Offset Area Management Plan: Croydon Offset Area

SLR Consulting Australia Pty Ltd

Horse Pit Extension Project – Caval Ridge Mine

Level 1
30 Little Cribb Street
MILTON QLD 4064

Issue Date: 3 March 2023

mail@e2mconsulting.com.au
www.e2mconsulting.com.au

Document management

Rev.	Issue Date	Description	Author (s)	Approved
A	21/07/2021	Issued for review	L. Wickson	B. Dreis
B	4/02/2022	Issued for review	L. Wickson	B. Dreis
C	11/03/2022	Issued for review	P. Wagner	B. Dreis
0	29/03/2022	Issued for use	P. Wagner	B. Dreis
1	12/05/2022	Updated	P. Wagner	B. Dreis
2	20/05/2022	Updated	P. Wagner	B. Dreis
3	2/06/2022	Updated	J. van Osta	B. Dreis
4	17/08/2022	Updated	P. Wagner	B. Dreis
5	14/12/2022	Updated	P. Wagner	B. Dreis
6	06/03/2023	Updated	L. Wickson	B. Dreis

Contents

List of tables

List of figures

Appendices

Definitions

Term	Definition
Broad Vegetation Group	High-level groupings of vegetation communities and Regional Ecosystems in Queensland by Neldner et al. (2020)
Croydon Offset Area	The approximately 512.26 ha Offset Area within the Croydon Station. The Offset Area is a subset of the Area of Interest. The size of the Offset Area reflects the area (ha) and habitat values required to acquit HPE Project impacts on ornamental snake, squatter pigeon (southern) and MSES Connectivity Areas.
Habitat Quality Score	A method of evaluating habitat quality within a particular community based on key indicators including site condition, site context and species habitat index (if necessary). The method produces a score out of 10, where the maximum score of 10 represents a fully intact system. Scores of 4, 5 and 6 may indicate good quality regrowth or medium value habitat.
Matters of National Environmental Significance	Environmental values protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Significant impacts to these values may require offsets under the legislation.
Matters of State Environmental Significance	State interests defined under Schedule F of the Queensland State Planning Policy and include ecological features such as Regulated Vegetation, wetlands, fish habitat areas and threatened species habitat.
Offset Investigation Area	The area within the Croydon property surveyed as part of the May 2020 field assessment conducted by E2M
Regional Ecosystem	A vegetation community in a bioregion that is consistently associated with a combination of geology, landform, and soil. Regional Ecosystems are described in the Regional Ecosystem Description Database, produced by the Queensland Herbarium.
Regulated Vegetation	Vegetation that is mapped within the regulated vegetation management map produced by Department of Natural Resources, Mines and Energy. The Queensland *Vegetation Management Act 1999* is applicable to regulated vegetation.
Remnant vegetation	Vegetation which forms the predominant canopy of the community that: a) covers more than 50% of the undisturbed predominant canopy; and b) averages more than 70% of the vegetation's undisturbed height; and c) is composed of species characteristic of the vegetation's undisturbed predominant canopy.
Suitable habitat	A species preferred environment required to sustain a viable population. Suitable habitat may include breeding, foraging and shelter resources for fauna or preferred environmental conditions for flora.
Threatened species	Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) or Conservation Dependent (CD) under the *Environmental Protection and Biodiversity Conservation Act 1999* or extinct in the wild (PE), critically endangered (CE), endangered (E), vulnerable (V) or near threatened (NT) under the *Nature Conservation Act 1992*.

Term	Definition
Vegetation community	An identified vegetation community (i.e. structure, composition, condition and/or underlying geology) verified from a field survey. Communities may include Regional Ecosystems, remnant vegetation and/or disturbed/novel ecosystems (e.g. parkland, disturbed roadsides etc.).

Abbreviations

Abbreviation	Description
BMA	BM Alliance Coal Operations Pty Ltd
BVG	Broad Vegetation Group
CVM	Caval Ridge Mine
DAF	Queensland Government Department of Agriculture and Fisheries
DAWE	Commonwealth Government Department of Agriculture, Water and the Environment
DCCEEW	Commonwealth Government Department of Climate Change, Energy, the Environment and Water
E2M	E2M Pty Ltd
EA	Environmental Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GTRE	Ground-truthed Regional Ecosystem
ha	Hectares
KPI	Key Performance Indicator
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
NC Act	*Nature Conservation Act 1992*
OAG	Offset Assessment Guide
OAMP	Offset Area Management Plan
RE	Regional Ecosystem
SIA	Significant Impact Assessment
SLR	SLR Consulting Pty Ltd
sp.	Singular species. For example, *Eucalyptus* sp. refers to a single species of *Eucalyptus*
spp.	Multiple species. For example, *Eucalyptus* spp. refers to multiple species of *Eucalyptus*

Abbreviation	Description
TEC	Threatened Ecological Community
the Project (or the HPE Project)	Horse Pit Extension Project
Vdec	Voluntary declaration is a delivery mechanism under the VM Act used to secure an environmental offset
VM Act	*Vegetation Management Act 1999*

1 Introduction

1.1 Background

The development of the BM Alliance Coal Operations Pty Ltd (BMA) Horse Pit Extension (HPE) Project at Caval Ridge Mine (CVM) will likely result in a significant residual impact on five environmental values categorised as Matters of National Environmental Significance (MNES) and/or Matters of State Environmental Significance (MSES) (herein referred to as 'target protected matters'):

- 167.84 ha of ornamental snake (*Denisonia maculata*) habitat;
- 83.53 ha of squatter pigeon (southern) (*Geophaps scripta scripta);*
- 23.40 ha of king bluegrass (*Dichanthium queenslandicum*) habitat;
- 23.40 ha of state-regulated vegetation[1]; and
- 84.19 ha of connectivity area.

The impacts are expected to trigger offset requirements under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) Environmental Offsets Policy (DSEWPaC 2012) (Commonwealth Offsets Policy) and the Queensland *Environmental Offsets Act 2014* (EO Act).

A delineated Area of Interest within a property known as "Croydon Station" (formally Lot 4 on Plan KL210) (Figure 1) was identified and surveyed for its offset suitability, concluding:

- the property is suitable to directly offset 100% of the HPE Project impacts to ornamental snake and squatter pigeon (southern) habitat (MNES) and connectivity area (MSES); and
- there is no king bluegrass habitat (MNES) or suitable regulated vegetation (MSES). Project impacts to these target protected matters are required to be directly offset on an alternative property.

Further details regarding the offset suitability of areas within Croydon Station are provided in the *Horse Pit Extension Project: Environmental Offset Strategy* (E2M, 2022).

This Offset Area Management Plan (OAMP) details the management actions and monitoring requirements necessary to achieve a conservation outcome for the ornamental snake, squatter pigeon (southern) and connectivity area within the Croydon Offset Area (Figure *2*).

1.2 Commonwealth offset conditions

The HPE Project's offset conditions under the Commonwealth EPBC Act are yet to be confirmed by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW). Therefore, the HPE Project's Commonwealth offset obligations presented in this OAMP are based on analysis from the *Environmental Offset Strategy: Horse Pit Extension Project – Caval Ridge Mine* (E2M 2023) (herein referred to as the 'Offset Strategy'). The Offset Strategy, under the Commonwealth offset framework, identified 259 ha of ornamental snake habitat and 228 ha of squatter pigeon (southern) habitat within the Croydon Offset Area are required to directly offset 100% of the HPE Project impacts on the species (Table 1). The area required to offset the HPE Project impacts on ornamental snake (i.e. 259 ha) and

[1] a native grassland community designated as Regional Ecosystem (RE) 11.8.11 within the Broad Vegetation Group (BVG) 30b[1] and listed as 'of concern' under the *Vegetation Management Act 1999*

squatter pigeon (southern) (i.e. 228 ha) habitat is based on the results of the EPBC Act Offsets Assessment Guide calculator as detailed in the Offset Strategy (E2M 2022).

Table 1. Commonwealth offset notional requirements summary

Target protected matter	Status		Significant Residual Impact (ha)	Offset Area required (ha)	Suitable habitat within the Croydon Offset Area (ha)
	EPBC Act	State			
Ornamental snake (*Denisonia maculata*)	V	V	167.84	259.00	263.68
Squatter pigeon (southern) (*Geophaps scripta scripta*)	V	V	83.53	228.00	246.50

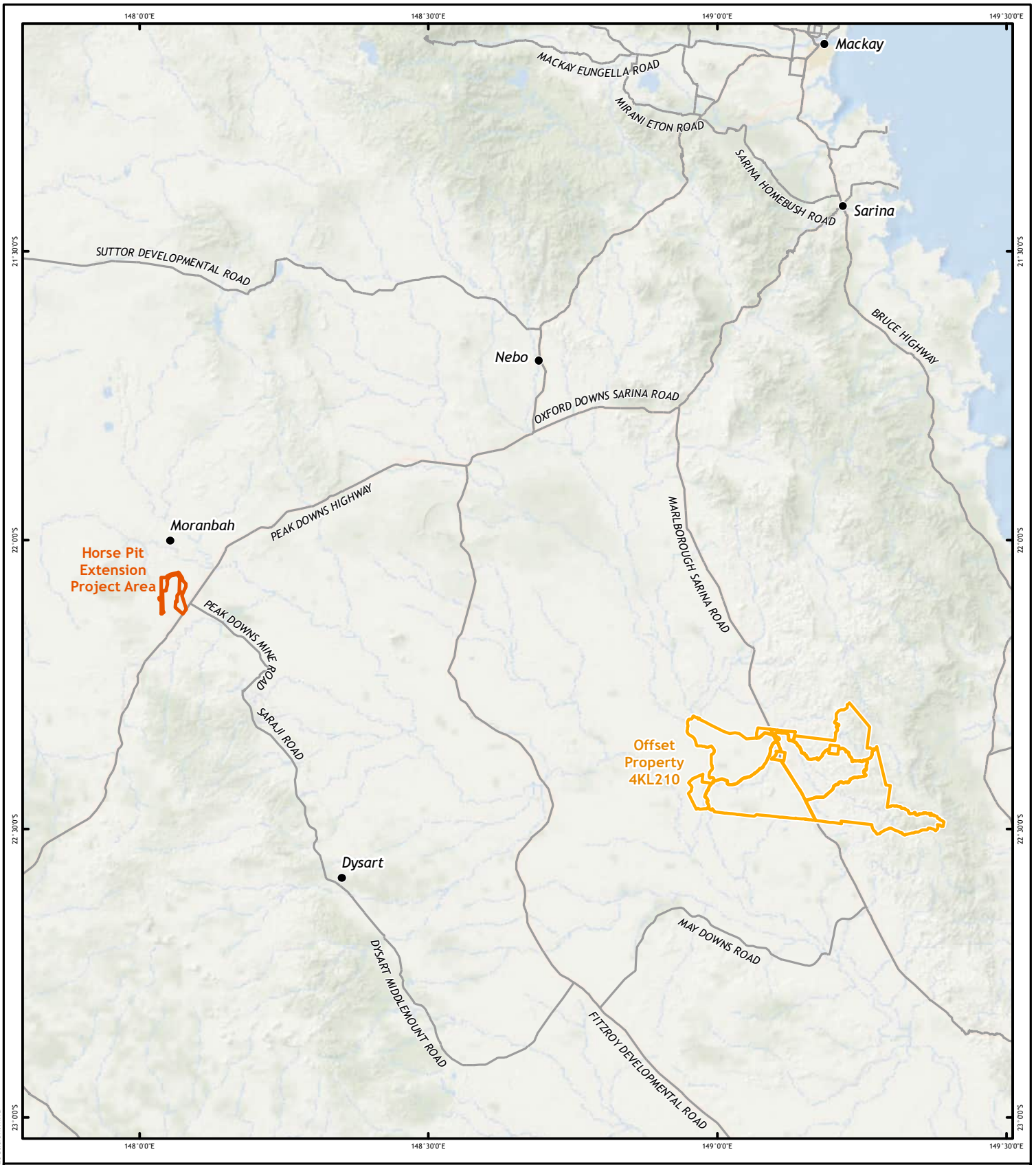
1.3 State offset conditions

The HPE Project's offset conditions under the *Queensland Environmental Offsets Policy Version 1.12* (QEOP) are yet to be identified. Therefore, the HPE Project's State offset requirements (i.e. MSES connectivity area) in this OAMP are based on the offset suitability analysis in the Offset Strategy (E2M, 2023).

The Offset Strategy, under the Queensland offset framework, identified that 84.19 ha of connectivity area within the Croydon HPE Offset Area is required to directly offset 100% of the HPE Project impacts on MSES connectivity area (Table 2). The area required to offset the HPE Project impacts on MSES connectivity area is based on the QEOP, with a multiplier of one. Approximately 263.68 ha of regrowth vegetation was recorded within the Croydon Offset Area.

