

MIDDLEMOUNT COAL MINE

WESTERN EXTENSION PROJECT (EPBC 2017/8130)

EPBC Act Preliminary Assessment Documentation

Attachment I

Western Extension Project
Terrestrial Habitat Quality Data



7 March 2019

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To whom it may concern,

**Re: Middlemount Coal Mine - Western Extension Project
Terrestrial Habitat Quality Data**

Biodiversity Australia undertook the ecological assessment for the Western Extension Project and this letter provides additional information. This letter provides:

- | | |
|--------------|--|
| Attachment A | Habitat Descriptions for the Ornamental Snake, Squatter Pigeon (southern) and Greater Glider |
| Attachment B | Justification for the inputs to the <i>EPBC Act Offsets Assessment Guide</i> (Department of Sustainability, Environment, Water, Population and Communities [DSEWPac], 2012a) |
| Attachment C | Justification for the Proposed Management Measures and Subsequent Increase in Habitat Quality Score |
| Attachment D | Terrestrial Habitat Quality Data |
| Attachment E | Figures (habitat mapping, past air photos, photos of regrowth habitat in the proposed offset area and the Regulated Vegetation Management Map) |

Current Land Management

The following is a description of the current land use of the proposed offset areas:

- The proposed offset is located on the Booroondarra Pastoral Station.
- The lessee of the Booroondarra Pastoral Station run up to 1,700 head of cattle across the station.
- The paddocks in which the proposed offset is located at times hold up to 800 head of cattle.
- The paddocks contain cleared, open grassland areas for the livestock to graze.
- Naturalised pasture grasses are promoted for livestock feed, such as Buffel Grass (*Cenchrus ciliaris*), Rhodes Grass (*Chloris spp.*) and Red Natal Grass (*Melinis repens*).
- These cleared open areas are maintained by clearing regrowth saplings, e.g. clearing occurred in 2004 and again in 2016. Example air photos from 1984, 2004, 2011 and 2016 are shown in Attachment E – Figures 7a to 7d.
- Maintaining the open areas is permitted without assessment or offsets under the Qld legislation as the clearing is only within Category X areas.

- Weeds (Rubber Vine, Lantana, Prickly Pear and Giant Rats Tail) are controlled ad hoc by the lessee (mostly along tracks and in open cleared areas, not within woodland and forest) when the lessee is able to identify a particular weed issue.
- Feral animals (pigs and dogs) are controlled ad hoc by the lease – there are no structured pest animal management programmes in place.
- Tracks run through the paddocks to enable the lessee to move the cattle.
- Livestock are permitted full access to woodland/forest habitat as well as watercourses (e.g. Roper Creek).
- Barbed wire fences divide the paddocks (additional barbed wire fences were constructed in 2017).

Current Status of Habitat within Proposed Offset Area

As a result of the above management, the current status of habitat is as follows:

- The woodland/forest habitat is fragmented due to the maintenance of large cleared areas, some with regrowth as shown in the example photos in Attachment E Figure 8.
- Regeneration of native vegetation is reduced by cattle feeding and trampling on native vegetation.
- Water sources are subject to grazing livestock.
- Erosion along watercourses due to cattle tracks
- Weeds are present (up to 75 % cover).
- Feral animals are present through-out.
- Woodland/forest habitat is divided by barbed wire fences.

Future Quality without the Offset

Without the proposed offset areas, the current land use would continue and the current habitat quality is predicted to decrease due to:

- Naturalised pasture grasses are promoted for livestock feed.
- Weeds are controlled ad hoc and mostly along tracks and in open cleared areas, not within woodland and forest.
- Regrowth currently present in paddocks would be cleared, resulting in:
 - greater edge effects on woodland/forest (environmental changes at boundaries);
 - removal of existing regrowth habitat for the Squatter Pigeon (southern); and
 - decrease in the existing connectivity of habitat for the Squatter Pigeon (southern).
- No structured pest animal management programmes in place (e.g. no control of feral cats).
- No restrictions upon the lessee not to install barbed wire fencing.

Proposed Land Management with the Offset

With the proposed offset areas, the current land use would change by:

- The land will be conserved under a Voluntary Declaration.
- Livestock numbers would be reduced and completely phased out of the proposed offset area once grazing is not required for management of Buffel Grass.
- Regrowth in cleared open areas would be conserved.
- A weed management strategy would be put in place to control weeds.
- A pest animal management strategy would be put in place to control pest animals.
- Barbed wire fencing within the offset areas will be removed upon exclusion of grazing.
- Structured management programme to control adverse impacts from erosion.
- Structured management programme to control adverse impacts from fire.
- regular inspection/survey for weed and pest to inform the weed and pest management strategy.

Future Quality with the Offset

With the proposed offset areas, the current habitat quality is predicted to increase due to:

- Regeneration of native vegetation, such as 444 ha of additional woodland/forest which is currently regrowth vegetation and could be cleared as it is within Category X areas (refer to Figure 9 in Attachment E).
- An increase in the connectivity of habitat and reduced edge effects on existing patches.
- Additional shelter and foraging habitat created for the Ornamental Snake.
- Additional shelter and foraging habitat created for the Greater Glider (note, no additional tree hollows).
- A decrease in the threats posed by pest animals due to improved pest animal management.
- Less weeds due to improved weed management.
- Less fauna barriers posed by barbed wire fences
- Less risk of out of control fires
- An increase in the importance of the habitat as the land will be conserved under a Voluntary Declaration.

Weed and Pest Management

Table 1 provides a comparison between current management actions and obligations of the offset area under the *Biosecurity Act 2016* and the management actions that would be undertaken as part of proposed comprehensive management of the offset areas.

Table 1
Weed and Pest Animal Management – Comparison between the *Biosecurity Act, 2014* and the Proposed Management of the Offset Areas

Aspect	Biosecurity Act, 2014	Proposed Management of the Offset Areas
Weeds		
Measures to <u>reduce spread</u> of prohibited or restricted invasive plants and <u>prevent</u> weeds from leaving property.	✓	✓
Measures to prevent new weeds entering property.	✓	✓
Overall reduction in abundance of weeds across the property.	x	✓
Targeted control of naturalised pasture grasses such as Buffel Grass (<i>Cenchrus ciliaris</i>), Rhodes Grass (<i>Chloris spp.</i>) and Red Natal Grass (<i>Melinis repens</i>)*	x	✓
Targeted control of environmental weeds such as Flannel Weed (<i>Sida hackettiana</i>), Cobblers Pegs (<i>Bidens pilosa</i>), Gomphrena Weed (<i>Gomphrena celosioides</i>) and Stylo (<i>Stylosanthes scabra</i>)*	x	✓
Structured management plan*	x	✓
Weed reduction targets and completion criteria.	x	✓
Regular targeted control of listed weed species.	x	✓
Regular weed monitoring*	x	✓
Regular weed reporting (annually for the first 5 years, then every 2 years until the completion criteria have been met).	x	✓
Internal and independent compliance auditing.	x	✓
Implementation of control measures and monitoring by a suitably qualified expert*	x	✓
Pests		
Feeding or keeping vertebrate pest species.	✓	✓
Transporting or releasing pest species to/from property.	✓	✓
Measures to reduce abundance and spread of invasive animals which pose a biosecurity risk (e.g. dog, cat, fox, rabbit)*	✓	✓
Reduction and removal of livestock.	x	✓
Structured management plan*	x	✓
Pest reduction targets and completion criteria.	x	✓
Regular targeted control of invasive pest species including trapping, shooting and baiting*	x	✓
Regular pest animal monitoring*	x	✓
Regular pest animal reporting (annually for the first 5 years, then every 2 years until the completion criteria have been met)*	x	✓
Internal and independent compliance auditing.	x	✓
Implementation of control measures and monitoring by a suitably qualified expert.	x	✓

* Consistent with the control of threats within relevant Threat Abatement Plans.

Monitoring Data from Existing Offset Areas

The following graphs show improvement in the existing Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394) since 2014. The first two graphs show a steady improvement in recruitment and canopy height. The third graph shows a decrease in non-native plant cover over time.

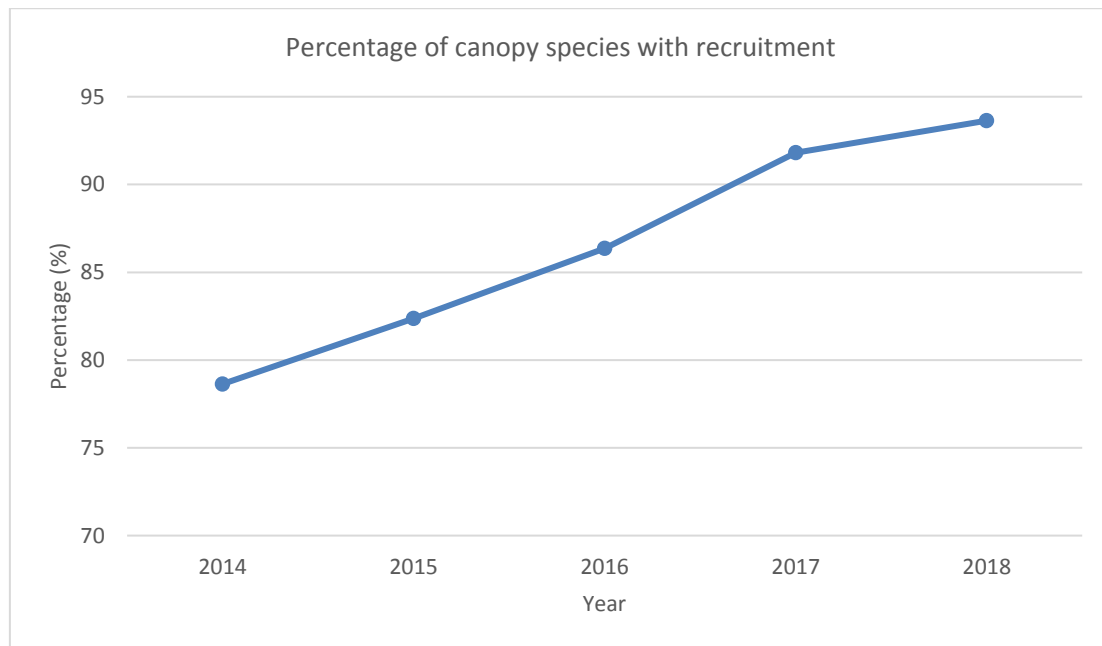


Plate 1 Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)
Improvement in Recruitment over Time

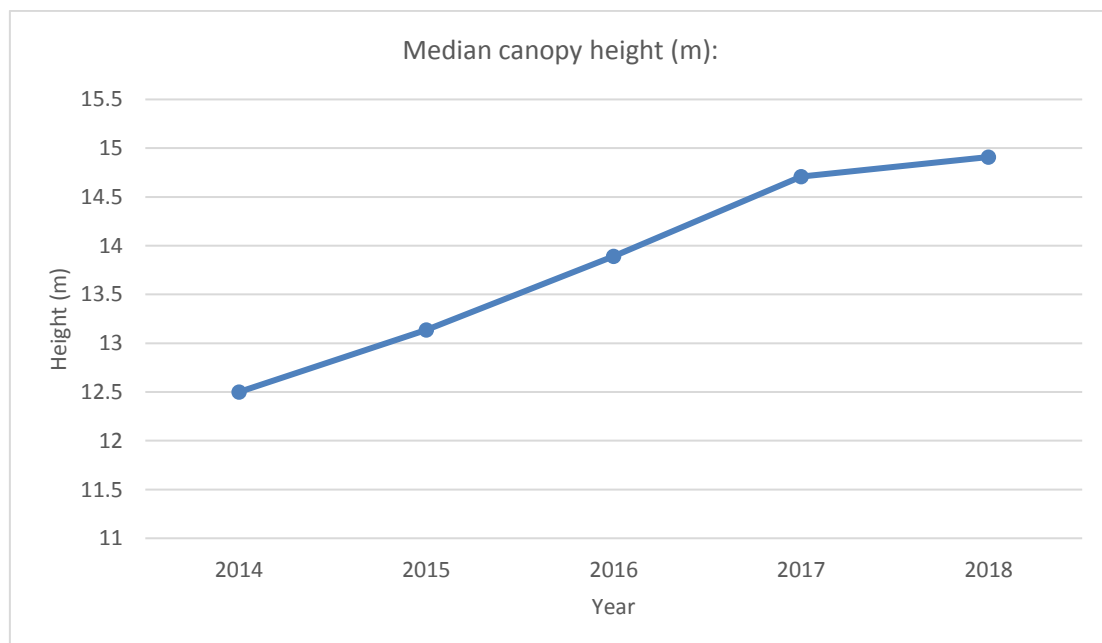


Plate 2 Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)
Improvement in Canopy Height Over Time

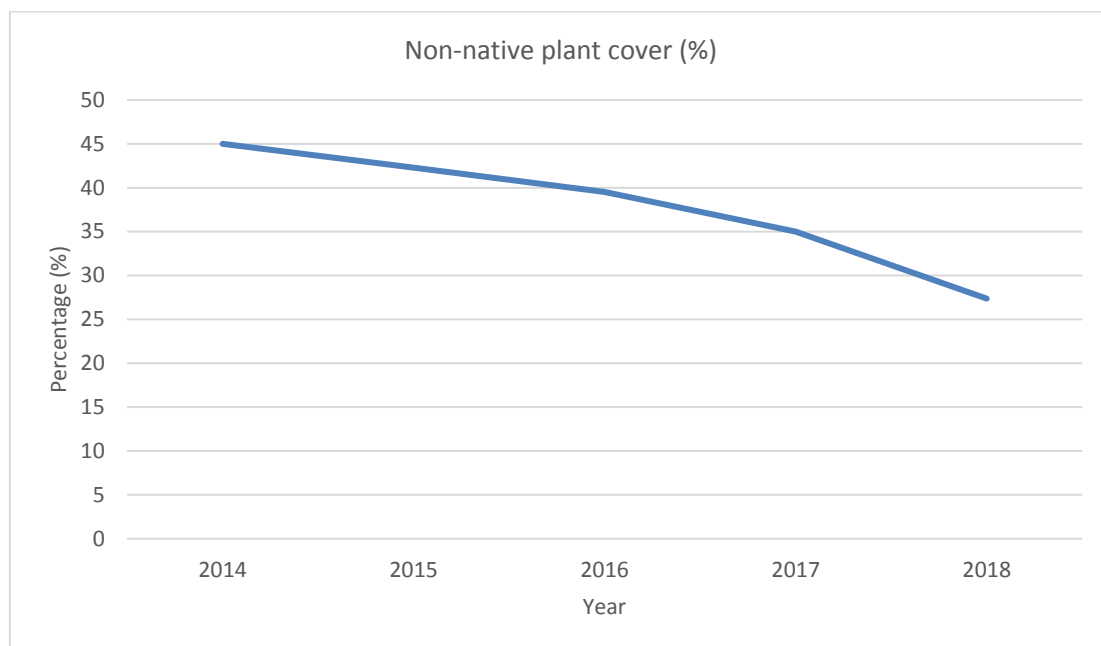


Plate 3 Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)
Decrease in Weed Cover over Time

Summary of the Result

Table 2 provides the summary of the results from applying the *EPBC Act Offsets Assessment Guide* (DSEWPaC, 2012a).

Table 2
Summary of the Result

Species/Community	Clearance Area (ha)	Component in the Offset Area	Offset Area (ha)	Percentage (%)
Squatter Pigeon (southern)	190.5 ha remnant and 198 ha of regrowth	Woodland/Forest Habitat	749.5	45.47
		Regrowth Habitat	405.5	61.5
		Total	1,155	106.97
Koala	175	Woodland/Forest Habitat	664.5	89.49
		Cleared Land Not Currently Habitat	400	80.81
		Total	1,064.5	170.3
Greater Glider	175	Woodland/Forest Habitat	575	38.72
		Cleared Land Not Currently Habitat	400	80.81
		Total	975	119.53
Ornamental Snake	15.5	Woodland/Forest Habitat	76	115
		Cleared Land Not Currently Habitat	30	68.43
		Total	106	183.43
Brigalow Woodland TEC	22 (of which 6.5 ha is regrowth)	Woodland/Forest Habitat	76	70.15
		Cleared Land Not Currently Habitat	30	55.38
		Total	106	125.53

The proposed offset areas would provide a suitable offset for all relevant Matters of National Environmental Significance in accordance with the *EPBC Act Environmental Offsets Policy* (DSEWPaC, 2012b).

Yours faithfully,



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REFERENCES

Department of Sustainability, Environment, Water, Population and Communities (2012a) *EPBC Act Offsets Assessment Guide*.

Department of Sustainability, Environment, Water, Population and Communities (2012b) *EPBC Act Environmental Offsets Policy*.

