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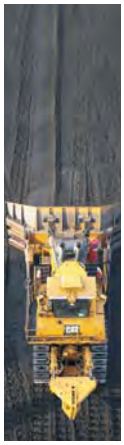
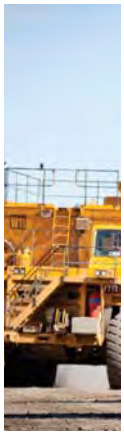
Duralie Open Pit Modification
Environmental Assessment





APPENDIX F

FAUNA ASSESSMENT

YANCOAL
兖煤澳大利亚有限公司

Resource Strategies

Duralie Open Pit Modification Fauna Assessment

Prepared by Australian Museum Consulting
for Duralie Coal Pty Ltd

Final Report

July 2014

AM Consulting Reference: 1400382

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Document Information 1400382

Citation:	Australian Museum Consulting 2014, *Duralie Open Pit Modification Fauna Assessment*. Consultancy report to Duralie Coal Pty Ltd.
Versions:	Version 1: Draft Report issued 14 May 2014 Version 2: Draft Report issued 26 May 2014 Version 3: Draft Report issued 5 June 2014 Version 4: Final Report issued 7 July 2014
Recipient:	Tony Dwyer, Duralie Coal Pty Ltd
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Executive Summary

The Duralie Coal Mine (DCM) has been operating since 2003. Duralie Coal Pty Ltd now wishes to modify some aspects of the approved DCM. The proposed Modification would require two increases in the extent of surface area disturbance, one (approximately 0.3 hectares [ha]) to the north of the approved open pit and the other (approximately 2.2 ha) to the west of the open pit. Overall, the additional area needed would be approximately 2.5 ha, or less than 1 percent (%), greater than the approved DCM. This study presents the results of a fauna assessment of the proposed Modification.

This study involved a desktop assessment and field surveys of the Modification area and surrounds, including database searches for records of threatened fauna, a review of the methods and results of fauna surveys performed previously within the study area and nearby areas, habitat assessments, spotlighting, camera traps, harp traps, ultrasonic call recorders, hand searches and bird surveys. The previous and current surveys included targeted searches for potentially occurring threatened fauna species.

Two broad fauna habitat types were recorded within the Modification area or immediate surrounds; dry sclerophyll forest, and cleared land with scattered trees. Areas of dry sclerophyll forest within the Modification area were in moderate to good condition, but mostly regrowth with few hollow-bearing trees. Areas of cleared land contained scattered eucalypt trees but lacked a well-developed understorey.

Nine species of threatened fauna listed under the TSC Act were recorded within the study area or nearby during the current surveys. These were the Speckled Warbler, White-fronted Chat, Spotted Harrier, Grey-crowned Babbler, Varied Sittella, Squirrel Glider, Brush-tailed Phascogale, Little Bentwing-bat and Eastern Bentwing-bat. Six threatened fauna species were recorded in the Modification area or immediate surrounds (Speckled Warbler, Varied Sittella, Squirrel Glider, Brush-tailed Phascogale, Little Bentwing-bat and Eastern Bentwing-bat).

The main type of impact on fauna that would occur as a result of the Modification would be the removal of an additional 0.7 ha of dry sclerophyll forest and 1.8 ha of cleared land with scattered trees, and the loss or displacement of any individuals using that habitat. Most of this area provides known or potential habitat for a range of threatened fauna. However, as indicated above this additional impact represents less than 1% of the area that would be cleared for the approved DCM, most of which contains similar habitat (dry sclerophyll forest and cleared land with scattered trees); thus, the additional or cumulative impacts that arise directly from the Modification are comparatively minor. Additionally, similar habitat is more widespread in the mining lease, existing and proposed offset areas as well as in wider landscape.

The following existing mitigation measures implemented at the DCM would be applied to the Modification:

- vegetation clearing protocols;
- irrigation and site water management;
- weed management;
- animal pest management and monitoring; and
- bushfire management.

The proposed Modification also includes the provision of an offset area to account for residual impacts on fauna. The proposed offset area includes approximately 9 ha of dry sclerophyll forest and approximately 3.5 ha of grassland. It adjoins the existing Northern Offset Area that was previously established for the approved DCM. The proposed offset area would be permanently set aside for the conservation of native flora and fauna.

Threatened fauna that have been recorded in the Northern Offset Area and/or the proposed additional offset for the Modification include the Squirrel Glider, Brush-tailed Phascogale, Koala, Eastern Bentwing-bat, Grey-crowned Babbler, Eastern Freetail-bat, White-fronted Chat, Varied Sittella and Speckled Warbler. The proposed Offset area provides known or potential habitat for all species recorded within or adjacent to the Modification surface disturbance area.

The potential impacts of the proposed Modification were described for a range of threatened fauna in accordance with the *Draft Guidelines for Threatened Species Assessment*. The results indicate that no threatened fauna are likely to be affected to the point that a local population would be placed at risk of extinction. Key thresholds were assessed as follows:

- The proposed Modification includes actions to avoid or mitigate impacts and provides an approximately 12.5 ha offset which includes either known or potential habitat for all of threatened species affected.
- All of the threatened fauna affected, including the Speckled Warbler, have been recorded in nearby areas, including the existing offset areas, and in some cases the proposed offset area.
- The proposed Modification is not likely to place a local population of a threatened species at risk of extinction.
- The proposed Modification does not affect any critical habitat.

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1 Introduction

1.1 Background

The Duralie Coal Mine (DCM) is located approximately 10 kilometres (km) north of the village of Stroud and approximately 20 km south of Stratford in the Gloucester Valley in New South Wales (NSW) (Figure 1). Operations at the DCM originally commenced in 2003.

The DCM currently operates in accordance with the conditions of Project Approval (08_0023) granted by the NSW Land and Environment Court in November 2011 (as modified in November 2012).

Duralie Coal Pty Ltd (DCPL) requires a modification to the DCM Project Approval (08_0203) (the Modification).

The main activities associated with the Modification include:

- Minor changes to the surface extent of the currently approved open pits to improve geotechnical stability, including a reduction in low wall angles of the Clareval open pit and the removal of the pillar between the Clareval and Weismantel Pits and the associated relocation of existing water diversion infrastructure adjacent to the Clareval pits. The additional surface development extent associated with the Modification (i.e. Modification disturbance area) is shown on Figure 2.
- Changes to the open pit shells, including an increased maximum pit depth, to reflect the results of recent geological exploration.
- Revised mining sequence (i.e. progression of mining in the Clareval and Weismantel open pits) to account for the revised pit shells and associated dumping requirements.
- Increased waste emplacement height in the central portion of the waste emplacement.

The Modification disturbance area is limited to two relatively small areas (approximately 2.5 hectares [ha] in total) along the northern and western extent of the Clareval North West Open Pit, located within Mining Lease (ML) 1646. These areas have been subject to extensive survey for the Duralie Extension Project.

The proposed Modification incorporates impact mitigation measures and provision of an offset for residual impacts on flora and fauna.

This study presents the results of a fauna assessment of the proposed Modification commissioned by DCPL and undertaken by Australian Museum Consulting (AM Consulting). A flora assessment is being carried out concurrently by FloraSearch Pty Ltd.

1.2 Scope and objectives

The primary aim of this assessment is to assess potential impacts on terrestrial fauna, in particular, fauna of conservation significance. Potential impacts of the proposed Modification on fauna were assessed in accordance with the *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation and Department of Primary Industries [DEC and DPI], 2005) due to the Modification being assessed under Section 75W Part 3A of the *Environmental Planning and Assessment Act* (EP&A Act).

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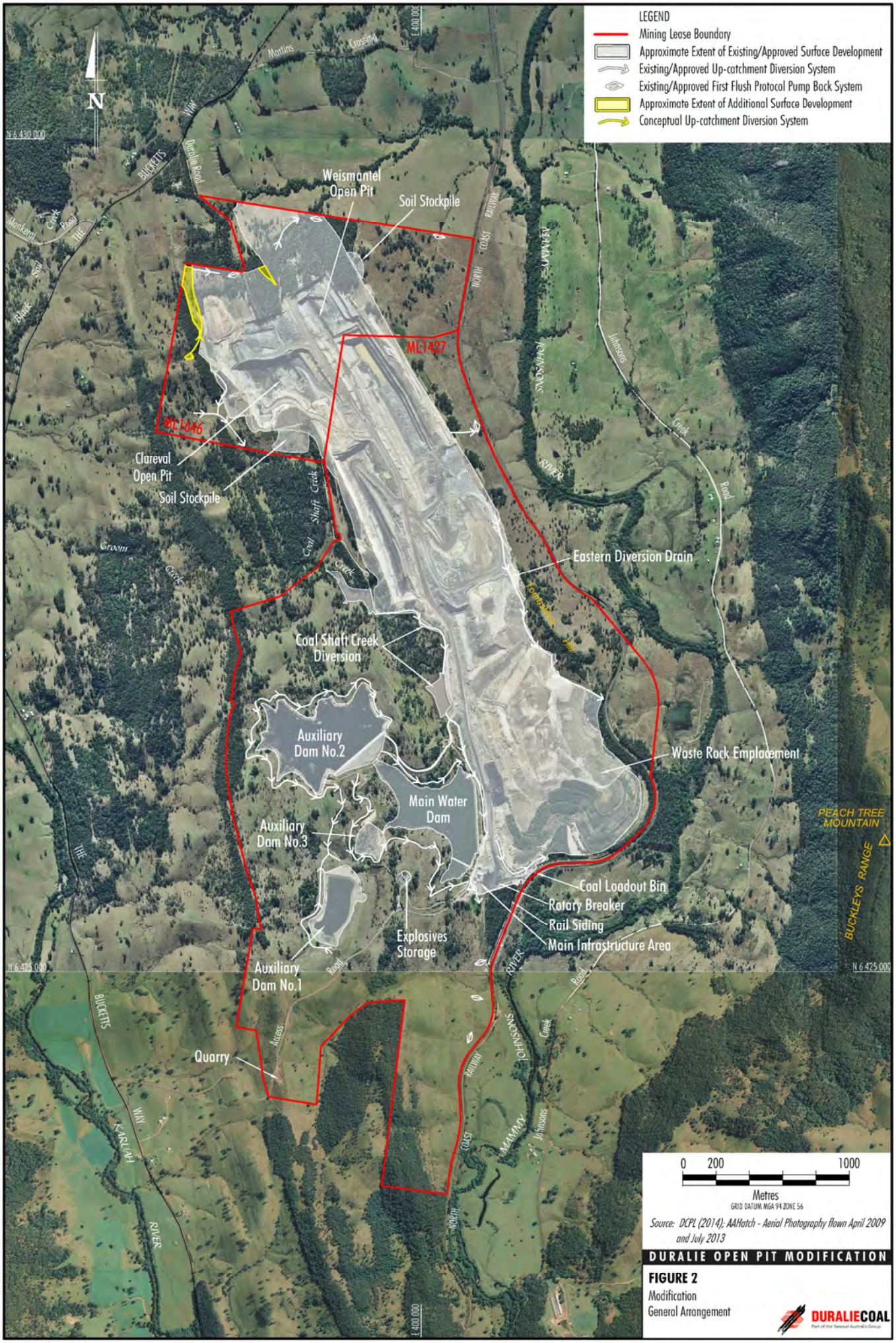

DURALIE OPEN PIT MODIFICATION

FIGURE 2
Modification
General Arrangement

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Fauna of conservation significance are defined in this report as threatened species or populations listed on the Schedules of the NSW *Threatened Species Conservation Act 1995* (TSC Act) and/or are listed as matters of national environmental significance by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The specific objectives of this impact assessment are to consider the:

- terrestrial fauna known or likely to occur in the area that would be affected by the Modification, including fauna of conservation significance;
- potential impacts of the Modification on those fauna;
- proposed impact avoidance and mitigation measures; and
- suitability of a proposed offset.

