoming aware of pest plants being present in greater than 5% of the offset area, the Landholder is to implement control measures within one month. These measures may include, and are not limited to: • foliar spraying; • basal bark spraying; • stem injection; • cut stump; • cut and swab; • stem scraper; and • wick applicators. The Offset Area Report will document the weed presence, weed control measures and extent of grass cover during the reporting period and the correlating responsive actions. Residual Risk: Low

Plate 1: Pasture cover in eucalypt woodland at 850kg/ha

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

6. Monitoring requirements

Monitoring of the offset area will occur in accordance with **Table 9**. It is noted that all costs and responsibilities associated with the implementation, and monitoring and reporting of the management plan rests with Senex Energy. Monitoring locations are listed in **Table 10** and shown in **Figure 3**.

The results of the monitoring program will inform adaptive management of the offset area so that over time there will be an increase in the extent and condition of the regional ecosystems and habitat. The monitoring will demonstrate an improvement over time of the functionality and condition for the watercourse and connectivity vegetation, and habitat for the Koala and Yakka Skink, and as defined in the relevant Approved Conservation Advices.

Table 9: Schedule of monitoring – offset area, [redacted]

Monitoring	Attributes monitored	Frequency	Method	Location/s
Surveys undertaken by Ecologists (by Senex Energy)				
Baseline assessment	Refer 'ecological condition' below	Completed in 2018 and is an input into the Offset Management Plan and OAMP	Field observations, vegetation assessment as per the *Guide to determining terrestrial habitat quality – a toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy (version 1.4 July 2017)* (DEHP, 2017) *	Sites listed at Section 6, *Table 10* of the OAMP at Schedule 1.

Monitoring	Attributes monitored	Frequency	Method	Location/s
Targeted surveys for Koala and Yakka Skink		Every five years to, and including, year 2033 (i.e. 2023, 2028 and 2033); reported every 5 years	EPBC Act referral guidelines for the vulnerable koala and the Environment Protection and Biodiversity Conservation Act 1999 Draft Referral guidelines for the nationally listed Brigalow Belt reptiles (or any subsequent published version of those documents).	Sites listed at Section 6, *Table 10* of the OAMP at Schedule 1.
Ecological condition	Recruitment of woody perennial species in EDL	Every five years to, and including, year 2033 (i.e. 2023, 2028 and 2033); reported every 5 years	Field observations, vegetation assessment as per the *Guide to determining terrestrial habitat quality – a toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy (version 1.1 December 2014)* (DEHP, 2014)*. Data for each of the ecological condition attributes monitored will be collected at each site listed in *Table 10* of the OAMP and reported on and presented in a sequential manner (including previous data collected) to quantify change from the benchmark collected in 2018. This will record the change in each attribute measured and hence the condition of the ecological community and habitat, thus enabling a statistical comparison to previous years' data and the progression of the offset site condition and EPBC Offset Assessment Guide Calculator inputs.	Sites listed at Section 6, *Table 10* of the OAMP at Schedule 1.
	Native plant species richness – trees			
	Native plant species richness – shrubs			
	Native plant species richness - grasses			
	Native plant species richness – forbs			
	Tree canopy height			
	Tree canopy cover			
	Shrub canopy cover			
	Native perennial grass cover			
	Organic litter			
	Large trees			
	Coarse woody debris			
	Non-native plant cover			
Quarterly Landholder/Authority Holder Records and monitoring ***Record keeping commences within three months of the Queensland Government approving the voluntary declaration***				
At the permanent survey points and any unauthorised impacts to vegetation and woody debris from activities such as illegal harvesting, illegal access/camping	Vegetation, woody debris, grass cover, weed cover, pest animal damage	Every May in Years 1, Year 2, Year 3, Year 4, and Year 5 (i.e. 2019, 2020, 2021, 2022 and 2023) and then every five years to (and including) year 2033	Landholder or suitable qualified person appointed by the Landholder will undertake quarterly inspections of the offset area to observe and record grass cover levels, pest plants, accessibility (i.e. condition of fencing), evidence of fire and evidence of pest animal incursion. The inspection records will serve as	Sites listed at Section 6, *Table 10* of the OAMP at Schedule 1.