ATTACHMENT A**HABITAT DESCRIPTIONS FOR THE ORNAMENTAL SNAKE, SQUATTER PIGEON (SOUTHERN) AND
GREATER GLIDER**

Table A-1
Ornamental Snake Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
Potential Habitat	The Ornamental Snake habitat is defined by DEE as: - any habitat within, or close to, habitat that is favoured by prey – frogs. Particular attention should be paid to riparian zones, as well as any areas of the Brigalow threatened ecological community; - open-forests to woodlands associated with gilgai formations and wetlands. These are commonly mapped as QLD REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.5.16 or mapped as cleared but where the above REs formerly occurred; and - any additional vegetation communities the Ornamental Snake has been recorded from at the project site.	Limited potential habitat for this species exists within the Action area, comprising a 0.5 ha patch of RE 11.4.9 (Brigalow) on the edge of the approved mine footprint and approximately 15 ha of RE 11.3.1 (Brigalow) in three patches (i.e. a total of approximately 15.5 ha in four patches) (Figure 1 - Attachment E). The <i>Species Profile and Threats Database</i> (DEE, 2019) recognises RE 11.4.9 (Brigalow on gilgai soils) as habitat for this species but does not list RE 11.3.1 (Brigalow on alluvial soils). Given the Ornamental Snake was previously recorded in RE 11.3.1 (Brigalow) elsewhere in the mine site (Parsons Brinkerhoff, 2010) and it provides suitable microhabitat for the species (e.g. woody debris, ground litter and gilgai), this RE is considered to provide potential habitat. As shown in Figure 1 - Attachment E some of this habitat occurs along an ephemeral drainage line, which at times would provide preferred habitat for this species (i.e. habitat within, or close to, habitat that is favoured by its prey – frogs [DEE, 2019]). It is noted, however, that the <i>Species Profile and Threats Database</i> (DEE, 2019) states that: ‘the species presumed preference for riparian areas is questionable.’ It is noted that this species often use gilgai or cracking soils on cleared land, however, the regrowth Brigalow TEC in the Action area (6.5 ha) (Figure 1 - Attachment E) does not provide habitat for the Ornamental Snake as it does not have gilgai or sufficient microhabitat requirements (e.g. fallen timber) for shelter and prey species. It is also located further away from the seasonal drainage line.	The Western Extension Commonwealth Offset Area contains approximately 76 ha of potential suitable habitat for the Ornamental Snake (represented by RE 11.3.1, RE 11.4.8, RE 11.4.9 and RE 11.4.9a) (Section 2.10.2.2) (Figure 2 - Attachment E). Consistent with the proposed clearance area (Section 2.2.2), given the Ornamental Snake was previously recorded in RE 11.3.1 (Brigalow) (Parsons Brinkerhoff, 2010) and it provides suitable microhabitat for the species (e.g. woody debris, ground litter, cracking clay soils and gilgai), this RE is considered to provide potential habitat. As shown in Figure 2 - Attachment E, Roper Creek and Two Mile Gully traverse the Western Extension Commonwealth Offset Area providing habitat that is favoured by its prey – frogs [DEE, 2019]). The offset area contains 30 ha of cleared land likely to have been formerly potential habitat (i.e. Brigalow RE 11.3.1) (Figure 2 - Attachment E). These areas currently do not have sufficient microhabitat requirements (e.g. fallen timber) for shelter and prey species. These cleared areas are currently not considered habitat for the species.

Table A-1 (Continued)
Ornamental Snake Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
Preferred Habitat	The <i>Species Profile and Threats Database</i> (DEE, 2019) states: <i>'The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions in Queensland Regional Ecosystem Land Zone 4, but also lake margins and wetlands'</i>	There is no preferred habitat within the Action area.	RE 11.4.8, RE 11.4.9 and RE 11.4.9a with the Western Extension Commonwealth Offset Area are preferred habitat (approximately 59.5 ha).
Suitable Habitat	The <i>EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles</i> (DSEWPac, 2011) recognises suitable habitat as: <i>'open-forests to woodlands associated with gilgai formations and wetlands. These are commonly mapped as QLD REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.5.16 or mapped as cleared but where the above REs formerly occurred.'</i>	All of the potential habitat in the Action area (described above) is suitable habitat for this species.	All of the potential habitat in the Western Extension Commonwealth Offset Area (described above) is suitable habitat for this species.
Known Important Habitat	As defined by the <i>EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles</i> (DSEWPac 2011), suitable habitat for any one of the listed Brigalow Belt reptiles is considered important if it is: • habitat where the species has been identified during a survey; • near the limit of the species' known range; • large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive generations); or • a habitat type where the species is identified during a survey, but which was previously thought not to support the species.	No suitable habitat in the action area is considered important as defined by the <i>EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles</i> (DSEWPac 2011) as: • The species has not been recorded in the habitat in the Action area, despite targeted surveys; • The Action area is not near the limit of the species' known range (after DSEWPac 2011); • The Action area does not contain large patches of contiguous, suitable habitat and viable landscape corridors as the habitat is instead small and fragmented (Figure 1 - Attachment E); and/or • The Action area does not contain a unique habitat type containing known records of the species.	No suitable habitat in the action area is known to be important as defined by the <i>EPBC Act Draft Referral Guidelines for the Nationally listed Brigalow Belt Reptiles</i> (DSEWPac 2011) as: • The species has not been recorded in the habitat in the Western Extension Commonwealth Offset Area; • The Western Extension Commonwealth Offset Area is not near the limit of the species' known range (after DSEWPac 2011); • The Western Extension Commonwealth Offset Area does not contain large patches of contiguous, suitable habitat and viable landscape corridors as the habitat is instead small and fragmented (Figure 2 - Attachment E); • The Western Extension Commonwealth Offset Area does not contain a unique habitat type containing known records of the species.

Table A-1 (Continued)
Ornamental Snake Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
	Conclusion	The Western Extension Commonwealth Offset Area is suitably offsetting the impact in the Action area as the offset would provide: • the equivalent type of habitat to that within the Action area (i.e. potentially suitable habitat for the Ornamental Snake); • a greater area of potential habitat (approximately 15.5 ha in the Action area verse 76 ha in the offset area); • larger patches of potential habitat (refer Figures 1 and 2); and • opportunity to re-establish approximately 30 ha of potential habitat in cleared land (mapped as 'cleared land likely to be formerly potential habitat' on Figure 2 - Attachment E) (resulting is a total of approximately 106 ha).	

Table A-2
Squatter Pigeon (Southern) Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
Known Habitat		The Squatter Pigeon (southern) was recorded in the Action area by Naturecall (2017, 2014) and Parsons Brinkerhoff (2010) (Figure 3). Habitat for the Squatter Pigeon (southern) in the Action area is considered to comprises all remnant and regrowth habitat with a suitable groundcover. The Action Area contains approximately 388.5 ha of potential habitat for the Squatter Pigeon (southern), comprising approximately 190.5 ha of woodland and 198 ha of vegetation in the early stage of regrowing from past clearance (Figure 3 - Attachment E).	The Squatter Pigeon (southern) has been recorded adjacent to the proposed offset areas (Figure 4 - Attachment E) in habitat which is contiguous with the proposed offset areas. Given the nearby records, the presence of potential habitat and nature of the species, it is highly likely that the Squatter Pigeon (southern) would use habitat in the proposed offset area. Habitat for the Squatter Pigeon (southern) in the Action area is considered to comprises all remnant and regrowth habitat with a suitable groundcover. Western Extension Commonwealth Offset Area contains approximately 1,155 ha of potential habitat for the Squatter Pigeon (southern), comprising approximately 749.5 ha of woodland and 405.5 ha of vegetation in the early stage of regrowing from past clearance (Figure 4 - Attachment E). The offset area is suitably located (on the same property) to benefit the same local population of this species that would use habitat within the Action area.
Breeding Habitat*	• Land Zones 5 & 7 and 3, 4 & 10) ○ <i>Remnant or regrowth open-forest to sparse, open-woodland or low-woodland dominated by Eucalyptus, Corymbia, Acacia or Callitris species within <u>one kilometre</u> of a suitable, permanent or seasonal waterbody. It is distinguished by ground-layer vegetation that:</i> ▪ <i>consists of patchy, native, perennial tussock grasses, or a mix of perennial tussock grasses and low shrubs or forbs; and</i> ▪ <i>does not cover more than 33% of the ground.</i> ○ <i>These preferred ground-layer vegetation conditions tend to occur on well-draining, sandy or gravelly soils low, gently sloping, flat to undulating plains and foothills, lateritic (duplex) soils on low 'jump-ups' and escarpments.</i>	The habitat in the Action area is within 1 km of seasonal waterbodies (ephemeral unnamed drainage lines) and therefore all of the potential habitat mapped on Figure 3 - Attachment E is considered to be potentially used for breeding. Noting, however, this species has not been observed breeding in the Action Area. Some areas of vegetation in the early stage of regrowing from past clearance (approximately 198 ha) has been identified as suitable breeding habitat for the Squatter Pigeon (southern). These areas contain a high percentage of native grass species that would provide food resources for the Squatter Pigeon (southern). The remaining portion of the vegetation in the early stage of regrowing from past clearance (approximately 51.5 ha) is not considered potential habitat for this species because the dominant ground cover composition is exotic grasses with native grasses and herbs being less common.	As shown in Figure 4 - Attachment E, Roper Creek and Two Mile Gully traverse the Western Extension Commonwealth Offset Area such that most of the potential habitat for this species is within 1 km of these watercourses and therefore potential breeding habitat. Similar to the Action area, some vegetation in the early stage of regrowing from past clearance (approximately 405.5 ha) is not considered potential habitat for this species because the dominant ground cover composition is exotic grasses with native grasses and herbs being less common (Figure 4 - Attachment E). The Western Extension Commonwealth Offset Area is providing the equivalent type of habitat to that within the Action area. Note that RE11.7.2 was excluded as potential habitat for this species due to very rocky or bare ground with low native grass cover.

Table A-2
Squatter Pigeon (Southern) Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
Foraging Habitat*	• Land Zones 5 & 7 and 3, 4 & 10) ○ <i>Remnant or regrowth open-forest to sparse, open-woodland or low-woodland dominated by Eucalyptus, Corymbia, Acacia or Callitris species within <u>three kilometres</u> of a suitable, permanent or seasonal waterbody. It is distinguished by ground-layer vegetation that:</i> ▪ <i>consists of patchy, native, perennial tussock grasses, or a mix of perennial tussock grasses and low shrubs or forbs; and</i> ▪ <i>does not cover more than 33% of the ground.</i> ○ <i>These preferred ground-layer vegetation conditions tend to occur on well-draining, sandy or gravelly soils low, gently sloping, flat to undulating plains and foothills, lateritic (duplex) soils on low 'jump-ups' and escarpments.</i>	The breeding habitat described above would also provide foraging resources for this species (Figure 3 – Attachment E).	The breeding habitat described above would also provide foraging resources for this species (Figure 4 - Attachment E).
Dispersal Habitat*	○ <i>Dispersal habitat is any forest or woodland occurring between patches of foraging or breeding habitat which facilitates movement between patches of foraging habitat, breeding habitat and/or waterbodies.</i> ○ <i>Dispersal habitat includes vegetation where the groundcover layer has been thinned through current land-use practices in a way that suits the species (e.g. light cattle grazing). The species does disperse into highly modified or degraded habitats, including cleared areas which are within 100 metres of remnant trees or patches of habitat.</i>	The breeding habitat described above would also provide dispersal habitat for this species. There are no additional areas of forest or woodland which would specifically aid the dispersal of the Squatter Pigeon (southern). There are very small areas of cleared land between patches of habitat (less than 100 m apart) as mapped on Figure 3 - Attachment E. These largely comprise of cleared tracks and a pipeline easement. Hence, these areas are not considered 'dispersal habitat' for the species.	The breeding habitat described above would also provide dispersal habitat for this species. There are no additional areas of forest or woodland which would specifically aid the dispersal of the Squatter Pigeon (southern). There are very small areas of cleared land between patches of habitat (less than 100 m apart) as mapped on Figure 4 - Attachment E. These are not considered 'dispersal habitat' for the species.

Table A-2
Squatter Pigeon (Southern) Habitat within the Action Area and Offset Area

Habitat Component	Description	Action Area	Offset Area
	Conclusion	The Western Extension Commonwealth Offset Area is suitably offsetting the impact in the Action area as the offset would provide: - the equivalent type of habitat to that within the Action area (i.e. potentially suitable habitat for the Squatter Pigeon [southern]); - a greater area of potential habitat (approximately 388.5 ha in the Action area verse 1,155 ha in the offset area); - larger patches of potential habitat (refer Figures 3 and 4); and - opportunity to re-establish approximately 405.5 ha of woodland/forest as part of the existing potential breeding habitat (i.e. in areas of regrowth).	

* Habitat Descriptions Provided by the Department of Environment and Energy

Table A-3
Greater Glider Habitat within the Action Area and Offset Area

Habitat Component/ Description*	Action Area	Offset Area
<i>Eucalypt forests and woodlands containing trees with hollows suitable for denning.</i> <i>Any additional vegetation communities the Greater Glider has been recorded from at the project site.</i>	The Greater Glider was recorded on numerous occasions during spotlighting (Figure 5 - Attachment E). This species is locally common and has also been recorded on numerous occasions within the wider locality (Naturecall, 2014; Parsons Brinkerhoff, 2010). Approximately 175 ha of known and potential habitat for the Greater Glider occurs in the Action area represented by all Eucalypt forests and woodlands present as these contain trees with hollows suitable for denning. Hollow-bearing trees and stags are common and a range of hollow-sizes are present i.e. <5 cm to >20 cm diameter cavities. In the Action area, the Greater Glider was recorded within Poplar Box Woodland (RE 11.5.3 and RE 11.3.2). Previous observations of this species on MCPL owned-land have noted that it prefers Eucalypt woodlands and open forest associated with major creeks (which do not occur in the Action area) and drainage lines, equivalent to RE types 11.3.25, 11.3.2, 11.3.4 and 11.3.7. It has also been occasionally noted in Poplar Box woodland equivalent to RE 11.5.3. Based on these previous observations, preferred forage species appear to be Moreton Bay Ash (<i>E. tessellaris</i>), Silver-leaved Ironbark (<i>E. melanophloia</i>) and Poplar Box.	Greater Gliders were observed during a spotlighting survey within the north of the Western Extension Commonwealth Offset area (Figure 6 - Attachment E). The Greater Gliders were recorded in open woodland habitats near Roper Creek equivalent to RE 11.5.3 and RE 11.3.7. Approximately 575 ha of known and potential habitat for the Greater Glider occurs in the Western Extension Commonwealth Offset Area represented by all Eucalypt forests and woodlands present as these contain trees with hollows suitable for denning (Figure 6 - Attachment E). Hollow-bearing trees and stags are common and a range of hollow-sizes are present i.e. <5 cm to >20 cm diameter cavities. The Western Extension Commonwealth Offset Area also contains approximately 400 ha of cleared land likely to have been formerly potential habitat (i.e. Eucalypt forests and woodlands). Note that RE 11.5.2a and 11.5.9 were excluded as potential habitat for this species as the tree canopy was generally sparse, the community was exposed and very dry and hollow-bearing trees were rare.
Conclusion	The Western Extension Commonwealth Offset Area is suitably offsetting the impact in the Action area as the offset would provide: - the equivalent type of habitat to that within the Action area (i.e. potentially suitable habitat for the Greater Glider); - a greater area of potential habitat (approximately 175 ha in the Action area verse 575 ha in the offset area); - larger patches of potential habitat (refer Figures 5 and 6); and - opportunity to re-establish approximately 400 ha of foraging habitat within areas of vegetation in the early stages of regrowth from past clearing (Figure 6 - Attachment E), resulting in 975 ha of habitat in the offset area.	

* Habitat Descriptions Provided by the Department of Environment and Energy

REFERENCES

Department of Sustainability, Environment, Water, Population and Communities (2011) *Environment Protection and Biodiversity Conservation Act 1999, Draft Referral guidelines for the nationally listed Brigalow Belt reptiles*.

Department of the Environment and Energy (2019) *Species Profile and Threats Database*.

Website: <http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl>

Date Accessed: March 2019.

Naturecall Environmental (2014) *Ecological Monitoring for Offset Area, Middlemount Coal Mine*.

Naturecall Environmental (2017) *Ecological Monitoring for Offset Area, Middlemount Coal Mine*.

Parsons Brinkerhoff (2010) *Middlemount Coal Project, Stage 2 Terrestrial Ecological Impact Assessment*. Prepared for Middlemount Coal Pty. Ltd.