This scope of this study includes:

- a desktop assessment of the fauna likely to occur in the vicinity;
- a review of the methods and results of the fauna surveys performed by EcoBiological between 2007 and 2009 (EcoBiological 2009a, 2009b);
- fauna surveys and field assessments;
- consideration of the conclusions of the fauna assessment undertaken for the Duralie Extension Project and the November 2011 Land and Environment Court decision;
- review of the *Duralie Coal Mine Biodiversity Management Plan* (Greening Australia, 2013).
- consideration of the existing mitigation measures and offset for the DCM.

There are no threatened fauna listed under the NSW *Fisheries Management Act 1994* that are likely to be affected by the proposed Modification as there is no aquatic habitat within the Modification area, and watercourses within or nearby the study area are unlikely to provide potential habitat. Threatened fauna listed under the NSW *Fisheries Management Act 1994* are not discussed further.

1.3 Location

The DCM is located in the NSW North Coast Interim Biogeographic Regionalisation of Australia bioregion (Commonwealth of Australia 2012), and within the Hunter Region as defined by NSW Local Land Services (Local Land Services 2013).

The DCM is located approximately 5 km north of Stroud Road and 20 km south of Stratford in the Gloucester Valley in NSW (Figure 1). The existing DCM primarily consists of mine pits, waste emplacements and supporting infrastructure (Figure 2). The surrounding landscape has been extensively cleared, particularly on the valley floor, and is mostly used for agriculture (e.g. cattle grazing, poultry farming), with wooded areas occurring mostly on the slopes to the west and east.

There are some areas of native vegetation within and adjacent to the existing mining lease, including within the northern part of the mining lease, and existing offset areas for the DCM (the Southern Offset Area and the Northern Offset Area). Most of the native vegetation at the northern end of the mining lease has been, or will be, cleared as part of the approved DCM.

Nature reserves in the surrounding area include the Glen Nature Reserve approximately 11.5 km to the north-east and Monkerai Nature Reserve approximately 9 km to the west. Other areas of native vegetation in the vicinity include the Myall River State Forest approximately 6 km to the east, the Trevor State Forest approximately 10.5 km to the west and the Avon River State Forest approximately 12 km to the north-west.

The DCM is located in the Mammy Johnsons River catchment. The Mammy Johnsons River is situated to the east of the DCM and flows in a southerly direction through an extensively cleared landscape. Prior to the commencement of the DCM, Coal Shaft Creek (a tributary of the Mammy Johnsons River) traversed a large proportion of the DCM deposit, but is now diverted around the DCM. An unnamed ephemeral drainage line occurs within the study area in the northern section of the mining lease boundary, in which surface water eventually drains east to the Mammy Johnsons River (Gilbert & Associates, 2014).

1.4 Definitions

Some common terms used in this report are defined below.

Direct impacts are those that directly affect fauna habitat or individual animals and/or their populations, for example, removal of habitat or loss of individuals resulting from vegetation clearing.

Indirect impacts are those that affect fauna in a manner other than direct loss, for example, weed invasion of the habitat around a development or hydrological changes downstream of a development.

The **Modification area** is defined in this report as the area directly affected, that is, the "footprint" of the Modification (Figure 2).

The **study area** is defined in this report as the areas that were surveyed by AM Consulting for the purpose of this assessment (Figure 3), including the land surrounding the **Modification area** and proposed offset area.

The **locality** is defined in this report as the area within a 10 km radius of the DCM.

The **region** is the Hunter Region as defined by the Local Land Services (2013).

Significant is defined as "important, notable or of consequence having regard to its context or intensity".

Likely is defined as "a real or not remote chance or possibility".

1.5 Authorship and acknowledgements

This fauna assessment was prepared by Mark Semeniuk, Terry O'Dwyer, Ulrike Kloecker and Glenn Muir.

This assessment references reports authored by others, in particular, the *Duralie Extension Project Terrestrial Flora and Fauna Assessment – Appendix E* (Cenwest Environmental Services and Resource Strategies 2010), the *Duralie Coal Mine Biodiversity Management Plan* (Greening Australia, 2013) and the results of flora surveys for the study currently being undertaken on flora (by FloraSearch) for the Modification. Where relevant, information from these sources has been incorporated into this document.

The information and data has been used by AM Consulting in the preparation of this assessment and it has been assumed by AM Consulting that the information presented is accurate. However, AM Consulting takes no responsibility for the comprehensiveness or accuracy of reports prepared by other parties.

2 Methodology

2.1 Desktop assessment

A desktop investigation was carried out to identify terrestrial fauna species and habitat that may be affected by the Modification. This included:

- several previous surveys of fauna in the mining lease and/or surrounds, listed in Section 2.2.1;
- a review of the *Duralie Extension Project Terrestrial Flora and Fauna Assessment* (Cenwest Environmental Services and Resource Strategies, 2010);
- a review of the *Duralie Coal Mine Biodiversity Management Plan* (Greening Australia, 2013);
- a review of the *Flora and Fauna Survey Report: Duralie Coal Mine, Gloucester, New South Wales* (EcoBiological 2009a);
- a review of the *Flora and Fauna Survey Report: Gloucester Coal Properties East of the Bucketts Way, Gloucester, New South Wales* (EcoBiological 2009b);
- a search of the Office of Environment and Heritage (OEH) Threatened Species Profiles database (OEH 2014a) for species known or predicted to occur within the Karuah Manning Catchment Management Authority sub-region;
- a search of the OEH Atlas of NSW Wildlife database (OEH 2014b) for records of threatened fauna within the locality (sourced 7 May 2014);
- a search of the Commonwealth Department of the Environment (DotE) Protected Matters database (DotE 2014) for matters of national environmental significance within the locality (sourced 7 May 2014);
- a search of the Australian Museum collections database for records of threatened fauna within the locality (sourced 29 April 2014);
- a search of the Birdlife Australia database for records of threatened birds within the locality (sourced 24 April 2014);
- an examination of updated vegetation maps and data from the concurrent flora study being undertaken by FloraSearch;
- an examination of current and historical aerial photographs of the Modification area and surrounds; and
- an examination of topographic maps of the Modification area and surrounds.

2.2 Survey techniques and effort

2.2.1 *Previous fauna surveys*

Several fauna studies have previously been undertaken in the vicinity of the DCM. The earliest studies were undertaken as part of the Environment Impact Statement (EIS) for the DCM in 1996, including:

- ERM Mitchell McCotter (1996) - *Winter Fauna Survey for Proposed Duralie Coal Mine Near Gloucester*;
- Fly-by-Night Bat Surveys Pty Ltd (Fly-by-Night Bat Surveys) (1996) - *Winter Survey of the Bat Fauna of the Proposed Duralie Coal Mine near Gloucester, New South Wales*;

- Paul Webber Consulting Services (1996) - *Herpetological Survey of the Proposed Duralie Coal Mine via Gloucester, NSW*;
- Debus (1995) - *Bird Survey of the Proposed Duralie Coal Mine Site, Stroud*; and
- Woodward-Clyde (1996) - *Summer Fauna Report*.

More recent survey work includes:

- FloraSearch (2005) - *Vegetation Mapping and Targeted Threatened Flora Species Search for Duralie Extended*;
- Place Planning and Design (2003) - *Duralie Coal Mine – Pre-clearance Survey and Habitat Assessment*;
- EcoBiological (2009a) - *Flora and Fauna Survey Report: Duralie Coal Mine, Gloucester, New South Wales*;
- EcoBiological (2009b) - *Flora and Fauna Survey Report: Gloucester Coal Properties East of the Bucketts Way, Gloucester, New South Wales*;
- Greening Australia (2013) – site inspections for the *Duralie Coal Mine Biodiversity Management Plan*;
- AM Consulting (2014), *Nest Box Programme for the Duralie Offset Area, Annual Report for 2013-2014*; and
- Giant Barred Frog monitoring reports (Biosphere Environmental Consultants (2012; 2013).

A summary of the fauna survey techniques and effort undertaken by Ecobiological between 2007 and 2009 was provided in the *Duralie Extension Project – Terrestrial Flora and Fauna Assessment* (Cenwest Environmental Services and Resource Strategies, 2010), and is reproduced here in Table 2.1. The data remains valid as there have been minimal changes to the landscape that would provide new opportunities for fauna in the years since these surveys.

Within or nearby the current study area, EcoBiological (2009a) undertook koala scat searches (three sites), habitat assessments (four sites), hair tube transect (one site), full trapping transect (two sites), ultrasonic microbat call recording (two sites), harp traps (one site), bird surveys (three 1 ha area plots and two transects), owl call playback (three sites), diurnal owl survey (two transects), frog surveys (three transects and four point surveys) and reptile surveys (five sites).

EcoBiological (2009b) also undertook fauna surveys of Southern Offset Area in August 2008 and January 2009. Fauna habitat assessments were undertaken as well as other survey techniques including arboreal and ground Elliot traps, cage traps, hair tubes, harp traps, Type IV funnel traps, spotlighting, ultrasonic microbat call recording, nocturnal call playback, bird surveys, herpetological surveys, spotlighting, opportunistic observations and a fauna tracks and traces search (EcoBiological, 2009b).

Table 2.1 Fauna survey techniques undertaken in the mining lease between 2007 and 2009.

Technique	Survey Period						Total Sampling Effort
	April 2007	July 2007	November 2007	August 2008	January/ February 2009	April 2009	
Hair tubes – Tree	35 traps, 4 nights	–	–	–	–	109 traps, 4 nights	576 hair tube nights
Hair tubes – Ground	–	–	–	–	–	31 traps, 4 nights	124 hair tube nights
Elliot A	60 traps, 4 nights	–	–	–	–	50 traps, 4 nights	440 trap nights
Elliot B – Tree	15 traps, 4 nights	–	–	–	–	12 traps, 4 nights	108 trap nights
Elliot B – Ground	–	–	–	–	–	50 traps, 4 nights	200 trap nights
Cage	11 traps, 4 nights	–	–	–	–	12 traps, 4 nights	92 trap nights
Harp Trap	4 traps, 4 nights	–	–	–	–	–	16 trap nights
Type IV Funnel Traps	12 traps, 4 nights	–	–	–	–	–	48 trap nights
Spotlighting	✓	✓	–	✓	✓	✓	21.5 person hours
Anabat Call Recording	✓	✓	–	✓	–	✓	✓
Nocturnal Call Playback	✓	✓	✓	✓	✓	✓	✓
Bird Surveys	✓	✓	✓	✓	✓	✓	12.5 person hours
Reptiles Searches	✓	–	✓	–	✓	✓	23 person hours
Amphibian Searches	✓	–	✓	–	✓	✓	16 person hours
Opportunistic Observations	✓	✓	✓	✓	✓	✓	–

2.2.2 AM Consulting field surveys

AM Consulting ecologists Mark Semeniuk and Chris Jackson undertook fauna habitat assessments and fauna surveys throughout the study area between 28 April 2014 and 1 May 2014, including surveys within the northern part of the Modification area and surrounds, the western part of the Modification area and surrounds, and the proposed offset area. The fauna survey techniques and effort undertaken are provided in Table 2.2. Survey locations are shown in Figure 3.

Table 2.2 Survey techniques and effort undertaken by AM Consulting within the study area in 2014.