Table 2: State offset requirements summary

Target protected matter	Significant Residual Impact (ha)	Offset Area required (ha)	Suitable area within Croydon Offset Area (ha)
MSES connectivity area	84.19	84.19	263.68



Legend

- Road
- Horse Pit Extension Project Area
- Croydon Station

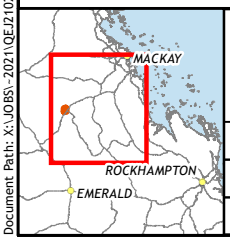
N

Scale 1:1,000,000 (A4)

0 10 20 30 40 50

Kilometres

Coordinate System: GCS GDA 1994



Notes:
Aerial Imagery: © ESRI 2021
Cadastre: © DNRME 2021
Watercourse: © DNRME 2020
Road: © DNRME 2020

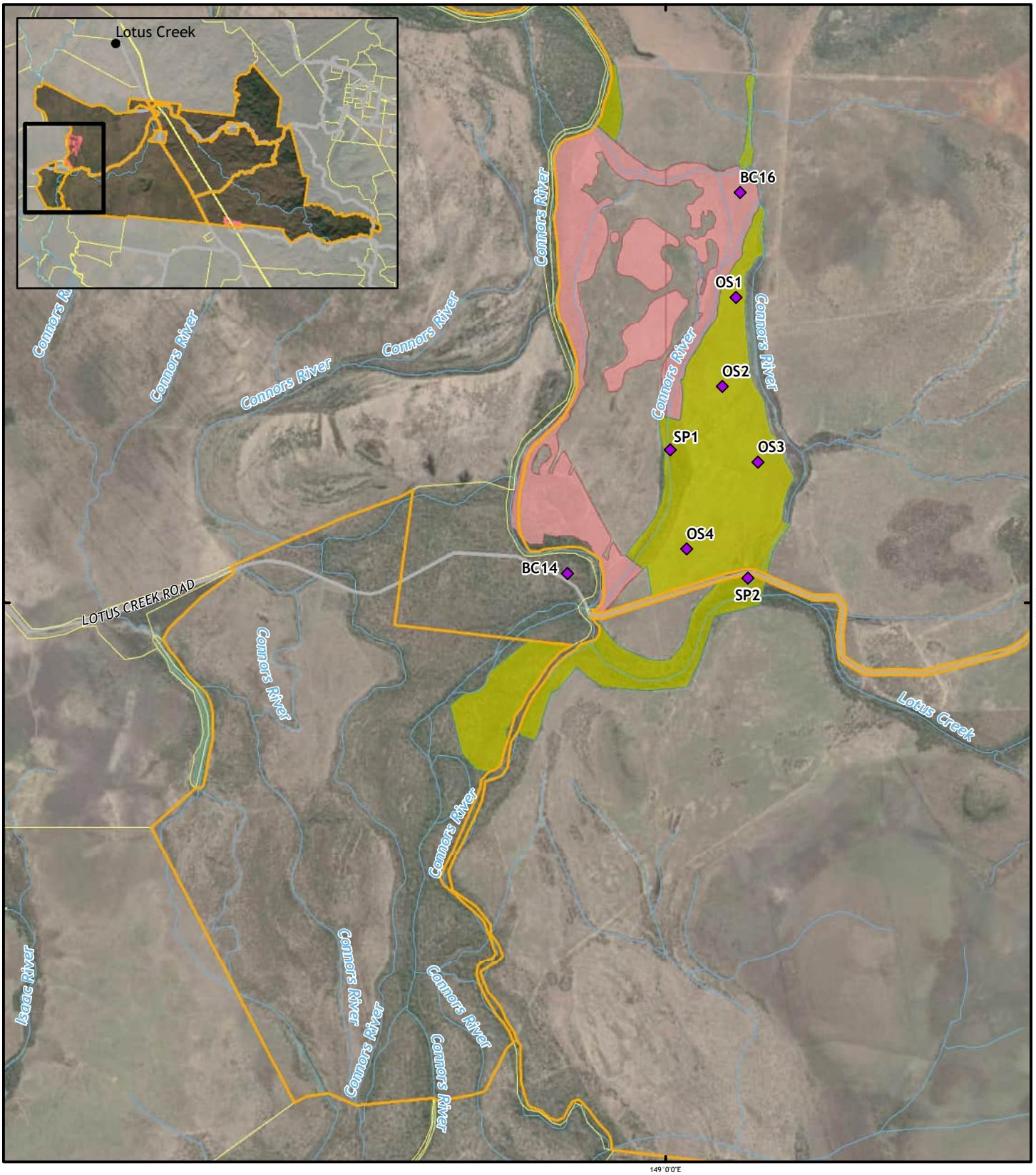
Rev	Description	Drawn	Approved	Date
6	Issued for Use	DL	LW	27/02/2023
5	Issued for Use	DL	PW	14/12/2022

FIGURE 1: LOCATION OVERVIEW

HPE OAMP - Croydon
BMA Caval Ridge Mine

Map Number	Job Number	Rev
1 of 1	QEJ21025	6

Document Path: X:\JOBS\-2021\QEJ21025\GIS\QEJ21025_OAMP_Croydon_1_Location.mxd



Legend

- Biocondition Site
- Road
- Watercourse
- Cadastre
- Croydon Station
- Existing Offset (Cat A Area)
- Croydon Offset Area (to offset HPE Project impacts) (263.68ha)

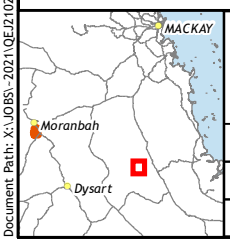
N

Scale 1:59,000 (A4)

0 1 2 3

Kilometres

Coordinate System: GCS GDA 1994



Notes:
Aerial Imagery: © ESRI 2021
Cadastre: © DNRME 2021
Watercourse: © DNRME 2020
Road: © DNRME 2020

Rev	Description	Drawn	Approved	Date
6	Issued for Use	DL	LW	27/02/2023
5	Issued for Use	CD	PW	14/12/2022

FIGURE 2: CROYDON OFFSET AREA

HPE OAMP - Croydon
BMA Caval Ridge Mine

Map Number	Job Number	Rev
1 of 1	QEJ21025	6

Document Path: X:\JOBS\-2021\QEJ21025\GIS\QEJ21025_OAMP_Croydon_2_OffsetArea.mxd

1.4 Purpose and content of this OAMP

This OAMP has been prepared to address the management objectives, actions and outcomes necessary to:

- Deliver an overall conservation outcome for the target protected matters within the Croydon Offset Area; and
- Satisfy the Commonwealth and Queensland approval offset conditions (yet to be finalised).

The OAMP must provide content as specified by DCCEEW and the Queensland Government. These requirements are detailed in Table 3 with reference to where the relevant information is provided.

Table 3. Overview of OAMP content

Requirement	Information Location
Details to demonstrate how the environmental offset/s compensate for residual significant impacts of the project on relevant listed threatened species and communities, and/or their habitat, in accordance with the principles of the Offsets Policy and all requirements of the Offsets Assessment Guide (OAG)	Offsets have been developed in accordance with both the EPBC Act Offsets Policy and the OAG. Details are provided in the *Horse Pit Extension Project Environmental Offsets Strategy* (E2M, 2022).
A description of the offset area/s, including location, size, condition, environmental values present and surrounding land uses	Section 2. Offset Area Details.
Baseline data and other supporting evidence that documents the presence of the relevant listed threatened species and communities, and the quality of their habitat within the offset area/s	An ecology field survey was conducted within the Croydon Offset Area to determine the suitability of the environment to support ornamental snake habitat and MSES connectivity area. Details are provided in the *Horse Pit Extension Project Environmental Offsets Strategy* (E2M, 2022).
An assessment of the site habitat quality for the offset area/s using the Queensland Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy (Version 1.2, April 2017), or subsequent revision	The site habitat quality of the Croydon Offset Area was determined during field assessments in accordance with the *Queensland Guide to determining terrestrial habitat quality* (DES, 2020). Details are provided in the *Horse Pit Extension Project Environmental Offsets Strategy* (E2M, 2022).
Details of how the offset area/s will provide connectivity with other habitats and biodiversity corridors and/or will contribute to a larger strategic offset for the relevant listed threatened species and communities	Section 2.3 Landscape connectivity.

Requirement	Information Location
Maps and shapefiles to clearly define the location and boundaries of the offset area/s, accompanied by the offset attributes (e.g. physical address of the offset area/s, coordinates of the boundary points in decimal degrees, the listed threatened species and communities that the environmental offset/s compensates for, and the size of the environmental offset/s in hectares)	• Figure 1 and Figure 2; • Section 2 Offset Area Details; and • CroydonOffsetArea_20221214.shp.
Specific offset completion criteria derived from the site habitat quality to demonstrate the improvement in the quality of habitat in the offset area/s over a 20 year period	Sections 3.2 Management objectives and 3.3 Completion scores and interim targets.
Details of the management actions, and timeframes for implementation, to be carried out to meet the offset completion criteria	• Section 3.5 Management actions; and • Section 4 Offset Monitoring.
Interim milestones that set targets at 5-yearly intervals for progress towards achieving the offset completion criteria	Section 3.3 Completion Scores and interim targets.
Details of the nature, timing and frequency of monitoring to inform progress against achieving the 5-yearly interim milestones (the frequency of monitoring must be sufficient to track progress towards each set of milestones, and sufficient to determine whether the offset area/s are likely to achieve those milestones in adequate time to implement all necessary corrective actions)	Table 8. Offset management action monitoring schedule.
Proposed timing for the submission of monitoring reports which provide evidence demonstrating whether the interim milestones have been achieved	Section 5 Reporting.
Timing for the implementation of corrective actions if monitoring activities indicate the interim milestones have not been achieved	Section 3.4 Risks and triggers and Appendix B Risk Analysis.
Risk analysis and a risk management and mitigation strategy for all risks to the successful implementation of the OAMP and timely achievement of the offset completion criteria, including a rating of all initial and post-mitigation residual risks in accordance with a risk assessment matrix	Section 3.4 Risks and triggers and Appendix B Risk Analysis.
Evidence of how the management actions and corrective actions consider relevant approved conservation advice and are consistent with relevant recovery plans and threat abatement plans	Section 3.5 Management Actions.

Requirement	Information Location
Details of the legal mechanism for legally securing the proposed offset area/s, such that legal security remains in force over the offset area/s for at least 20 years to provide enduring protection for the offset area/s against development incompatible with conservation	• The offset will be secured via a Voluntary Declaration under the Queensland *Vegetation Management Act 1999*. • Section 3.5.7 Offset securement.

2 Offset Area Details

2.1 Property location and regional context

The Croydon Offset Area (512.26 ha) is located entirely within Croydon Station (formally Lot 4 on Plan KL210), a large 58,669 ha cattle station located 100 km north of Marlborough and approximately 100 km southeast of the CVM (Figure 1). The Croydon Offset Area is located within the Isaac-Comet Downs biogeographic subregion and is bordered by the Connors Ranges to the east.

There is an existing 360.54 ha offset area which has been secured by other parties (Category A) located north of the proposed Offset Area (Figure 2).

2.2 Offset Area and values

2.2.1 Target threatened species habitat

The Croydon Offset Area is located within the western portion of the Croydon Station and includes anabranches of the Connors River and Lotus Creek. The Croydon Offset Area comprises approximately 264 ha of suitable ornamental snake habitat (Photo 1), 246.5 ha of squatter pigeon (southern) habitat and MSES connectivity area.

The ornamental snake habitat and MSES connectivity area is characterised by regrowth brigalow (*Acacia harpophylla*) shrublands (RE 11.4.9) adjacent to riparian communities associated with branches of Connors River (stream order 4) (Figure 3). The regrowth brigalow community contains an abundance of gilgai, shallow in depth and variable in size. The ground cover (native and introduced species) was sparse consisting predominantly of native grass species with associated introduced pasture species resulting from a combination of a historical land management methods and the dry conditions at the time of survey (i.e. May 2021).

Photo 1. Brigalow regrowth and ornamental snake habitat (gilgai) within the Croydon Offset Area

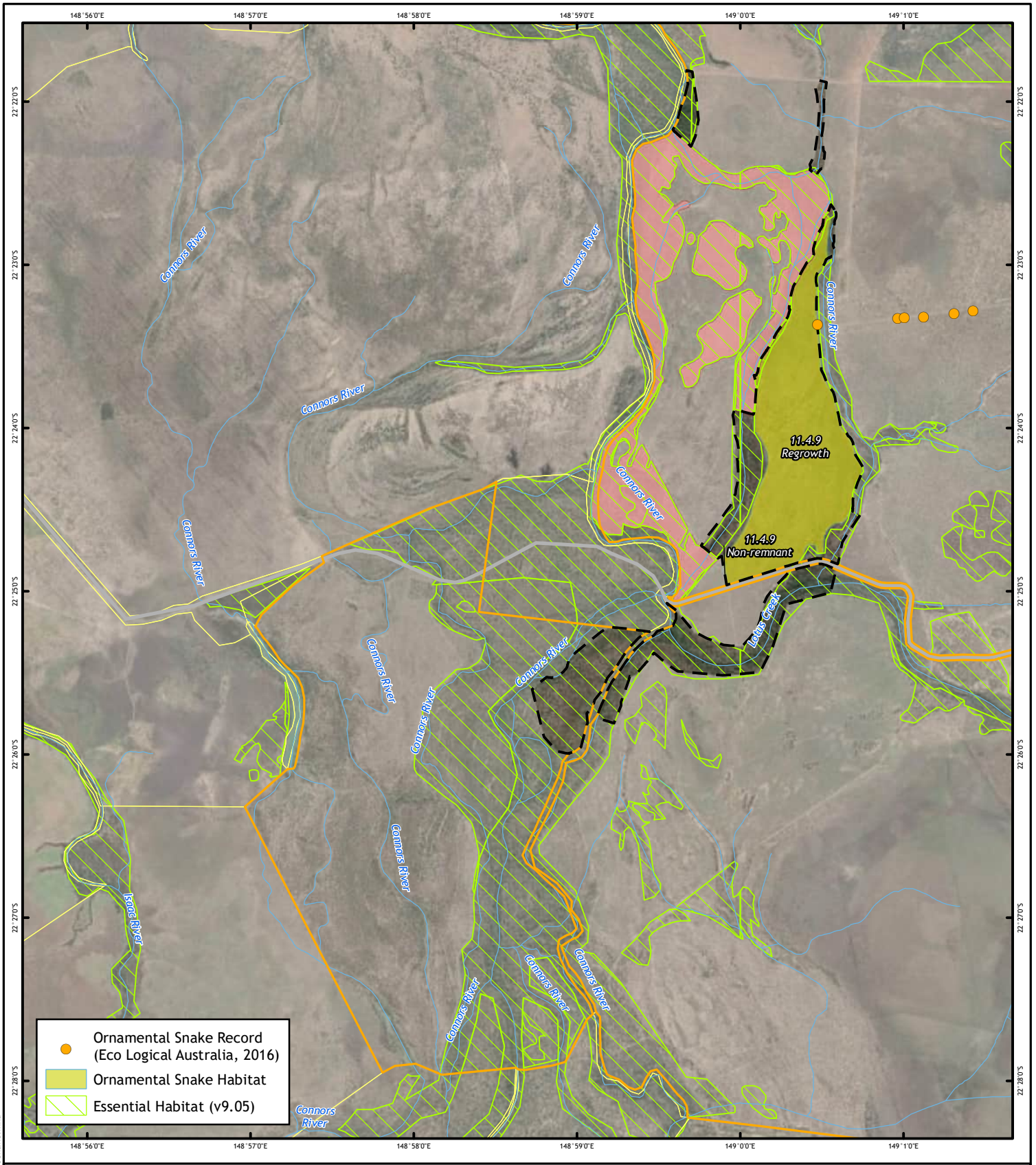
No ornamental snakes were observed within the Croydon Offset Area or adjacent areas (refer to Offset Investigation Area within the Offset Strategy (E2M, 2022)) during the field survey conducted in May 2021. Survey conditions during the field survey were dry, with temperatures ranging from 11˚C to 31˚C (Bureau of Meteorology, 2022). Recent rainfall data was limited for the area with available data from weather stations and anecdotal evidence suggesting Croydon Station was likely to have received limited rainfall (~100 mm) over the three months preceding the field survey. The cooler, night temperatures and dry

conditions are considered likely to reduce the availability of prey (i.e. frogs) and nocturnal activity (and likelihood of detection) of the species.