ATTACHMENT B**JUSTIFICATION FOR THE INPUTS TO THE COMMONWEALTH OFFSET CALCULATOR**

Table B-1
Calculator Inputs and Output – Squatter Pigeon (Southern) Existing Woodland/Forest Habitat

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	388.5 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Quality (0 to 10)	7	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	Management of the offset areas is expected to improve the quality and composition of habitat for the Squatter Pigeon (southern) as described below under 'future quality with offset'. It is considered that the ecological benefit (future quality described below) is likely to conservatively occur within 15 years given monitoring data from the existing offset areas showing positive trends in recruitment over 5 years (refer to the cover letter).
Start area (ha) (Size of the offset)	749.5 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Start Quality (0 to 10)	7	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	6	The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D). Without the offset, the woodland/forest habitat would continue to be degraded by weed invasion and cattle grazing, and be subjected to edge effects through clearing of adjoining regrowth vegetation.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	8	The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D). A quality value of 8 is considered appropriate because the starting quality is 7 and management of the offset areas would include due to management of threats relevant to this species, namely management of livestock and management of weeds (including Buffel Grass).
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the QLD Vegetation Management Act, 1999. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		45.47%

Table B-2
Calculator Inputs and Output – Squatter Pigeon (Southern) Regrowth Habitat

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	388.5 ha	Refer to Table B-1
Quality (0 to 10)	7	Refer to Table B-1
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	Management of the offset areas is expected to improve the quality and composition of habitat for the Squatter Pigeon (southern) as described below under 'future quality with offset'. It is considered that the ecological benefit (future quality described below) is likely to conservatively occur within 15 years given monitoring data from the existing offset areas showing positive trends in recruitment over 5 years (refer to the cover letter).
Start area (ha) (Size of the offset)	405.5 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Start Quality (0 to 10)	5	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost. As above, the future value of the regrowth habitat in the future could very well be '0' due to clearing for promotion of livestock feed.
Future quality without offset (scale of 0-10)	2	Without the offset the Booroondarra Station would continue to be used for the primary purpose of grazing livestock. Clearing of regrowth is typically undertaken to promote the growth of grass (Buffel Grass) as feed for livestock. The future value of the regrowth habitat in the future could very well be '0' due to clearing for promotion of livestock feed. It has been conservatively assumed that habitat value of the regrowth would be '2' in the future due to the anticipated loss of structural complexity and native ground cover.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	7	The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D). An increase in quality is anticipated with natural regeneration and protection of existing vegetation. A quality value of 7 is considered appropriate because the starting quality is 5 and management of the offset areas would include due to management of threats relevant to this species, namely management of livestock and management of weeds (including Buffel Grass). Further, there is a commitment for regrowth to be management to become remnant (refer to the Offset Management Plan).
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the QLD Vegetation Management Act, 1999. Monitoring data from the existing offset areas showing positive trends in recruitment over 5 years. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		61.5%

Table B-3
Calculator Inputs and Output – Koala Existing Woodland/Forest Habitat

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	175 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys.
Quality (0 to 10)	7	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	Management of the offset areas is expected to improve the quality and composition of habitat for the Koala as described below under 'future quality with offset'. It is considered that the ecological benefit (future quality described below) is likely to conservatively occur within 15 years given monitoring data from the existing offset areas showing positive trends in recruitment over 5 years (refer to the cover letter).
Start area (ha) (Size of the offset)	664.5 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Start Quality (0 to 10)	6	The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	6	Assumed to be the same as the start quality.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	8	The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D). A quality value of 8 is considered appropriate because the starting quality is 6 and management of the offset areas would result in natural regeneration of food trees, reduction in fragmentation and feral predators.
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i> . Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		89.49%

Table B-4
Calculator Inputs and Output – Cleared Land (Regrowth) in the Offset Proposed to Become Koala Habitat

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	175 ha	Refer to Table B-3
Quality (0 to 10)	7	Refer to Table B-3
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	It is considered that the ecological benefit (future quality described below) is likely to conservatively occur within 15 years given there are already signs of natural regeneration occurring and monitoring data from the existing offset areas showing positive trends in recruitment over 5 years.
Start area (ha) (Size of the offset)	400 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys.
Start Quality (0 to 10)	0	The regrowth present is currently too juvenile to provide habitat for the Koala.
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	0	Assumed to be the same as the start quality.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	3	The creation of habitat with at least a future value of '3' is possible given there are already signs of natural regeneration occurring and monitoring data from the existing offset areas showing positive trends in recruitment over 5 years. Management of the offset areas would result in natural regeneration of food trees, reduction in fragmentation and feral predators.
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. For example, with the offset, the regrowth present would be protected from clearance that would otherwise occur in the next five years for grazing purposes. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Monitoring data from the existing offset areas showing positive trends in recruitment over 5 years. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		80.81%

Table B-5
Calculator Inputs and Output – Greater Glider Existing Woodland/Forest Habitat

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	175 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Quality (0 to 10)	7	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	It is considered that the ecological benefit is likely to conservatively occur within 15 years given monitoring data from the existing offset areas showing positive trends in recruitment over 5 years (refer to the cover letter).
Start area (ha) (Size of the offset)	575 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Start Quality (0 to 10)	7	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	7	Assumed to be the same as the start quality.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	8	The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D). A quality value of 8 is considered appropriate because the starting quality is 7 and management of the offset areas would include removal of barbed wire fences and management of feral pests.
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i> . Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		38.72%

Table B-6
Calculator Inputs and Output – Cleared Land (Regrowth) in the Offset Proposed to Become Greater Glider Habitat

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	175 ha	Refer to Table B-5
Quality (0 to 10)	7	Refer to Table B-5
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	It is considered that the ecological benefit (future quality described below) is likely to conservatively occur within 15 years given there are already signs of natural regeneration occurring and monitoring data from the existing offset areas showing positive trends in recruitment over 5 years.
Start area (ha) (Size of the offset)	400 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Start Quality (0 to 10)	0	The regrowth present is currently too juvenile to provide habitat for the Greater Glider.
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	0	Assumed to be the same as the start quality.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	3	The creation of habitat with at least a future value of '3' is possible given there are already signs of natural regeneration occurring and monitoring data from the existing offset areas showing positive trends in recruitment over 5 years. Management of the offset areas would result in natural regeneration of foraging habitat amongst breeding habitat, reduction in fragmentation, barbed wire fences and feral predators.
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Monitoring data from the existing offset areas showing positive trends in recruitment over 5 years. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		80.81%

Table B-7
Calculator Inputs and Output – Ornamental Snake Existing Woodland/Forest Habitat

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	15.5 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Quality (0 to 10)	7	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	It is considered that the ecological benefit (future quality described below) is likely to conservatively occur within 15 years given there are already signs of natural regeneration occurring and monitoring data from the existing offset areas showing positive trends in recruitment over 5 years.
Start area (ha) (Size of the offset)	76 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Start Quality (0 to 10)	7	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) without offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	6	Without the offset, the regrowth present would be cleared in the next five years for grazing purposes. This would lead to higher levels of habitat fragmentation, reducing the quality of the habitat for this species. This would lead to higher levels of habitat fragmentation and habitat destruction caused by cattle trampling, reducing the quality of the habitat for this species. This would also likely lead to a reduction in the abundance of prey species (i.e. frogs) and increase in abundance of weed and pest species. The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	8	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D). An increase in quality is anticipated with natural regeneration and protection of existing vegetation. A quality value of 8 is considered appropriate because the starting quality is 7 and management of the offset areas would include the following measures relevant to the Ornamental Snake: - no vegetation in or adjacent patches of suitable habitat would be cleared, unless required for management purposes (e.g. fire breaks); - management of livestock (i.e. rotational grazing); - pest animal management strategy; and - weed management strategy.

Aspect	Input	Justification
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		115%

Table B-8
Calculator Inputs and Output – Cleared Land (Regrowth) in the Offset Proposed to Become Ornamental Snake Habitat

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	15.5 ha	Refer to Table B-7
Quality (0 to 10)	7	Refer to Table B-7
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	It is considered that the ecological benefit (future quality described below) is likely to conservatively occur within 15 years given there are already signs of natural regeneration occurring and monitoring data from the existing offset areas showing positive trends in recruitment over 5 years.
Start area (ha) (Size of the offset)	30 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys (refer to Attachment A).
Start Quality (0 to 10)	0	The regrowth present is currently too juvenile to provide habitat for the Ornamental Snake.
Risk of loss (%) without offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	0	Assumed to be the same as the start quality.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	3	The creation of habitat with at least a future value of '3' is possible given there are already signs of natural regeneration occurring and monitoring data from the existing offset areas showing positive trends in recruitment over 5 years. MCPL will exclude livestock from the Cleared Land Likely to be Formerly Potential Habitat (Brigalow Woodland – RE11.3.1) within a year after approval.
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i> . Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		68.43%

Table B-9
Calculator Inputs and Output – Brigalow TEC

Aspect	Input	Justification
Impact		
Species Status	Endangered	-
Area of Habitat to be Impacted	22 ha	Area defined by Biodiversity Australia (2018) during field surveys.
Quality (0 to 10)	7	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D). Approximately 30% (6.5 ha) of the Brigalow TEC is regrowth.
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	It is considered that the ecological benefit is likely to conservatively occur within 15 years given monitoring data from the existing offset areas showing positive trends in recruitment over 5 years (refer to the cover letter).
Start area (ha) (Size of the offset)	76 ha	Area defined by Biodiversity Australia (2018) during field surveys.
Start Quality (0 to 10)	7	The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	6	Without the offset, a minor decrease in the quality of the Brigalow TEC is possible due as Naturalised pasture grasses are promoted for livestock feed. Weeds are controlled ad hoc and mostly along tracks and in open cleared areas, not within woodland and forest.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	8	An increase in quality is anticipated due to an increase in the connectivity of habitat and reduced edge effects on existing patches, a decrease in the threats posed by pest animals due to improved pest animal management, less weeds due to improved weed management and less risk of out of control fires.
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		70.15%

Table B-10
Calculator Inputs and Output – Cleared Land (Regrowth) in the Offset Proposed to Become Brigalow TEC

Aspect	Input	Justification
Impact		
Species Status	Endangered	-
Area of Habitat to be Impacted	22 ha	Refer to Table B-9
Quality (0 to 10)	7	Refer to Table B-9
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	It is considered that the ecological benefit (future quality described below) is likely to conservatively occur within 15 years given there are already signs of natural regeneration occurring and monitoring data from the existing offset areas showing positive trends in recruitment over 5 years.
Start area (ha) (Size of the offset)	30 ha	Area defined by Biodiversity Australia (2018) during field surveys.
Start Quality (0 to 10)	0	The regrowth present does not meet the definition of Brigalow TEC.
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	0	Without the offset, the regrowth present would be cleared in the next five years for grazing purposes. This would lead to higher levels of weed incursion which is a recognised threat to this community. In addition, as no grazing management strategy would be in place, it is likely that there would be reduction in the recruitment of native species.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	4	The creation of habitat with at least a future value of '4' is possible given there are already signs of natural regeneration occurring and monitoring data from the existing offset areas showing positive trends in recruitment over 5 years. MCPL will exclude livestock from the Cleared Land Likely to be Formerly Potential Habitat (Brigalow Woodland – RE11.3.1) within a year after approval.
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the QLD <i>Vegetation Management Act, 1999</i> . Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		55.38%

Table B-11
Calculator Inputs and Output – Stage 2 Commonwealth Offset (Brigalow)

Aspect	Input	Justification
Impact		
Species Status	Endangered	-
Area of Habitat to be Impacted	11 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys.
Quality (0 to 10)	6	In consideration of the site condition and context, a quality value of 6 is considered appropriate for Brigalow TEC on-site because much of the Brigalow TEC to be cleared has been subject to past disturbances. Approximately 60% (6.5 ha) of the Brigalow Woodland is regrowth.
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	Management of the offset areas is expected to improve the quality and composition of Brigalow Woodland. Management of the offset areas would include the following measures relevant to Brigalow: • no vegetation in or adjacent patches of suitable habitat would be cleared, unless required for management purposes (e.g. fire breaks); • weed management strategy; • management of livestock (i.e. rotational grazing); and • fire management. It is considered that the ecological benefit is likely to conservatively occur within 15 years.
Start area (ha) (Size of the offset)	29.5 ha	Area defined during field survey, consisting of 29.5 ha of woodland habitat mapped by Biodiversity Australia (2018).
Start Quality (0 to 10)	6	Areas of habitat within the offset areas are considered to have a similar starting quality as the habitat in the impact area.
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	4	Without the offset, the regrowth present would be cleared in the next five years for grazing purposes. This would lead to higher levels of weed incursion which is a recognised threat to this community. In addition, as no grazing management strategy would be in place, it is likely that there would be reduction in the recruitment of native species.
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality with offset (scale of 0-10)	8	An increase in quality is anticipated with natural regeneration. A quality value of 8 is considered appropriate because the starting quality is 6 and management of the offset areas would include the following measures relevant to Brigalow: • no vegetation in or adjacent patches of suitable habitat would be cleared, unless required for management purposes (e.g. fire breaks); • weed management strategy; • management of livestock (i.e. rotational grazing); and • fire management. In addition, regeneration of regrowth vegetation that would occur if the offset is established would allow for greater connectivity between the patches of Brigalow EEC, and minimise the threat of weed incursion. Further to this, the grazing management strategy would enable recruitment of native plant species and maintain a good cover of litter and woody debris including logs and fallen tree limbs.

Aspect	Input	Justification
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		127.07%

Table B-12
Calculator Inputs and Output – Stage 2 Commonwealth Offset (Squatter Pigeon)

Aspect	Input	Justification
Impact		
Species Status	Endangered	-
Area of Habitat to be Impacted	32 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys.
Quality (0 to 10)	7	In consideration of the site condition and context, a quality value of 7 is considered appropriate for the Squatter Pigeon (southern) because: • this species has been recorded in one location within the Action area. • much of the potential habitat to be cleared has been subject to past disturbances (e.g. logging). The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a).
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	Management of the offset areas is expected to improve the quality and composition of habitat for the Squatter Pigeon (southern). Management of the offset areas would include the following measures relevant to the Squatter Pigeon (southern): • no vegetation in or adjacent patches of suitable habitat would be cleared, unless required for management purposes (e.g. fire breaks); • regeneration and active seeding/planting (if required); • weed management strategy; • pest animal management strategy; • management of livestock (i.e. rotational grazing). It is considered that the ecological benefit is likely to conservatively occur within 15 years.
Start area (ha) (Size of the offset)	114 ha	Area defined during field survey, consisting of 114 ha of woodland habitat mapped by Biodiversity Australia (2018).
Start Quality (0 to 10)	6	Areas of habitat within the offset areas are considered to have a similar starting quality as the habitat in the impact area. The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	5	Areas of habitat within the offset areas are considered to have a similar starting quality as the habitat in the impact area. The starting score is slightly less than that of the impact area given greater areas of regenerating habitat included in the potential habitat mapping, thereby bringing down the quality score. The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.

Aspect	Input	Justification
Future quality with offset (scale of 0-10)	8	An increase in quality is anticipated with natural regeneration and protection of existing vegetation. A quality value of 8 is considered appropriate because the starting quality is 6 and management of the offset areas would include the following measures relevant to the Squatter Pigeon (southern): • regeneration; • erosion and sediment control; • management of livestock; • restrictions to access; • additional habitat features; and • removal of barbed wire. Regeneration of derived grassland/regrowth vegetation that would occur if the offset is established would allow for greater connectivity between the patches of woodland vegetation, thereby increasing the habitat quality for this species. Further to this, the regrowth vegetation that is currently present within the offset area would not be cleared for agricultural purposes, thereby increasing habitat connectivity and availability for the Squatter Pigeon (southern). The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the QLD Vegetation Management Act, 1999. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		125.95%

Table B-13
Calculator Inputs and Output – Stage 2 Commonwealth Offset (Ornamental Snake)

Aspect	Input	Justification
Impact		
Species Status	Vulnerable	-
Area of Habitat to be Impacted	7 ha	Habitat area defined by Biodiversity Australia (2018) during field surveys.
Quality (0 to 10)	6	In consideration of the site condition and context, a quality value of 6 is considered appropriate for the Ornamental Snake because: - this species has not been recorded within the Action area despite targeted survey work. - the Action area does not contain large areas of Gilgai habitat. The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Offset		
Time over which loss is averted (max. 20 years)	20 years	An arrangement would be made for the enduring protection and management of the offset area.
Time until ecological benefit	15 years	Management of the offset areas is expected to improve the quality and composition of habitat for the Ornamental Snake. Management of the offset areas would include the following measures relevant to the Ornamental Snake: - no vegetation in or adjacent patches of suitable habitat would be cleared, unless required for management purposes (e.g. fire breaks); - management of livestock (i.e. rotational grazing); - pest animal management strategy; and - weed management strategy. It is considered that the ecological benefit is likely to conservatively occur within 15 years.
Start area (ha) (Size of the offset)	29.5 ha	Area defined during field survey, consisting of 29.5 ha of woodland habitat mapped by Biodiversity Australia (2018).
Start Quality (0 to 10)	6	Areas of habitat within the offset areas are considered to have a similar starting quality as the habitat in the impact area, however the presence of permanent waterbodies increase the quality of habitat for this species based on the likely presence of prey species. The habitat quality score has been calculated using the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) without offset	0%	Within the next 20 years, without the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.
Future quality without offset (scale of 0-10)	6	The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a) (refer to Attachment D).
Risk of loss (%) with offset	0%	Within the next 20 years, with the offset, it is conservatively assumed that there is a 0% risk that the ecological values will be lost.