Monitoring	Attributes monitored	Frequency	Method	Location/s
Grazing	Stocking rates Grass cover	Monitored monthly during grazing periods and reported annually until, and including, May 2033 *Level 1 monitoring as per the Land Manager's Monitoring Guide (DERM, 2010)*	the primary data source for the Offset Area Report. Grass and weed cover is to be undertaken as per the Level 1 methodology described in the *Land Manager's Monitoring Guide* (DERM, 2010) (or any subsequent published version of this document) provided at Attachment 2 of the OAMP.	Within offset areas
Fire	Occurrence, control measures implemented, timing and result of the control measures as per Table 8 of the OAMP.	Monitored quarterly and reported annually until, and including, May 2033. Monitored as required by fire events (at least annually) and activity reported		
Pest plants	Occurrence, control measures implemented, timing and the result of the control measures as per Table 8 of the OAMP.	Monitored quarterly and reported annually until, and including, May 2033. Monitored in conjunction with photo point monitoring and reported in reporting detailed above. Weed cover is to be monitored by the same methodology and at the same time and at the same time as the grass cover measurements.		
Pest animals	Occurrence, control measures implemented, timing and the result of the control measures as per Table 8 of the OAMP.	Monitored quarterly and reported annually until, and including, May 2033. Monitored quarterly and reported in reporting detailed above. Quarterly inspections will involve traversing the offset area with streams, low lying areas and vehicle access tracks being noted for to record the presence of		

Monitoring	Attributes monitored	Frequency	Method	Location/s
		wallow holes, tracks and visual incidents in the offset area. If detected, these locations will be GPSed and photographed and rechecked at the next quarterly inspection.		

*A methodology for assessing ecological condition published subsequent to the *Guide to determining terrestrial habitat quality – a toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy (version 1.4 July 2017)* (DEHP, 2014) that captures the required scope of information may be used.

Table 10: Monitoring sites

Site number	Regional Ecosystem	Condition	Location - easting	Location - northing
H15	11.3.2	regrowth	[redacted]	[redacted]
H16	11.3.2	regrowth	[redacted]	[redacted]
H17	11.3.2	regrowth	[redacted]	[redacted]
H18	11.3.2	regrowth	[redacted]	[redacted]

Coordinates system: GDA_1994_MGA_Zone_55

7. Reporting

Senex will report on the offset area management and submit the reports to the Commonwealth and State administering authorities every year for the first 5 years for the life of this plan and thereafter each 5 years, in conjunction with ecological surveys and targeted species surveys starting at year 5 (2023), for the life of this plan (i.e. until 2033) (**Table 11**).

Table 11: Schedule of reporting – offset area, [redacted]

Report Details	Reporting period	Submission due date
Offset Area Report detailing photo point and management actions	From grant of voluntary declaration to 30 May 2019	30 June 2019
Offset Area Report detailing photo point and management actions	1 May 2018 – 30 June 2020	30 June 2020
Offset Area Report detailing photo point and management actions	1 May 2020 – 30 June 2021	30 June 2021
Offset Area Report detailing photo point and management actions	1 May 2021 – 30 June 2022	30 June 2022
Offset Area Report detailing photo point and management actions	1 May 2022 – 30 June 2023	30 June 2023
Ecological condition assessment and targeted surveys for Koala and Yakka Skink to accompany the Offset Area Report to cover the preceding 5 years	From grant of voluntary declaration to 30 June 2023	30 June 2023
Ecological condition assessment and targeted surveys for Koala and Yakka Skink to accompany the Offset Area Report to cover the preceding 5 years	1 May 2021 – 30 June 2028	30 June 2028
Ecological condition assessment and targeted surveys for Koala and Yakka Skink to accompany the Offset Area Report to cover the preceding 5 years	1 May 2026 – 30 June 2033	30 June 2033

8. Consent

Administering authority

Chief Executive, Department of Natural Resources, Mines and Ener[redacted]

SIGNED by the [redacted] to indicate approval of the Offset[redacted]

Name: [redacted] Signature: [redacted]

Witness name: [redacted] Signature: [redacted]

Date: 26 March 2019

Landholder

The Landholder agrees:

1. A non-compliance with the requirements of this Offset Area Management Plan shall constitute a breach of the terms and conditions of the legally-binding mechanism entered into.
2. To notify the State in writing of an Event, or the likelihood of the occurrence of an Event.
   Event means any agreement or understanding entered into, or accepted by and/or circumstance permitted or suffered by the landholder which effects a change of ownership, control or use of the offset area, the exercise of power of sale under any Mortgage, the granting of a Mortgage, the appointment of a receiver, the death of a landholder or any other circumstance which may allow or permit a person, other than the landholder to own, control or use the offset area.
   In notifying the State of an Event, the landholder will notify the State of the nature of the change, or potential change of ownership, control or use result from the Event, and the name and address of any person who may own, control or use the offset area as a result of the Event.
3. That if, at the time of execution of this Offset Area Management Plan, there exists a Property Map of Assessable Vegetation (PMAV) over the offset area or a part of it, the landholder hereby agrees, where the management plan area is identified as Category X on the PMAV, to the replacement of the PMAV by the State to reflect the offset area as Category A.
4. To take all necessary steps as may be required to accomplish the obligations contained in this Offset Area Management Plan.

The Landholder acknowledges:

5. That before the State will agree to the release this Offset Area Management Plan the State must be satisfied that the results of the ecological assessments demonstrate achievement of the objectives contained in this Offset Area Management Plan.

The Landholder notes:

6. All reports, notices or requests for amendment in relation to this Offset Area Management Plan must be in writing and delivered to the administering authority at the following address:
   <Insert departmental name>
   <Insert postal address and telephone number>
   1. Energy & Extractive Resources, Qld Dept. Environment & Science, GPO Box 2454, Brisbane Q 4001
   2. Assessment & Governance Branch, Dept. Environment & Energy, PO Box 787, Canberra ACT 260

SIGNED [redacted] being the current owner of the abovementioned property to indicate that the terms of this Offset Area Management Plan including responsibilities under the Offset Area Management Plan, have been read, understood and accepted.

Name: [redacted] Signature: [redacted]

Witness name: [redacted] Signature: [redacted]

Date: 25/6/18

Attachment 1: Offset Area Ecological Data

Attachment 1A – Ecological Equivalence Methodology Scores AU6

Habitat Quality Final Summary Template

Case Reference	
Project Name	
Total Area	132.63

PART	Habitat Quality Attributes	Requirement	Assessment Unit Number									
			6	6	0	0	5	6	7	8	9	10
	Assessment Unit Area (ha)	Area (ha)	66.315	66.315	0	0	0	0	0	0	0	0
	Regional Ecosystems	RE	11.3.2	11.3.2								
	Bioregion	Bioregion	Brigalow Belt	Brigalow Belt								
1 Site Condition Attributes	1. Recruitment of woody perennial species	Score	0	0								
	2. Native plant species richness											
	- Trees	Score	2.5	3								
	- Shrubs	Score	2.5	2.5								
	- Grasses	Score	3	2.5								
	- Forbs	Score	2.5	2.5								
	3. Tree canopy height											
	- Canopy layer	Score	0	0								
	- Sub-Canopy Layer	Score										
	- Emergent Layer	Score										
	Average Score	Average Score	0	0								
	4. Tree canopy cover											
	- Canopy layer	Score	0									
	- Sub-Canopy Layer	Score										
	- Emergent Layer	Score										
	Average Score	Average Score	0									
	5. Shrub canopy cover	Score										
	6. Native perennial grass cover	Score	5									
	7. Organic litter	Score	3	5								
	8. Large trees	Score										
	9. Coarse woody debris	Score	0	5	0							
	10. Weed cover	Score	5	5								
2 Site Context Attributes	11. Size of patch (fragmented)	Score	10	10								
	12. Connectedness (fragmented)	Score	2	2								
	13. Context (fragmented)	Score	2	2								
	14. Distance from water (intact)	Score										
	15. Ecological corridors	Score	0	0								
3 Species Habitat Index	16. Threats to species	Score	1	1								
	17. Quality and availability of food and foraging habitat	Score	1	1								
	18. Quality and availability of shelter	Score	1	1								
	19. Species mobility capacity	Score	7	7								
	20. Role of site location to overall population in the State.	Score	1	1								