While this survey was outside the optimal survey period for the species, previous field studies (refer to Eco Logical Australia, 2016) associated with the adjacent existing offset area have detected the presence of ornamental snake on Croydon Station in 2016 (Figure 3). Five records of the species are situated to the east of the Croydon Offset Area, with one record located on the boundary of the Offset Area (Figure 3). DoR mapped essential habitat for the ornamental snake is also mapped adjacent to the Croydon Offset Area in association with riparian corridors of Lotus Creek and branches of Connors River (Figure *3*). However, initial field surveys found these areas to lack the attributes required to support the species. Based on the availability of suitable habitat and proximity to previous records, the Croydon Offset Area is considered likely to contain the species.

Squatter pigeon habitat comprises remnant and regrowth vegetation in association with remnant, riparian vegetation along Lotus Creek, anabranches of Connors River and the associated floodplains (Figure 4). These areas are considered suitable breeding and foraging habitat for the species, with sections of Lotus Creek and Connors River anabranches are considered permanent water sources within and adjacent to the Croydon Offset Area.

A total of seven squatter pigeon were recorded across three locations within the Croydon Study Area during the field survey in association with remnant riparian vegetation fringing the eastern anabranch of Connors River.



Legend

- Road
- Watercourse
- Cadastre
- Croydon Station
- Croydon Offset Area
- Existing Offset Category A Area (2017)

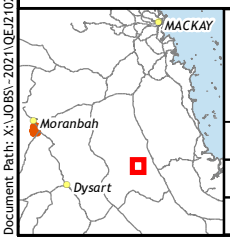
N

Scale 1:59,000 (A4)

0 1 2 3

Kilometres

Coordinate System: GCS GDA 1994



Notes:
Aerial Imagery: © ESRI 2021
Cadastre: © DNRME 2021
Ordered Drainage: © DNRME 2020
Road: © DNRME 2020

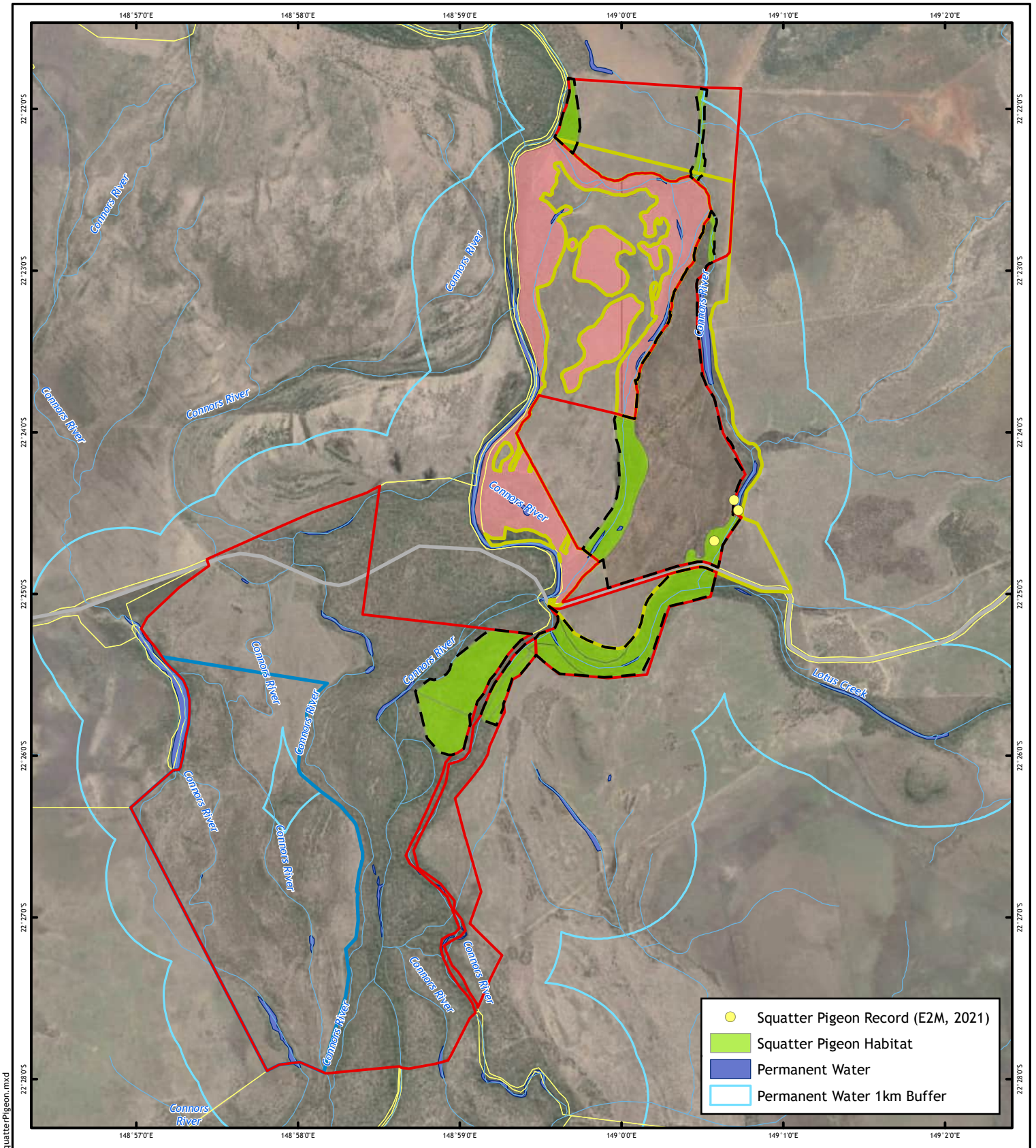
Rev	Description	Drawn	Approved	Date
6	Issued for Use	DL	LW	27/02/2023
5	Issued for Use	CD	PW	14/12/2022

FIGURE 3: CROYDON ORNAMENTAL SNAKE HABITAT

HPE OAMP - Croydon
BMA Caval Ridge Mine

Map Number	Job Number	Rev
1 of 1	QEJ21025	6

Document Path: X:\JOBS\-2021\QEJ21025\GIS\QEJ21025_OAMP_Croydon_3_OSnake.mxd



Legend

- Road
- Watercourse
- Cadastre
- Croydon Offset Area
- E2M Offset Investigation Area (May 2021)
- E2M Offset Investigation Area (April 2022)
- Area of Interest (BHP supplied shapefile)
- Existing BMC Offset Category A Area (2017)

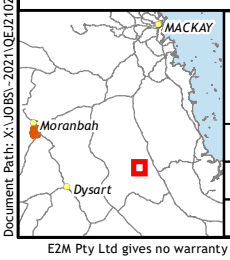
N

Scale 1:59,000 (A4)

0 1 2 3

Kilometres

Coordinate System: GCS GDA 1994



Notes:
Aerial Imagery: © ESRI 2021
Cadastre: © DNRME 2021
Ordered Drainage: © DNRME 2020
Road: © DNRME 2020
Area of Interest supplied 23/11/2022

Rev	Description	Drawn	Approved	Date
6	Issued for Use	DL	LW	28/02/2023
5	Issued for Use	CD	PW	14/12/2022

FIGURE 4: CROYDON SQUATTER PIGEON HABITAT

HPE OAMP - Croydon
BMA Caval Ridge Mine

Map Number	Job Number	Rev
1 of 1	QEJ21025	6

Document Path: X:\JOBS\-2021\QEJ21025\GIS\QEJ21025_OAMP_Croydon_4_SquatterPigeon.mxd

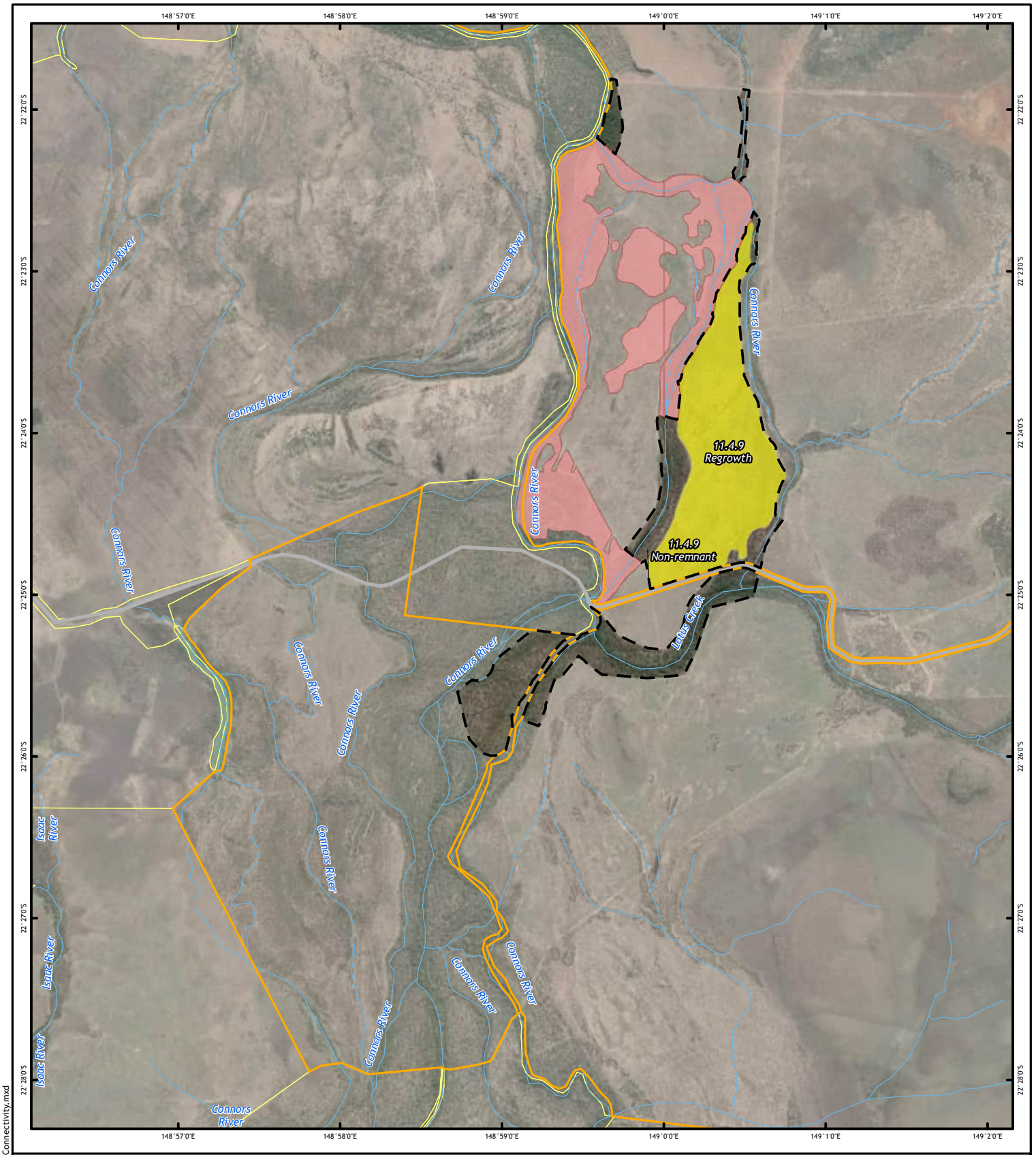
2.3 Landscape connectivity

The Croydon Offset Area is located within a largely fragmented landscape, mostly attributed to agricultural development within the region. Remnant vegetation is generally restricted to riparian corridors (e.g. Connors River, Lotus Creek and associated tributaries) and vegetation along Connors Ranges to the east. The Croydon Offset Area includes and is located adjacent to DES (2019) mapped State and Regional Biodiversity Corridors, associated with Connors River and Lotus Creek.

Remnant brigalow (*Acacia harpophylla*) communities have been largely cleared/disturbed within the surrounding areas, with non-remnant areas containing various stages of regrowth. Ornamental snake is a habitat specialist largely dependent on gilgai for foraging and refuge habitat, being recorded in both remnant and non-remnant vegetation (Brigalow Belt Reptiles Workshop, 2010). Similarly, squatter pigeon will also utilise both remnant and regrowth/non-remnant vegetation provided the habitat is in proximity (approx. 3 km) to a permanent water body (DCCEEW, 2022). As such, habitat within the Croydon Offset Area is connected to larger tracts of likely habitat on clay plains to the north, west and east.

The Croydon Offset Area contains approximately 263.68 ha of regrowth vegetation suitable to offset MSES connectivity area. The Croydon Offset Area is also strategically located adjacent to the existing secured offset (Figure 2).

Locating the Offset Area adjacent to other legally secured offset in the northern extent will enable the establishment of one contiguous habitat area (> 625 ha) and a cumulative conservation benefit for the threatened fauna and vegetation communities targeted (i.e. ornamental snake, yakka skink, squatter pigeon, koala, Brigalow Threatened Ecological Community).