Aspect	Input	Justification
Future quality with offset (scale of 0-10)	8	An increase in quality is anticipated with natural regeneration and protection of existing vegetation. A quality value of 8 is considered appropriate because the starting quality is 6 and management of the offset areas would include the following measures relevant to the Ornamental Snake: • no vegetation in or adjacent patches of suitable habitat would be cleared, unless required for management purposes (e.g. fire breaks); • management of livestock (i.e. rotational grazing); • pest animal management strategy; and • weed management strategy. The management of livestock within the offset area would significantly reduce the likelihood of habitat destructions/degradation caused by cattle trampling. The habitat quality score has been calculated by using predicted inputs into the <i>Guide to Determining Terrestrial Habitat Quality Version 1.2</i> (DEHP, 2017a).
Confidence in the result	85%	There is a high level of confidence that loss of habitat values in the offset areas would be averted because an arrangement would be made for the enduring protection and management of the offset areas. MCPL has a positive history in regards to meeting offsetting requirements. For example, in accordance with Conditions 1 and 2 of the Commonwealth Approval Decision (EPBC 2010/5394), appropriate long-term security for the Stage 2 Biodiversity Offset Area was established by securing a voluntary declaration of the area under the <i>QLD Vegetation Management Act, 1999</i>. Further, it is noted that the land on which the offset area is proposed is freehold land owned by MCPL and as a result, there is certainty regarding the management commitments.
Calculator Output - % of Impact Offset		115.88%

ATTACHMENT C**JUSTIFICATION FOR THE PROPOSED MANAGEMENT MEASURES AND SUBSEQUENT INCREASE IN
HABITAT QUALITY SCORE**

Table C-1
Justification for the Proposed Management Measures and Subsequent Increase in Habitat Quality Score

Recognised Management Actions as per the DEE SPRAT Profile	MCPL Proposed Management Actions	Specific Habitat Requirements of the MNES being Affected by the Proposed Management Actions	Change in Habitat Quality Score
Brigalow EEC			
<i>Limiting disturbance/ clearing in or adjacent to remnants to minimise weed incursion</i>	No vegetation in or adjacent remnants would be cleared, unless required for management purposes (e.g. fire breaks).	All Brigalow EEC habitat components would benefit.	The management action would minimise weed incursion (as acknowledged by the SPRAT profile) and therefore result in a decrease in non-native plant cover and increase in habitat quality score. Actions would also result in an increase in the connectedness of the existing patches by avoiding loss of regenerating Brigalow.
<i>Making regular checks and carrying out appropriate treatment to avoid weed invasion</i>	The procedure for controlling and monitoring environmental weeds/restricted invasive plants will be implemented annually, during spring to early summer.	Improve the quality of the understory of the Brigalow EEC	The management action would minimise weed incursion (as acknowledged by the SPRAT profile) and therefore result in a decrease in non-native plant cover and increase in habitat quality score.
<i>Managing grazing in a way that enables recruitment of native plant species and maintains a good cover of litter and woody debris including logs and fallen tree limbs</i>	Strategic rotational grazing of cattle and cattle exclusion will be practiced to allow natural regeneration to continue and leaf litter/coarse woody debris to accumulate through natural processes.	Improve the quality of the understory and groundcover of the Brigalow EEC	The management action would result in continued natural regeneration, increased litter and CWD cover and increase in habitat quality score.
<i>Managing grass fuel loads to avoid hot fires in remnants</i>	Grass fuel loads in Brigalow will be managed through rotational cattle grazing and strategic burning as part of a fire management plan	All Brigalow EEC habitat components would benefit.	The management action would manage grass fuel loads and reduce the potential for hot fires.
<i>Maintaining fire breaks to avoid hot fires in remnants</i>	Creation and maintenance of fire tracks (fire breaks) for fire control.	All Brigalow EEC habitat components would benefit.	Actions would result in an increase in the connectedness of the existing patches by avoiding loss of some remnants through bushfire.
Squatter Pigeon (southern)			
<i>Protect sub-populations of the subspecies through the development of covenants and conservation agreements, or by including them in reserve tenure.</i>	The species' habitat in the proposed offset area would be secured under a VDec.	All Squatter Pigeon (southern) habitat components would benefit.	The management measures that accompany the VDec would result in an improvement of the habitat quality score.
<i>Manage threats to areas of vegetation that support important sub-populations of the Squatter Pigeon (southern).</i> Recognised threats include: - Loss of habitat; - degradation of habitat by invasive weeds; - predation from feral cats	No vegetation in or adjacent patches of suitable habitat would be cleared, unless required for management purposes (e.g. fire breaks). The procedure for controlling and monitoring environmental weeds/restricted invasive plants will be implemented annually, during spring to early summer. Appropriately qualified persons will be engaged to undertake pest animal control annually or more frequently as required.	All Squatter Pigeon (southern) habitat components would benefit.	The management action would result in a decrease in non-native plant cover, an increase in quality and availability of foraging and shelter habitat, reduction in the threats, and increase in habitat quality score.

Recognised Management Actions as per the DEE SPRAT Profile	MCPL Proposed Management Actions	Specific Habitat Requirements of the MNES being Affected by the Proposed Management Actions	Change in Habitat Quality Score
<i>Protect and rehabilitate areas of vegetation that support important sub-populations.</i>	The primary method for regenerating the offset areas will be through management of threatening processes that inhibit natural regeneration. In the unlikely event that natural regeneration is not readily occurring or species composition is poor, contingency measures include active seeding/planting or disturbance to reduce competition.	All Squatter Pigeon (southern) habitat components would benefit.	The management action would result in an increase in context and connectedness of suitable habitat, quality and availability of foraging and shelter habitat and increase in habitat quality score.
<i>Develop and implement a stock management plan for key sites.</i>	Rotational grazing of cattle will be implemented within the offset area.	Improve the quality of the understory habitat for the Squatter Pigeon (southern)	The management action would result in an increase in quality and availability of foraging habitat and increase in habitat quality score.
<i>Develop and implement a management plan, or nominate an existing plan to be implemented, for the control and eradication of feral herbivores in areas inhabited by the squatter pigeon (southern).</i>	An Offset Management Plan has been developed for the offset areas and contains measures for feral animal control. Appropriately qualified persons will be engaged to undertake pest animal control annually or more frequently as required.	Improve the quality of the understory habitat for the Squatter Pigeon (southern)	The management action would result in an increase in quality and availability of foraging habitat and increase in habitat quality score.
<i>Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them, if necessary.</i>	MNES fauna relevant to each offset area will be monitored over time to document their usage of the relevant offset area(s) and determine the success of the management actions being implemented.	All Squatter Pigeon (southern) habitat components would benefit.	Monitoring would confirm the success of the management actions and allow MCPL to adjust the actions if required, making sure that habitat quality scores would continue to increase.
Koala			
<i>Development plans should explicitly address ways to mitigate risk of vehicle strike when development occurs adjacent to, or within, Koala habitat.</i>	Access into the offset areas will be restricted to authorised personnel. Locks will be installed on gates into the offset areas and vehicles will be restricted to designated access tracks. Speed limits of 60 km per hour will be imposed on vehicles using access tracks.	All Koala habitat components would benefit.	The management action would result in decrease in the threats to the Koala and increase in habitat quality score.
<i>Develop and implement a management plan to control the adverse impacts of predation on Koalas by dogs in urban, peri-urban and rural environments.</i>	Appropriately qualified persons will be engaged to undertake pest animal control annually or more frequently as required.	All Koala habitat components would benefit.	The management action would result in decrease in the threats to the Koala and increase in habitat quality score.
<i>Manage any other known, potential or emerging threats such as a Bell Miner (Manorina melanophrys) Associated Dieback or Eucalyptus rust.</i>			
<i>Develop and implement options of vegetation recovery and re-connection in regions containing fragmented Koala populations, including inland regions in which Koala populations were diminished by drought and coastal regions where development pressures have isolated Koala populations.</i>	The primary method for regenerating the offset areas will be through management of threatening processes that inhibit natural regeneration. In the unlikely event that natural regeneration is not readily occurring or species composition is poor, contingency measures include active seeding/planting or disturbance to reduce competition.	All Koala habitat components would benefit.	The management action would result in an increase in context and connectedness of suitable habitat, quality and availability of foraging and shelter habitat and increase in habitat quality score.

Recognised Management Actions as per the DEE SPRAT Profile	MCPL Proposed Management Actions	Specific Habitat Requirements of the MNES being Affected by the Proposed Management Actions	Change in Habitat Quality Score
<i>Investigate formal conservation arrangements, management agreements and covenants on private land, and, for both Crown and private land, investigate and/or secure inclusion of habitat critical to the survival of the Koala in reserve tenure, if possible.</i>	The species' habitat in the proposed offset area would be secured under a VDec.	All Koala habitat components would benefit.	The management measures that accompany the VDec would result in an improvement of the habitat quality score.
<i>Develop and implement a development planning protocol to be used in areas of Koala sub-populations or sub-population fragments to prevent loss of Koala sub-populations, habitat critical to the survival of the species and vital habitat connectivity.</i>	MNES fauna relevant to each offset area will be monitored over time to document their usage of the relevant offset area(s) and determine the success of the management actions being implemented.	All Koala habitat components would benefit.	Monitoring would confirm the success of the management actions and allow MCPL to adjust the actions if required, making sure that habitat quality scores would continue to increase.
<i>Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them, if necessary.</i>			
Greater Glider			
<i>Removal of barbed wire fencing to avoid entanglement</i>	Barbed wire fencing within the offset areas will be removed upon exclusion of grazing.	All Greater Glider habitat components would benefit.	The management action would result in decrease in the threats to the Greater Glider and increase in habitat quality score.
<i>Reduce the frequency and intensity of prescribed burns.</i>	Ground fuel loads will be controlled through the strategic rotational grazing of cattle to prevent thick grass biomass from accumulating over time. In addition, creation and maintenance of fire tracks (fire breaks) for fire control will be undertaken.	All Greater Glider habitat components would benefit.	The management action would result in an increase in quality and availability of foraging and shelter habitat, reduction in the threats, and increase in habitat quality score.
<i>Constrain clearing in forests with significant subpopulations, to retain hollow-bearing trees and suitable habitat.</i>	No vegetation in or adjacent patches of suitable habitat would be cleared to retain hollow bearing trees, unless required for management purposes (e.g. fire breaks).	All Greater Glider habitat components would benefit.	The management action would result in an increase in context and connectedness of suitable habitat, quality and availability of foraging and shelter habitat and increase in habitat quality score.
<i>Avoid fragmentation and habitat loss due to development and upgrades of transport corridors.</i>			
<i>Develop conservation covenants on lands with high value for this species.</i>	The species' habitat in the proposed offset area would be secured under a VDec.	All Greater Glider habitat components would benefit.	The management measures that accompany the VDec would result in an improvement of the habitat quality score.
Ornamental Snake			
<i>Avoid habitat fragmentation and loss through clearing (roads, ploughing, railways, mining-related activities, pipeline constructions)</i>	No vegetation in or adjacent patches of suitable habitat would be cleared, unless required for management purposes (e.g. fire breaks).	All Ornamental Snake habitat components would benefit.	The management action would result in an increase in context and connectedness of suitable habitat, quality and availability of foraging and shelter habitat and increase in habitat quality score.
<i>Reduce habitat degradation by overgrazing by stock, especially cattle, or grazing of gilgais during the wet season leads to soil compaction and compromising of soil structure</i>	Rotational grazing of cattle will be implemented within the offset area.	Improve the quality of the understory habitat for the Ornamental Snake.	The management action would result in an increase in quality and availability of foraging and shelter habitat, reduction in the threats, and increase in habitat quality score.

Recognised Management Actions as per the DEE SPRAT Profile	MCPL Proposed Management Actions	Specific Habitat Requirements of the MNES being Affected by the Proposed Management Actions	Change in Habitat Quality Score
<i>Control of invasive weeds.</i>	The procedure for controlling and monitoring environmental weeds/restricted invasive plants will be implemented annually, during spring to early summer. The spread and introduction of environmental weeds/restricted invasive plants to and within the offset areas will be minimised by restricting vehicles to designated access tracks.	Improve the quality of the understory habitat for the Ornamental Snake.	The management action would result in a decrease in non-native plant cover, an increase in quality of foraging and shelter habitat, reduction in the threats, and increase in habitat quality score.
<i>Control introduced pests such as pigs to manage threats at known sites.</i>	Appropriately qualified persons will be engaged to undertake pest animal control annually or more frequently as required.	Improve the quality of the understory habitat for the Ornamental Snake.	The management action would result in a reduction in the threats, and increase in habitat quality score.
<i>Develop and implement a management plan for the control of Cane Toads in the region.</i>			
<i>Negotiate management agreements and voluntary conservation agreements with landholders, on whose land the Ornamental Snake occurs, in line with the recommended management guidelines.</i>	The species' habitat in the proposed offset area would be secured under a VDec.	All Ornamental Snake habitat components would benefit.	The management measures that accompany the VDec would result in an improvement of the habitat quality score.
<i>Implement recommended fire management guidelines in property and reserve designs.</i>	Ground fuel loads will be controlled through the strategic rotational grazing of cattle to prevent thick grass biomass from accumulating over time. In addition, creation and maintenance of fire tracks (fire breaks) for fire control will be undertaken.	All Ornamental Snake habitat components would benefit.	The management action would result in an increase in quality of foraging and shelter habitat and increase in habitat quality score.
<i>Monitor and evaluate recovery actions applying an adaptive management approach.</i>	MNES fauna relevant to each offset area will be monitored over time to assess the success of the management actions being implemented.	All Ornamental Snake habitat components would benefit.	Monitoring would confirm the success of the management actions and allow MCPL to adjust the actions if required, making sure that habitat quality scores would continue to increase.

ATTACHMENT D

TERRESTRIAL HABITAT QUALITY DATA

Squatter Pigeon (southern)

Terrestrial Habitat Quality Data was collected using the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (Department of Environment and Heritage Protection, 2017a).

Table D-1 provides the Terrestrial Habitat Quality Data for the Squatter Pigeon (southern) habitat in the Action Area.

Table D-1
Terrestrial Habitat Quality Data Action Area – Squatter Pigeon (southern)

Assessment Unit	1	2	3	4	5	6
RE	11.3.1	11.3.2	11.3.4	11.3.27	11.5.3	11.4.9
Assessment Unit Area (ha)	15	43.5	1.5	1.9	128	0.5
Recruitment of wood perennial species in EDL (%)	100	58	75	100	74	100
Native plant species richness- trees	5	4	4	7	11	12
Native plant species richness- shrubs	2	3	2	0	3	2
Native plant species richness- grasses	6	10	0	8	7	8
Native plant species richness- forbs	10	11	5	13	4	6
Tree canopy height	13.5	17.5	20	7.5	17.4	15
Tree canopy cover (%)	48.6%	21.1%	47.1%	47.7%	23.4%	54.6%
Shrub canopy cover (%)	10.9%	3.9%	0%	0%	9.5%	9.3%
Native perennial grass cover (%)	3%	4.5%		19%	11.8%	36%
Organic litter cover (%)	23%	12.5%	39%	18%	38.3%	51%
Large Trees	3	14	20	22	10	8
Coarse woody debris (m)	678.5	267.5	346	176	456	349
Non-native plant cover (%)	17.5%	82.5%	60%	10%	33.8%	10%
Size of patch	10	10	0	7	10	0
Connectedness	4	2	0	5	4	4
Context	4	4	4	4	4	4
Ecological corridors	6	6	6	6	6	6
Threats to species	7	7	7	7	7	7
Quality and availability of foraging habitat	5	5	1	5	5	5
Quality and availability of shelter	5	10	1	1	5	5
Species mobility category	10	10	10	10	10	10
Role of the site location to species overall population in the state	1	1	1	1	1	1
Score Total	7.19					

The following notes are made in relation to the data in Table D-1:

- The 'threats to the species' was assessed as 'moderate threat level' due to presence of feral cats and risk of fires, recognised threats to this species.
- The 'quality and availability of foraging habitat' was assessed as 'low to moderate' as some assessment units contained higher quality habitat than others.
- The 'quality and availability of shelter' was assessed as 'low to high' due to some RE's providing high quality habitat while others only provide poor shelter habitat such as areas with dense exotic grasses and areas with sparse groundcover.
- The 'species mobility category' was assessed as '10 (i.e. *Minor Restriction [0-25% Reduction]*)' due to the high mobility of this species and that no barriers to movement exist.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' as the impact site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

Table D-2 provides the 'Species Habitat Index Scoring Guide' from the *Guide to Determining Terrestrial Habitat Quality Version 1.2* (Department of Environment and Heritage Protection, 2017a).

Table D-2
Species Habitat Index Scoring Guide

1 Threats to Species	Score	1	7	15	-
	Description	High Threat Level (i.e. likely to result in death, irreversible damage)	Moderate Threat Level	Low Threat Level (i.e. likely to survive)	-
2 Quality and Availability of Food and Foraging Habitat	Score	1	5	10	-
	Description	Poor	Moderate	High	-
3 Quality and Availability of Shelter	Score	1	5	10	-
	Description	Poor	Moderate	High	-
4 Species Mobility Capacity	Score	1	4	7	10
	Description	Severely Restricted (76-100% reduction)	Highly Restricted (51-75% Reduction)	Moderately Restricted (26-50% Reduction)	Minor Restriction (0-25% Reduction)
5 Role of Site Location to Species Overall Population in the State	Score	1	4	5	-
	Description	Not or Unlikely to be Critical to Species' Survival	Likely to be Critical to Species' Survival	Critical to Species' Survival	-

Source: Department of Environment and Heritage Protection (2017a)

Table D-3 provides the Terrestrial Habitat Quality Data for the Squatter Pigeon (southern) woodland/forest habitat in the Western Extension Commonwealth Offset Area.