Habitat Quality Score (measured)	48.50	50.50								
Habitat Quality Score (max)	136.00	126.00								
Assessment Unit Area (ha)	66.32	66.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Assessment Unit Habitat Quality Score	3.57	4.01								
Size weighting	0.50	0.50								
Weighted Assessment Unit Habitat Quality Score	1.78	2.00								
FINAL TOTAL HABITAT QUALITY SCORE	**3.79**									

Administrative Information

Name of Assessment Officer		Date	
Organisation/Company Name			
Project Name			
Phone Number		Email	

Attachment 1B – Ecological Equivalence Methodology Scores AU9

Habitat Quality Final Summary Template

Case Reference	
Project Name	
Total Area	35.38

PART	Habitat Quality Attributes	Requirement	Assessment Unit Number									
			0	0	9	9	5	6	7	8	9	10
	Assessment Unit Area (ha)	Area (ha)	0	0	17.69	17.69	0	0	0	0	0	0
	Regional Ecosystems	RE			11.3.2	11.3.2						
	Bioregion	Bioregion			Brigalow Belt	Brigalow Belt						
1	Site Condition Attributes											
	1. Recruitment of woody perennial species	Score	0	0	3	5						
	2. Native plant species richness											
	- Trees	Score			5	5						
	- Shrubs	Score			5	3						
	- Grasses	Score			3	3						
	- Forbs	Score			3	2.5						
	3. Tree canopy height											
	- Canopy layer	Score	0	0	3	3						
	- Sub-Canopy Layer	Score										
	- Emergent Layer	Score										
	Average Score	Average Score	0	0	3	3						
	4. Tree canopy cover											
	- Canopy layer	Score			5	5						
	- Sub-Canopy Layer	Score										
	- Emergent Layer	Score										
	Average Score	Average Score			5	5						
	5. Shrub canopy cover	Score			5	5						
	6. Native perennial grass cover	Score			5	1						
	7. Organic litter	Score			5	5						
	8. Large trees	Score			10	10						
	9. Coarse woody debris	Score			0	0						
	10. Weed cover	Score			5	5						
2	Site Context Attributes											
	11. Size of patch (fragmented)	Score			10	10						
	12. Connectedness (fragmented)	Score			2	2						
	13. Context (fragmented)	Score			4	4						
	14. Distance from water (intact)	Score			2	2						
	15. Ecological corridors	Score			0	0						
3	Species Habitat Index											
	16. Threats to species	Score			15	15						
	17. Quality and availability of food and foraging habitat	Score			10	10						
	18, Quality and availability of shelter	Score			10	10						
	19. Species mobility capacity	Score			10	7						
	20. Role of site location to overall population in the State.	Score			4	4						

Habitat Quality Score (measured)			124.00	116.50						
Habitat Quality Score (max)			171.00	171.00						
Assessment Unit Area (ha)	0.00	0.00	17.69	17.69	0.00	0.00	0.00	0.00	0.00	0.00
Assessment Unit Habitat Quality Score			7.25	6.81						
Size weighting			0.50	0.50						
Weighted Assessment Unit Habitat Quality Score			3.63	3.41						
FINAL TOTAL HABITAT QUALITY SCORE	**7.03**									