Legend

- Road
- Watercourse
- Cadastre
- Croydon Station
- Croydon Offset Area
- Existing Offset Category A Area (2017)
- Suitable Offset Area for MSES Connectivity

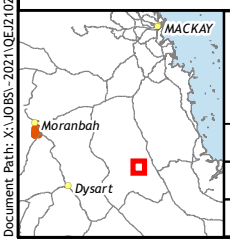
N

Scale 1:59,000 (A4)

0 1 2 3

Kilometres

Coordinate System: GCS GDA 1994



Notes:
Aerial Imagery: © ESRI 2021
Cadastre: © DNRME 2021
Ordered Drainage: © DNRME 2020
Road: © DNRME 2020

Rev	Description	Drawn	Approved	Date
6	Issued for Use	DL	LW	28/02/2023
5	Issued for Use	CD	PW	14/12/2022

FIGURE 5: CONNECTIVITY AREAS

HPE OAMP - Croydon
BMA Caval Ridge Mine

Map Number	Job Number	Rev
1 of 1	QEJ21025	6

Document Path: X:\JOBS\-2021\QEJ21025\GIS\QEJ21025_OAMP_Croydon_5_Connectivity.mxd

2.4 Threatening processes

A number of existing threatening processes to the ornamental snake and squatter pigeon (southern) are present within and adjacent to the Croydon Offset Area. Broadscale land clearing and habitat degradation are identified as the main threats to both the ornamental snake and squatter pigeon (southern) (Department of the Environment, 2014; Threatened Species Scientific Committee, 2015). Historical and existing land management practices have contributed to habitat degradation and fragmentation within the Croydon Offset Area and surrounds. Brigalow vegetation (REs 11.4.9 and 11.3.1) was initially cleared within Croydon Station in the 1970s and periodically re-cleared thereafter to manage regrowth.

Although areas of squatter pigeon habitat comprising remnant vegetation has not been previously cleared, these areas are subject to habitat degradation in association with livestock grazing. High intensity livestock grazing and pasture improvement displaces natural grass species, reducing the availability of native foraging species (Threatened Species Scientific Committee, 2015).

Habitat degradation can be further exacerbated by introduced species, including cattle and feral pigs, impacting gilgai soils and associated destruction of native frog habitat, reducing the availability of prey for the species, as well as direct competition for food resources (DoE, 2014). Croydon Station has been utilised for livestock grazing since the initial clearing activities and was under low intensity grazing at the time of the field survey with minimal impacts from cattle (i.e. overgrazing and/or soil compaction) observed within the Croydon Offset Area. Squatter pigeon also nest on the ground and can be subject to livestock trampling during breeding seasons (Threatened Species Scientific Committee, 2015).

Similarly, encroachment of invasive, environmental weeds species can also degrade the quality of habitat available. Weed species can out-compete native flora, altering the vegetative structure and composition within native communities that provide connectivity values. Environmental weed species observed within the Croydon Offset Area include Jerusalem thorn (*Parkinsonia aculeata*), *Opuntia* spp. parthenium (*Parthenium hysterophorus*), harrisia cactus (*Harrisia martinii*)and rubber vine (*Cryptostegia grandiflora*).

A number of feral pest species were also identified during the field surveys and are considered likely to occur within the Offset Area and surrounds. Feral pigs were observed at multiple locations during the field survey, including suitable habitat within the Croydon Offset Area and riparian vegetation associated with the adjacent branches of Connors River. Observations comprised solitary individuals and droves of up to nine individuals, comprising adults and juveniles. Evidence of disturbance from pigs (i.e. wallows, trampling) and habitat degradation was observed within gilgai and watercourses within the Croydon Offset Area and adjacent environments. Wild dogs, feral cats and foxes are also identified as a potential threat to the squatter pigeon and have been previously recorded in proximity to the Offset Area (DES, 2022; Threatened Species Scientific Committee, 2015).

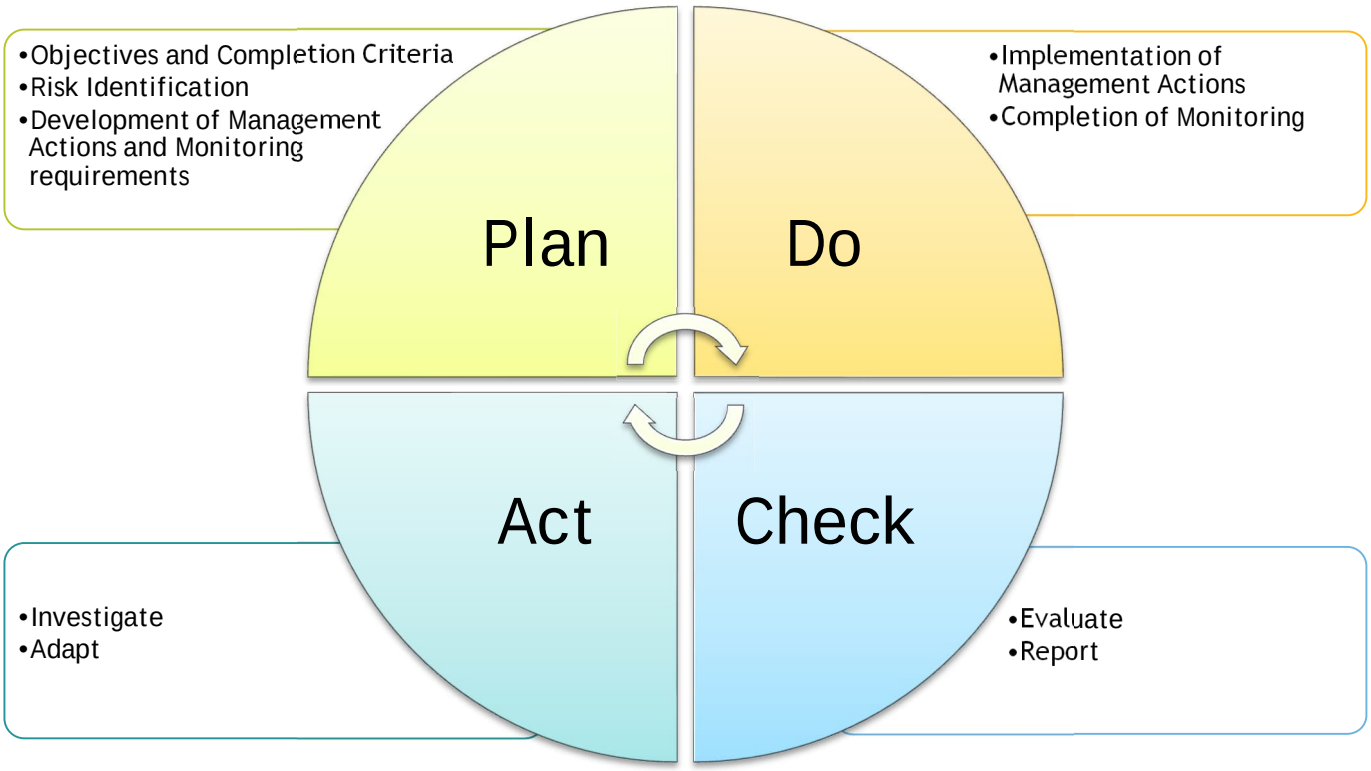
Ingestion and poisoning from cane toads (*Rhinella marina*) has also been identified as a threat to the ornamental snake (DoE, 2014). Despite the dry conditions observed at the time of the survey, cane toads were observed throughout the Croydon Offset Area and surrounds, particularly in proximity to the riparian corridors. The effective control of cane toads in Australia is problematic with limited effective broad-scale methods currently available (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2010).

3 Offset Management Framework

3.1 Overview

The management of the offset commitment will be implemented in accordance with an Offset Management Framework centred on an adaptive management cycle. The cycle is based on the PLAN – DO – CHECK – ACT model used in the overarching BHP Environmental Management System (EMS). The accountability for implementation of the framework will lie with BMA, however for some aspects (e.g. stock management, fence monitoring, habitat quality assessment) a suitably qualified person will be appointed and held accountable to BMA to deliver the necessary outcomes (e.g. maintenance of infrastructure, monitoring reports etc.).

A key aspect of the framework is the feedback cycle facilitated by CHECKing outcomes of monitoring, investigating contributing factors to results not considered in line with milestones or Key Performance Indicators (KPIs) (ACT), adapting approaches to management (informed by experts where appropriate) with the aim of improving likelihood of success (ACT) and finally circling back to updating documentation and work plans (PLAN) to ensure improved actions are then incorporated and implemented (DO) in future.



The framework encompasses the following key components:

PLAN

- Offset Management Objectives – the understanding of the MNES values to be offset and threats to those values drives the management objectives for the site. The objectives are outlined in Section 3.2 and Section 3.3.

- Completion Criteria – final completion criteria specific to the management objectives have been identified. Performance targets are defined to measure performance of the management actions during the offset management period and progress toward final completion criteria. Criteria are shown in Section 3.3.
- Risk Planning – a risk assessment identifies threats to the management process whereby management actions and monitoring design can incorporate precautionary measures, or ensure monitoring parameters are appropriate for detection of negative results. The risk assessment is summarised in Section 3.4.
- Management Actions Definition – management actions have been designed specific to the desired conservation outcomes of the offset. Actions are documented in terms of method, location, timing for implementation and responsibility. In addition, action specific performance indicators have been defined for each management action and options for corrective actions identified. Management actions and schedule are documented in Section 3.5.
- Monitoring Program – the monitoring requirements are documented in Section 4.1. Firstly, baseline data will be collected to establish the benchmark for reporting against. Baseline data collection will be undertaken by a suitably qualified person depending on the nature of the parameter (e.g. ecologist will be required for measuring of habitat quality whereas the location and condition of fire breaks would be assessed by a land manager).
- Establish Process – obligations of approval and management/monitoring commitments will be recorded in the BMA Coal Legal Obligations Register (CLOR) and Management Plan LOR (or comparable management systems of the time). A corresponding mechanism for assigning and tracking monitoring, management actions, reporting etc. will be implemented (e.g. the BMA Enterprise Work Management System (SAP) that is currently in place). Work orders are developed to provide a detailed breakdown of tasks to be completed. The SAP currently provides a mechanism for tracking activity completion and assigning work orders (among other things).

Outcomes of the PLAN component of the framework are documented in the below sections of this document. The nature of the adaptive management cycle is such that the management actions and monitoring program will be updated and implemented where investigation outcomes identify a necessary amendment.

DO

- Implementation – management actions and the monitoring program will be implemented in accordance with the work orders as they are scheduled, currently provided within the SAP. Implementation will be undertaken by suitably qualified personnel depending on the nature of the task.
- Operation – the offset site will be operated in accordance with the management strategies defined within this OAMP. This includes land use restrictions identified to ensure the delivery of an improved environmental outcome, and the legally binding mechanism under the *Vegetation Management Act 1999* under which the offset will be secured (Section 3.5.7).

CHECK

- Evaluate – outcomes of the monitoring undertaken will be evaluated following each monitoring event. The method of evaluation will be dependent on the parameter measured and relevant target/KPI for comparison. The monitoring schedule is shown in Section4.
- Report – results of all monitoring will be captured and data collected will be maintained in an appropriate data storage format. Maintaining a record of results throughout the life of the offset will

allow for trends to be identified (if relevant to measuring success) and measuring against KPIs and performance targets.

ACT

- Record – non-conformances (i.e. if actions were not completed within schedule) will be recorded in the BMA Event Management System, triggering an investigation. Non-conformance investigation will be completed and solutions identified and implemented.
- Investigate - in the event monitoring results identify performance targets or KPIs are not reached or other aspects of monitoring indicate areas of concern, an investigation will be undertaken. The investigation will:
  - Identify key drivers/parameters that relate to the monitoring result not in line with milestones or KPIs.
  - Require development of suitable mitigation or corrective actions. Where items can be solved in the short term, work order notifications will be raised for implementation (e.g. minor fencing repair). For major actions or repair works, a plan for completion will be developed in consideration of budgeting cycle or if the work is considered urgent, escalated for prioritisation. Where actions are required for impacts other than maintenance or repair activities (i.e. a change in the approach to managing the property) a suitably trained fauna ecologist will be consulted to inform the identification of appropriate corrective actions (specifically actions that are scientifically robust and targeted to the objectives of meeting completion criteria for ornamental snake conservation).
  - The investigation may require multiple stakeholder input such as BHP Environment representative, the suitably qualified persons (e.g. ecological consultants and/or experts in specialists disciplines, landholder or land management specialists) depending on the complexity of the outcome.
- Adapt – where investigation outcomes require a long-term amendment to the OAMP (i.e. for actions or monitoring changes to be permanently implemented rather than one-time-only repair actions) relevant documents will be updated and changes to scheduling, obligations or monitoring revised (i.e. cycle back to the PLAN component) to update work orders. These updates will enable implementation of revised management and monitoring through the DO component of the framework.

Management and monitoring will continue in accordance with PLAN documentation (and subsequent updates installed as a result of the investigation process), renewing the implementation of the DO component. The framework cycle will continue until final completion criteria are determined to be reached, or for the minimum 20-year term (whichever is longer).

The OAMP will be formally reviewed every five years (at a minimum and more frequently should monitoring outputs trigger adaptive management updates). The review will consider results of all monitoring including information gathered by the suitably qualified person, results of ecological condition scoring and pest animal monitoring. The formal review will be a further opportunity for effectiveness of management actions to be assessed and amendments considered for implementation.

3.2 Management objectives

The management objective of the Croydon Offset Area is to achieve a conservation gain for three protected matters:

- ornamental snake (*Denisonia maculata*)
- squatter pigeon (southern) (*Geophaps scripta scripta*); and

- MSES connectivity area.

Specifically, the management objectives of this OAMP are:

- To protect and improve ornamental snake and squatter pigeon (southern) habitat within the Offset Area to a level at which:
  - the habitat over time provides greater conservation value than its current form; and
  - the habitat over time provides greater conservation than that of the current impact site.
- To improve the habitat quality scores for MSES connectivity area by a minimum of two points; and
- Improve the condition and quality of regrowth vegetation providing connectivity values.

3.3 Completion scores and interim targets

The final completion scores for the Croydon Offset Area are detailed in Table 4. To determine whether the management actions are effective, habitat quality completion scores (Year 20) and interim performance targets (Year 5, 10 and 15) have been developed (Table 4). The baseline habitat quality scores have been calculated using the *Queensland Guide to determining terrestrial habitat quality* (DES 2020). Habitat Quality scores have been calculated using the site-based attributes method (based on BioCondition Assessment survey data). This method consists of a number of vegetation attributes (i.e. structure and species composition) that are measured in comparison to a 'benchmark', which is the reference for a particular regional ecosystem in an undisturbed state with most of its natural values intact (DES 2020). The habitat quality score (out of 10) is then calculated based on the site-based attribute score and an area weighting (refer to *Queensland Guide to determining terrestrial habitat quality* (DES 2020)). The interim and final habitat quality scores will be measured and calculated using the same approach (site condition via BioCondition Assessment) with additional consideration to species habitat attributes (such as foraging habitat, shelter and presence of threatening processes).