Table D-3
Terrestrial Habitat Quality Data Western Extension Commonwealth Offset Area – Squatter Pigeon (southern) (Woodland/Forest Habitat)

Assessment Unit	1	2	3	5	6	7	8	9	10	11	12	14
RE	11.3.1	11.3.2	11.3.25	11.3.4	11.3.7	11.4.8 ⁻	11.4.9	11.5.18 [^]	11.5.2	11.5.3	11.5.9	11.7.4*
Assessment Unit Area (ha)	16.5	281	57	117.5	29	17	42.5	9	52.5	86.5	23.5	13.5
Recruitment of wood perennial species in EDL (%)	90	75	75	64	40	100	88	60	75	50	25	50
Native plant species richness- trees	6	12	8	11	7	7	11	5	7	14	7	18
Native plant species richness- shrubs	3	4	0	3	1	7	4	1	4	3.5	0	4
Native plant species richness- grasses	5	5	2	4	5	7	6	5	4	6	8	6
Native plant species richness- forbs	9	6	4	5	6	5	5	2	5	8.5	5	2
Tree canopy height	13	18	20	18.8	16	14	14	2.50	15	16	12	18
Tree canopy cover (%)	45%	32%	69%	31.2%	14.5%	48%	52.90%	0%	25%	54.3%	0%	36.5%
Shrub canopy cover (%)	6.9%	2.5%	1%	3.3%		19.90%	31.50%	30.50%	0%	17.3%	3%	4.5%
Native perennial grass cover (%)	15.1%	14%	10%	17.6%	2%	8%	13.10%	12.20%	21%	22.5%	23%	18.8%

Assessment Unit	1	2	3	5	6	7	8	9	10	11	12	14
Organic litter cover (%)	51%	45.5%	44%	37.8%	22%	52%	56%	7%	36%	45.5%	33%	41%
Large Trees	5	4	13	10	6	5	6.50	6	5	3		13
Coarse woody debris (m)	1684.5	273.5	101	483.3	904	1258	1729.50	28	641	415	231	623
Non-native plant cover (%)	10%	10%	60%	41.3%	75%	5%	7.50%	0%	0%	7.5%	5%	10%
Size of patch	10	10	10	10	10	10	10	10	10	10	10	10
Connectedness	2	4	4	4	5	2	2	5	5	5	5	5
Context	4	4	4	4	4	4	4	5	5	4	5	4
Ecological corridors	6	6	6	6	6	6	6	6	6	6	6	6
Threats to species	7	7	7	7	7	7	7	7	7	7	7	7
Quality and availability of foraging habitat	5	5	5	5	5	5	5	5	5	5	5	5
Quality and availability of shelter	5	5	5	5	5	5	5	5	5	5	5	5
Species mobility category	10	10	10	10	10	10	10	10	10	10	10	10
Role of the site location to species overall population in the state	1	1	1	1	1	1	1	1	1	1	1	1
Current Habitat Quality	6.82											
Future Quality without Offset	6.06											
Future Quality with Offset	7.99											

⁻ Local benchmark created by GHD in 2012 was used for the calculator runs.

[^] Benchmark data has been established based on the field data collected during the assessment for the north-eastern Extension Project.

* In 2017, a reference site was undertaken in RE 11.7.4 to establish a local benchmark as no formal benchmark has been established by the Herbarium to date.

The following notes are made in relation to the species index scoring in Table D-3:

- The 'threats to the species' was assessed as 'moderate threat level' due to presence of feral cats and risk of fires, recognised threats to this species.
- The 'quality and availability of foraging habitat' was assessed as 'moderate' due to presence of areas of moderate quality foraging habitat.
- The 'quality and availability of shelter' was assessed as 'moderate' due to presence of areas of suitable shelter habitat.
- The 'species mobility category' was assessed as '10 (i.e. *Minor Restriction [0-25% Reduction]*)' due to the high mobility of this species and that no barriers to movement exist.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' as the offset site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

The species index scoring for a future without the offset has been assessed as:

- A reduction in the 'quality and availability of foraging habitat' to 'poor' due to the presences of recognised threats to this species (loss and fragmentation of habitat due to clearing for agricultural purposes, the degradation of habitat by livestock and the degradation of habitat by invasive weeds, such as Buffel Grass).
- A reduction in the 'quality and availability of shelter habitat' to 'poor' due to the presences of recognised threats to this species (loss and fragmentation of habitat due to clearing for agricultural purposes, the degradation of habitat by livestock, the degradation of habitat by invasive weeds (such as Buffel Grass) and predation by pest animals.
- A reduction in the 'species mobility category' to '7 (i.e. *Moderately Restricted [25-50%]*)' due to the presences of recognised threats to this species (loss and fragmentation of habitat due to clearing for agricultural purposes).

The species index scoring for a future with the offset has been assessed as follows:

- A decrease in the 'threats to the species' to 'low threat level' due to management of threats relevant to this species, namely management of livestock and management of weeds (including Buffel Grass).
- An increase in the 'quality and availability of foraging habitat' to 'high' due to management of threats relevant to this species, namely management of livestock and management of weeds (including Buffel Grass).
- An increase in the 'quality and availability of shelter habitat' to 'high' due to management of threats relevant to this species, namely management of livestock and management of weeds (including Buffel Grass).

Table D-4 provides the Terrestrial Habitat Quality Data for the Squatter Pigeon (southern) regrowth habitat in the Western Extension Commonwealth Offset Area.

Table D-4
Terrestrial Habitat Quality Data Western Extension Commonwealth Offset Area – Squatter Pigeon (southern) (Regrowth Habitat)

Assessment Unit	1	2	3
RE	Regrowth 11.3.2	Regrowth 11.3.4	Regrowth 11.5.3
Assessment Unit Area (ha)	105.4	12.27	833
Recruitment of wood perennial species in EDL (%)	100	100	100
Native plant species richness- trees	8	4	6
Native plant species richness- shrubs	5	3	12
Native plant species richness- grasses	4	5	8
Native plant species richness- forbs	4	6	5
Tree canopy height	2.50	15	2.50
Tree canopy cover (%)		11%	
Shrub canopy cover (%)	3%	0%	32.60%
Native perennial grass cover (%)	16%	12%	17%
Organic litter cover (%)	25%	32%	13%
Large Trees	1	4	0
Coarse woody debris (m)	4440	29	974
Non-native plant cover (%)	40%	50%	30%
Size of patch	10	10	10
Connectedness	4	4	5
Context	4	4	4
Ecological corridors	6	6	6
Threats to species	1	1	1
Quality and availability of foraging habitat	5	5	5
Quality and availability of shelter	5	5	5
Species mobility category	10	10	10
Role of the site location to species overall population in the state	1	1	1
Current Habitat Quality	5.8		
Future Quality without Offset	2*		
Future Quality with Offset	7.48		

* Without the offset the Booroondarra Station would continue to be used for the primary purpose of grazing livestock. Clearing of regrowth is typically undertaken to promote the growth of grass (Buffel Grass) as feed for livestock. The future value without the regrowth habitat in the offset could very well be '0' due to clearing for promotion of livestock feed. It has been conservatively assumed that habitat value of the regrowth would be '2' in the future due to the anticipated loss of structural complexity and native ground cover.

The following notes are made in relation to the data in Table D-4:

- The 'threats to the species' was assessed as 'high threat level' due to land use (e.g. clearing of regrowth, naturalised grasses, pests).
- The 'quality and availability of foraging habitat' was assessed as 'moderate' due to presence of areas of moderate quality foraging habitat.
- The 'quality and availability of shelter' was assessed as 'moderate' due to presence of areas of suitable shelter habitat.
- The 'species mobility category' was assessed as '10 (i.e. *Minor Restriction [0-25% Reduction]*)' due to the high mobility of this species and that no barriers to movement exist.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' as the offset site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

The species index scoring for a future with the offset has been assessed as follows:

- A decrease in the 'threats to the species' to 'low threat level' due to management of threats relevant to this species, namely management of livestock and management of weeds (including Buffel Grass).
- An increase in the 'quality and availability of foraging habitat' to 'high' due to management of threats relevant to this species, namely management of livestock and management of weeds (including Buffel Grass).
- An increase in the 'quality and availability of shelter habitat' to 'high' due to management of threats relevant to this species, namely management of livestock and management of weeds (including Buffel Grass).

Koala

Table D-5 provides the Terrestrial Habitat Quality Data for the Koala habitat in the Action Area.

Table D-5
Terrestrial Habitat Quality Data Action Area – Koala

Assessment Unit	2	3	4	5
RE	11.3.2	11.3.4	11.3.27	11.5.3
Assessment Unit Area (ha)	43.5	1.5	1.9	128
Recruitment of wood perennial species in EDL (%)	58	75	100	74
Native plant species richness- trees	4	4	7	11
Native plant species richness- shrubs	3	2	0	3
Native plant species richness- grasses	10	0	8	7
Native plant species richness- forbs	11	5	13	4
Tree canopy height	17.5	20	7.5	17.4
Tree canopy cover (%)	21.1%	47.1%	47.7%	23.4%
Shrub canopy cover (%)	3.9%	0%	0%	9.5%
Native perennial grass cover (%)	4.5%	0%	19%	11.8%
Organic litter cover (%)	12.5%	39%	18%	38.3%
Large Trees	14	20	22	10
Coarse woody debris (m)	267.5	346	176	456
Non-native plant cover (%)	82.5%	60%	10%	33.8%
Size of patch	10	0	7	10
Connectedness	2	0	5	4
Context	4	4	4	4
Ecological corridors	6	6	6	6
Threats to species	7	7	7	7

Assessment Unit	2	3	4	5
Quality and availability of foraging habitat	5	5	5	5
Quality and availability of shelter	5	5	5	5
Species mobility category	7	7	7	7
Role of the site location to species overall population in the state	1	1	1	1
Score Total	7.16			

The following notes are made in relation to the data in Table D-5:

- The 'threats to the species' was assessed as 'moderate threat level' due to presence of cleared land, risk of fire and presence of wild dogs.
- The 'quality and availability of foraging habitat' was assessed as 'moderate' due to presence of forest/woodland habitat and some preferred food trees.
- The 'quality and availability of shelter' was assessed as 'moderate' due to presence of some areas with good shelter habitat.
- The 'species mobility category' was assessed as '7 (i.e. Moderately Restricted [26-50% Reduction])' due to presence of cleared areas and fragmented habitat.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' as the impact site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

Table D-6 provides the Terrestrial Habitat Quality Data for the Koala habitat in the Western Extension Commonwealth Offset Area.

Table D-6
Terrestrial Habitat Quality Data Western Extension Commonwealth Offset Area – Koala

Assessment Unit	2	3	5	6	10	11	12	14
RE	11.3.2	11.3.25	11.3.4	11.3.7	11.5.2	11.5.3	11.5.9	11.7.4*
Assessment Unit Area (ha)	281	57	117.5	29	52.5	86.5	23.5	13.5
Recruitment of wood perennial species in EDL (%)	75	75	64	40	75	50	25	50
Native plant species richness- trees	12	8	11	7	7	14	7	18
Native plant species richness- shrubs	4	0	3	1	4	3.5	0	4
Native plant species richness- grasses	5	2	4	5	4	6	8	6
Native plant species richness- forbs	6	4	5	6	5	8.5	5	2
Tree canopy height	18	20	18.8	16	15	16	12	18
Tree canopy cover (%)	32%	69%	31.2%	14.5%	25%	54.3%	0%	36.5%
Shrub canopy cover (%)	2.5%	1%	3.3%	0%	0%	17.3%	3%	4.5%
Native perennial grass cover (%)	14%	10%	17.6%	2%	21%	22.5%	23%	18.8%
Organic litter cover (%)	45.5%	44%	37.8%	22%	36%	45.5%	33%	41%
Large Trees	4	13	10	6	5	3	0	13
Coarse woody debris (m)	273.5	101	483.3	904	641	415	231	623
Non-native plant cover (%)	10%	60%	41.3%	75%	0%	7.5%	5%	10%
Size of patch	10	10	10	10	10	10	10	10
Connectedness	4	4	4	5	5	5	5	5
Context	4	4	4	4	5	4	5	4
Ecological corridors	6	6	6	6	6	6	6	6
Threats to species	1	1	1	1	1	1	1	1
Quality and availability of foraging habitat	5	5	5	5	5	5	5	5
Quality and availability of shelter	5	5	5	5	5	5	5	5
Species mobility category	10	10	10	10	10	10	10	10
Role of the site location to species overall population in the state	1	1	1	1	1	1	1	1

Assessment Unit	2	3	5	6	10	11	12	14
Current Habitat Quality	6.53							
Future Quality without Offset	6.53							
Future Quality with Offset	8.1							

* In 2017, a reference site was undertaken in RE 11.7.4 to establish a local benchmark as no formal benchmark has been established by the Herbarium to date.

The following notes are made in relation to the data in Table D-6:

- The 'threats to the species' was assessed as 'high' due to presence of feral dogs, fragmented shelter habitat and risk of wildfire.
- The 'quality and availability of foraging habitat' was assessed as 'moderate' due to presence of forest/woodland habitat and some preferred food trees.
- The 'quality and availability of shelter' was assessed as 'moderate' due to presence of some areas with good shelter habitat.
- The 'species mobility category' was assessed as '10 (i.e. *Minor Restriction [0-25% Reduction]*)' due to presence of areas of contiguous forest and woodland habitat which would act as movement corridors e.g vegetation fringing Roper Creek and the Travelling Stock Reserve.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' as the offset site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

For the Koala, the species index scoring for a future without the offset has conservatively assumed to be the same as the above.

The species index scoring for a future with the offset has been assessed as follows:

- A decrease in the 'threats to the species' to 'low threat level' due to a reduction in the current level of fragmentation and feral predators.
- An increase in the 'quality and availability of foraging habitat' to 'high' due to natural regeneration of food trees.
- An increase in the 'quality and availability of shelter habitat' to 'high' due to reduction in the current level of fragmentation and feral predators.

Greater Glider

Table D-7 provides the Terrestrial Habitat Quality Data for the Greater Glider habitat in the Action Area.

Table D-7
Terrestrial Habitat Quality Data Action Area – Greater Glider

Assessment Unit	2	3	4	5
RE	11.3.2	11.3.4	11.3.27	11.5.3
Assessment Unit Area (ha)	43.5	1.5	1.9	128
Recruitment of wood perennial species in EDL (%)	58	75	100	74
Native plant species richness- trees	4	4	7	11
Native plant species richness- shrubs	3	2	0	3
Native plant species richness- grasses	10	0	8	7
Native plant species richness- forbs	11	5	13	4
Tree canopy height	17.5	20	7.5	17.4
Tree canopy cover (%)	21.1%	47.1%	47.7%	23.4%
Shrub canopy cover (%)	3.9%	0%	0%	9.5%
Native perennial grass cover (%)	4.5%	0%	19%	11.8%

Assessment Unit	2	3	4	5
Organic litter cover (%)	12.5%	39%	18%	38.3%
Large Trees	14	20	22	10
Coarse woody debris (m)	267.5	346	176	456
Non-native plant cover (%)	82.5%	60%	10%	33.8%
Size of patch	10	0	7	10
Connectedness	2	0	5	4
Context	4	4	4	4
Ecological corridors	6	6	6	6
Threats to species	7	7	7	7
Quality and availability of foraging habitat	5	5	5	5
Quality and availability of shelter	5	5	5	5
Species mobility category	7	7	7	7
Role of the site location to species overall population in the state	1	1	1	1
Score Total	7.15			

The following notes are made in relation to the data in Table D-7:

- The 'threats to the species' was assessed as 'moderate threat level' due to presence of pest species, barbed wire fences and risk of wildfire.
- The 'quality and availability of foraging habitat' was assessed as 'moderate' due to presence of some areas of preferred foraging habitat.
- The 'quality and availability of shelter' was assessed as 'moderate' due to a moderate abundance of tree hollows and areas of woodland habitat.
- The 'species mobility category' was assessed as '7 (i.e. Moderately Restricted [26-50% Reduction])' due to level of fragmentation in the impact site.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' as the impact site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

Table D-8 provides the Terrestrial Habitat Quality Data for the Greater Glider habitat in the Western Extension Commonwealth Offset Area.

Table D-8
Terrestrial Habitat Quality Data Western Extension Commonwealth Offset Area – Greater Glider

Assessment Unit	2	3	5	6	11
RE	11.3.2	11.3.25	11.3.4	11.3.7	11.5.3
Assessment Unit Area (ha)	281	57	117.5	29	86.5
Recruitment of wood perennial species in EDL (%)	75	75	64	40	50
Native plant species richness- trees	12	8	11	7	14
Native plant species richness- shrubs	4	0	3	1	3.5
Native plant species richness- grasses	5	2	4	5	6
Native plant species richness- forbs	6	4	5	6	8.5
Tree canopy height	18	20	18.8	16	16
Tree canopy cover (%)	32%	69%	31.2%	14.5%	54.3%
Shrub canopy cover (%)	2.5%	1%	3.3%		17.3%
Native perennial grass cover (%)	14%	10%	17.6%	2%	22.5%
Organic litter cover (%)	45.5%	44%	37.8%	22%	45.5%
Large Trees	4	13	10	6	3
Coarse woody debris (m)	273.5	101	483.3	904	415
Non-native plant cover (%)	10%	60%	41.3%	75%	7.5%

Assessment Unit	2	3	5	6	11
Size of patch	10	10	10	10	10
Connectedness	4	4	4	5	5
Context	4	4	4	4	4
Ecological corridors	6	6	6	6	6
Threats to species	7	7	7	7	7
Quality and availability of foraging habitat	5	5	5	5	5
Quality and availability of shelter	5	5	5	5	5
Species mobility category	10	10	10	10	10
Role of the site location to species overall population in the state	1	1	1	1	1
Current Habitat Quality	6.9				
Future Quality without Offset	6.9				
Future Quality with Offset	8.07				

The following notes are made in relation to the data in Table D-8:

- The 'threats to the species' was assessed as 'moderate threat level' due to presence of pest species, barbed wire fences and risk of wildfire.
- The 'quality and availability of foraging habitat' was assessed as 'moderate' due to presence of some areas of preferred foraging habitat.
- The 'quality and availability of shelter' was assessed as 'moderate' due to a moderate abundance of tree hollows and areas of woodland habitat.
- The 'species mobility category' was assessed as '10 (i.e. *Minor Restriction [0-25% Reduction]*)' due to presence of areas of contiguous forest and woodland habitat which would act as movement corridors.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' as the offset site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

For the Greater Glider, the species index scoring for a future without the offset has conservatively assumed to be the same as the above.