Technique	No. of sites	Survey Effort/Description
Diurnal bird survey	3	Twenty-minute standard search within three hours of dawn. All birds observed or heard were recorded. Each site was surveyed on two separate mornings.
Diurnal reptile search	3	Active search of potential reptile habitats performed at each site on two separate days. Survey effort during each survey was a minimum of 30 person minutes (60 person minutes total at each site).
Nocturnal spotlighting	3	Active searches on foot for nocturnal species, including amphibians, reptiles, birds and mammals were performed at each site on two separate nights. Effort during each survey was a minimum of 60 person minutes (120 person minutes total at each site). Given the relatively small size of the survey area, surveys within the northern part of the study area commenced within the Modification area moving north, to also include spotlighting the nearby creek.
Harp trapping	2	Two harp traps were deployed at each site and checked each morning for two days (four harp trap nights at each site).
Anabat	3	Two anabats were left overnight for two nights within the northern Modification area and the proposed offset area (four anabat nights at each site). Two anabats were left overnight for one night within the western Modification area (two anabat nights).
Opportunistic records	n/a	Opportunistic observations of fauna were recorded throughout the survey period. Access to the proposed offset area was best achieved by walking from the northern part of the study area, along the western side of the open pit and continuing south. Thus good coverage of the study area and surrounds was achieved during each survey day, providing many opportunities for opportunistic records of a range of vertebrate species utilising the habitats within and around the study area.
Infra-red cameras	3	Two cameras were deployed at each site, one with universal bait and one with sardine bait. All cameras were left in-situ for a minimum of 9 nights between 28 April 2014 and 7 May 2014.
Koala SPOT Assessment	3	One SPOT Assessment was undertaken at each site in accordance with the methodology described in Phillips and Callaghan (2011).
Habitat assessment	4	At each site a number of features were recorded within a sample area of 50 x 20 metres [m]. Features recorded included broad habitat type, age and structure of the vegetation, predominant topography, altitude, disturbance history (e.g. fire, grazing), dominant canopy/shrub/ground layers, litter/humus depth, abundance of key plant species (e.g. *Acacia* spp., *Allocasuarina* spp., mistletoe), abundance of weeds, ground layer features (percent cover vegetation, rock, soil, litter, logs), number of large dead trees, number of trees with hollows, number of small (<10 centimetres [cm]), medium (10-30 cm), large (>30 cm), or basal hollows, abundance of decorticating bark, number of logged stumps, fallen branches and rock crevices, length of large (>30 cm) logs; and stream or water body characteristics. At locations throughout the study area where standard habitat assessments were not undertaken, brief habitat descriptions and photographs were recorded. It was also noted whether the habitat was similar to an area in which a standard habitat assessment was undertaken.

The survey methodology was guided by the following:

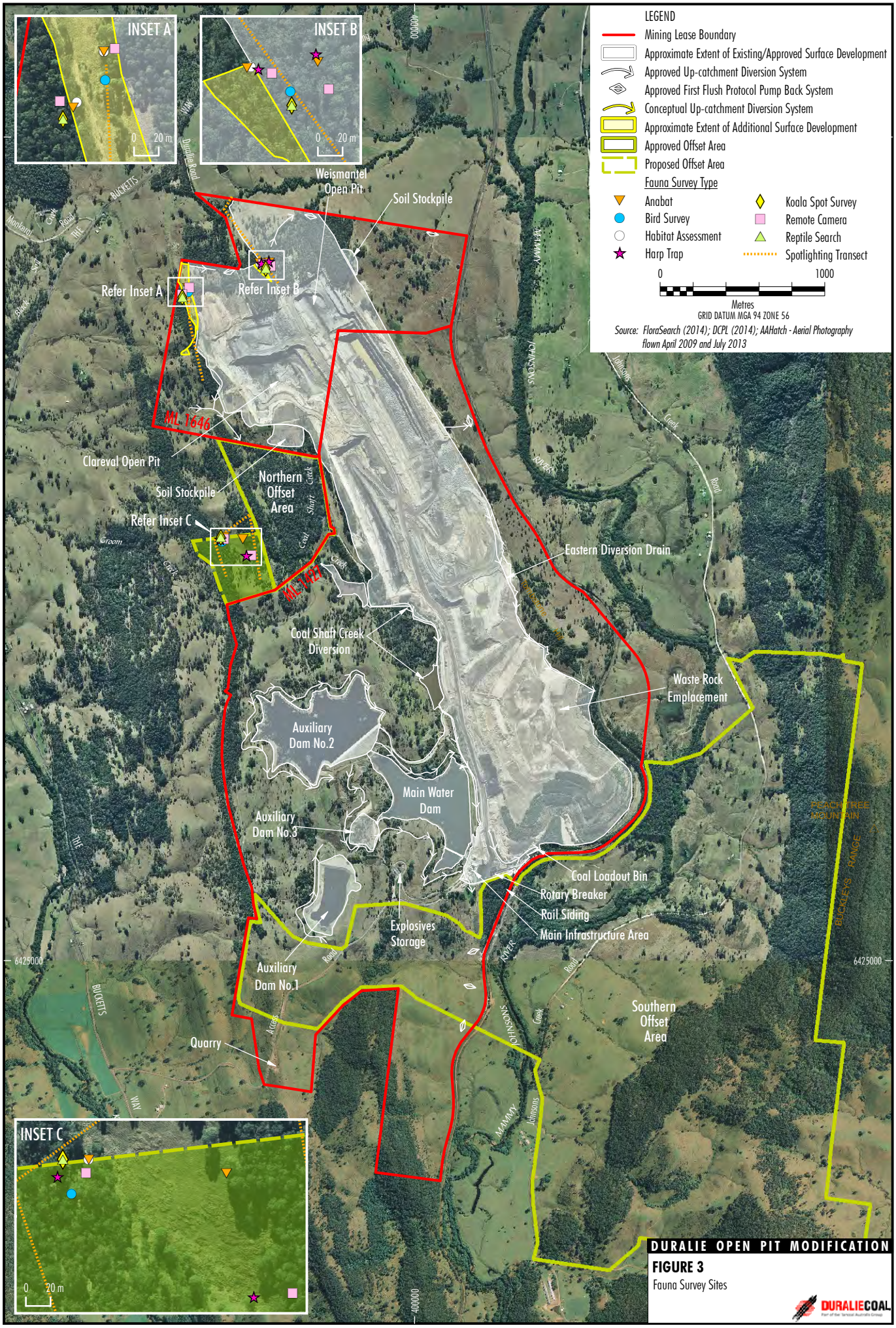
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (Department of Environment and Conservation, 2004);
- Office of Environment and Heritage *Field Survey Methods* (OEH 2013);
- *Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians* (Department of Environment and Climate Change, 2009); and
- the EPBC survey guidelines for Australia's threatened species, which includes guidelines for bats (Department of Environment, Water, Heritage and Arts [DEWHA] 2010a), birds (DEWHA 2010b), mammals (Department of Sustainability, Environment, Water, Population and Communities [DSEWPaC] 2011a), reptiles (DSEWPaC 2011b) and frogs (DEWHA 2010c).

Climate conditions during the current survey period are summarised within Table 2.3. The climate data obtained is only approximate as the weather stations are between 14 and 44 km from the study area. Nonetheless minimum and maximum temperatures experienced on the ground are likely to be similar to those identified in the table. Rainfall may have varied slightly, however, as steady rainfall occurred during most of the day on 30 April 2014.

Table 2.3 Climate data during the survey period.

Date	Temp min (°C)*	Temp max (°C)*	Rainfall (mm)**	Moon phase
28/04/2014	15.3	22.3	9.8	1%
29/04/2014	10.2	25.7	0.0	New moon
30/04/2014	14.7	22.9	1.0	2%
1/05/2014	9.6	22.1	0.0	6%
2/05/2014	10.9	23.3	0.0	12%
3/05/2014	10.2	17.7	0.0	18%
4/05/2014	10.5	19.9	0.4	26%
5/05/2014	8.8	19.1	0.0	35%
6/05/2014	6.1	19.7	0.0	44%
7/05/2014	9.6	20.2	0.2	54%

Note: Rainfall data from Dungog – Main Creek (Yeranda). Temperature data from Paterson 44 km away. Dates shown include the full period remote sensing cameras were deployed.



DURALIE OPEN PIT MODIFICATION

FIGURE 3

Fauna Survey Sites

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2.3 Assessment of impacts

Potential impacts of the proposed Modification on fauna were assessed in accordance with the *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005) due to the Modification being assessed under Section 75W Part 3A of the EP&A Act. The survey methodology undertaken by AM Consulting were developed in consideration of the considerable survey effort previously undertaken, including some covering and close to the Modification area and proposed offset area (see Section 2.2.1). The majority of threatened species likely to occur have previously been documented and the impacts of the DCM on those species previously assessed. Further, the Modification area is relatively small in size (approximately 2.5 ha) and partly surrounded by disturbance associated with the currently approved open pit. The modified survey effort, in conjunction with the previous surveys, is considered sufficient to assess the impact on threatened species.

Calculations of potential impact areas were based on GIS files of the Modification area, and existing approved disturbance area.

2.4 Limitations

Surveys undertaken by AM Consulting were conducted during one season (autumn) and for a limited period of time (four days for active surveys and nine days for remote monitoring cameras). The techniques used were mostly observation-based rather than trapping (other than harp traps used for microbats). Accordingly, it is likely the surveys would not have recorded the full range of threatened fauna potentially occurring within the study area, particularly those which may only occur seasonally or occasionally. The surveys were undertaken for the purpose of assessing the impacts for the Modification and the characteristics of the offset area. The surveys were designed in consideration of the considerable survey effort previously undertaken (Section 2.2.1) and the relatively small size of the Modification area (approximately 2.5 ha) which is partly surrounded by disturbance associated with the currently approved open pit.

A conservative approach was adopted whereby the potential impacts on all potentially occurring and previously recorded threatened fauna species have been considered, regardless of whether or not they were recorded during the surveys in 2014. For example, the Swift Parrot (a winter migrant) has been previously recorded in the mining lease and therefore the potential impact on its habitat has been considered. Further, the conclusions of this report are based on a range of data, including the 2014 surveys, previous studies, database searches and habitat assessments.

3 Results

3.1 Threatened fauna previously recorded or predicted to occur

Appendix A provides a summary of the threatened fauna species that are known or considered to have potential to occur within the locality and/or region. The table indicates which of those species have been recorded previously within the DCM or surrounds during all of the studies discussed in Section 2 (i.e. surveys between 1996 and 2014). The table also provides an assessment of the likelihood of each species occurring within the Modification area or immediate surrounds. Only those species with the potential to occur (or "Unlikely" to occur but with survey records in the DCM or nearby surrounds) within the disturbance area were assessed further.

3.2 Habitat types, condition and features

Two broad fauna habitat types were recorded within the Modification area or immediate surrounds:

- Dry Sclerophyll Forest; and
- Cleared Land with Scattered Trees.