While compliance will not be measured or reported on the interim performance targets, they do provide a means to compare monitoring results and track progress. The habitat quality improvements are based on the improvement within the Offset Area and the estimated time for improvement to occur. The reduction of threats (e.g. livestock, weeds, pest animals) is expected to have a short-term effect on the habitat quality; while criteria associated with vegetation structure and composition (i.e. non-native cover and ground cover, recruitment, and species richness) is likely to be recognised over a longer time period.

Table 4: Interim and final completion criteria

Criteria	Baseline Score/condition	Interim Performance Targets			Final Completion Score
		Year 5	Year 10	Year 15	
Ornamental snake (*Denisonia maculata*)					
Species occurrence	Species yet to be detected	Species detected	Continued species occurrence		Continued species occurrence
Habitat Quality (site-based attributes)*	3 (refer to Appendix A)	4	5	5	≥5

Criteria	Baseline Score/condition	Interim Performance Targets			Final Completion Score
		Year 5	Year 10	Year 15	
Squatter pigeon (southern) (*Geophaps scripta scripta*)					
Species occurrence	Species detected	Continued species occurrence			
Habitat Quality (site-based attributes)*	6	6	7	7	≥7
MSES connectivity area					
Habitat Quality (site-based attributes)*	3 (refer to Appendix A)	4	5	5	≥5

* derived from site-based attributes (i.e. BioCondition scores)

3.4 Risks and triggers

A risk assessment was undertaken to assess known and potential risk events which may prevent the OAMP's KPIs (identified in Table 8), interim performance targets and ultimately, management objectives from being met. Table 5 summarises the key risks associated with the proposed management actions and the corrective actions to be undertaken if the risk occurs. The corrective actions will be put into action as soon as reasonably practicable and continue to be monitored in accordance with Table 8.

A detailed risk assessment is provided in Appendix B.

Table 5. Risks associated with management actions

Risk Type	Risks	Risk description	Risk to target fauna species (ornamental snake and squatter pigeon) conservation outcome
Standard	Overgrazing	Inappropriate grazing regimes resulting in soil compaction and impacting cover and composition of groundcover.	Potential to: • reduce the availability of habitat for the ornamental snake • reduce the availability of foraging resources for the squatter pigeon • negatively impact existing populations of both species • reduce the habitat quality scores of habitat within the Offset Area, reducing conservation value; and • reduce the conservation value less than that of the impact site

Risk Type	Risks	Risk description	Risk to target fauna species (ornamental snake and squatter pigeon) conservation outcome
	Feral pest proliferation	Increased feral pest abundance within the Offset Area.	Potential to: • negatively impact existing populations of squatter pigeon from increased predation from wild dogs and cats etc • negatively impact existing populations of ornamental snake through habitat degradation and prey abundance; and • reduce the habitat quality score of habitat within the Offset Area by soil compaction from feral pigs, reducing conservation value
	Vegetation clearing	Removal of habitat within the Offset Area.	Potential to: • result in the loss of individuals and species habitat within the Offset Area • impact vegetation composition and structure resulting in reduced habitat quality scores • reduce the conservation value of the Offset Area to less than that of the impact site
	Erosion	Loss of vegetation composition and structure, particularly groundcover.	Potential to: • impact groundcover composition and structure resulting in reduced habitat quality scores • reduced availability of foraging and breeding habitat for squatter pigeon • reduce the conservation value of the Offset Area to less than that of the impact site
	Failed vegetative regeneration	No recruitment of establishment and spread of native flora species within the Offset Area	Failure to achieve completion criteria.
	Introduction and spread of weeds	The extent of existing infestations of invasive weed species and exotic pasture grass expand or the weed/exotic pasture grass species	Potential to reduce the habitat quality scores of habitat within the Offset Area, reducing conservation value.

Risk Type	Risks	Risk description	Risk to target fauna species (ornamental snake and squatter pigeon) conservation outcome
	High fuel loads resulting in high intensity fire	Impacts to vegetation composition and structure impacting habitat quality scores.	Potential to: • result in the loss of individuals and habitat within the Offset Area • impact vegetation composition and structure resulting in reduced habitat quality scores • reduce the conservation value of the Offset Area to less than that of the impact site
	Fence failure	Unauthorised access to offset area by persons, vehicles or stock.	Potential to: • lead to the introduction and spread of weeds impacting habitat quality scores • result in the degradation of habitat (trampling) within gilgai, impacting habitat and groundcover; and • result in unauthorised vegetation clearing
Force majeure	Drought	Dry conditions resulting in negative impacts to vegetation regeneration (groundcover) or dieback, due to a lack of water resources.	Potential to: • reduce the availability and abundance of prey, impacting existing populations of ornamental snake • reduced foraging habitat (i.e. grasses) for squatter pigeon • reduce the habitat quality scores of habitat within the Offset Area, reducing conservation value; and • reduce the conservation value less than that of the impact site
	Bushfire	Moderate to high intensity bushfire resulting in short term degradation of habitat.	Potential to result in localised damage to vegetation leading to a reduction in canopy and ground cover, impacting habitat quality scores.
	Severe storm/tropical low	Flooding/inundation and destructive winds	Potential to result in localised damage to vegetation leading to a reduction in canopy and ground cover, impacting habitat quality scores.

3.5 Management actions

To achieve the management objectives, management actions will centre on the regional and local priority recovery and threat abatement actions outlined in the relevant Approved Conservation Advice (DoE 2014). A detailed overview of the management actions are provided in Table 6, including the associated methods, timing, location and responsibilities for each action. Further details regarding relevant management action are also provided in the following sections.

Table 6. Croydon Offset Area management actions summary

Management Action	Method (i.e. how the action will be implemented)	Location (i.e. where the action will be implemented)	Timeframe (i.e. when the action will be carried out)	Responsibility (i.e. who will carry out the action)
Pest animal assessment and ongoing monitoring	Baseline levels for pest animals are not able to be established due to the transient nature of the animals. Numbers are established via visual signs recorded during quarterly inspections. Quarterly maintenance inspections will assist in identifying and map the presence, relative abundance and distribution of pest animals within the offset and surrounds. Evidence of pest animals and their activity (including key locations) will be documented. If an increase in pest activity is noted, an additional baiting and/or control program is to be instigated until the increased activity has ceased. For example, if twelve or more half grown and/or mature wild pigs are noted during the quarterly inspections, then a control program will be initiated.	Croydon Offset Area	Monitoring is to be undertaken over the duration of the OAMP. When an increased feral pest activity is observed, a control program will be implemented.	Suitably qualified professional and Landholder.

Management Action	Method (i.e. how the action will be implemented)	Location (i.e. where the action will be implemented)	Timeframe (i.e. when the action will be carried out)	Responsibility (i.e. who will carry out the action)
Feral pig control to reduce degradation of habitat	Introduction of pest animals and control of existing populations will be minimised in accordance with the Queensland *Biosecurity Act 2014* and through the development of property based feral animal management. Current control methods within Croydon Station and the adjacent existing offset area consist of annual baiting and periodic shooting. The land manager may also remove any individuals encountered during other monitoring events. Further details regarding feral pig control measures are detailed within Section 3.5.1. Where practicable, co-ordination of control measures will be undertaken in conjunction with actions implemented within the existing offset area. Similarly, an integrated control program may be developed in conjunction with Croydon Station manager or landholder and surrounding properties.	Within the Croydon Offset Area and where practicable, in conjunction with control actions implemented within the adjacent existing offset area.	• Dry season • Annually for the first five years of the offset subject to efficacy of action	Suitably qualified professional
Weed and pest animal prevention	Implementation of good weed hygiene practices, including vehicle and machinery wash downs if equipment is coming from weed infested areas.	Croydon Offset Area	For the duration of the OAMP.	Suitably qualified professional and Landholder.

Management Action	Method (i.e. how the action will be implemented)	Location (i.e. where the action will be implemented)	Timeframe (i.e. when the action will be carried out)	Responsibility (i.e. who will carry out the action)
Controlled livestock grazing to prevent impacts to microhabitat features (soil cracks etc.) and foraging resources (squatter pigeon)	Low-intensity cattle grazing using existing fencing and natural barriers will be employed from May to November, outside of the wet season (December to March) and early dry season (April to May) provided minimum ground cover thresholds are maintained: • Brigalow communities - 60% groundcover or 1,500kg/ha pasture biomass • Eucalypt communities - 60% groundcover or 850kg/ha pasture biomass; or • in accordance with Queensland government requirements (if available). Outside of the wet season, changes to livestock densities will be considered following significant rainfall events to minimise compaction and disturbance of soil cracks. Further details regarding control of livestock grazing measures are detailed within Section 3.5.3.	Croydon Offset Area	For the duration of the Offset.	Landholder

Management Action	Method (i.e. how the action will be implemented)	Location (i.e. where the action will be implemented)	Timeframe (i.e. when the action will be carried out)	Responsibility (i.e. who will carry out the action)
Natural regeneration	Vegetation is to regenerate through natural processes (passive). Further details regarding natural regeneration measures are detailed within Section 3.5.4. Fire is to be, where possible, excluded, unless identified to be appropriate by a suitably qualified person in order to promote management objectives. Further details regarding fire management measures are detailed within Section 3.5.5.	Croydon Offset Area	For the duration of the Offset with the exception of controlled burns as required (as per Section 4.2.4).	Landholder
Fire management to mitigate frequency and intensity of potential burns	Firebreaks will be maintained across the Offset Area to mitigate the threat of uncontrolled fire events. Any new firebreaks are to be co-located with existing access tracks and fence lines where possible. Further details regarding fire management measures are detailed within Section 3.5.5.	Croydon Offset Area	Firebreaks are to be inspected biannually for condition and adequacy. Maintenance will be undertaken as required over the duration of the offset.	Suitably qualified professional and/or Landholder.

Management Action	Method (i.e. how the action will be implemented)	Location (i.e. where the action will be implemented)	Timeframe (i.e. when the action will be carried out)	Responsibility (i.e. who will carry out the action)
Inspection/repair of infrastructure following extreme weather events (e.g. fire, flood, cyclone)	For extreme weather events: • Determine the extent of damage to Offset Area infrastructure (such as fence lines) through visual inspection of infrastructure and associated monitoring (see Table 8). • Cattle will be removed from the Offset Area to prevent further damage following the extreme weather event. Undertake investigations to identify a suitable timeframe for reintroduction of cattle when conditions are stable and ecosystem functions have been restored. • Weed cover in areas disturbed by the weather event to be monitored to ensure progress / measure outcomes are still maintained. • Investigate to determine if additional restoration / revegetation required to maintain offset progress toward completion criteria.	Croydon Offset Area	As soon as safely possible after an extreme weather event.	Suitably qualified professional and/or Landholder.
Establishment of Offset Area restrictions	Identification of actions that will impact/impede the achievement of management objectives. Further details regarding Offset Area restrictions (i.e. vegetation clearing, livestock grazing etc.) are provided in Section 3.5.6.	Croydon Offset Area	Prior to the implementation of this OAMP or as required in accordance with the Offset management framework detailed within Section 3.1.	Suitably qualified professional and/or Landholder.

3.5.1 Pest animal assessment and control

The abundance of feral pest species, particularly wild dogs and feral cats, are a threat to existing populations of squatter pigeon (southern) within the Offset Area. The destruction of gilgai and wetland habitat by feral pigs is also a threat to ornamental snake along with the associated destruction of frog habitat and direct competition for their food source (i.e. frogs) (WWF-Australia/QMDC 2008).

Baseline levels for pest animals are not able to be established due to the transient nature of the pest animals (i.e. pigs). Assessment of pest animal abundance and activity will be undertaken as part of the quarterly maintenance inspections. Although these species typically occur in small numbers and are transient in nature, more significant damage to vegetation and habitat can occur when larger numbers occur within an area (Department of Agriculture and Fisheries (DAF), 2020). Population estimates can be undertaken through spotlighting and use of motion cameras (DAF, 2020). Once an assessment of the utilisation and abundance of the pest is undertaken, the need for control measures within the Croydon Offset Area can be determined. If the inspections note activity above the determined threshold (i.e. twelve or more half grown and/or mature wild pigs) then a control program will be initiated.

3.5.1.1 Feral pest control measures

The abundance and density of feral pests can fluctuate over time depending on the climatic conditions and availability food resources. Feral pigs, for example, are highly fecund and able to double their population size annually (Choquenot et al. 1996). Effective control of the species requires a minimum population reduction of 70% (Choquenot et al. 1996).

Current control methods for feral pests within Croydon Station and the adjacent existing offset area consist of annual baiting and periodic shooting. Poison baits is considered the most appropriate technique for achieving large-scale control. Sodium monofluoroacetate (1080) is the only toxin recommended by the Queensland Government. Pre-feeding of non-toxic grain is required to encourage bait uptake and should be carried out for at least three nights before poisoned grain is introduced. Using 1080 carries a high risk of non-target poisoning due to the large doses required to kill feral pigs and dogs (Centre for Invasive Species Solutions 2021). The uptake of bait by non-target species can be significantly reduced by considering the placement, timing, size and amount of bait. Additionally, the risk is reduced by using specific bait stations, mechanical exclusion devices, collecting uneaten baits and where practical dying baits green (The Department of Primary Industries and Fisheries, 2008).

The land manager may also remove any pest individuals encountered during monitoring events (i.e. periodic shooting). Where practicable, co-ordination of control measures associated with feral pest control will be undertaken in conjunction with actions implemented within the adjacent existing offset area. Similarly, an integrated control program may be developed in conjunction with Croydon Station manager or landholder and surrounding properties.

3.5.2 Weed management

Removal of infestations of non-native weeds including invasive plants listed under the Biosecurity Act 2014 (Qld), as per the recommended controls outlined in the Department of Agriculture and Fisheries fact sheets. This includes infestations reported as part of baseline characterisation and new infestations detected during monitoring events.

Detailed surveys will identify and map the presence, abundance and distribution of weeds to represent the baseline condition. Outcomes of baseline characterisation will be appended to the OAMP (as an appendix) for comparison following each monitoring event.