Administrative Information

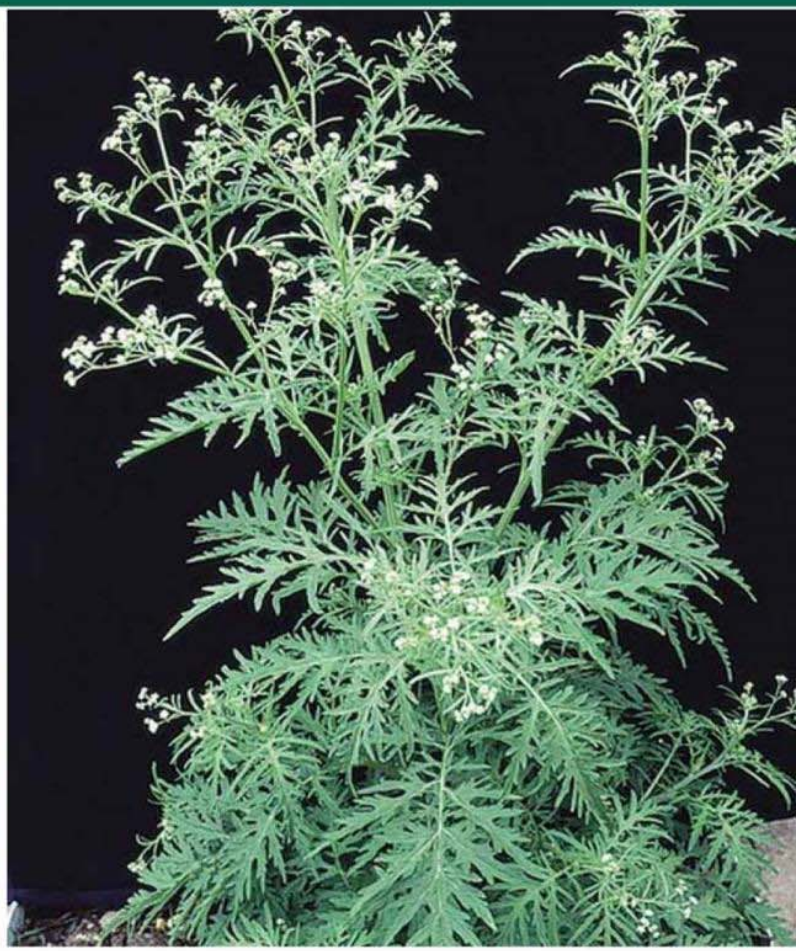
Name of Assessment Officer		Date	
Organisation/Company Name			
Project Name			
Phone Number		Email	

Attachment 1C: Weed Fact Sheets

Fact sheet
DECLARED CLASS 2 PEST PLANT

Parthenium weed

Parthenium hysterophorus



Parthenium costs the beef industry a total of $16.5 million per year and cropping industries several million dollars per year.

Declaration details

In Queensland, Parthenium is a Class 2 declared plant.

Under the *Land Protection (Pest and Stock Route Management) Act 2002*, Class 2 declaration requires landholders to control pests on the land and waters under their control. A local government may serve a notice upon a landholder requiring control of declared pests.

WEED BUSTERS

Queensland Government

PP2 June 2011

Description and general information

Size

Parthenium weed is an annual herb with a deep tap root and an erect stem that becomes woody with age. As it matures, the plant develops many branches in its top half and may eventually reach a height of two metres.

Leaves

Its leaves are pale green, deeply lobed and covered with fine soft hairs.

Flowers

Small creamy white flowers occur on the tips of the numerous stems. Each flower contains four to five black seeds that are wedge-shaped, two millimetres long with two thin, white scales.

Lifecycle

Parthenium weed normally germinates in spring and early summer, produces flowers and seed throughout its life and dies around late autumn. However, with suitable conditions (rain, available moisture, mild temperatures), parthenium weed can grow and produce flowers at any time of the year. In summer, plants can flower and set seed within four weeks of germination, particularly if stressed.

Potential damage

Parthenium weed is a vigorous species that colonises weak pastures with sparse ground cover. It will readily colonise disturbed, bare areas along roadsides and heavily stocked areas around yards and watering points. Parthenium weed can also colonise brigalow, gidgee and softwood scrub soils. Its presence reduces the reliability of improved pasture establishment and reduces pasture production potential.

Parthenium weed is also a health problem as contact with the plant or the pollen can cause serious allergic reactions such as dermatitis and hay fever.

Habitat and distribution

Parthenium weed is capable of growing in most soil types but becomes most dominant in alkaline, clay loam soils.

The plant is well established in Central Queensland and present in isolated infestations west to Longreach and in northern and southern Queensland.

Infestations have also been found in northern and central parts of New South Wales and it is capable of growing in most states of Australia.

Control

Prevention and weed seed spread

As with most weeds, prevention is much cheaper and easier than cure. Pastures maintained in good condition, with high levels of grass crown cover, will limit parthenium weed colonisation. Drought, and the subsequent reduced pasture cover, creates the ideal window of opportunity for parthenium weed colonisation when good conditions return.