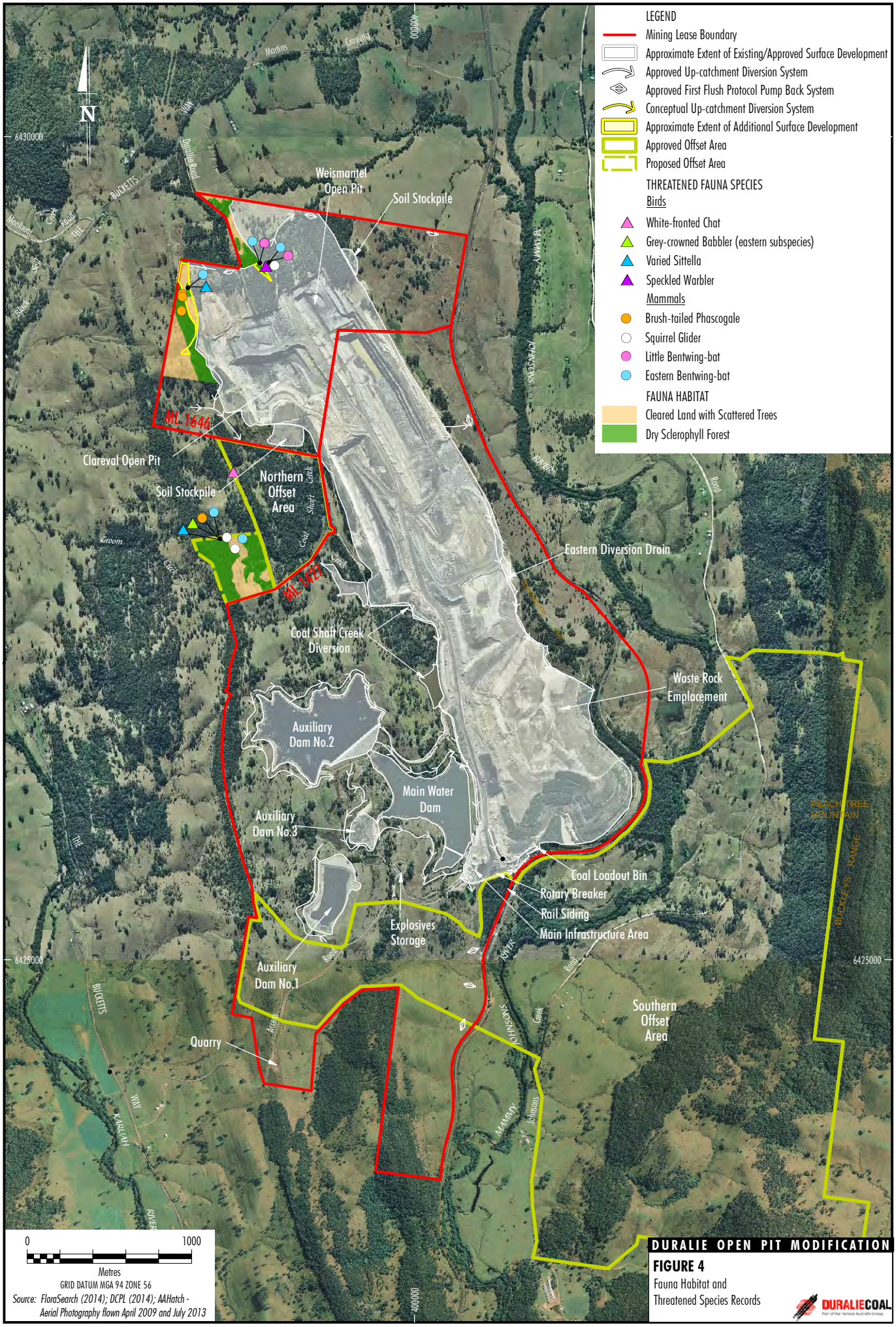
The location of these habitat types within the study area is shown in Figure 4.

Dry Sclerophyll Forest

This habitat type occupies the majority of the Modification area. Two main areas of this habitat type occur within the Modification area, one to the north of the existing open pit (Plate 1), and one to the west of the existing open pit (Plate 2).

The dry sclerophyll forest to the north of the open pit is regrowth approximately 20-25 m high, with few hollow-bearing trees present. Dominant canopy species included Thick-leaved Mahogany (*Eucalyptus carnea*), Ironbarks and Spotted Gum (*Corymbia maculata*). Throughout the mid-storey Forest Oaks (*Allocasuarina torulosa*) were occasional; however, no evidence of chewing from Glossy Black-cockatoos (*Calyptorhynchus lathami*) was found. The shrub layer is well-structured, ranging from 1-3 m high, with common species including Prickly Moses (*Acacia ulicifolia*), Prickly Beard-heath (*Leucopogon juniperinus*) and Gorse Bitter Pea (*Daviesia ulicifolia*). Good ground cover is present and composed primarily of native grasses interspersed between low shrubs. Large logs were present but uncommon (a total of 30 m of logs within 20 x 50 m plot) and large rocks or rocky outcrops were absent. Leaf litter is patchy and mostly shallow. Mesic plant species were noted within a small drainage line that extended across the Modification area in one location on the east side of the site, and weeds were most common within this part of the area. This drainage line was dry at the time of the survey. Hollow-bearing trees were present but uncommon in the area (six potential tree hollows within 20 x 50 plot).

The dry sclerophyll forest to the west of the open pit and within the Modification area is younger than the northern area, with canopy height approximately 15 m high and hollow-bearing trees absent. The vegetation is dominated by Thick-leaved Mahogany (*Eucalyptus carnea*) and Spotted Gum (*Corymbia maculata*) and lacked structural complexity, with only a very sparse shrub layer present. Grass cover and leaf litter is also relatively sparse. Large logs were present but uncommon (a total of 30 m of logs within 20 x 50 m plot). Some large rocks were present.



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To the west of the Modification area a north-south orientated corridor of regrowth dry sclerophyll forest occurs. Hollow-bearing trees were more common here than in the other parts of the Modification area (13 potential tree hollows within 20 x 50 m plot), as were large fallen logs (a total of 85 m of logs within 20 x 50 m plot). Dominant canopy species included Thick-leaved Mahogany (*Eucalyptus carnea*), Ironbarks and Spotted Gum (*Corymbia maculata*). Throughout the mid-storey Forest Oaks (*Allocasuarina torulosa*) were occasional; however, no evidence of chewing from Glossy Black-cockatoos (*Calyptorhynchus lathami*) was found. The shrub layer is sparse and lacked the diversity found in the area to the north of the open pit. Grassy ground cover is also sparse. Leaf litter is abundant in patches.

Further south within the vegetated corridor a small area of degraded dry rainforest is situated on either side of a narrow drainage line. The habitat occupies an area of approximately 0.4 ha. There is a greater influence of mesic species throughout the canopy (e.g. Grey Myrtle [*Backhousia myrtifolia*]), understorey (e.g. Orange Thorn [*Pittosporum multiflorum*]). Vines were common throughout and ferns dominated the ground cover.

All areas of dry sclerophyll forest were in moderate to good condition, with no evidence of grazing and low abundance of weeds. Previous disturbance was evidenced by the presence of logged stumps in some locations.

Plate 1 Examples of dry sclerophyll habitats within the northern portion of the Modification area.

Plate 2 Examples of habitats in the western portion of the Modification area (dry sclerophyll and cleared land on the left; cleared land on the right).

Cleared Land with Scattered Trees

This habitat type occurs to the north and to the west of the open pit and is characterised by open grassland with scattered trees. Most trees were regrowth Ironbarks and did not contain hollows. The shrub layer is generally absent, with the exception of a few scattered wattles (*Acacia* sp.) in the northern part of the study area. The ground cover is dominated by native grasses and some weeds that were dense in some areas. Large logs and rocks were mostly absent. There was no evidence of grazing by ungulates (e.g. sheep, horses or cattle).

A small dam (approximately 8 x 10 m) is located in the northern section of the study area (outside the Modification area). The dam contained abundant aquatic and fringing vegetation and is largely surrounded by dense tall grasses. A small creek is located through the north-western corner of the study area (also outside the Modification area). The creek width varied greatly, with narrow riffles in sections, opening to small pools approximately 1-2 m wide in other areas. There is abundant thick fringing vegetation dominated by grasses and ferns. The canopy is relatively open, composed of small wattles (approximately 2-3 m high) and regrowth *Eucalyptus* species.

A drainage channel (constructed as part of the Up-catchment Diversion System to divert water around the open pit) is present to the west of the open pit. The channel is a shallow depression and only likely to contain free-flowing water after heavy rainfall.

3.3 Fauna recorded during the surveys

A total of 95 species of vertebrate fauna were recorded during the current (2014) surveys and are listed in Appendix B. This included 65 species of bird, 22 species of mammal, two species of reptile and six species of frog. Of these, nine threatened fauna species were recorded within the study area or nearby. Six threatened fauna species were recorded in the Modification area or immediate surrounds (Speckled Warbler, Varied Sittella, Squirrel Glider, Brush-tailed Phascogale, Little Bentwing-bat and Eastern Bentwing-bat).

A brief discussion of each recorded threatened species is provided below. Locations of threatened fauna recorded are shown on Figure 4. Previously recorded threatened fauna species are shown on Figure 5.

Speckled Warbler (*Pyrrholaemus sagittatus*)

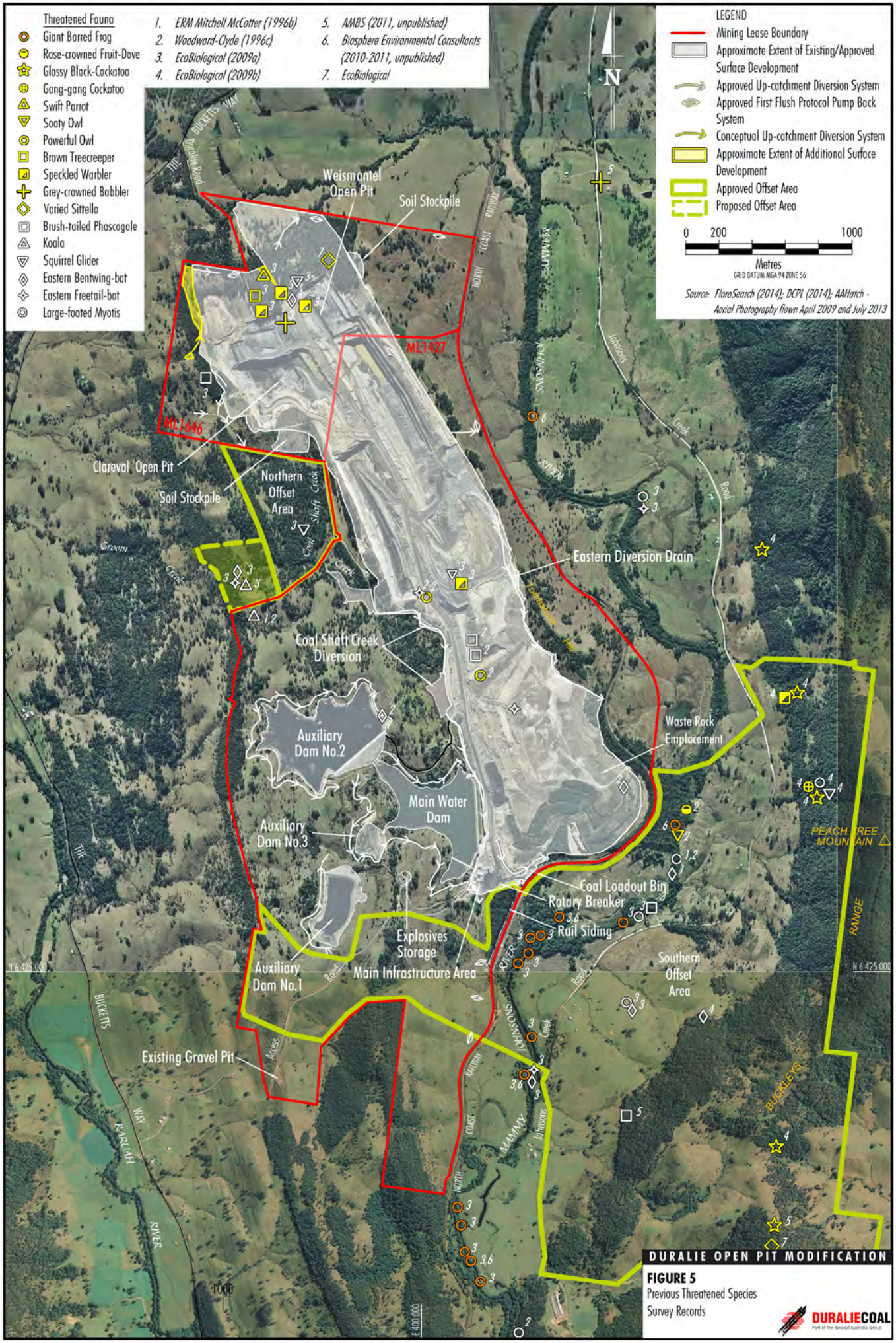
The Speckled Warbler was recorded on one occasion during the current surveys. One individual was heard and observed during diurnal bird surveys on 29 April 2014, within the Dry Sclerophyll Forest adjacent to the Modification area north of the open pit (coordinates 399094 E, 6429214 N).