Small weed infestations to be GPS marked and large infestations mapped out across the offset area.

3.5.3 Controlled livestock grazing

Grazing pressure by livestock can reduce shelter and food for ornamental snake by slowing and preventing the recruitment and growth of brigalow, grasses and understorey shrubs, and by trampling and reducing the amount of litter and fallen timber (Butler 2008). Cattle often use patches of brigalow for shade; therefore tending to selectively graze palatable plant species, facilitate the spread of introduced weeds and increase soil compaction (Cook et al. 2006). Soil compaction of gilgai impacts the quality of ornamental snake habitat by reducing refuge and foraging habitat.

At the time of surveys, cattle grazed freely throughout the Croydon Offset Area, however, impacts from cattle (i.e. overgrazing and/or soil compaction) were minimal. Changes to livestock densities may be considered following significant rainfall events to minimise compaction and disturbance of soil cracks and allow native grass to seed.

Livestock exclusion within the Croydon Offset Area is to take place during the wet season (January to May). Livestock grazing is permitted outside of these times provided the minimum live groundcover thresholds is maintained:

- Brigalow communities - 60% groundcover or 1,500kg/ha pasture biomass
- Eucalypt communities - 60% groundcover or 850kg/ha pasture biomass; or
- in accordance with Queensland government requirements (if available).

3.5.4 Natural regeneration

Natural regeneration is most suitable in areas containing mature vegetation, as natural recruitment suggests the presence of a viable seed bank. Provided that the vegetation contains species from each stratum, this method is best for restoring an area to its pre-clearing condition. Vegetation within the Croydon Offset Area currently contains native species (consistent with RE 11.4.9, 11.3.1 and 11.8.4), from each stratum (ground layer and shrub/tree layers), indicating the presence of a viable seedbank. Brigalow vegetation communities often regenerate naturally after disturbance by suckering, a process facilitating the development of new shoots from the existing root system (Peeters and Butler, 2014). Areas within the Croydon Offset Area are already regenerating, in comparison to some adjacent areas (see Photo 2). Natural regeneration will be facilitated for areas within the Offset Area containing remnant and regrowth vegetation.

Natural, or passive regeneration, in conjunction with other management measures (i.e. weed management, fire management and fencing etc.), will utilise existing vegetation and soil seed bank to promote rehabilitation through natural processes. Over the duration of the offset the existing native vegetation will assist in the re-introduction of native species to areas previously occupied by environmental weeds.

All vegetation clearing will be prohibited within the Croydon Offset Area except for works associated with:

- Establishment of fire breaks (if necessary);
- Maintenance of existing access tracks (if necessary); and
- Weed management (if necessary).

Photo 2. Fence line separates the regrowth brigalow (left) from the non-remnant brigalow (right) vegetation community (RE 11.4.9) south of Lotus Creek Road adjacent to the Croydon Offset Area

3.5.5 Fire management

Fire is to be, where possible, excluded from the Croydon Offset Area by maintaining firebreaks relative to the Offset Area (if applicable) and not using fire as a management tool in the Croydon Offset Area unless identified by a suitably qualified person in order to promote management objectives (e.g. low intensity controlled burn to reduce fuel loads or promote native species growth).

3.5.6 Offset Area restrictions

The Croydon Offset Area is to be managed for conservation purposes and is subject to land use restrictions to ensure the delivery of an improved environmental outcome for targeted matters. These restrictions are summarised in Table 7.

Table 7: Croydon Offset Area restrictions

Restrictions	Details
Vegetation clearing is prohibited unless in accordance with an exemption(s) under the Queensland *Vegetation Management Act 1999* and EPBC Act.	Vegetation clearing within the Offset Area is restricted to: • that necessary for the removal of non-native weeds or pests identified under the Queensland *Biosecurity Act 2014* • to ensure public safety • for construction and maintenance of tracks, fence lines or firebreaks; and • that necessary to establish and maintain access to BioCondition. Clearing for new fencing will be on the outside of the Offset Area boundary.

Restrictions	Details

Livestock grazing	Grazing of livestock (cattle) will occur in the Offset Area under the following arrangements:
	• graze stock at rates and times necessary to reduce the fuel load in the Offset Area with a minimum grass cover of
	  • 60% groundcover or 1,500kg/ha pasture biomass in brigalow communities
	  • 60% groundcover or 850kg/ha pasture biomass in eucalypt communities
	  • or in accordance with Queensland government requirements (if available)
	  This to be measured as per the *Land Manager's Monitoring Guide* (Department of Environment and Resource Management (DERM), 2010), or any subsequent published version of this document.
	• cattle are to be excluded from the Offset Area during the wet season (January to May) to allow native species to seed.

Fire	Fire (apart from force majeure events and prescribed, low intensity burns as identified by a suitably qualified person) is excluded from the Offset Area.
Feral animals and weeds	Minimise the introduction of feral animals, weeds control of existing populations within the Offset Area in accordance with the Queensland *Biosecurity Act 2014*. Monitor and manage feral animal populations and subsequently adapt control effort with populations with regards to feral pigs and wild dogs. Keep the introduction, establishment and spread of non-native weeds including restricted and prohibited biosecurity matter listed under the Queensland *Biosecurity Act 2014* to no more than 10% weed cover over the Offset Area.

3.5.7 Offset securement

The mechanism to legally secure the offset is a Voluntary Declaration (Vdec) under the provisions of the Queensland *Vegetation Management Act 1999* where it is secured for the life of the approval, for the purposes of an environmental offset. This process requires the OAMP be connected to the land title. It is accepted that the adaptive management process adopted in this plan may require periodic review and the most recent revision of the plan will be considered the accepted plan.

4 Offset Monitoring

4.1 Monitoring actions

Ongoing monitoring is required to gauge the effectiveness of and, if necessary, adapt the management actions, as well as record the progress towards completion criteria. The following monitoring actions are recommended:

- Targeted ornamental snake and squatter pigeon surveys to monitor relative abundance and habitat utilisation;
- Habitat Quality Assessments (i.e. site-based attribute BioCondition surveys) to monitor vegetation regeneration (includes photo monitoring);
- Weed surveys to monitor the cover and abundance of non-native/environmental pest flora species;
- Feral pest monitoring to assess pest control; and
- Livestock impact monitoring to assess habitat degradation.

Monitoring will be undertaken in the Croydon Offset Area for the duration of the environmental offset or until completion criteria are met, whichever is longer. Monitoring will continue in the Offset Area for the duration of the environmental offset, even after completion criteria are achieved, to ensure the completion criteria are maintained for life of the offset.

A detailed overview of the monitoring requirements within the Croydon Offset Area are provided in Table 8. Specific KPIs for each monitoring action have also been provided in order to measure targets associated with management objectives and the overall desired conservation outcomes for the Offset Area. Further details regarding the monitoring actions are also provided in the following sections.

Table 8. Offset management action monitoring schedule

Monitoring activity	Monitoring timeframe and frequency	Attribute monitored	Method	Location	Key Performance Indicators (KPIs)	Possible Corrective Actions
Target ornamental snake survey	Baseline assessment conducted during optimal conditions (i.e. Feb-April). Subsequent surveys are to be conducted annually for first five years (Year 1 – Year 5) and then once every five years to Year 20	Species stocking rate: • presence within the Croydon Offset Area • species usage of Offset Area • density • Threats to species (refer to section 2.4)	*Commonwealth Survey guidelines for Australia's threatened reptiles* (DSWEPaC, 2011)	Croydon Offset Area	• The species is recorded within the Offset Area during optimal survey conditions; and • The number of individuals detected within the Offset Area is not significantly different to the number detected during previous monitoring.	Corrective actions will be determined firstly through an investigation (CHECK-ACT) to identify drivers. If the number of individuals detected have reduced and is significantly different (± standard error of the mean) to previous monitoring results, an investigation into possible causes for a decline will be undertaken. A suitably qualified fauna ecologist will be consulted to inform the development of scientifically robust management actions and possible corrective actions. Corrective actions and suitable corresponding monitoring actions will be documented and incorporated into the OAMP revisions where required (ACT-PLAN). Corrective actions will be implemented as part of the DO component of the Offset Management Framework where the feedback loop allows for continuous improvement. Examples of possible corrective actions may include: • Livestock exclusion or revision of stocking densities • Additional feral animal control or weed removal

Monitoring activity	Monitoring timeframe and frequency	Attribute monitored	Method	Location	Key Performance Indicators (KPIs)	Possible Corrective Actions
Habitat Quality Assessment	Annually for first five years (Year 1 – Year 5) and then once every five years to Year 20.	Site condition: • Recruitment of woody perennial species • Native plant species richness (tree, shrub, grass, forb) • Canopy height (tree) • Canopy cover (tree, shrub) • Native grass cover • Organic litter • Large trees • Coarse woody debris • Non-native plant cover • Quality and availability of food and foraging habitat • Quality and availability of shelter	In accordance with the *Guide to determining terrestrial habitat quality* (DES, 2020).	Croydon Offset Area: BioCondition monitoring sites	Increase in Habitat Quality Score (Site-based attributes) over time. Interim KPIs are detailed within Table 4 No decrease in Habitat Quality scores as based on the BioCondition survey data	Corrective actions will be determined firstly through an investigation (CHECK-ACT) to identify drivers. If the habitat quality scores have reduced and is significantly different (± standard error of the mean) to previous monitoring results, an investigation into possible causes for a decline will be undertaken. A suitably qualified ecologist will be consulted to inform the development of scientifically robust management actions and possible corrective actions. Corrective actions and suitable corresponding monitoring actions will be documented and incorporated into the OAMP revisions where required (ACT-PLAN). Corrective actions will be implemented as part of the DO component of the Offset Management Framework where the feedback loop allows for continuous improvement. Examples of possible corrective actions may include: • Livestock exclusion or revision of stocking densities • Active revegetation • Weed removal

Monitoring activity	Monitoring timeframe and frequency	Attribute monitored	Method	Location	Key Performance Indicators (KPIs)	Possible Corrective Actions
Feral pig monitoring	Annually for first five years (Year 1 – Year 5) and then once every five years to Year 20	• Damage/degradation of gilgai from feral pigs • Relative pig density to thresholds	• gilgai assessment (refer to Section 4.1.3) • Runsheet of pigs removed (where quantifiable (shooting, baiting))	• Assessment of gilgai in conjunction with BioCondition Assessments and observations across the Offset Area	• No evidence of pig wallows or trampling in gilgai • Pigs continue to be removed at each control event or; • No pigs are observed in/near the Offset Area or below the identified thresholds	Examples of possible corrective actions may include additional feral animal monitoring or adoption of alternative control methods. Potential for the implementation of an integration control strategy with the adjacent existing offset area and Croydon Station landholder.
Weed monitoring	Annually for first five years (Year 1 – Year 5) and then once every five years to Year 20	• Abundance and distribution of weeds, including the location, species, population density, general health and life stage (flowering, mature, etc.).	• Targeted surveys of key infestation areas (as determined by the baseline survey) • Weed surveys (refer to Section 4.1.4)	• Croydon Offset Area	• No new weed infestations • Decrease in the weed cover within key infestation areas	Examples of possible corrective actions may include additional weed control measures and follow-up surveys or adoption of alternative control methods.

Monitoring activity	Monitoring timeframe and frequency	Attribute monitored	Method	Location	Key Performance Indicators (KPIs)	Possible Corrective Actions

Ground cover monitoring	Annually for first five years (Year 1 – Year 5) and then once every five years to Year 20	• Damage/degradation of gilgai by livestock trampling
		• Minimum levels of groundcover for each community is as follows:
		  ◦ Brigalow communities - 60% groundcover or 1,500kg/ha pasture biomass
		  ◦ Eucalypt communities - 60% groundcover or 850kg/ha pasture biomass; or
		  ◦ in accordance with Queensland government requirements (if available).
			• Level 1 visual inspections in accordance with DERM *Land Manager's Monitoring Guide* (2010)
			• Guide to determining terrestrial habitat quality (DES, 2020)
				• Assessment of gilgai in conjunction with Habitat Quality assessments and quarterly inspections	• No evidence of habitat degradation resulting from livestock trampling is observed.
					• Graze stock during the dry season, at rates and times necessary to reduce the fuel load in the Offset Area with a minimum grass cover as detailed in this OAMP
						Upon being notified or becoming aware of grass cover falling below the stated percentage in the Offset Area, the Pastoral Manager is to remove cattle from the Offset Area within one fortnight. Grazing period may recommence when the grass cover has increased to the levels using the methodology in the Land Manager's Monitoring Guide (DERM, 2010).
						Examples of possible corrective actions may include Livestock exclusion or revision of stocking densities.

Maintenance inspection	Quarterly and/or following extreme weather events.	• Condition and functionality of fences	• Inspection of fence lines and firebreaks.	• Throughout the Offset Area and boundary fencing	• Fences are intact and exclude livestock/ unauthorised entry. • Inspections are conducted within two weeks following an extreme weather event (tropical low, cyclone, flood etc.)	Examples of possible corrective actions may include fence maintenance and repairs to resecure the Offset Area and re-establishment of firebreaks.

4.1.1 Targeted species surveys

4.1.1.1 Ornamental snake

Targeted ornamental snake surveys will be conducted in accordance with Commonwealth *Survey guidelines for Australia's threatened reptiles* (DSEWPC, 2011). A baseline survey is to be conducted during optimal survey conditions (i.e. late wet season (February to April)) to determine the presence of ornamental snake within the Croydon Offset Area. If possible, an estimate of population density should also be calculated. Outcomes of baseline surveys will be appended to the OAMP (as an appendix) for comparison following each subsequent targeted survey.

Subsequent surveys are to be conducted during the middle to late wet season (February to April) when conditions are considered optimal for peak activity of the species (DSEWPC, 2011). The species is likely to be encountered in proximity to suitable gilgai habitat where native frogs (prey) are active. Survey methods are to comprise nocturnal spotlighting, including driving and walking transects, through suitable habitat within the Croydon Offset Area. Diurnal active searches involving the inspection of sheltering sites (i.e. under rocks, woody debris etc) may also be employed.

The location of all individuals encountered are to be recorded, including date and time. Where possible photographs of individuals may also be collected.

Targeted ornamental snake surveys are to be conducted annually for first five years (Year 1 – Year 5) and then once every five years to Year 20.