The species index scoring for a future with the offset has been assessed as follows:

- A decrease in the 'threats to the species' to 'low threat level' due to removal of barbed wire fences and management of feral pests.
- An increase in the 'quality and availability of foraging habitat' to 'high' due to natural regeneration of food trees.
- An increase in the 'quality and availability of shelter habitat' to 'high' due to reduction in the current level of fragmentation and feral predators.

Ornamental Snake

Table D-9 provides the Terrestrial Habitat Quality Data for the Ornamental Snake potential habitat in the Action Area.

Table D-9
Terrestrial Habitat Quality Data Action Area – Ornamental Snake

Assessment Unit	1	6
RE	11.3.1	11.4.9
Assessment Unit Area (ha)	15	0.5
Recruitment of wood perennial species in EDL (%)	100	100
Native plant species richness- trees	5	12
Native plant species richness- shrubs	2	2
Native plant species richness- grasses	6	8
Native plant species richness- forbs	10	6
Tree canopy height	13.5	15
Tree canopy cover (%)	48.6%	54.6%
Shrub canopy cover (%)	10.9%	9.3%
Native perennial grass cover (%)	3%	36%
Organic litter cover (%)	23%	51%
Large Trees	3	8
Coarse woody debris (m)	678.5	349
Non-native plant cover (%)	17.5%	10%
Size of patch	10	0
Connectedness	4	4
Context	4	4
Ecological corridors	6	6
Threats to species	7	1
Quality and availability of foraging habitat	5	5
Quality and availability of shelter	5	5
Species mobility category	7	1
Role of the site location to species overall population in the state	1	1
Score Total	6.67	

The following notes are made in relation to the data in Table D-9:

- The 'threats to the species' was assessed as 'Moderate to high Threat Level' due to presence of threats including cane toads and other pest species as well as high isolation and exposure of habitat in AU1.
- The 'quality and availability of foraging habitat' was assessed as 'moderate' due to presence of patchy areas of suitable habitat.
- The 'quality and availability of shelter' was assessed as 'moderate' due to presence of some areas of suitable shelter habitat.
- The 'species mobility category' was assessed as '7 (i.e. Moderately Restricted [26-50% Reduction])' for AU1 due to the moderate level of fragmentation associated with the RE and 1 (i.e. Severely Restricted [76-100% reduction]) for AU2 due to the very high level of fragmentation associated with the RE.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' due to as the impact site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

Table D-10 provides the Terrestrial Habitat Quality Data for the Ornamental Snake potential habitat in the Western Extension Commonwealth Offset Area.

Table D-10
Terrestrial Habitat Quality Data Western Extension Commonwealth Offset Area – Ornamental Snake

Assessment Unit	1	7	8
RE	11.3.1	11.4.8 ⁻	11.4.9
Assessment Unit Area (ha)	16.5	17	42.5
Recruitment of wood perennial species in EDL (%)	90	100	88
Native plant species richness- trees	6	7	11
Native plant species richness- shrubs	3	7	4
Native plant species richness- grasses	5	7	6
Native plant species richness- forbs	9	5	5
Tree canopy height	13	14	14
Tree canopy cover (%)	45%	48%	52.90%
Shrub canopy cover (%)	6.9%	19.90%	31.50%
Native perennial grass cover (%)	15.1%	8%	13.10%
Organic litter cover (%)	51%	52%	56%
Large Trees	5	5	6.50
Coarse woody debris (m)	1684.5	1258	1729.50
Non-native plant cover (%)	10%	5%	7.50%
Size of patch	10	10	10
Connectedness	2	2	2
Context	4	4	4
Ecological corridors	6	6	6
Threats to species	7	7	7
Quality and availability of foraging habitat	5	5	5
Quality and availability of shelter	5	5	5
Species mobility category	7	7	7
Role of the site location to species overall population in the state	1	1	1
Current Habitat Quality	6.75		
Future Quality without Offset	6.24		
Future Quality with Offset	8.1		

⁻ Local benchmark created by GHD in 2012 was used for the calculator runs.

The following notes are made in relation to the data in Table D-10:

- The 'threats to the species' was assessed as 'moderate threat level' due to presence of threats including cane toads and other pest species as well as habitat fragmentation.
- The 'quality and availability of foraging habitat' was assessed as 'moderate' due to presence of areas of suitable Brigalow foraging habitat.
- The 'quality and availability of shelter' was assessed as 'moderate' due to presence of suitable shelter components in some patches of Brigalow.
- The 'species mobility category' was assessed as '7 (i.e. Moderately Restricted [26-50% Reduction])' due to the level of habitat fragmentation in the offset site.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' due to as the offset site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

For the Ornamental Snake, the species index scoring for a future without the offset has conservatively assumed to be the same as the above.

The species index scoring for a future with the offset has been assessed as follows:

- A decrease in the 'threats to the species' to 'low threat level' due to management of threats relevant to this species, namely grazing livestock and pests.
- An increase in the 'quality and availability of foraging habitat' to 'high' due to management of threats relevant to this species, namely grazing livestock and pests.
- An increase in the 'quality and availability of shelter habitat' to 'high' due to management of threats relevant to this species, namely grazing livestock and pests.

Brigalow Woodland TEC

Table D-11 provides the Terrestrial Habitat Quality Data for Brigalow in the Action Area.

Table D-11
Terrestrial Habitat Quality Data Action Area – Brigalow Threatened Ecological Community

Assessment Unit	1	6
RE	11.3.1	11.4.9
Assessment Unit Area (ha)	15	0.5
Recruitment of wood perennial species in EDL (%)	100	100
Native plant species richness- trees	5	12
Native plant species richness- shrubs	2	2
Native plant species richness- grasses	6	8
Native plant species richness- forbs	10	6
Tree canopy height	13.5	15
Tree canopy cover (%)	48.6%	54.6%
Shrub canopy cover (%)	10.9%	9.3%
Native perennial grass cover (%)	3%	36%
Organic litter cover (%)	23%	51%
Large Trees	3	8
Coarse woody debris (m)	678.5	349
Non-native plant cover (%)	17.5%	10%
Size of patch	10	0
Connectedness	4	4
Context	4	4
Ecological corridors	6	6
Current Habitat Quality	7.07	

Table D-12 provides the Terrestrial Habitat Quality Data for Brigalow TEC in the Western Extension Commonwealth Offset Area.

Table D-12
Terrestrial Habitat Quality Data Western Extension Commonwealth Offset Area – Brigalow Threatened Ecological Community

Assessment Unit	1	7	8
RE	11.3.1	11.4.8	11.4.9
Assessment Unit Area (ha)	16.5	17	42.5
Recruitment of wood perennial species in EDL (%)	90	100	88
Native plant species richness- trees	6	7	11
Native plant species richness- shrubs	3	7	4
Native plant species richness- grasses	5	7	6
Native plant species richness- forbs	9	5	5
Tree canopy height	13	14	14
Tree canopy cover (%)	45%	48%	52.90%
Shrub canopy cover (%)	6.9%	19.90%	31.50%
Native perennial grass cover (%)	15.1%	8%	13.10%
Organic litter cover (%)	51%	52%	56%
Large Trees	5	5	6.50
Coarse woody debris (m)	1684.5	1258	1729
Non-native plant cover (%)	10%	5%	7.5%
Size of patch	10	10	10
Connectedness	2	2	2
Context	4	4	4
Ecological corridors	6	6	6
Current Habitat Quality	7.58		

Impact Area of the Existing Stage 2 Commonwealth Offset Area – Brigalow TEC

Table D-13 provides the Terrestrial Habitat Quality Data for the Brigalow TEC in the Impact Area of the Existing Stage 2 Commonwealth Offset Area.

Table D-13
Terrestrial Habitat Quality Data Impact Area of the Existing Stage 2 Commonwealth Offset Area – Brigalow TEC

Assessment Unit	1	2
RE	11.3.1	11.3.1
Assessment Unit Area (ha)	7	4
Recruitment of wood perennial species in EDL (%)	100	88
Native plant species richness- trees	4	6
Native plant species richness- shrubs	2	3
Native plant species richness- grasses	3	6
Native plant species richness- forbs	5	7
Tree canopy height	8	9
Tree canopy cover (%)	25.5%	33.3%
Shrub canopy cover (%)	0%	21%
Native perennial grass cover (%)	9%	7%
Organic litter cover (%)	10%	22.5%
Large Trees	0	0
Coarse woody debris (m)	194.1	1684
Non-native plant cover (%)	25%	25%
Size of patch	10	10
Connectedness	4	2
Context	4	4

Assessment Unit	1	2
Ecological corridors	6	6
Score Total	6.72	

Table D-14 provides the Terrestrial Habitat Quality Data for the Brigalow TEC in the Modified Stage 2 Commonwealth Offset Area.

Table D-14
Terrestrial Habitat Quality Data Modified Stage 2 Commonwealth Offset Area – Brigalow TEC

Assessment Unit	1	2
RE	11.4.8	11.4.9
Assessment Unit Area (ha)	15.5	14
Recruitment of wood perennial species in EDL (%)	33.3	100
Native plant species richness- trees	6	3
Native plant species richness- shrubs	2	4
Native plant species richness- grasses	3	2
Native plant species richness- forbs	6	3
Tree canopy height	16	13
Tree canopy cover (%)	14%	14%
Shrub canopy cover (%)	36%	29%
Native perennial grass cover (%)	9%	6%
Organic litter cover (%)	49%	37%
Large Trees	00	00
Coarse woody debris (m)	1774	1726
Non-native plant cover (%)	5%	4%
Size of patch	7	7
Connectedness	4	5
Context	4	4
Ecological corridors	0	0
Current Habitat Quality	5.76	
Future Quality without Offset	4.71	
Future Quality with Offset	7.54	

With respect to the future quality scores with/without the offset outlined in Table D-14, the following changes were made to the biometric values to justify the increase/decrease in quality scores:

- future quality with the offset has been assessed as follows:
 - Increase in recruitment of wood perennial species;
 - Increase in native grass species richness;
 - Increase in native forb species richness;
 - Increase in native grass cover;
 - Increase in organic litter cover;
 - Increase in tree canopy height;
 - Increase in tree canopy cover;
 - Decrease in non-native plant cover; and
 - Increase in patch size, connectedness and context;
- future quality without the offset has been assessed as follows:
 - Decrease in recruitment of wood perennial species;
 - Decrease in native grass species richness;
 - Decrease in native forb species richness;

- Decrease in native grass cover;
- Decrease in organic litter cover; and
- Increase in non-native plant cover.

Impact Area of the Existing Stage 2 Commonwealth Offset Area – Squatter Pigeon (southern)

Table D-15 provides the Terrestrial Habitat Quality Data for the Squatter Pigeon (southern) in the Impact Area of the Existing Stage 2 Commonwealth Offset Area.

Table D-15
Terrestrial Habitat Quality Data Impact Area of the Existing Stage 2 Commonwealth Offset Area – Squatter Pigeon (southern)

Assessment Unit	1	2
RE	11.3.1	11.3.2
Assessment Unit Area (ha)	7	8.5
Recruitment of wood perennial species in EDL (%)	100	75
Native plant species richness- trees	4	14
Native plant species richness- shrubs	2	2
Native plant species richness- grasses	3	10
Native plant species richness- forbs	5	6
Tree canopy height	8	18
Tree canopy cover (%)	25.5%	39.8%
Shrub canopy cover (%)	0%	15%
Native perennial grass cover (%)	9%	4%
Organic litter cover (%)	10%	6%
Large Trees	0	40
Coarse woody debris (m)	194.1	157
Non-native plant cover (%)	25%	25%
Size of patch	10	10
Connectedness	4	4
Context	4	4
Ecological corridors	6	6
Threats to species	7	7
Quality and availability of foraging habitat	5	5
Quality and availability of shelter	5	10
Species mobility category	10	10
Role of the site location to species overall population in the state	1	1
Score Total	6.88	

The following notes are made in relation to the data in Table D-15:

- The 'threats to the species' was assessed as 'moderate threat level' due to presence of feral cats and risk of fires, recognised threats to this species.
- The 'quality and availability of foraging habitat' was assessed as 'low to moderate' as some assessment units contained higher quality habitat than others.
- The 'quality and availability of shelter' was assessed as 'low to high' due to some RE's providing high quality habitat while others only provide poor shelter habitat such as areas with dense exotic grasses and areas with sparse groundcover.
- The 'species mobility category' was assessed as '10 (i.e. *Minor Restriction [0-25% Reduction]*)' due to the high mobility of this species and that no barriers to movement exist.

- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' as the impact site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

Table D-16 provides the Terrestrial Habitat Quality Data for the Squatter Pigeon (southern) in the Modified Stage 2 Commonwealth Offset Area.

Table D-16

Terrestrial Habitat Quality Data Modified Stage 2 Commonwealth Offset Area – Squatter Pigeon (southern)

Assessment Unit	1	2	3	4	5	6
RE	11.4.8	11.4.9	11.5.18	11.5.2	11.5.3	11.5.9
Assessment Unit Area (ha)	15.5	14	18	7	12.5	47
Recruitment of wood perennial species in EDL (%)	33.3	100	60	50	60	25
Native plant species richness- trees	6	3	5	12	15	7
Native plant species richness- shrubs	2	4	1	1	2	0
Native plant species richness- grasses	3	2	5	5	5	8
Native plant species richness- forbs	6	3	2	8	7	5
Tree canopy height	16	13	2.5	12	18	12
Tree canopy cover (%)	14%	14%	0%	21%	23.7%	0%
Shrub canopy cover (%)	36%	29%	30.5%	0%	0%	3%
Native perennial grass cover (%)	9%	6%	12.2%	0%	22%	23%
Organic litter cover (%)	49%	37%	7%	71%	48%	33%
Large Trees	00	00	60	110	20	00
Coarse woody debris (m)	1774	1726	28	752	450	231
Non-native plant cover (%)	5%	4%	0%	4%	4%	5%
Size of patch	7	7	10	10	10	10
Connectedness	4	5	5	5	5	5
Context	4	4	5	5	5	5
Ecological corridors	0	0	6	6	6	6
Threats to species	7	7	7	7	7	7
Quality and availability of foraging habitat	5	5	5	5	5	5
Quality and availability of shelter	5	5	5	5	5	5
Species mobility category	10	10	10	10	10	10
Role of the site location to species overall population in the state	1	1	1	1	1	1
Current Habitat Quality	6.26					
Future Quality without Offset	5.6					
Future Quality with Offset	7.45					

With respect to the future quality scores with/without the offset outlined in Table D-16, the following changes were made to the biometric values to justify the increase/decrease in quality scores:

- Future quality with the offset:
 - Increase in recruitment of wood perennial species;
 - Increase in native grass species richness;
 - Increase in native forb species richness;
 - Increase in native grass cover;
 - Increase in organic litter cover;
 - Increase in tree canopy height;
 - Increase in tree canopy cover;
 - Decrease in non-native plant cover;
 - Increase in patch size, connectedness and context;

- Increase in the quality and availability of foraging habitat, and quality and availability of shelter; and
- Reduction in threats to the species.
- Future quality without the offset:
 - Decrease in recruitment of wood perennial species;
 - Decrease in native grass species richness;
 - Decrease in native forb species richness;
 - Decrease in native grass cover;
 - Decrease in organic litter cover; and
 - Increase in non-native plant cover.

Impact Area of the Existing Stage 2 Commonwealth Offset Area – Ornamental Snake

Table D-17 provides the Terrestrial Habitat Quality Data for the Ornamental Snake in the Impact Area of the Existing Stage 2 Commonwealth Offset Area.

Table D-17
Terrestrial Habitat Quality Data Impact Area of the Existing Stage 2 Commonwealth Offset Area – Ornamental Snake

Assessment Unit	1
RE	11.3.1
Assessment Unit Area (ha)	7
Recruitment of wood perennial species in EDL (%)	100
Native plant species richness- trees	4
Native plant species richness- shrubs	2
Native plant species richness- grasses	3
Native plant species richness- forbs	5
Tree canopy height	8
Tree canopy cover (%)	25.5%
Shrub canopy cover (%)	0%
Native perennial grass cover (%)	9%
Organic litter cover (%)	10%
Large Trees	0
Coarse woody debris (m)	194.1
Non-native plant cover (%)	25%
Size of patch	10
Connectedness	4
Context	4
Ecological corridors	6
Threats to species	7
Quality and availability of foraging habitat	5
Quality and availability of shelter	5
Species mobility category	7
Role of the site location to species overall population in the state	1
Score Total	6.42

The following notes are made in relation to the data in Table D-17:

- The 'threats to the species' was assessed as 'Moderate Threat Level' due to presence of threats including cane toads and other pest species.
- The 'quality and availability of foraging habitat' was assessed as 'moderate' due to presence of patchy areas of suitable habitat.