Parthenium seeds can spread via water, vehicles, machinery, stock, feral and native animals and in feed and seed. Drought conditions aid the spread of seed with increased movements of stock fodder and transports.

Vehicles and implements passing through parthenium weed infested areas should be washed down with water. Wash down facilities are located in Alpha, Biloela, Charters Towers, Emerald, Gracemere, Injune, Monto, Moura, Rolleston, Springsure and Taroom. Particular care should be taken with earthmoving machinery and harvesting equipment. The wash down procedure should be confined to one area, so that plants that establish from dislodged seed can be destroyed before they set seed.

Extreme caution should be taken when moving cattle from infested to clean areas. Avoid movement during wet periods as cattle readily transport seed in muddy soil. On arrival, cattle should be held in yards or small paddocks until seed has dropped from their coats and tails prior to their release into large paddocks. Infestations around yards can be easily spotted and controlled whereas infestations can develop unnoticed in large paddocks.

Particular care should be taken when purchasing seed, hay and other fodder materials. Always keep a close watch on areas where hay has been fed out for the emergence of parthenium or other weeds.

Property hygiene is important. Owners of clean properties should ensure that visitors from infested areas do not drive through their properties. If your property has parthenium weed on it, ensure that it is not spread beyond the boundary or further within the property.

Pasture management

Grazing management is the most useful method of controlling large-scale parthenium weed infestations. Maintain pastures in good condition with high levels of ground and grass crown cover. This may require rehabilitation of poor pastures, followed by a sound grazing maintenance program.

Sown pasture establishment—Poor establishment of sown pastures can allow parthenium weed colonisation. pasture agronomist Aerial seeding prior to scrub pulling is normally beneficial.

Overgrazing—High grazing pressure caused by drought or high stock numbers decreases the vigour and competitiveness of pastures and allows the entry and spread of parthenium weed. Maintenance of correct stock numbers is most important in controlling parthenium weed. pasture agronomist

Pastures spelling—In situations of serious infestation, pasture spelling is essential for rehabilitation. Total spelling is much more effective than simply reducing the

stocking rate. However, overgrazing of the remainder of the property must be avoided.

The most appropriate time for pasture spelling is the spring–summer growing period, with the first 6–8 weeks being particularly important. If the condition of perennial grasses (native or sown) is low, spelling for the entire growing season may be required or introduced grasses may need to be re-sown. Herbicide treatment can hasten the rehabilitation process by removing a generation of parthenium seedlings and allowing grass seedlings to establish without competition. In the presence of parthenium weed, grass establishment is poor.

Grazing during winter should not increase the parthenium weed risk. Most tropical grasses are dormant and can tolerate moderate grazing during this period. However, parthenium weed may germinate and grow at this time.

Fencing—One of the main problems in controlling parthenium weed is the large paddock size and the variability of country within paddocks. The resulting uneven grazing pressures encourage parthenium weed to colonise the heavily grazed country. Ideally, similar land types should be fenced as single units. Fencing can be used to great effect to break up large paddocks, allowing more flexible management such as pasture spelling or herbicide application, options not available previously.

Burning—Burning is not promoted as a control strategy for parthenium weed. However, research suggests that burning for pasture management (e.g. woody weed control) should not result in an increased infestation if the pasture is allowed to recover prior to the resumption of grazing. Stocking of recently burnt areas known or suspected to contain parthenium decreases pasture competition and favours parthenium, ultimately creating a more serious infestation.

Herbicide control

Non-crop areas—Parthenium weed should be sprayed early before it can set seed. A close watch should be kept on treated areas for at least two years.

Small and/or isolated infestations should be treated immediately. Herbicide control will involve a knockdown herbicide to kill plants that are present and a residual herbicide to control future germinations. Repeated spraying may be required even within the one growing season to prevent further seed production.

Extensive infestations will require herbicide treatment in conjunction with pasture management. Timing of spraying is critical so that parthenium weed is removed when plants are small and before seeding has occurred. Grasses should be actively growing and seeding so that they can recolonise the infested area.

Table 1 shows the herbicides registered for parthenium weed control and application rates. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label.

Cropping areas—Controlling parthenium weed in cropland requires selective herbicide use and/or crop rotations. For further information on parthenium weed control in crops consult your local biosecurity officer.