Varied Sittella (*Daphoenositta chrysoptera*)

The Varied Sittella was recorded on two occasions during the current surveys. A group of at least five individuals were recorded opportunistically on 28 April 2014, within the Dry Sclerophyll Forest of the proposed offset area (coordinates 398818 E, 6427556 N). A group of at least five individuals were also recorded during diurnal bird surveys on 1 May 2014, within Dry Sclerophyll Forest of the Modification area west of the open pit (coordinates 398622 E, 6429083 N).

White-fronted Chat (*Epthianura albifrons*)

The White-fronted Chat was recorded on one occasion during the current surveys outside of the Modification area. Three individuals were observed opportunistically on 30 April 2014, on the edge of the existing Northern Offset Area. The area was a drainage depression within Dry Sclerophyll Forest (coordinates 398898 E, 6427965 N).



DURALIE OPEN PIT MODIFICATION

FIGURE 5
Previous Threatened Species Survey Records

DURALIECOAL
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GCL-14-23_Mod2_Fauna_101D

Spotted Harrier (*Circus assimilis*)

The Spotted Harrier was recorded on one occasion during the current surveys. One individual was observed opportunistically on 1 May 2014, near the turn off from Bucketts Way to the DCM office (coordinates 398146 E, 6424318 N). This record is not displayed on Figure 4.

Grey-crowned Babbler (*Pomatostomus temporalis*)

The Grey-crowned Babbler was recorded on one occasion during the current surveys. At least one individual was heard opportunistically on 29 April 2014 within the proposed offset area. The habitat was Dry Sclerophyll Forest, and the individuals were likely to be within 100 m from coordinates 398817 E, 6427556 N.

Squirrel Glider (*Petaurus norfolkensis*)

The Squirrel Glider was recorded on two occasions during the current surveys.

The first was during spotlighting surveys on 29 April 2014, where one individual was observed foraging in a Thick-leaved Mahogany (*Eucalyptus carnea*). The tree was approximately 10 m outside the boundary of the Modification area north of the open pit (coordinates 399150 E, 6429217 N). The second was during spotlighting surveys on 30 April 2014, where two individuals were observed foraging in two separate Green Wattles (*Acacia irrorata*) in a drainage depression within the proposed offset area (coordinates 398908 E, 6427497 N and 398859 E, 6427566 N).

Brush-tailed Phascogale (*Phascogale tapaotafa*)

The Brush-tailed Phascogale was recorded several times during the surveys. The first was during spotlighting on 30 April 2014, where one individual was observed foraging in an Ironbark within Dry Sclerophyll Forest to the west of the open pit (coordinates 398589 E, 6429028 N). Shortly after this sighting another individual was observed approximately 100 m to the south, in an Ironbark (coordinates 398583 E, 6428942 N). The remote monitoring camera in this area also detected at least one individual of the species on several nights (coordinates 398586 E, 6429043 N).

The Brush-tailed Phascogale was also detected within the proposed offset area by one of the remote monitoring cameras (coordinates 398841 E, 6427599 N). The species was recorded during one evening on 1 May 2014.

Little Bentwing-bat (*Miniopterus australis*)

The Little Bentwing-bat was positively recorded using anabats within the Modification area north of the open pit. A total of seven passes were recorded over two nights within Dry Sclerophyll Forest (coordinates 399116 E, 6429237 N and 399058 E, 6429233 N).

Eastern Bentwing-bat (*Miniopterus* [*schreibersii*] *orianae oceanensis*)

The Eastern Bentwing-bat was positively recorded using anabats in all survey locations within the study area. This included the Modification areas to the north of the open pit (three passes), to the west of the open pit (one pass), and the proposed offset area (420 passes).

3.4 Migratory species

One migratory species listed under the EPBC Act was recorded nearby the study area during the current surveys, the White-bellied Sea-eagle (*Haliaeetus leucogaster*), which was observed flying overhead near the DCM offices. This record is not displayed on Figure 4.

No migratory species were recorded within the study area during the current surveys. A summary of migratory species previously recorded within the study area and/or locality is provided within Appendix C.

3.5 Endangered populations

Two endangered populations listed under the TSC Act are known within the Karuah-Manning CMA sub-region, as defined within the NSW OEH Threatened Species Profiles database (OEH 2014a):

- Emu Population in the NSW North Coast Bioregion and Port Stephens Local Government area; and
- Koala, Hawks Nest and Tea Gardens population.

Neither of these endangered populations occurs within or near the Modification area.

3.6 Exotic fauna

A total of 17 exotic vertebrate species have been previously recorded within the DCM or surrounds (Table 3.1). The current surveys recorded five exotic species including the European Rabbit, European Red Fox, Common Myna, Feral Cat and European Cattle.

Table 3.1 Exotic vertebrate species previously recorded within the DCM and surrounds or locality.

Common name	Scientific name	DCM/surrounds	Locality
Black Rat	*Rattus rattus*	✓	✓
Brown Hare	*Lepus capensis*	✓	✓
Common Myna	*Sturnus tristis*	✓	✓
Common Starling	*Sturnus vulgaris*	✓	✓
European Cattle	*Bos Taurus*	✓	✓
European Rabbit	*Oryctolagus cuniculus*	✓	✓
European Red Fox	*Vulpes vulpes*	✓	✓
Feral Cat	*Felis catus*	✓	✓
Feral Goat	*Capra hircus*		✓
Feral Pig	*Sus scrofa*		✓
House Mouse	*Mus musculus*		✓
House Sparrow	*Passer domesticus*	✓	✓
Mallard	*Anas platyrhynchos*	✓	✓
Red Deer	*Cervus elaphus*		✓
Rock Dove	*Columbia livia*	✓	✓
Spotted Turtle-Dove	*Streptopelia chinensis*	✓	✓
Wild Dog	*Canis lupus* sp.	✓	✓

Information sources: Cenwest Environmental Services and Resources Strategies (2010), AM Consulting (2013).

4 Potential impacts

The Terrestrial Flora and Fauna Assessment for the Duralie Extension Project (Cenwest Environmental Services and Resource Strategies, 2010) evaluated the magnitude and extent of potential impacts on fauna of conservation significance, and their habitats. In general, the range of potential impacts associated with the Modification are similar to those previously identified by that assessment, given that the habitats are similar and adjacent to some of the areas affected by that project and likely to contain a similar range of threatened species.

The magnitude and extent of potential impacts from the Modification is assessed in the following sections including direct impacts (Section 4.1), indirect impacts (Section 4.2) and cumulative impacts (Section 4.3). The significance of these impacts is assessed within Section 4.4, using the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005).

4.1 Direct impacts

4.1.1 *Loss of habitat*

The Modification would require the removal of small areas of vegetation and fauna habitat mostly on the side of the approved open cut pit. The total disturbance area would be 2.5 ha, which includes 0.7 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees. Most of the disturbance area provides habitat for native fauna, some of which are of conservation significance.

A number of key threatening processes listed under the TSC Act could occur as a result of the habitat removal (and are discussed in more detail below):

- Clearing of native vegetation;
- Loss of hollow bearing trees;
- Removal of dead wood and dead trees; and
- Bushrock removal.

Clearing of native vegetation

The Modification area is approximately 2.5 ha in size comprising dry sclerophyll forest in various stages of regeneration and derived native grassland. This loss of vegetation would result in impacts to a range of fauna, including a number of threatened species that are known to occur within or nearby the Modification area. Clearing of vegetation results in the loss of habitat for species that utilise the vegetation and may also result in the loss of habitat resources such as food trees, hollow bearing trees, rocks, and fallen timber.

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. Similar habitat occurs to the west of the open pit, and within the Northern Offset area and proposed offset area. A small patch of similar habitat also occurs to the west of Duralie Road, which connects with the creek and vegetated areas west of Bucketts Way.

To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees would be removed from the edge of the existing disturbance area. The Dry Sclerophyll Forest is young regrowth, while the Cleared Land with Scattered Trees has already been extensively modified by previous activities. The corridor of habitat west of the Modification area is unlikely to be directly impacted.

The Modification would therefore result in the loss of small areas of moderate to good fauna habitat, noting though that the habitat occurs at the edge of the existing approved open cut pit. The Modification is unlikely to sever habitat connectivity for threatened fauna within the study area or locality.

Loss of hollow-bearing trees

The clearance of fauna habitat associated with the Modification would result in the loss of some hollow-bearing trees. However, the majority of the area is regrowth forest, and very few old growth trees with potential tree hollows were observed within the Modification area (from zero to 13 potential tree hollows were recorded within 20 x 50 m plots [Section 3.2]). In particular, the vegetation that would be removed west of the existing open pit is unlikely to contain any tree hollows given the age of the vegetation. Overall, hollow-bearing trees were considered to be uncommon within the Modification area, with greater numbers recorded throughout the proposed offset area and the vegetation within the forested corridor west of the existing open pit.

The threatened species that are likely to use the hollow-bearing trees in the Modification area (e.g. Squirrel Glider, Brush-tailed Phascogale and threatened microbats) are all known to occur more widely in the locality (including within the proposed offset area [Figure 4]).

Removal of dead wood and dead trees

The Modification would result in the removal of dead standing trees and dead wood on the ground as a part of the clearing of habitat. Dead wood and dead trees were present but uncommon within the Modification area (30 m within 20 x 50 m plot), with greater numbers recorded throughout the proposed offset area and the vegetation within the forested corridor west of the existing open pit (85 m within 20 x 50 m plot). Large logs were patchily distributed throughout the Modification area, but dead trees were very uncommon.

Bushrock removal

No major rock formations or continuous rock formations were observed in the Modification area. There was some surface rock within the western section of the Modification area but these are likely to have been deposited. While bushrocks generally provide a fauna habitat resource, they are considered an extremely uncommon resource within the Modification area, and unlikely to be important habitat for the threatened species that occur in the locality.

4.1.2 *Loss of individual animals*

The Modification has the potential to cause mortality of some animals during the removal of fauna habitat. Nocturnal species, species with low mobility, territorial species and some ground-dwelling species (such as lizards and snakes) are particularly susceptible to injury or death during construction and clearing. However, given that the Modification area is adjacent to the existing approved disturbance area, it is also possible that by the time vegetation clearance activities reach the edge of the Modification area, some local fauna may have already been indirectly impacted by the approved works (e.g. individuals move away).

It is considered unlikely that wildlife mortality on roads would substantially increase as a result of the Modification, given there are existing roads currently in operation with low vehicle speed limits, and no new roads would be created.

4.2 Indirect impacts

4.2.1 Loss of habitat connectivity

Habitat corridors provide essential pathways for the movement of native fauna and play an important role in ensuring the long-term genetic viability of species. Vegetation connectivity in the surrounds of the study area is highly variable. To the north of the Modification area a relatively small area of forest extends along Duralie Road, eventually connecting to a larger patch of forest on the western side of the Bucketts Way. To the east, vegetative connectivity is extremely limited. To the west and south, a north-south forested corridor occurs within the study area, which eventually links to the habitats of the Northern Offset Area and the proposed offset area to the south. From here, there is scattered vegetative connectivity with the forested hills to the west.

The Modification would have a minor impact on habitat connectivity. A shallow depression would be constructed within the forested corridor west of the open pit, as part of the Conceptual Up-catchment Diversion System to divert water entering the pit. The diversion is not likely to isolate any existing habitat areas. The diversion would not present a major barrier to wallabies or similar animals that may be moving around in the area. Wallabies are a highly mobile fauna capable of crossing a range of terrain and negotiating creeks, gullies and similar landscape features. The banks of the diversion would not be too high or too steep and the rocky substrate is only a few metres wide.

The remaining vegetation would be cleared from the edge of the existing open pit without impacting on vegetative connectivity to the north, west or south.

4.2.2 Competition and grazing by the feral European rabbit

The European Rabbit (*Oryctolagus cuniculus*) has been recorded within the study area and throughout the locality. The species is associated with a key threatening process under the TSC Act, *Competition and grazing by the Feral European Rabbit*.