- The 'quality and availability of shelter' was assessed as 'moderate' due to presence of some areas of suitable shelter habitat.
- The 'species mobility category' was assessed as '7 (i.e. Moderately Restricted [26-50% Reduction])' due to the moderate level of fragmentation associated with the RE.
- The 'role of the site location to species overall population in the state' was assessed as '1 (i.e. *Not or Unlikely to be Critical to Species' Survival*)' due to as the impact site is unlikely to provide habitat critical to the survival of this species in a state-wide context.

Table D-18 provides the Terrestrial Habitat Quality Data for the Ornamental Snake in the Modified Stage 2 Commonwealth Offset Area.

Table D-18
Terrestrial Habitat Quality Data Modified Stage 2 Commonwealth Offset Area – Ornamental Snake

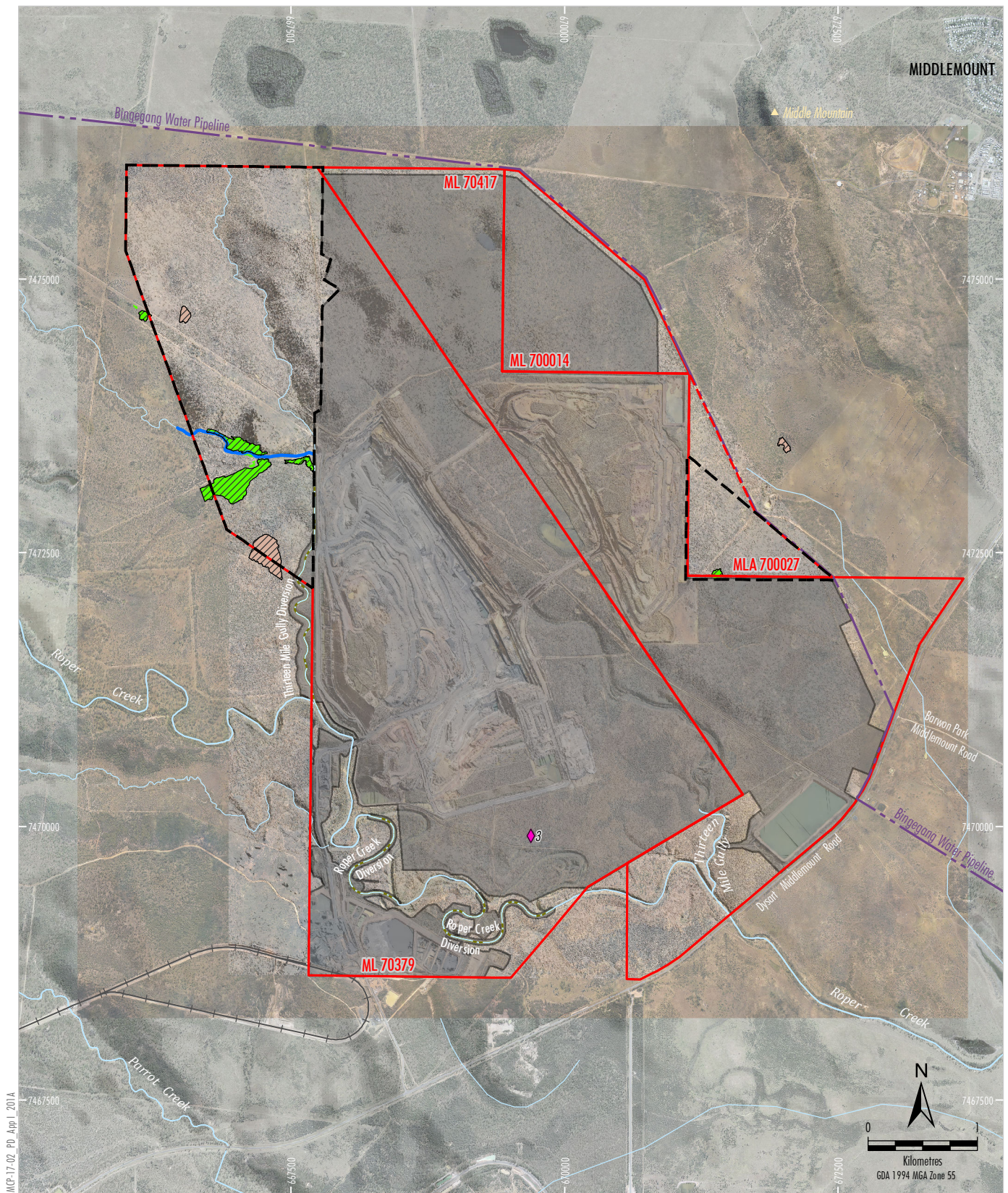
Assessment Unit	1	2
RE	11.4.8	11.4.9
Assessment Unit Area (ha)	15.5	14
Recruitment of wood perennial species in EDL (%)	33.3	100
Native plant species richness- trees	6	3
Native plant species richness- shrubs	2	4
Native plant species richness- grasses	3	2
Native plant species richness- forbs	6	3
Tree canopy height	16	13
Tree canopy cover (%)	14%	14%
Shrub canopy cover (%)	36%	29%
Native perennial grass cover (%)	9%	6%
Organic litter cover (%)	49%	37%
Large Trees	00	00
Coarse woody debris (m)	1774	1726
Non-native plant cover (%)	5%	4%
Size of patch	7	7
Connectedness	4	5
Context	4	4
Ecological corridors	0	0
Threats to species	7	7
Quality and availability of foraging habitat	5	5
Quality and availability of shelter	5	5
Species mobility category	10	10
Role of the site location to species overall population in the state	1	1
Current Habitat Quality	5.68	
Future Quality without Offset	4.6	
Future Quality with Offset	8.4	

With respect to the future quality scores with/without the offset outlined in Table D-18, the following changes were made to the biometric values to justify the increase/decrease in quality scores:

- Future quality with the offset:
 - Increase in recruitment of wood perennial species;
 - Increase in native grass species richness;
 - Increase in native forb species richness;
 - Increase in native grass cover;
 - Increase in organic litter cover;

- Increase in tree canopy height;
- Increase in tree canopy cover;
- Decrease in non-native plant cover;
- Increase in patch size, connectedness and context;
- Increase in the quality and availability of foraging habitat, and quality and availability of shelter; and
- Reduction in threats to the species.
- Future quality without the offset:
 - Decrease in recruitment of wood perennial species;
 - Decrease in native grass species richness;
 - Decrease in native forb species richness;
 - Decrease in native grass cover;
 - Decrease in organic litter cover; and
 - Increase in non-native plant cover.

ATTACHMENT E**FIGURES**



MP-17-02 PD Apr 1 2014

- LEGEND**
- Mining Lease Boundary (ML)
 - Mining Lease Application Boundary (MLA)
 - Middlemount Rail Spur and Loop
 - Approved Disturbance Footprint
 - Approved Diversion Structure
 - Western Extension Project
 - Approximate Extent of Additional Surface Disturbance

- Habitat**
- Ornamental Snake Potential Suitable Habitat
 - ◆ Ornamental Snake Recorded Location
- Other Map Units**
- Seasonal Waterbody Associated with Potential Habitat
 - Brigalow Threatened Ecological Community
 - Vegetation in the Early Stages of Regrowth from Past Clearing without Suitable Microhabitat

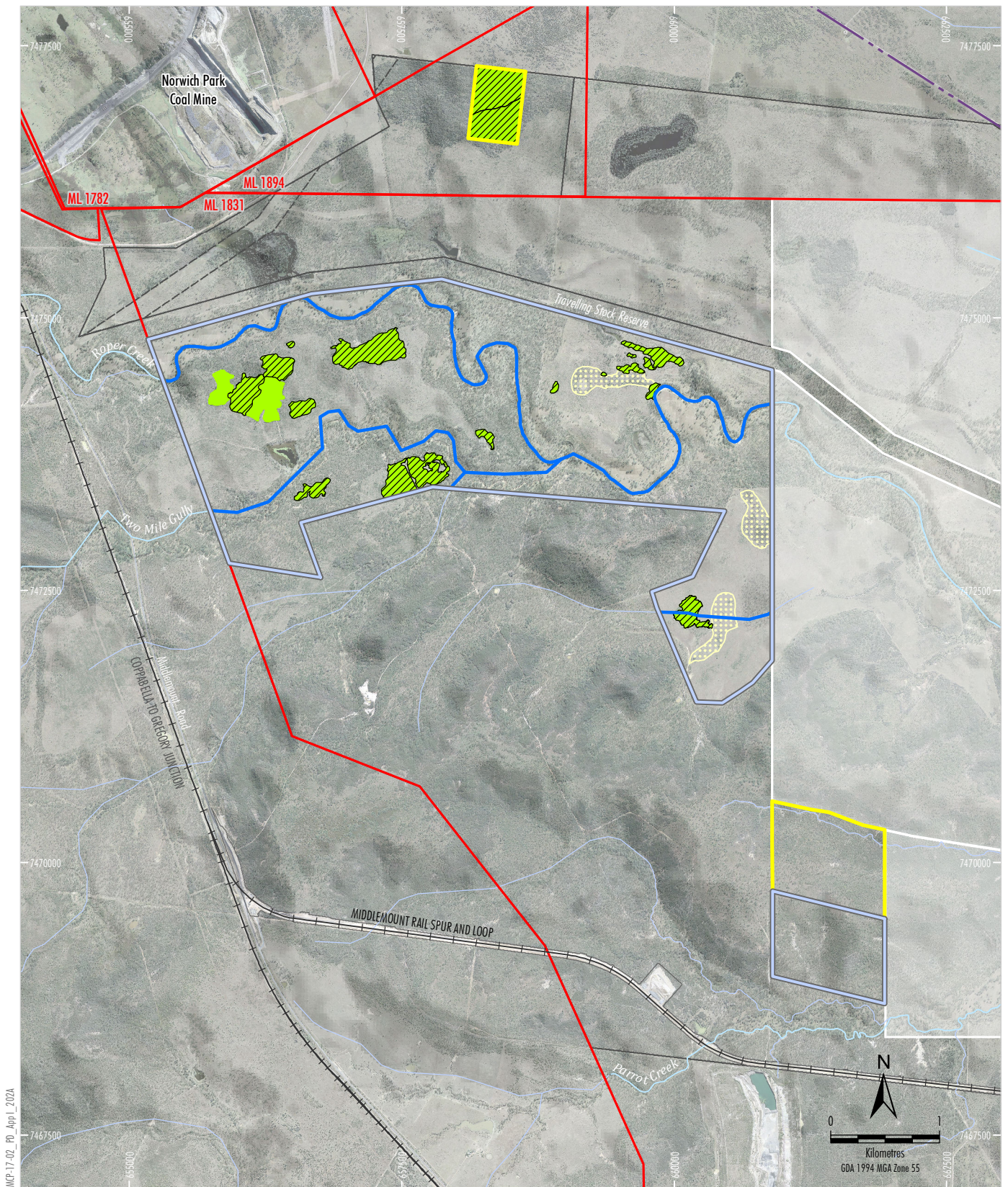
Reference: 3 Parsons Brinkerhoff (2010)
Note: There are no references 1 and 2 on this figure.

Source: MCPL (2018); Biodiversity Australia (2019); © State of Queensland (Department of Science, Information Technology and Innovation, 2017); Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT
Ornamental Snake Habitat Mapping
- Mine Site

Figure 1



LEGEND

- Mining Lease Boundary (ML)
- Middlemount Coal Owned Land
- + Railway
- Existing Offset Area
- Proposed Western Extension Commonwealth Offset Area (EPBC 2017/8130)
- Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)

Potential Habitat

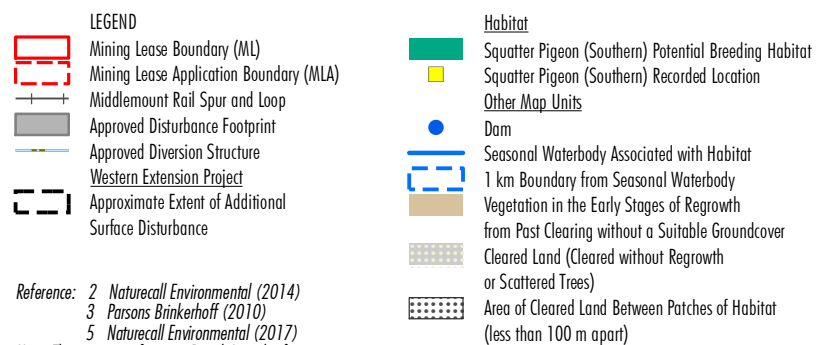
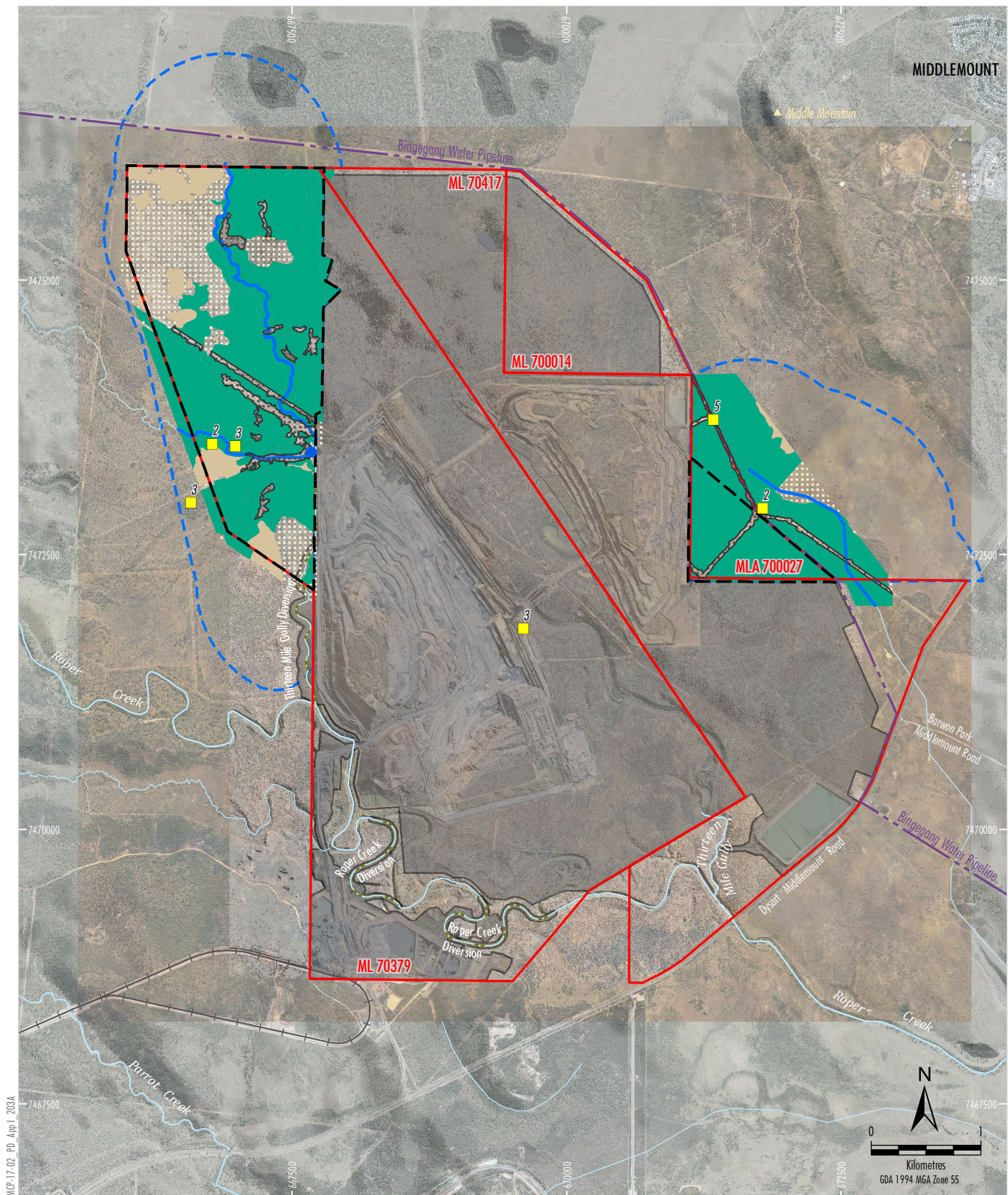
- Ornamental Snake Potential Suitable Habitat
- Other Map Units
- Seasonal Waterbody
- Brigalow Threatened Ecological Community
- Cleared Land Likely to be Formerly Potential Habitat (Brigalow Woodland - RE11.3.1)

Source: MCPL (2018); Biodiversity Australia (2019); © State of Queensland (Department of Science, Information Technology and Innovation (2017); Department of Natural Resources and Mines (2016) Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT Ornamental Snake Potential Habitat Mapping - Proposed Offset Areas