Biological control

The combined effects of biological control agents reduced the density and vigour of parthenium weed and increased grass production.

There are currently a number of insect species and two rust pathogens that have been introduced to control parthenium weed—a selection of these are outlined below.

Epiblema strenuana is a moth introduced from Mexico established in all parthenium weed areas. The moth's larvae feed inside the stem, forming galls that stunt the plant's growth, reduce competitiveness and seed production.

Listronotus setosipennis is a stem-boring weevil from Argentina but is of limited success in reducing parthenium weed infestations.

Zygogramma bicolorata is a defoliating beetle from Mexico which is highly effective where present. It emerges in late spring and is active until autumn.

Smicronyx lutulentus (Mexico) lays eggs in the flower buds where the larvae feed on the seed heads.

Conotrachelus albocinereus (stem-galling weevil from Argentina) produces small galls and is still becoming established in Queensland.

Bucculatrix parthenica (leaf mining moth from Mexico) larvae feed on leaves, leaving clear windows in the leaf.

Carmentia ithacae is a stem boring moth from Mexico which is becoming established at favourable sites in the northern Central Highlands.

Puccinia abrupta is a winter rust from Mexico that infects and damages leaves and stems. It is currently established over a wide area from Clermont south. It requires a night temperature of less than 16 degrees and 5–6 hours of leaf wetness (dew). Sporadic outbreaks occur where weather conditions are suitable.

Puccinia melampodii is a summer rust from Mexico that weakens the plant by damaging the leaves over the summer growing season. It is currently established and spreading at a number of sites from north of Charters Towers to Injune in the south.

Manual control

Hand pulling of small areas is not recommended. There is a health hazard from allergic reactions and a danger that mature seeds will drop off and increase the area of infestation.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

Table 1 Herbicides registered for parthenium weed.

Herbicide	Rate	Situation	Comments
2,4-D amine 500 g/L	0.4 L/100 L	Land—industrial, pastures; rights-of-way	Spot spray
atrazine 500 g/L	3.6–6 L/ha	Fields and fallow	Boom spray
max 3 kg/ha/yr	6 L/ha	Land—industrial, commercial, non-agricultural, roadside, right-of-way	Boom spray
atrazine 900 g/kg	2–3.3 kg/ha	Fields and fallow	Boom spray
max 3 kg/ha/yr	3.3 kg/ha	Land—non-agricultural, commercial, industrial	Boom spray
2,4-D + picloram (Tordon 75-D)	125 ml/100 L	Land—commercial, industrial, pastures, right-of-way	Spot spray
	3 L/ha	Land—commercial, industrial, pastures, right-of-way	Boom spray
2,4-D ester[1]	.025 L/10 L	Land—non-agricultural, pastures	Rosette stage
glyphosate (450 g/L)	0.8–1.2 L/ha	Fields and fallow	Spot spray
metsulfuron methyl	5–7 g/ha	Fields and fallow	Seedlings only
	5 g/100 L	Land—commercial, industrial, pastures, rights-of-way	Spot spray
hexazinone	3.5 L/ha or 7 L/10 L/20 m^2	Land—commercial, industrial, pastures, rights-of-way	Boom spray or spot spray
dicamba (200 g/L)	0.7–2.8 L/ha or 0.1–0.19 L/100L	Grass pastures	Boom spray or spot spray
(500 g/L)	0.28–1.1 L/ha or 0.40–0.76 L/100L	Grass pastures	Boom spray or spot spray
(700 g/kg)	200–800 g/ha or 30–60 g/100 L	Grass pastures	Boom spray or spot spray

[1]Use restricted in some areas of Central Queensland

Notes The registered rates are for non-crop uses. Consult label for in-crop recommendations.
For power hand spray or knapsack use, spray plants to the point of runoff.

CS0564

Attachment 2: Land Manager's Monitoring Guide

Department of Environment
and Resource Management

Land Manager's Monitoring Guide

Ground cover indicator

Tomorrow's Queensland:
strong, green, smart, healthy and fair

Toward Tomorrow's Queensland | Queensland Government

Prepared by:

Environment and Resource Sciences

Department of Environment and Resource Management

August 2010

Contents