The small loss of habitat within the Modification area, which occurs adjacent to the existing open pit, is unlikely to substantially increase the impacts of this feral species on native fauna.

4.2.3 Predation by feral animals

The European Red Fox (*Vulpes vulpes*) and Feral Cat (*Felis catus*) have both been recorded within the study area and throughout the locality. Both species are associated with a key threatening process under the TSC Act, *Predation by the European red fox* and *Predation by feral cats*.

The small loss of habitat within the Modification area, which occurs adjacent to the existing open pit, is unlikely to substantially increase the impacts of these feral species on native fauna.

4.2.4 Ecological consequences of high frequency fires

High Frequency fire resulting in disruption of life cycle processes in plants and animals and loss of vegetation structure and composition is listed as a key threatening process the TSC Act. Several threatened species predicted or known to occur within the Modification area and locality that could be impacted by fire regimes include but are not restricted to, the Squirrel Glider and Glossy Black-cockatoo.

Bushfires have a potential to occur due to various activities associated with the DCM, but are unlikely to significantly increase as a result of the Modification.

4.2.5 *Invasion and establishment of exotic vines and scramblers*

Invasion and establishment of exotic vines and scramblers is listed as a key threatening process under the TSC Act. A number of exotic vines and scramblers have become established in NSW and are having a significant adverse effect on biodiversity.

The Modification has the potential to result in the invasion and establishment of exotic vines and scramblers in the Modification area or surrounds in the same way as for the DCM and the Duralie Extension Project. However, weed monitoring and weed removal would continue as part of the standard operation procedures for the existing DCM, particularly in areas in which a new edge has been created.

4.2.6 *Final Landform*

Rehabilitation of the approved DCM will be progressively undertaken, resulting in a rehabilitated and revegetation landform consistent with the local surrounding environment (DCPL 2013a). The final landform would become slightly greater in volume and surface area as a result of the Modification, but would not significantly affect any local fauna populations or threatened species.

4.2.7 *Irrigation*

Irrigation activities associated within the approved DCM would not change as part of the Modification. Following prolonged dry spells, when runoff would be expected to contain some salt loads as a result of irrigation, as a precaution under the existing DCM Surface Water Management Plan (DCPL, 2013b) DCPL collects initial rainfall runoff that drains to Coal Shaft Creek or Mammy Johnsons River (i.e. "first flush" protocol). There would be no change to the existing Environment Protection Licence (EPL) conditions with regard to the quality of water to be released to the Mammy Johnson River (i.e. only water with salinity 1300 µs/cm or below would be released offsite as per existing EPL conditions).

It is considered unlikely that the continuation of irrigation activities associated with the Modification would result in any additional impacts to fauna of conservation significance (e.g. the Giant Barred Frog).

4.2.8 *Edge effects*

Most of the habitats within the study area are already impacted by edge effects (light, noise, dust, etc.). The Dry Sclerophyll Forest north of the open pit is bounded by Duralie Road to the west, cleared land to the north, and an open pit to the south. The habitats to the west of the open pit are already highly fragmented. The Modification would remove a small area of habitat from the edge of the existing open pit, and a 10 m wide impact area within the forested corridor to the west of the open pit for the purposes of drainage diversion. No further habitat fragmentation would occur. Edge effects are therefore unlikely to increase substantially from those that have or would occur as a result of the approved DCM.

4.2.9 *Noise and Air Quality*

There is no increase in noise and air quality impacts for the Modification to those currently approved under the Duralie Extension Project (SLR Consulting 2014; Pacific Environment Limited 2014).

4.2.10 *Artificial lighting*

The current DCM operates all day and night, with artificial light used during nocturnal works. Artificial lighting associated with the Modification is unlikely to substantially increase compared with the activities associated with the approved DCM.

4.2.11 *Changes to hydrology*

A shallow depression would be constructed as part of the Conceptual Up-catchment Diversion System to divert water entering the pit. However, the land clearance associated with the Modification is unlikely to significantly alter the conditions that would occur as a result of the activities associated with the approved DCM. A creek occurs to the north of the Modification area and would not be directly impacted.

4.3 Cumulative impacts

Cumulative impacts are the successive, incremental and combined impacts (both positive and negative) of an activity on society, the economy and the environment (Franks *et al.,* 2010). They can arise from the compounding activities of a single operation given the interaction of that operation with past, current and future activities that may or may not be related to the existing development. Cumulative impacts may also arise through the interaction of one development with other types of activities and industries, such as grazing and broad scale agriculture.

In relation to the proposed Modification, the cumulative impacts are considered to be the total impact on the environment that would result from incremental impacts (including both direct and indirect impacts) of the Modification, added to other existing impacts.

The main cumulative impact associated with the Modification is the loss of approximately 0.7 ha of dry sclerophyll forest, which is in addition to the approximate 196 ha of native vegetation which was approved to be cleared for the Duralie Extension Project. The Modification area would therefore result is an additional 0.9 percent native vegetation clearance (i.e. dry sclerophyll forest). This small increase is not considered to be significant in terms of cumulative impacts.

The proposed impact avoidance, mitigation and offset measures described in Sections 5 and 6 of this report are likely to assist with the maintenance of regional fauna biodiversity in the short-term and to potentially enhance it in the medium to long-term once rehabilitation and revegetation programmes become more established.

4.4 Significance of impacts on threatened fauna listed under the TSC Act

A total of 51 species of threatened fauna were considered to have potential to occur within the Modification area or immediate surrounds (Appendix A). For these species assessments were undertaken to determine the significance of potential impacts.

Assessment Approach

In accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005) six questions require consideration and assessment in relation to each threatened species that could be impacted by the Modification:

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

2. How is the proposal likely to affect habitat for a threatened species, population or ecological community?
3. Does the proposal affect any threatened species or populations that area at the limit of its known distribution?
4. How is the proposal likely to affect current disturbance regimes?
5. How is the proposal likely to affect habitat connectivity?
6. How is the proposal likely to affect critical habitat?

In relation to 1, 2 and 3 above, an assessment of the potential impacts for each species of threatened fauna is provided in Appendix D. For species where the ecology or habitat requirements are similar, they have been grouped and assessed together.

In relation to 4, it is considered unlikely the Modification would result in a significant change to existing disturbance regimes, given impacts would be limited to the clearing of a small additional area of vegetation adjacent to an existing operating coal mine. The loss of vegetation would not impact on any waterways, in particular the Mammy Johnsons River. Further, the frequency of fires is unlikely to change as the existing fire management undertaken at the DCM would continue.

In relation to 5, the potential impacts of the Modification on habitat connectivity were discussed in Section 4.2. It is considered unlikely the Modification would have a significant impact on any threatened species from changes in habitat connectivity, given the area impacted would occur adjacent to the existing disturbance area.

In relation to 6, the Modification would not impact on any area of critical habitat. No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2009), Register of Critical Habitat held by the Director-General of the OEH (OEH 2013), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2014).

Summary

In summary, the conclusions of the assessment were that the modification would be unlikely to significantly impact any threatened species given:

- the relatively small area of potential habitat that would be impacted;
- very few old growth features were observed;
- habitat fragmentation within the locality would be minor;
- a greater area of potential habitat would be conserved and enhanced within the proposed offset area; and
- impact avoidance and mitigation measures would be implemented.

4.5 Significance of impacts on threatened fauna listed under the EPBC Act

AM Consulting has identified potential impacts from the Modification on threatened fauna listed under the EPBC Act and assessed whether the identified impacts would likely result in a significant impact on any Matters of National Environmental Significance. The conclusion of this assessment is that the proposed Modification is not likely to have a significant impact on any threatened fauna.

4.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection

There are two important definitions that apply when considering Koala habitat under SEPP 44:

- "core koala habitat" means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings and historical records of a population; and
- "potential koala habitat" means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Preferred food trees recorded within the Study Area included Tallowwood (*E. microcrys*), Forest Red Gum (*E. tereticornis*), and Large-fruited Grey Gum (*E. canaliculata*), which were scattered throughout. Few food trees were recorded in the Modification Area. The potential habitat for the Koala that would be removed is small and does not represent preferred habitat for the species due to the scarcity of preferred food trees.

Using the SAT no evidence of Koala activity was found and no individuals were observed. Based on the requirements of SEPP 44, potential Koala habitat may occur within the Modification area, but core Koala habitat does not occur within the Modification area.

4.7 Migratory species

Twelve migratory bird species listed under the EPBC Act have been recorded within the locality or predicted to occur in the *Protected Matters* database (Appendix C). Five of these species have been recorded within the DCM or surrounds. The Modification is not likely to significantly impact any listed migratory species under the EPBC Act, on the basis of the following:

- no 'important habitat' exists within the Modification area for any listed migratory species;
- the Modification would not result in an invasive species that is harmful to any migratory species becoming established in an area of important habitat; and
- the Modification would not disrupt the life cycle of an ecologically significant proportion of any population of any migratory species.

5 Mitigation measures

A number of impact avoidance and mitigation measures are currently in operation at the DCM, as identified within a number of relevant management plans, including:

- *Duralie Coal Mine Biodiversity Management Plan* (Greening Australia, 2013).
- *Duralie Coal Mine Rehabilitation Management Plan* (DCPL, 2013a).
- *Duralie Coal Mine Water Management Plan* (DCPL, 2013b).

5.1 Vegetation clearance plan

The DCM Vegetation Clearance Plan (VCP) as outlined in the Biodiversity Management Plan (BMP) (Greening Australia, 2013) was developed to minimise the impact of vegetation clearance on flora and fauna. The key components of the VCP include delineation of areas to be cleared of native remnant vegetation to ensure that only those areas designated for clearing are cleared, pre-clearance surveys, fauna management measures and vegetation clearance supervision (i.e. fauna rescue during vegetation clearing).

The VCP (Greening Australia, 2013) also contains the following fauna management measures:

- where practicable, vegetation clearing would only occur once per year during late summer or early autumn.
- pre-clearance fauna management strategies would be implemented including inspection of hollows and/or nesting resources, using appropriate timing for clearance activities, capture and release of animals to suitable habitat and allowing for bats to exit potential roosts prior to felling.
- habitat resources, such as hollows, are opportunistically salvaged for placement within rehabilitation areas or other fauna habitat enhancement areas, where practicable.
- nesting boxes are placed in suitable habitat for birds and arboreal mammals.
- placement of bat boxes in suitable habitat for bats.

The measures outlined in the BMP (Greening Australia 2013) would be applicable to the Modification.

5.2 Water management plan

The DCM Water Management Plan (DCPL, 2013b) outlines the statutory requirements for the DCM, and the management and reporting of non-compliances. It also describes the review and improvement of environmental performance process, and outlines the management and reporting of incidents and complaints. The Water Management Plan (DCPL 2013b) incorporates three documents as appendices, including the Site Water Balance (DCPL 2013b, Appendix 1), Surface Water Management Plan (DCPL 2013b, Appendix 2), and Groundwater Management Plan (DCPL 2013b, Appendix 3). An Irrigation Management Plan is also included as a component of the Surface Water Management Plan. These documents contain more detailed management measures for water management within the DCM. The key objectives of the on-site water management system are the interception and diversion of runoff from undisturbed and rehabilitated landforms around mining activities and collection, treatment (where necessary) and irrigation of excess mine water over pasture.

Water management measures within the DCM including the following:

- clean water diversion systems;
- erosion and sediment controls;
- water storages and irrigation systems;
- first flush system;
- ongoing monitoring including water flow, water quality, riparian vegetation and channel stability;
- performance criteria and trigger levels to maintain water quality and avoid potential impacts;
- design and management of final voids and creek/drainage line reconstructions; and
- a plan to respond to any exceedances of the impact assessment criteria and/or performance criteria.

The measures outlined in the Water Management Plan (DCPL 2013b) and its appendices would be applicable to the Modification.