Figure 2



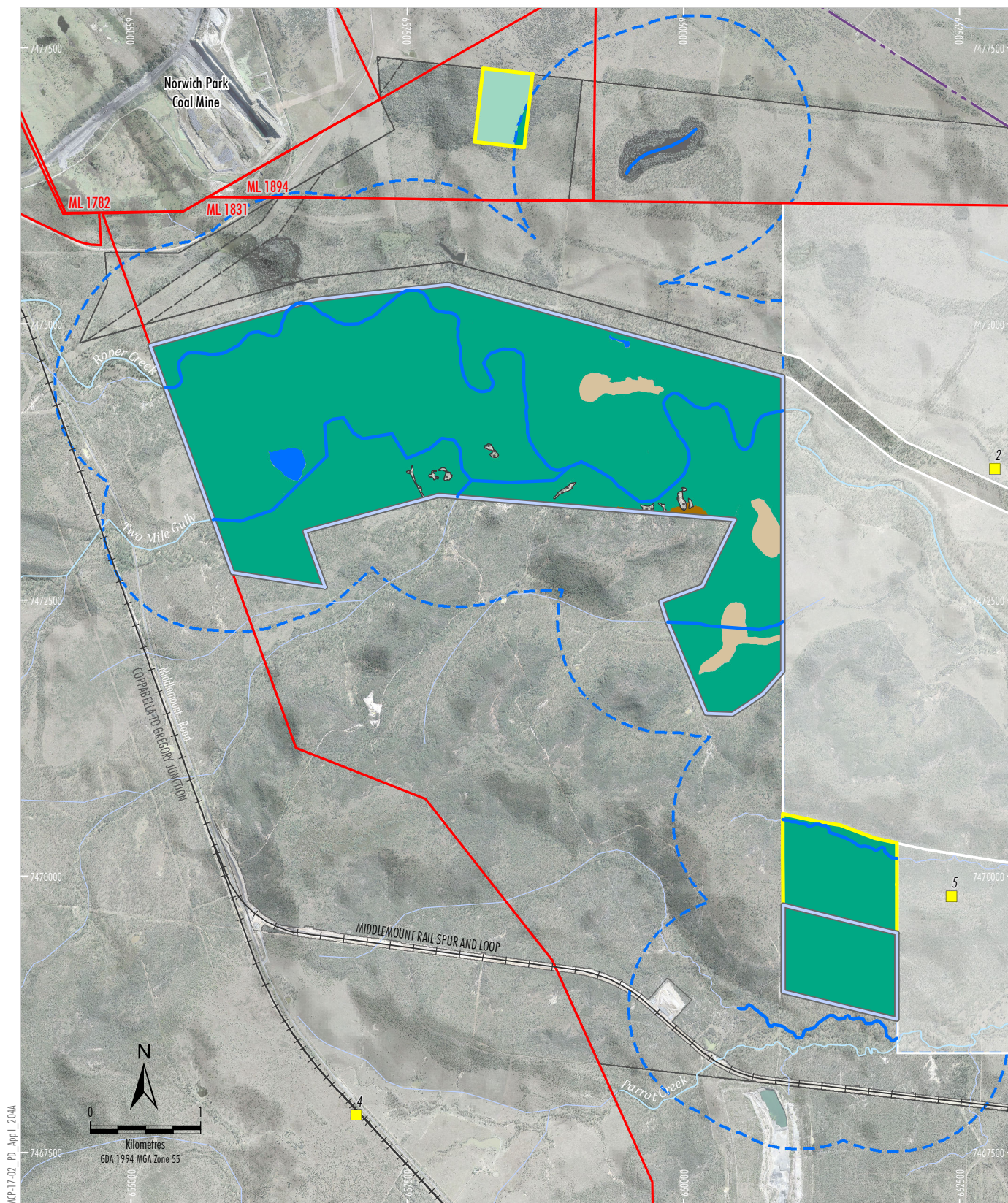
Source: MCPL (2018); Biodiversity Australia (2019); © State of Queensland (Department of Science, Information Technology and Innovation, 2017); Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT

Squatter Pigeon (Southern) Habitat Mapping - Mine Site

Figure 3



- LEGEND**
- Mining Lease Boundary (ML)
 - Middlemount Coal Owned Land
 - Railway
 - Existing Offset Area
 - Proposed Western Extension Commonwealth Offset Area (EPBC 2017/8130)
 - Modified Middlemount Coal (Stage 2) Project Commonwealth Offset Area (EPBC 2010/5394)

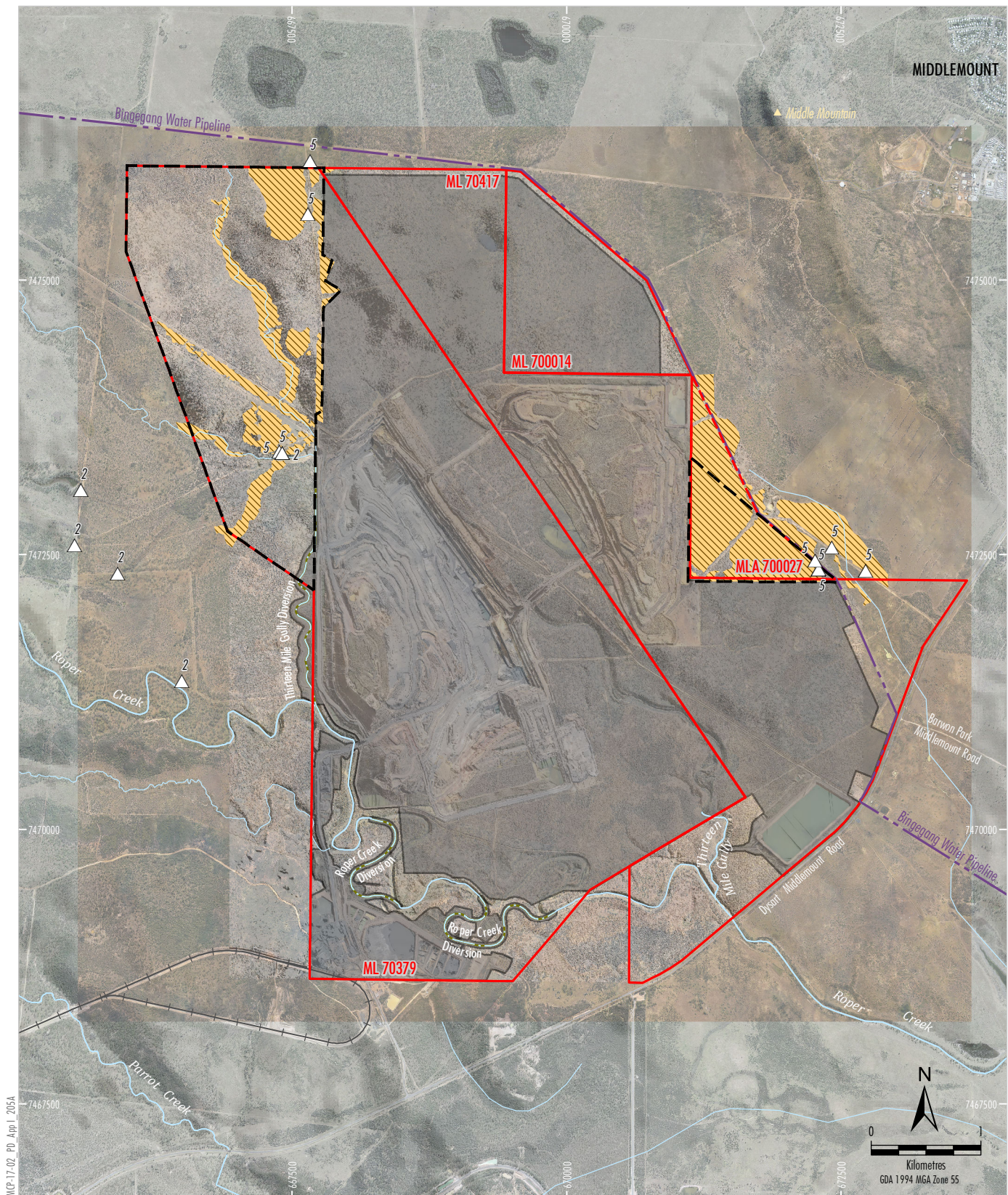
- Habitat**
- Squatter Pigeon (Southern) Potential Breeding Habitat
 - Squatter Pigeon (Southern) Potential Foraging Habitat
 - Squatter Pigeon (Southern) Recorded Location
- Other Map Units**
- Dam
 - Seasonal Waterbody Associated with Habitat
 - 1 km Boundary from Seasonal Waterbody
 - Vegetation in the Early Stages of Regrowth from Past Clearing without a Suitable Groundcover
 - Area of Cleared Land Between Patches of Habitat (less than 100 m apart)
 - RE 11.7.2 Excluded due to Unsuitable Groundcover

Source: MCPL (2018); Biodiversity Australia (2019); © State of Queensland (Department of Science, Information Technology and Innovation (2017); Department of Natural Resources and Mines (2016) Orthophoto: MCPL (June 2017, 2012)

middlemount coal
WESTERN EXTENSION PROJECT
Squatter Pigeon (Southern) Habitat Mapping
- Proposed Offset Areas

Reference: 2 Naturecall Environmental (2014)
4 Biodiversity Australia (2018)
5 Naturecall Environmental (2017)
Note: There are no references 1 and 3 on this figure.

Figure 4



LEGEND

- Mining Lease Boundary (ML)
- Mining Lease Application Boundary (MLA)
- Middlemount Rail Spur and Loop
- Approved Disturbance Footprint
- Approved Diversion Structure
- Western Extension Project
- Approximate Extent of Additional Surface Disturbance

Habitat

- Greater Glider Potential Habitat (Eucalypt Forests and Woodlands with Tree Hollows)
- Greater Glider Recorded Location
- Eucalypt Forests and Woodlands

Reference: 2 Naturecall Environmental (2014)
5 Naturecall Environmental (2017)

Note: There are no references 1, 3 and 4 on this figure.

Source: MCPL (2018); Biodiversity Australia (2019); © State of Queensland (Department of Science, Information Technology and Innovation, 2017); Department of Natural Resources and Mines (2016)
Orthophoto: MCPL (June 2017, 2012)



WESTERN EXTENSION PROJECT

Greater Glider Habitat Mapping
- Mine Site

Figure 5

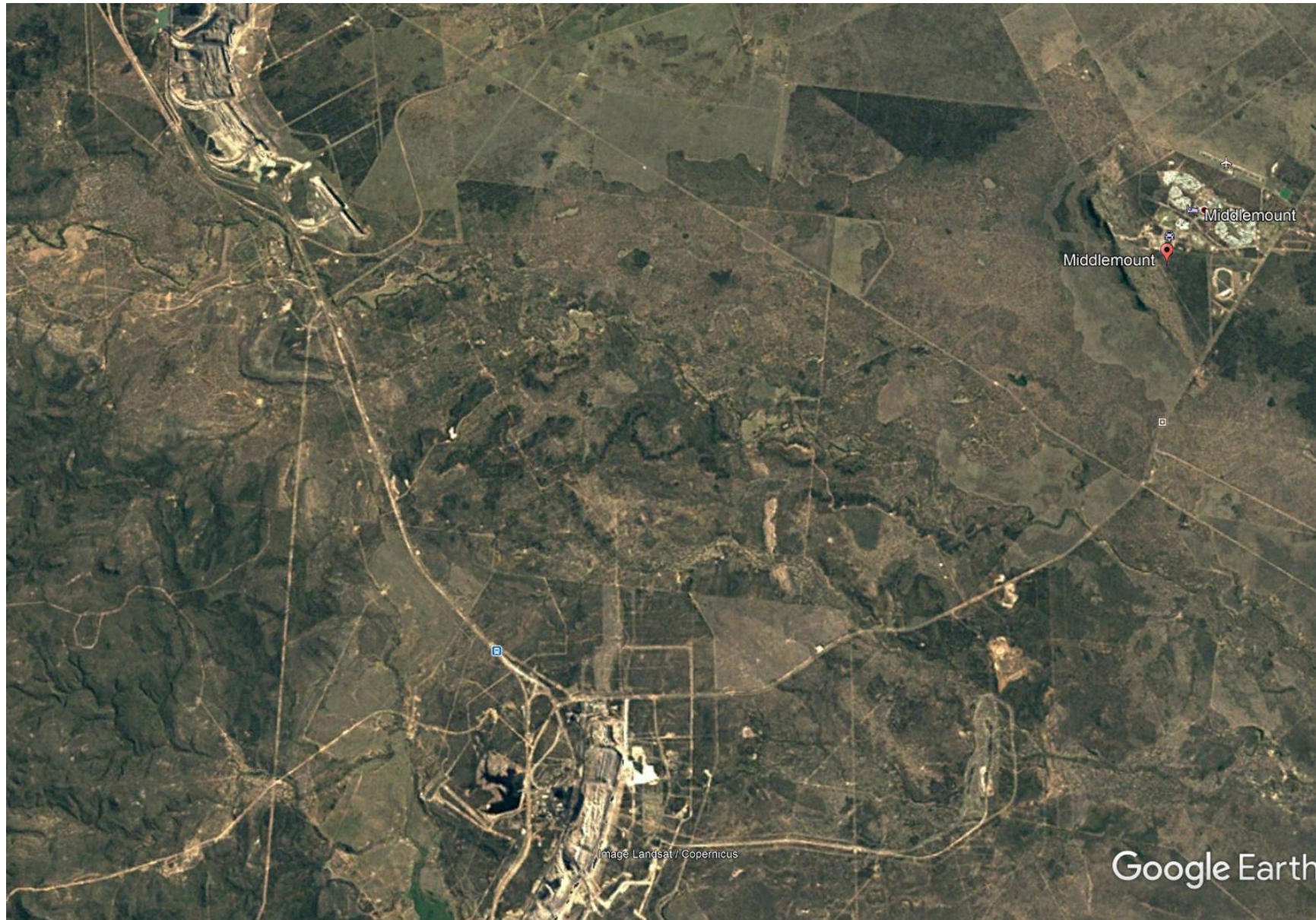


Figure 7a **Air photo from 1984**



Figure 7b Air photo from 2004



Figure 7c **Air photo from 2011**



Figure 7d **Air photo from 2016**

Figure 8 **Example Photos of Regrowth (Non-remnant)**



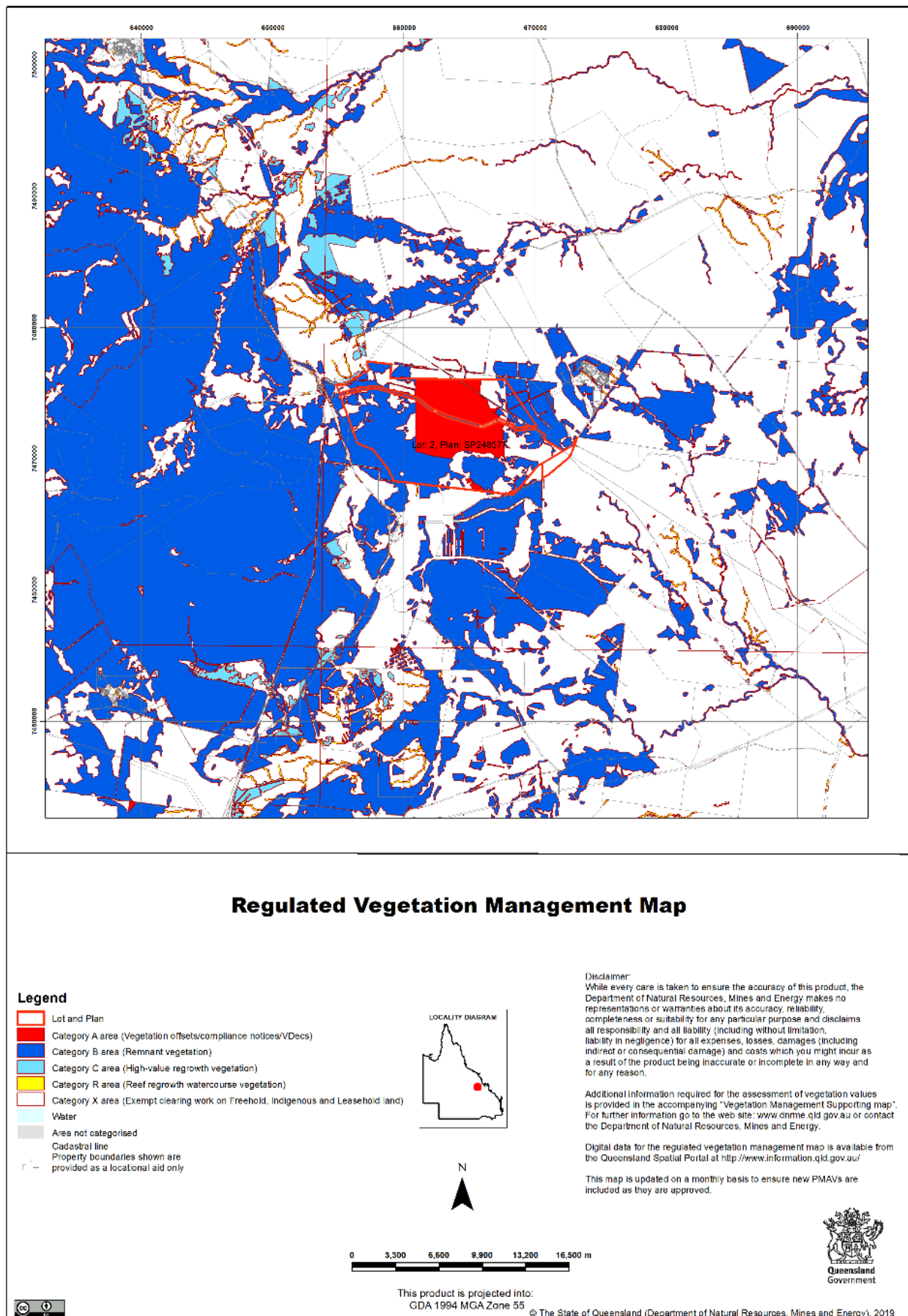


Figure 9 Regulated Vegetation Management Map