4.1.1.2 Squatter pigeon (southern)

Targeted squatter pigeon (southern) surveys will be conducted in accordance with Commonwealth *Survey guidelines for Australia's threatened birds* (Department of the Environment, Water, Heritage and the Arts, 2010). While squatter pigeon can be detected throughout the year, the optimal period to detect the species is during the mid to late dry season from May to the end of October (DCCEEW, 2022). If possible, an estimate of population densities should also be calculated for the species during survey events. Outcomes of baseline surveys will be appended to the OAMP (as an appendix) for comparison following each subsequent targeted survey. Survey methods are to comprise water body watches, driving and walking transects through suitable habitat within the Croydon Offset Area.

The location of all individuals encountered are to be recorded, including date and time. Where possible photographs of individuals may also be collected.

Targeted squatter pigeon surveys are to be conducted annually for first five years (Year 1 – Year 5) and then once every five years to Year 20.

4.1.2 Habitat quality assessments

Habitat quality assessments using the site-based attributes methods (i.e. BioCondition) detailed within the *Guide to determining terrestrial habitat quality* (DES, 2020) are to be conducted to monitor the natural regeneration of habitat areas over time. BioCondition assessments were conducted across the Croydon Offset Area and surrounds during the initial surveys and were used to derive the baseline score. Initial BioCondition monitoring sites located within the Croydon Offset Area are detailed in Table 9 and depicted in Figure 2. Additional BioCondition monitoring sites will also be established within the Offset Area during the first monitoring event to ensure suitable replication for each assessment unit. BioCondition assessments will be undertaken when plant diversity is greatest (Eyre et al., 2015). For the majority of Queensland, this is typically from March to late May, but is dependent on local seasonal conditions (Eyre

et al., 2015). Habitat quality assessments are to be conducted annually for first five years (Year 1 – Year 5) and then once every five years to Year 20.

Baseline BioCondition data is presented in Appendix A.

Table 9. BioCondition monitoring sites within the Croydon Offset Area

Survey site name	Longitude	Latitude
Ornamental snake		
OS1	149.0069	-22.3866
OS2	149.0056	-22.3954
OS3	149.0091	-22.4028
OS4	149.0021	-22.4114
Squatter pigeon (southern)		
SP1	149.0004	-22.4016
SP2	149.0081	-22.4143
SP3	148.9617	-22.4576
SP4	148.9630	-22.4592
SP5	148.9621	-22.4601
SP6	148.9628	-22.4610
SP7	148.9638	-22.4625
SP8	148.9646	-22.4626
SP9	148.9630	-22.4632
SP10	148.9643	-22.4649

4.1.3 Feral pest monitoring

As detailed within Table 6, quarterly maintenance inspections will assist in identifying the presence, relative abundance and distribution of pest animals within the offset and surrounds. If the inspections note activity above the determined threshold (i.e. twelve or more half grown and/or mature wild pigs) then a control program will be initiated.

For each ongoing monitoring event evidence of pest animals and their activity (including key locations) will be documented. Following the application of feral pest control (periodic shooting and/or baiting), the success of the program will be monitored by:

- A running scorecard of pests directly removed from the environment (quantifiable methods only (i.e. periodic shooting, discussion with landholder and/or suitably qualified professional to track progress));
- Gilgai assessment associated with feral pigs
  - frog abundance; and
  - evidence of wallows/soil compaction/rooting/degradation of soil cracks.
- Comparison against activity recorded during previous inspections.

4.1.4 Weed monitoring

Supplementary to habitat quality assessments, weed monitoring will be conducted across the Croydon Offset Area to detect the presence and extent of new infestations of weeds, as well as monitor if weed control measures are sufficient for existing populations. Weed surveys will comprise traversing the Croydon Offset Area to identify and determine the extent of non-native/environmental weeds species present, particularly along disturbed edges (fence lines), drainage lines and access tracks. The detection of weeds will include collection of data relating to the location, species, population density, general health (i.e. stressed, dead, healthy) and life stage (flowering, seeding, mature, etc.).

Subsequent weed surveys will assess previously identified key infestation areas to determine the effectiveness of weed control measures as well as any new infestations within the Croydon Offset Area.

4.1.5 Ground cover monitoring

To ensure light stocking rates are not adversely impacting ornamental snake and squatter pigeon habitat, areas will be surveyed for evidence of soil compaction and any other adverse impacts on habitat associated with cattle. Where necessary, any corrective actions (detailed within Table 8) will be implemented where evidence of increased soil compaction is observed.

Similarly monitoring of groundcover across the Croydon Offset Area in relation to grazing intensity will also be undertaken to ensure a minimum level of groundcover is met, including:

- 60% groundcover or 1,500kg/ha pasture biomass for brigalow communities
- 60% groundcover or 850kg/ha pasture biomass for eucalypt communities; or
- in accordance with Queensland government requirements (if available).

Visual inspections, in accordance with the Level 1 monitoring detailed within the DERM *Land Manager's Monitoring Guide* (2010) (or any subsequent version of this document), will be undertaken as part of the habitat quality assessments and maintenance inspections.

4.1.6 Maintenance inspections

Inspections of fencing and firebreaks are to be conducted quarterly over the duration of the offset to ensure security of the Croydon Offset Area is maintained. Inspections are to be carried out throughout the Croydon Offset Area and boundary fencing. Additional maintenance inspections will also be conducted within two weeks of extreme weather events (i.e. cyclone, tropical storms etc.) to ensure the security of the Croydon Offset Area is maintained.

4.2 Management responsibilities

The responsible party assigned to undertake each management action is summarised in Table 10.

Table 10. Management action implementation responsibility

Management Action	Responsibility
Feral pest control	Suitably qualified person appointed by landholder
Controlled domestic livestock grazing	Landholder
Natural regeneration via vegetation clearing prevention	Landholder
Fire management (if necessary)	Landholder

4.3 Force majeure

The offset risk assessment identified a number of potential risks to achieving the objectives of the OAMP that may result in significant set-backs to the progress toward final completion criteria. For example, in the event of an extreme weather event (i.e. catastrophic bushfire, severe cyclone or prolonged drought), whereby the habitat values of the Offset Area are severely impacted. The purpose of the offset is to counterbalance the significant residual impacts of the HPE Project and in the event a catastrophic event occurs BMA are committed to fulfilling the requirements of the approval.

BMA will notify DCCEEW as soon as it becomes aware the Offset Area has been affected by a Force Majeure event and will take all reasonable steps to prevent, limit and minimise the effects of the event on the habitat quality of the Offset Area. Depending on the severity of the event, the OAMP may require a review and consultation with stakeholders/advisors (including experienced land managers or fauna ecologist) to identify appropriate course of action (in accordance with the Offset Assessment Framework approach). Identification of alternative management strategies (and corresponding monitoring) will prompt an update to the OAMP, the monitoring program and the schedule of work orders (in accordance with the PLAN – DO – CHECK – ACT approach). Updates would then be implemented in accordance.

BMA currently manages a portfolio offset sites across the region. Sites secured for the sole purpose of providing compensatory measures in accordance with Queensland or Commonwealth offset requirements. In the event of a catastrophic event at the Croydon Offset Areas, BMA will be able to draw on experience in managing the other offset sites. Similarly, BMA undertakes a variety of rehabilitation activities within its operations and as a result has access to commercially available stores of seed for us in regeneration activities. As described in Table 8, active revegetation/restoration works may be implemented to address impacts on protected matters from catastrophic events. A rehabilitation or revegetation specialist/ecologist may be consulted to develop a works program specific to the extent and nature of the impact.

5 Reporting

BMA will prepare a report on the implementation of this OAMP at year 5, and then every five years for the remaining 15 years or until completion criteria are met (for a minimum of 20 years whichever is longer). The report will summarise the activities implemented under the OAMP and discuss the effectiveness of mitigation measures, based on the results of monitoring activities. Reporting will be conducted through internal BMA compliance reporting and will be made available upon request.

6 References

Brigalow Belt Reptiles Workshop. (2010). *Proceedings from the workshop for the nine listed reptiles of the Brigalow Belt bioregions*. Queensland Herbarium.

Bureau of Meteorology. (2022). *Climate Data Online*. http://www.bom.gov.au/climate/data/

Centre for Invasive Species Solutions. (2021). *PestSmart*. https://pestsmart.org.au/about-pestsmart/

Choquenot, D., McIlroy, J., & Korn, T. (1996). *Managing Vertebrate Pests: Feral Pigs*. Bureau Of Resource Sciences, Australian Government Publishing Service.

Department of Agriculture and Fisheries (DAF). (2020). *Restricted Invasive animal: Feral pig (Sus scrofa)*. Department of Agriculture and Fisheries.

Department of Climate Change, Energy, the Environment and Water (DCCEEW). (2022). *Species Profiles and Threats Database*. Species Profile and Threats Database. https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Department of Environment and Resource Management (DERM). (2010). *Land Manager's Monitoring Guide: Ground cover indicator*. Department of Environment and Resource Management.

Department of Environment and Science (DES). (2021a). *Guide to determining terrestrial habitat quality (Version 1.3): Methods for assessing habitat quality under the Queensland Environmental Offsets Policy*. Department of Environment and Science.

Department of Environment and Science (DES). (2021b). *Queensland Statewide Corridors* [Map]. Department of Environment and Science. https://www.data.qld.gov.au/dataset/queensland-statewide-corridors

Department of Environment and Science (DES). (2022). *Wildlife Online Extract*. https://apps.des.qld.gov.au/report-request/species-list/

Department of Sustainability, Environment, Water, Population and Communities. (2011). *Survey guidelines for Australia's threatened reptiles*. Australian Government.

Department of Sustainability, Environment, Water, Population and Communities. (2012). *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. Australian Government.

Department of the Environment. (2014). *Approved Conservation Advice for Denisonia maculata (Ornamental Snake)*. http://www.environment.gov.au/biodiversity/threatened/species/pubs/1193-conservation-advice.pdf

Department of the Environment, Water, Heritage and the Arts. (2010). *Survey guidelines for Australia's threatened birds*. Australian Government. https://www.awe.gov.au/sites/default/files/documents/survey-guidelines-birds-april-2017.pdf

Department of the Environment, Water, Heritage and the Arts (DEWHA). (2010). *The cane toad (Bufo marinus)*. Department of the Environment, Water Heritage and the Arts (DEWHA).

E2M Pty Ltd (E2M). (2023). *Environmental Offsets Strategy: Horse Pit Extension Project—Caval Ridge Mine*. E2M Pty Ltd.

Eco Logical Australia. (2016). *GCOS – Croydon property offset values assessment*. Eco Logical Australia.

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

Hines, F., Tolhurst, K., Wilson, A., & McCarthy, G. (2010). *Overall Fuel Hazard Assessment Guide*. Victorian Government Department of Sustainability and Environment.

Peeters, P. J., & Butler, D. W. (2014). *Brigalow: Regrowth benefits—Management Guideline*. Department of Science, Information Technology, Innovation and the Arts.

The Department of Primary Industries and Fisheries. (2008). *Feral pig control—A practical guide to pig control in Queensland*. Queensland Government.

Threatened Species Scientific Committee. (2015). *Approved Conservation Advice for Geophaps scripta (Squatter Pigeon (southern)*. Department of the Environment.

WWF-Australia/Queensland Murray Darling Committee (2008). Ornamental Snake Information Sheet. Available on the Internet at: http://www.qmdc.org.au/publications/download/39/fact-sheets-case-studies/reptilerecovery/ornamental-snake.pdf

Appendix A Baseline Offset Habitat Quality Data

Croydon Station - BioCondition survey site data

Assessment Unit		**1**			**2**
Site		BC1			BC10
Regional ecosystem		11.4.9			11.4.9
Broad condition state		regrowth			Non-remnant
Biocondition attribute	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**
Recruitment of woody perennial species (%)		100	5		100
Native plant species richness - trees (No.)	5	4	2.5	5	3
Native plant species richness - shrubs (No.)	10	5	2.5	10	6
Native plant species richness - grasses (No.)	5	3	2.5	5	2
Native plant species richness - forbs (No.)	10	3	2.5	10	3
Tree emergent height (m)	na	0		na	0
Tree canopy height (m)	13	0	0	13	1
Tree sub-canopy height (m)	8	0	0	8	0
Tree height - average			0		
Tree emergent cover (%)	na	0		na	0
Tree canopy cover (%)	25	0	0	25	0
Tree sub-canopy cover (%)	10	0	0	10	0
Tree cover - average			0		
Native shrub canopy cover (%)	5	20	3	5	6.7
Native perennial grass cover (%)	20	1.4	0	20	0
Organic litter (%)	45	18.8	3	45	18
Large trees/ha - total	45	0	0	45	0
Coarse woody debris (m/ha)	1200	20	0	1200	0
Non-native plant cover (%)	0	15	5	0	70
Maximum site-based score			80		
Site-based BioCondition score (out of 10)			**3.25**		

	1			3			3	
	BC11			BC12			BC13	
	11.4.9			11.3.25			11.3.25	
	regrowth			Remnant			Remnant	
Score	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**
5		100	5		100	5		80
2.5	5	3	2.5	4	6	5	4	5
2.5	10	6	2.5	2	4	5	2	3
2.5	5	3	2.5	8	3	2.5	8	4
2.5	10	3	2.5	12	6	2.5	12	4
	na	0		na	0		na	0
0	13	4.5	3	23	21	5	23	20
0	8	1.5	0	na	0		na	0
0			1.5			5		
	na	0		na	0		na	0
0	25	5.1	2	22	36.6	5	22	38.5
0	10	0	0	na	0		na	0
0			1			5		
5	5	19.4	3	1	4	3	1	1.5
0	20	0.2	0	12	11.4	5	12	4.4
3	45	6.4	3	15	61	3	15	17
0	45	0	0	21	14	10	21	18
0	1200	20	0	375	285	5	375	210
0	0	40	3	0	15	5	0	15
80			80			80		
2.875			**3.3125**			**7.625**		