5.3 Weed management

The BMP (Greening Australia 2013) outlines a variety of weed control measures, including the following:

- regular site inspections and communication with lessees and authorities;
- annual control of weeds prior to each specific plant's seeding period were possible;
- physical and chemical removal of weeds, with chemical use subject to DCPL approval;
- only herbicides registered for aquatic situations to be used near the Mammy Johnsons River; and
- site vehicle wash bays used to minimise seed transport to or from site.

The measures outlined in the BMP (Greening Australia 2013) would be applicable to the Modification.

5.4 Animal pest management and monitoring

The BMP (Greening Australia 2013) outlines a variety of animal pest management and monitoring procedures, including the following:

- the maintenance of a clean, rubbish-free environment in order to discourage scavenging and reduce the potential for colonisation of these areas by non-endemic fauna (e.g. introduced rodents, predators and birds);
- monitoring of feral animals (including pigs, foxes, dogs, rabbits and newly established exotics species) every two years;
- undertaking pest animal control where necessary;
- domestic pets prohibited in the DCM; and
- employees and contractors are not permitted to encourage fauna through feeding.

These measures outlined in the BMP (Greening Australia 2013) would be applicable to the Modification.

5.5 Bushfire management

The BMP (Greening Australia 2013) outlines a variety of weed control measures, including the following:

- Controlled grazing – cattle are grazed on portions of ML 1427 upon which active mining operations are not occurring and appropriate fencing is available. Sustainable stocking levels result in low residual fuel loads.
- Hazard reduction burns, chemical control or slashing – in areas where controlled grazing is not possible or appropriate and fuel loads are high, hazard reduction burns may be undertaken.
- Firefighting equipment –if a significant bushfire occurs within ML 1427 the local Rural Fire Service (RFS) would be called for assistance. The RFS, if required, could be assisted by mine personnel and mine resources. The mine has a water cart with water cannon and fire suppressant foam, trailer mounted fire fighting equipment and dozers.
- Risk management to include maintenance of access trails, identification of dangerous fuel loads and landholder liaison.

These measures outlined in the BMP (Greening Australia 2013) would be applicable to the Modification.

5.6 Rehabilitation

The Modification disturbance area is associated with changes to the open pit limits (i.e. to improve geotechnical stability) and the associated relocation of existing water diversion infrastructure adjacent to the Clareval pit.

Consistent with the approved DCM, final voids would remain in the Clareval and Weismantel open pits at the cessation of mining. The portion of the Modification disturbance area associated with changes to the open pit limits would form part of the of the DCM final void, and therefore, would not be rehabilitated. The final voids would be expected to fill with water until an equilibrium level is reached.

The surface catchment of the final voids would be reduced to a practicable minimum by maximising backfilling of the natural surface and through the use of upslope diversion and contour drains around their perimeter. As such, the relocated water diversion infrastructure within the Modification disturbance area would be retained as part of the final landform.

The Modification would increase the elevation of the central portion of the waste emplacement, however, there would be no change to the approved rehabilitation strategy and goals due the Modification. The waste rock emplacement would continue to be progressively rehabilitated and revegetated with native grass, shrub and tree species characteristic of the vegetation communities cleared during the progression of mining activities.

Consistent with the currently approved DCM, the revegetation objective for the waste rock emplacement would be to provide areas of woodland and pasture on the waste rock emplacement surface and batters. The woodland areas would be linked to broader habitat in the area.

5.7 Other fauna protection and management measures

Other fauna protection and management initiatives are outlined in the BMP (Greening Australia 2013), including the following:

- setting speed limits (60 km per hour on mine roads and tracks);
- installing warning signs on roads and tracks in the vicinity of the DCM to reduce potential vehicle strikes;
- the maintenance of a clean, rubbish-free area; and
- preparation of procedures which detail how to care for animals found at risk of harm or injured at DCM.

These measures outlined in the BMP (Greening Australia 2013) would be applicable to the Modification.

6 Characteristics of the offset area

6.1 Existing Biodiversity Offset Strategy

DCPL has established offset areas on company owned land to the east and west of the DCM (Northern and Southern Offset Areas) (Figure 4). The broad completion criteria are outlined in Table 6.1.

Table 6.1 Offset strategy completion criteria

Domain	Completion Criteria
Enhancement areas (i.e. existing remnant vegetation)	Areas of remnant vegetation within the offset area (290ha) have been conserved and enhanced.
Revegetation areas	354 ha of revegetated woodland/open woodland habitat areas and 36 ha of revegetated forest habitat areas as a self-sustaining ecosystem.
Direct links between the offset area and rehabilitation area	Native vegetation has been established which directly links vegetation areas of the offset area with the rehabilitation area.

The approved BMP (Greening Australia 2013) includes detailed management measures for the existing offset areas (Figure 4), including:

- encouraging native regeneration by providing appropriate fencing to exclude grazing from existing treed areas;
- selective revegetation in derived grasslands by appropriate plantings or seeding using local seed sources;
- managing weeds and pests;
- managing fire including mosaic burnings likely needed to optimise species diversity;
- creating signage of the proposed offset area;
- restricting vehicular and people access; and
- monitoring ongoing management performance, habitat quality and diversity, species diversity, landscape resilience and landscape function within the offset, by suitably qualified person(s).

Where practicable, habitat features (e.g. large hollows and some suitable logs) are salvaged during vegetation clearance activities from the Modification, and relocated to areas where habitat enhancement is required (e.g. in the proposed offset area) (DCPL 2013a). Nest boxes would be installed within the proposed offset area for hollow bearing features that are cleared, at a 1:1 ratio.

In accordance with the BMP (Greening Australia 2013), the existing offset area will be independently audited every three years unless the Director-General directs otherwise. The audits would be conducted by a suitably qualified person(s) to:

- assess compliance with the management plan;
- assess the environmental performance of the proposed offset area;
- review the adequacy of strategies in the BMP (Greening Australia 2013) and other Management Plans (DCPL 2012, 2013a, 2013b, 2013c, 2013d); and
- recommend actions or measures to improve the performance of the offset, BMP (Greening Australia 2013), or other Management Plans (DCPL 2012, 2013a, 2013b, 2013c, 2013d).

6.2 Proposed Biodiversity Offset Strategy

As part of the Modification, the Northern Offset area would be augmented with an additional proposed offset area. The existing and proposed offset strategies are quantified in Table 6.2.

Table 6.2 Existing and proposed offset strategies

Domain	Existing Biodiversity Offset Strategy	Proposed Biodiversity Offset Strategy	Outcome
Enhancement areas (i.e. existing remnant vegetation)	290	9	299
Revegetation areas	354	3.5	357.5
Total	644	12.5	656.5

The proposed offset area is discussed in the following sections, including habitat types, condition and features (Section 6.2.1), threatened species records (Section 6.2.2), management (Section 6.2.3) and an overall consideration of the values of the proposed offset in Section 6.2.4.

6.2.1 *Habitat types, condition and features*

Approximately 0.7 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees would be cleared for the Modification. The proposed offset for the Modification would add 9 ha of Dry Sclerophyll Forest and approximately 3.5 ha of grassland to the existing offset areas for the DCM (Table 6.3).

Table 6.3 Quantification of fauna habitats within the Modification area and proposed offset area

Broad Habitat Type	Approximate Area to be Cleared (ha)	Approximate Area in Offset (ha)
Dry Sclerophyll Forest	0.7	9
Cleared Land with Scattered Trees	1.8	3.5
Total	2.5	12.5

Dry Sclerophyll Forest occurs throughout most of the proposed offset area (Plate 3). The habitat type and condition here is broadly similar to the habitats within the Modification area.

The land is characterised by undulating hills dissected by a north-south orientated drainage depression. The forest is mostly regrowth approximately 20-30 m high with scattered remnant old growth trees present throughout (eight potential tree hollows within 20 x 50 m plot). Dominant tree species include Thick-leaved Mahogany (*Eucalyptus carnea*), Ironbarks, Grey Gum (*E. canaliculata*) and Forest Red Gum (*E. tereticornis*). In the eastern portion Spotted Gum (*E. maculata*) and Grey Box (*E. moluccana*) are also present. Mature and regrowth Grey Box (*E. moluccana*) were most common downslope in the southern drainage depression areas. Forest Oaks (*Allocasuarina torulosa*) were not observed. The shrub layer was generally sparse but present in the form of very young regenerating plants mostly less than 0.5 m high, including Prickly Moses (*Acacia ulicifolia*), Prickly Beard-heath (*Leucopogon juniperinus*) and *Melaleuca* species, while in the eastern portion a small area of dense regenerating acacias occurs. Overall the forest was in moderate to good condition but lacking structural complexity.

Native grasses provided good ground cover interspersed between low shrubs, while large logs were abundant (a total of 85 m within 20 x 50 m plot). Large rocks were absent, and leaf litter was patchy and mostly shallow. Weeds were present but uncommon. The property is currently being used for grazing by cattle, and evidence of this was observed throughout.

The drainage depression which extends through the centre of the area was sparsely vegetated with scattered Green Wattle (*Acacia irrorata*). The ground cover was dominated by grasses, and in several locations small pools of varying size (maximum size approximately 2 by 3 m) were observed. Other groundcover features such logs and rocks were lacking. This depression area is unlikely to permanently contain free water, particularly during extended dry conditions.

Plate 3 Examples of habitat within the proposed offset area.

6.2.2 *Threatened species*

Five threatened fauna species have been recorded within the proposed offset area (Figure 4). Descriptions of the sightings of these species are provided in Table 6.4. The area provides potential habitat for most threatened fauna which could occur within the Modification area.

Table 6.4 Threatened fauna recorded in the proposed offset area

Common Name	Scientific Name	TSC Act	EPBC Act	Description
Squirrel Glider	*Petaurus norfolkensis*	V	-	Two individuals recorded during spotlighting in Green Wattle (*Acacia irrorata*) within the drainage depression.
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis*	V	-	At least one individual heard opportunistically within the western section of the proposed offset area.
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V	-	Recorded during both evenings using anabat detectors.
Brush-tailed Phascogale	*Phascogale tapaotafa*	V	-	Recorded during one evening from the remote monitoring cameras.
Varied Sittella	*Daphoenositta chrysoptera*	V	-	At least five individuals opportunistically recorded within the western section of the proposed offset area.

The existing consent condition for the DCM describes habitat for threatened species in the existing offset strategy. Table 6.5 provides the habitat for threatened species in the existing and proposed offset strategies.

Table 6.5 Habitat for threatened fauna species – existing and proposed offset strategies

Fauna Species	Habitat (ha)		
	Existing Biodiversity Offset Strategy	Proposed Biodiversity Offset Strategy	Total
Swift Parrot/Brown Treecreeper/Grey-crowned Babbler	174	9	183
Speckled Warbler	126	9	135
Varied Sittella	172	9	181
Squirrel Glider	128	9	137

6.2.3 Management

The sub-sections below outline the proposed method of conserving the offset area, proposed management and monitoring.

Enduring Conservation for the Proposed Offset Area

Enduring conservation of the proposed offset area would be secured to the satisfaction of the NSW Secretary of the Department of Planning & Environment.

Proposed Management and Management Plan

The BMP would be revised to incorporate the proposed offset area. A number of management measures are listed and described below based on flora and fauna surveys of the proposed offset area and an assessment of the measures required to enhance the flora and fauna values of the area, including:

- revegetation of cleared land to substantially increase the amount of vegetation in the area;
- management of livestock grazing;
- control of weeds to enable natural regeneration of native vegetation;
- exotic animal management to benefit native wildlife;
- bushfire management; and
- controlling vehicular access.

Revegetation

Part of the proposed offset area is cleared land (3.5 ha) comprising predominantly native and introduced grasses. The cleared land is between two patches of remnant native vegetation comprising mainly dry sclerophyll forests. The aim of revegetation would be to establish a range of habitat niches through revegetation (including canopy, understorey and ground cover).