	3			3			3	
	BC14			BC15			BC16	
	11.3.25			11.3.25			11.3.25	
	Remnant			Remnant			Remnant	
Score	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**
5		100	5		67	3		83
5	4	3	2.5	4	6	5	4	6
5	2	7	5	2	3	5	2	4
2.5	8	3	2.5	8	5	2.5	8	3
2.5	12	6	2.5	12	5	2.5	12	3
	na	0		na	0		na	0
5	23	24	5	23	20	5	23	21
	na	0		na	0		na	0
5			5			5		
	na	0		na	0		na	0
5	22	41.4	5	22	38.7	5	22	30.5
	na	0		na	0		na	0
5			5			5		
5	1	12.6	3	1	3.9	3	1	2.1
1	12	3.4	1	12	5.6	1	12	3
5	15	89	3	15	87	3	15	74
10	21	8	5	21	6	5	21	12
5	375	335	5	375	230	5	375	100
5	0	30	3	0	15	5	0	5
80			80			80		
7.625			**5.9375**			**6.25**		

	1			1			1	
	BC2			BC3			BC4	
	11.4.9			11.4.9			11.4.9	
	regrowth			regrowth			regrowth	
Score	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**
5		100	5		100	5		100
5	5	2	2.5	5	4	2.5	5	3
5	10	10	5	10	7	2.5	10	5
2.5	5	5	5	5	3	2.5	5	3
2.5	10	7	2.5	10	5	2.5	10	5
	na	0		na	0		na	0
5	13	4	3	13	2.5	0	13	4
	8	1.5	0	8	1.5	0	8	2
5			1.5			0		
	na	0		na	0		na	0
5	25	0	0	25	0	0	25	0
	10	0	0	10	0	0	10	0
5			0			0		
3	5	25.1	3	5	13	3	5	30.4
1	20	0	0	20	0.4	0	20	0.6
3	45	11	3	45	32	5	45	15.8
10	45	0	0	45	0	0	45	0
2	1200	0	0	1200	20	0	1200	35
5	0	20	5	0	15	5	0	15
80			80			80		
6.75			**4.0625**			**3.5**		

	1			2			1	
	BC5			BC6			BC7	
	11.4.9			11.4.9			11.4.9	
	regrowth			Non-remnar			regrowth	
Score	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**
5		100	5		100	5		100
2.5	5	2	2.5	5	1	0	5	3
2.5	10	10	5	10	7	2.5	10	6
2.5	5	5	5	5	5	5	5	4
2.5	10	6	2.5	10	4	2.5	10	6
	na	0		na	0		na	0
3	13	3	0	13	0.5	0	13	3
3	8	1	0	8	0	0	8	1
3			0			0		
	na	0		na	0		na	0
0	25	0	0	25	0	0	25	0
0	10	0	0	10	0	0	10	0
0			0			0		
3	5	27	3	5	1	3	5	11.3
0	20	0.6	0	20	0.8	0	20	0.6
3	45	14	3	45	8.6	3	45	18
0	45	0	0	45	0	0	45	0
0	1200	25	0	1200	0	0	1200	50
5	0	15	5	0	65	0	0	40
80			80			80		
3.625			**3.875**			**2.625**		

	1			1		
	BC8			BC9		
	11.4.9			11.4.9		
	regrowth			regrowth		
Score	**Benchmark**	**Value**	**Score**	**Benchmark**	**Value**	**Score**
5		100	5		100	5
2.5	5	2	2.5	5	2	2.5
2.5	10	6	2.5	10	7	2.5
2.5	5	1	0	5	1	0
2.5	10	4	2.5	10	3	2.5
	na	0		na	0	
0	13	5	3	13	7	3
0	8	1	0	8	2	3
0			1.5			3
	na	0		na	0	
0	25	0	0	25	0	0
0	10	0	0	10	0	0
0			0			0
3	5	29.2	3	5	27	3
0	20	0	0	20	0	0
3	45	3	0	45	6.75	3
0	45	0	0	45	0	0
0	1200	75	0	1200	20	0
3	0	10	5	0	5	5
80			80			80
3			**2.75**			**3.3125**

Appendix B Risk Analysis

Table B.1: Standard risk assessment

Risk event	Risk description	Initial risk rating			Management actions	Residual risk rating			Performance criteria	Management triggers	Corrective actions	Monitoring
		Likelihood	Consequence	Result		Likelihood	Consequence	Result				
Overgrazing	• gilgai soil compaction • reduced foraging habitat for squatter pigeon • hindered regeneration of vegetation	Possible	High	Medium	Low-intensity cattle grazing using existing fencing and natural barriers will be employed when timing and conditions are permissible. Changes to livestock densities may be considered following significant rainfall events to minimise compaction and disturbance of soil cracks, particularly following rainfall events.	Unlikely	Minor	Low	• Stock grazed only at permissible times • no evidence of soil impacts in gilgai • relevant BioCondition site assessment score attributes increase (particularly ground cover)	• evidence of soil impacts in gilgai • relevant BioCondition site assessment score attributes decrease (particularly ground cover	Investigate cause of habitat degradation. Exclusion of cattle grazing or reduced stocking densities in Offset Area during wet season, coinciding with peak ornamental snake activity periods and allow native grasses to seed	Ground cover monitoring Habitat quality assessments

Risk event	Risk description	Initial risk rating			Management actions	Residual risk rating			Performance criteria	Management triggers	Corrective actions	Monitoring
		Likelihood	Consequence	Result		Likelihood	Consequence	Result				
Feral pest proliferation	• gilgai soil compaction • predation of squatter pigeon from wild dogs and feral cats • reduction of ornamental snake foraging habitat	Possible	Moderate	Medium	Introduction of pest animals and control of existing populations will be minimised in accordance with the Queensland *Biosecurity Act 2014* and through the development of property based feral animal management. Current control methods within Croydon Station and the adjacent existing offset area consist of annual baiting and periodic shooting. The land manager may also remove any individuals encountered during other monitoring events.	Possible	Minor	Low	• feral pest abundance/ activity remains below the threshold • no evidence of soil impacts, particularly in gilgai • stable/increase of frog abundance	• increase in feral pig abundance above the threshold • evidence of soil impacts • no/significant decrease of frog abundance in gilgai • no/significant decrease in squatter pigeon abundance	Increased frequency and/or extent of feral pest management activities	Maintenance inspections and feral pest monitoring Habitat quality assessments
Vegetation clearing	• ornamental snake and squatter pigeon habitat loss • hindered regeneration of vegetation	Unlikely	Major	High	• offset will be legally secured under the Voluntary Declaration • vegetation clearing within the Offset Area is prohibited	Rare	Major	Medium	No vegetation clearing to occur within the Offset Area	vegetation is intentionally cleared within the Offset Area	Investigate cause of vegetation clearing to mitigate potential for future clearing events. Active regeneration/rehabilitation	Habitat quality assessments

Risk event	Risk description	Initial risk rating			Management actions	Residual risk rating			Performance criteria	Management triggers	Corrective actions	Monitoring
		Likelihood	Consequence	Result		Likelihood	Consequence	Result				
Erosion	• reduced groundcover • hindered regeneration of vegetation	Unlikely	Minor	Low	Livestock grazing and maintenance is undertaken in accordance with this OAMP.	Rare	Minor	Low	• No significant erosion activity is observed. • Groundcover remains consistent or improves	• Significant erosion activity is observed. • Groundcover decreases	Cause of erosion identified and remedied via investigation Active regeneration (i.e. seeding) to improve ground cover	Habitat quality assessments Ground cover monitoring
Failed vegetative regeneration	• No increase in habitat quality observed over time • Failure to meet completion/interim criteria	Rare	Critical	High	Natural regeneration Low-intensity cattle grazing using existing fencing and natural barriers will be employed when timing and conditions are permissible. Control of feral animals and weeds	Rare	Major	Medium	• Offset achieves interim and final completion criteria • Habitat Quality improves over time	• Offset does not achieves interim or final completion criteria • Habitat Quality decreases over time	Investigate cause of failed regeneration to determine suitable management approach. Example corrective actions may include active regeneration/rehabilitation Or livestock exclusion	Habitat quality assessments Ground cover monitoring
Introduction and spread of weeds	• Increased abundance and spread of existing weeds impacting habitat quality scores observed over time • Introduction of new weeds impacting habitat quality scores observed over time	Possible	Moderate	Medium	Weed management Weed hygiene protocols	Unlikely	Moderate	Low	• Non-native cover remains consistent with baseline or reduces over time • Offset achieves interim and final habitat quality completion criteria • Habitat Quality improves over time	• Non-native cover increases from baseline over time • Offset does not achieve interim and final completion criteria • Habitat Quality decreases over time	Active weed control (spraying, mechanical removal)	Habitat quality assessments Ground cover monitoring
High fuel loads resulting in high intensity fire	• hindered regeneration of vegetation from high intensity fire • ornamental snake habitat loss from high intensity fire	Possible	Moderate	Medium	Livestock grazing and maintenance is undertaken in accordance with this OAMP.	Possible	Minor	Low	• no unplanned fires occur within the Offset Area	• uncontrolled fire occurs within Offset Area	Management of fuel loads through livestock grazing management	Habitat quality assessments Ground cover monitoring

Risk event	Risk description	Initial risk rating			Management actions	Residual risk rating			Performance criteria	Management triggers	Corrective actions	Monitoring
		Likelihood	Consequence	Result		Likelihood	Consequence	Result				
Fence failure	Unauthorised access to offset vehicles (vehicles and people) Increased access by stock and feral animals	Possible	Minor	Low	Quarterly maintenance inspections of fences and gates	Unlikely	Minor	Low	• No unauthorised access to Offset Area. • All offset areas appropriately fenced. Fencing is intact. • No breaches in fencing during cattle exclusion times.	• Unauthorised access to Offset Area. • Fencing falls into disrepair. • Increased cattle densities and grazing through fence failure.	Upon being notified or becoming aware of an unsecured Offset Area, fence maintenance and repairs to resecure the Offset Area as soon as possible and within a month.	Quarterly maintenance inspections and all monitoring actions.

Table B.2: Force majeure risk assessment

Risk event	Risk description	Initial risk rating			Management actions	Residual risk rating			Performance criteria	Management triggers	Corrective actions	Monitoring
		Likelihood	Consequence	Result		Likelihood	Consequence	Result				
Drought	• Decreased groundcover and vegetative dieback • No increase in habitat quality observed over time • Failure to meet completion/interim criteria	Likely	Minor	Low	Limited mitigation measures can be implemented. Grazing of the offset area will be in accordance with this OAMP to ensure that minimum grass cover requirements are met.	Likely	Minor	Low	• Offset achieves interim and final completion criteria • Habitat Quality improves over time • Species still detected within offset area	• Offset does bot achieves interim or final completion criteria • Groundcover falls below baseline • Habitat Quality decreases over time	Grazing exclusion to be undertaken to allow offset area to recover	Habitat quality assessments Ground cover monitoring

Risk event	Risk description	Initial risk rating			Management actions	Residual risk rating			Performance criteria	Management triggers	Corrective actions	Monitoring
		Likelihood	Consequence	Result		Likelihood	Consequence	Result				
Bushfire	• Moderate to severe intensity bushfires (incl. lightning strike) impacting regeneration of vegetation • ornamental snake and squatter pigeon habitat loss	Possible	Major	High	In the event of a fire approaching or within the Offset Area, the landholder will coordinate with relevant fire and emergency services. Fuel loads will be managed and kept as low as practicable at all times, and firebreaks will be established and maintained. Fire will not be used as a tool for management. To prevent arson, only authorised persons will be permitted on site, and site access will be restricted through fencing and other barriers. Surveys undertaken as soon as possible following unplanned fire to measure impacts to habitat quality.	Possible	High	Medium	• Fuel loads will be managed and kept as low as practicable. • Firebreaks established and maintained. • No unplanned fire occurs.	• Fire impacts the Offset Area. • Fuel loads (dead litter material) exceed acceptable levels (60% ground cover) (refer to Overall Fuel Hazard Assessment Guide (Hines et al., 2010). • Unauthorised access to the site is detected or notified to the Landholder.	If fire impacts the offset site, the Offset Area will be destocked, fire breaks and control lines will be re-established. If unauthorised access to the site is detected (or notified to the Landholder), within two weeks, identify and repair fencing or other barriers to prevent future access Restoration/revegetation measures to support recovery of habitat quality.	Habitat quality assessments Ground cover monitoring Maintenance inspections

Risk event	Risk description	Initial risk rating			Management actions	Residual risk rating			Performance criteria	Management triggers	Corrective actions	Monitoring
		Likelihood	Consequence	Result		Likelihood	Consequence	Result				
Severe storm/tropical low	Flooding of vegetation and impacts to habitat quality	Possible	Minor	Low	Determine the extent of damage to offset area infrastructure (such as fence lines) and habitat quality caused by the event. Cattle to be removed from the offset area to prevent soil compaction following the extreme weather event. Weed cover in areas disturbed by the weather event to be monitored to ensure progress / measure outcomes are still maintained.	Possible	Minor	Low	• Offset achieves interim and final completion criteria • Habitat Quality improves over time • Species still detected within offset area • No evidence of soil compaction in low lying wet areas or waterways.	• Offset does not achieves interim or final completion criteria • Groundcover falls below baseline as a result of prolonged inundation or soil compaction • Habitat Quality decreases over time	All infrastructure is re-instated as soon as practicable. Active weed management	Habitat quality assessments Ground cover monitoring

Table B.3: Risk assessment matrix

Qualitative measure of likelihood (how likely is it that this event/circumstance will occur after management activities are implemented)	
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the offset
Possible	Might occur during the life of the offset
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances
Qualitative measure of consequences (what will be the consequence/result if the issue does occur)	
Minor	Minor incident of environmental damage that can be reversed (e.g. short term delays to achieving OAMP objectives, implementing low-cost, well-characterised corrective actions)
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts (e.g. short-term delays to achieving plan objectives, implementing well-characterised, high cost/effort corrective actions)
High	Substantial instances of environmental damage that could be reversed with intensive efforts (e.g. medium-long term delays to achieving objectives, implementing uncertain, high-cost/effort corrective actions)
Major	Major loss of environmental amenity and real danger of continuing (e.g. OAMP objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evident mitigation strategies)
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage (e.g. OAMP objectives are unable to be achieved, with no evident mitigation strategies)

	Consequences				
	Minor	Moderate	High	Major	Critical
Highly	Medium	High	High	Severe	Severe
Likely	Low	Medium	High	High	Severe
Possible	Low	Medium	Medium	High	Severe
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High