Natural regeneration of woodland/forest is likely to occur in the cleared lands owing to the proximity of adjoining native forests. However, to speed up the process, the cleared lands would be actively managed as follows:

1. Increase potential for natural regeneration through management of threatening processes that inhibit natural regeneration (e.g. removal of weeds).
2. Revegetate, if required, with appropriate plantings or seeding of species represented in the surrounding native vegetation communities. Local seed sources would be used.

Management of Livestock Grazing

Livestock grazing would be excluded from the Offset Area through the provision of appropriate stock fencing.

Control of Weeds

Four flora species listed as Noxious in the Dungog Shire under the *Noxious Weeds Act, 1993* were recorded in the proposed Offset Area. Three of these species are listed as Class 4 weeds (Mistflower [*Ageratina riparia*], Fireweed [*Senecio madagascariensis*], Lantana [*Lantana camara*], and one is listed as a Class 3 weed, Giant Parramatta Grass (*Sporobolus fertilis*). These and other weeds would be controlled and monitored by an appropriately qualified contractor using standard methods.

Animal Pest Management

Animal pests would be controlled and monitored by an appropriately qualified contractor using standard methods.

Fire Management

Access tracks throughout the proposed Offset Area would be maintained for fire management.

Controlling Vehicular Access

Vehicular access would be controlled by fencing and signing the Offset Area. Vehicle movements would be predominately on designated vehicle tracks.

Monitoring

A programme would be undertaken to monitor and report on the effectiveness of the measures and the performance of the offset, with summary reporting to be carried out annually and comprehensive reporting following the independent environmental audit. The monitoring would be undertaken by a suitably qualified person(s).

6.2.4 Value as an offset for the Modification area

The proposed offset (its area, location and proposed management) was selected on the basis of a range of factors, including:

- the location of the proposed offset area relative to the proposed disturbance area;
- the location of existing offset areas;
- the land tenure available on which to locate a proposed offset area (i.e. company-owned land);
- the location of potential mineral resources;
- the occurrence of the same vegetation and habitat types as the proposed disturbance area;
- the shape of the proposed offset area in relation to the spatial arrangement of existing vegetation and offset areas;
- the vegetation/fauna habitat composition/condition of the proposed disturbance area relative to the proposed offset area;

- the fauna species present (including threatened species) and the habitat needed to maintain local populations of the species;
- the size of the proposed offset area relative to the proposed disturbance area;
- the ecosystem resilience and condition of the proposed offset area; and
- existing infrastructure – e.g. roads, rail, powerlines, houses and the proposed Gloucester Gas pipeline corridor (all outside of the proposed offset area).

The land in the proposed offset area is currently used for grazing purposes. Establishing the proposed offset area would result in the following biodiversity gains related to fauna:

- The proposed offset area provides an opportunity to provide a net gain in vegetation communities/ broad fauna habitat types present in the proposed offset area through natural regeneration.
- The proposed offset area is adjacent to an existing conserved area thereby potentially strengthening the integrity of the proposed and existing conserved area.
- it is within the same general locality as Modification area and therefore has the potential to benefit the local fauna populations that would be adversely impacted by the Modification.
- it contains existing records of the Varied Sittella, Grey-crowned Babbler [eastern subspecies], Squirrel Glider, Brush-tailed Phascogale and Eastern Bentwing-bat, thereby conserving known habitat for the local populations. Further, EcoBiological (2009a) recorded evidence of the Koala in the proposed offset area in 2009.
- The proposed offset area contains potential habitat for all threatened fauna species recorded within, or near, the disturbance area, such as the Swift Parrot.
- The condition of fauna habitat within the proposed offset area is similar to the Modification area. For some habitat features, such as hollow-bearing trees and fallen logs, there is a greater density within the proposed offset area.
- The ground cover and understorey features (which contribute towards structural complexity of fauna habitat) are likely to improve over time within the proposed offset area, given appropriate management (e.g. reduction in cattle grazing and cessation of vegetation clearing).

The proposed biodiversity offset strategy is underpinned by sound ecological principles. For example:

- The proposed offset area expands on an existing conserved area thereby potentially strengthening the integrity of the proposed and existing conserved area.
- The proposed offset area contains like-for-like vegetation communities and broad fauna habitat types compared with the Modification area.
- Natural regeneration would be promoted to strengthen the integrity of the habitat within the proposed offset area.
- The proposed offset focuses on enhancing the existing habitat through a range of conservation measures.

Based on the above, it is considered that the proposed offset is suitable to offset the residual impacts of the Modification, and that fauna biodiversity in the region would be maintained and improved in the long-term.

Table 6.6 provides a reconciliation of the proposed offset strategy against the NSW Offset Principles for Major Projects (State Significant Development and State Significant Infrastructure).

Table 6.6 Reconciliation of the proposed offset strategy against OEH offset principles

OEH Offset Principles (OEH 2014)	How the Proposed Offset Addresses the OEH Offset Principles
Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.	Section 5 describes measures to avoid and mitigate impacts from the Modification on fauna. The offset strategy is proposed to address residual impacts.
Offset requirements should be based on a reliable and transparent assessment of losses and gains.	The fauna in the Modification area and surrounds, including the proposed offset area, has been surveyed in various studies since 1996, including targeted fauna surveys between 2007 and 2009 and in 2014. This report provides an assessment of this information including: • area of the offset and area of impact; • threatened fauna species present and their conservation status; • connectivity and condition of habitat; and • management actions for the proposed offset area.
Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.	The proposed offset area has been targeted to offset impacts of the Modification. See the points above this table which outline the value of the offset area. The proposed offset area contains a similar suite of fauna species and fauna habitats to those in the Modification area.
Offsets must be additional to other legal requirements.	The proposed offset is additional to previous offsetting commitments provided in relation to the DCM and is not currently part of any conservation reserve system.
Offsets must be enduring, enforceable and auditable.	The land tenure underlying the proposed Offset areas would be secured in perpetuity for flora and fauna conservation. Enduring conservation of the proposed offset area would be secured to the satisfaction of the NSW Secretary of the Department of Planning & Environment. Management actions would be undertaken within the offset area in accordance with a BMP. Measures to monitor and independently audit the proposed offset area are also provided in the BMP.
Supplementary measures can be used in lieu of offsets.	Section 6 describes the proposed offset strategy. The strategy includes securing in perpetuity an offset area for flora and fauna conservation. Supplementary measures are therefore not required.
Offsets can be discounted where significant social and economic benefits accrue to NSW as a consequence of the proposal.	The social and economic benefits of the Modification are described in the Environmental Assessment.

7 Key Thresholds

Key thresholds are discussed below in relation to the Modification in accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005).

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts would maintain or improve biodiversity values.

It is likely that the biodiversity values within the locality would be maintained or improved in the medium to long-term, considering the measures that would be undertaken to avoid and mitigate the potential impacts (Section 5), and offset measures (Section 6).

Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.

The Modification is unlikely to reduce the long-term viability of a local population of any fauna species or population, given the area of fauna habitat that would be removed is small (approximately 2.5 ha), of which only a smaller area of Dry Sclerophyll Forest (approximately 0.7 ha) is likely to constitute important habitat for any threatened species. Similar fauna habitat types of at least equivalent quality would be conserved and enhanced in the offset area. Further, the habitat to be disturbed by the Modification would mostly be removed from the edge of the existing open pit, thus fragmentation of important habitat would be unlikely.

Whether or not the proposal is likely to accelerate the extinction of a species, population or ecological community or place it at risk of extinction.

The Modification is unlikely to reduce the long-term viability of a local population of any fauna species or population, given the area of fauna habitat that would be removed is small (approximately 2.5 ha), of which only a smaller area of Dry Sclerophyll Forest (approximately 0.7 ha) is likely to constitute important habitat for any threatened species. Similar fauna habitat types of at least equivalent quality would be conserved and enhanced in the offset area. Further, the habitat to be disturbed by the Modification would mostly be removed from the edge of the existing open pit, thus fragmentation of important habitat would be unlikely.

Whether or not the proposal would adversely affect critical habitat.

The Modification would not impact on any area of critical habitat. No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2009), Register of Critical Habitat held by the Director-General of the OEH (OEH 2013), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2014).

8 Conclusion

The proposed Modification represents a relatively small change to the design of the approved DCM. It would result in two increases in the area of disturbance, one area (approximately 0.3 ha) occurs to the north of the approved open pit, the other area (approximately 2.2 ha) occurs to the west of the open pit. Overall, the Modification would increase the total area of surface disturbance by approximately 2.5 ha, or less than 1 % greater than the area disturbed by the approved DCM.

Two broad fauna habitat types were identified in the Modification area, dry sclerophyll forest and cleared land with scattered trees. Dry sclerophyll forest occurs mainly to the north of the existing open pit (approximately 0.3 ha), with a small area present to the west (approximately 0.3 ha). Cleared land with scattered native trees occurs to the west of the existing open pit (approximately 1.8 ha). These areas provide known or potential habitat for a range of threatened fauna species.

During recent surveys undertaken by AM Consulting (2014), nine threatened fauna species were recorded, including the Speckled Warbler, Spotted Harrier, White-fronted Chat, Grey-crowned Babbler, Varied Sittella, Squirrel Glider, Brush-tailed Phascogale, Eastern Bentwing-bat and Little Bentwing-bat. Six threatened fauna species were recorded in the Modification area or immediate surrounds (Speckled Warbler, Varied Sittella, Squirrel Glider, Brush-tailed Phascogale, Little Bentwing-bat and Eastern Bentwing-bat).

The significance of potential impacts on threatened fauna known or considered likely to occur within or nearby the Modification, was assessed in accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI, 2005). In summary, the conclusions of the assessment were that the modification would be unlikely to significantly impact any threatened species given:

- the relatively small area of potential habitat that would be impacted;
- very few old growth features were observed;
- habitat fragmentation within the locality would be minor;
- a greater area of potential habitat would be conserved and enhanced within the proposed offset area; and
- impact avoidance and mitigation measures would be implemented.

The Modification would not impact on any critical habitat or endangered populations.

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Appendix A: Likelihood of occurrence of threatened fauna

Scientific Name	Common Name	Conservation Status		Known or predicted occurrence in region		Records from the locality			Survey records at the DCM or surrounds?	Potential occurrence in the Modification area or immediate surrounds
		TSC Act	EPBC Act	NSW OEH Database*	Protected Matters	Birdlife Australia	Atlas of NSW Wildlife	Australian Museum		
FROGS										
Crinia tinnula	Wallum Froglet	V	-	✓	-	-	-	-	-	Unlikely. No potential habitat.
Mixophyes balbus	Stuttering Frog	E	V	✓	✓	-	-	-	-	Unlikely. No potential habitat.
Mixophyes iteratus	Giant Barred Frog	E	E	✓	✓	-	✓	-	✓	Unlikely. Limited potential habitat.
Litoria aurea	Green and Golden Bell Frog	E	V	✓	✓	-	-	-	-	Unlikely. No potential habitat.
Litoria booroolongensis	Booroolong Frog	E	E	✓	-	-	-	-	-	Unlikely. No potential habitat.
Litoria brevipalmata	Green-thighed Frog	V	-	✓	-	-	-	-	-	Unlikely. Limited potential habitat.
REPTILES										
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	✓	-	-	-	-	-	Possible, but limited potential habitat.
Hoplocephalus stephensii	Stephens' Banded Snake	V	-	✓	-	-	✓	-	-	Possible, but limited potential habitat.
BIRDS										
Oxyura australis	Blue-billed Duck	V	-	✓	-	-	-	-	-	Possible, in dams on occasion.
Stictonetta naevosa	Freckled Duck	V	-	✓	-	-	-	-	-	Possible, in dams on occasion.
Anseranas semipalmata	Magpie Goose	V	-	✓	-	-	-	-	-	Possible, in dams on occasion.
Botaurus poiciloptilus	Australasian Bittern	E	E	✓	✓	-	-	-	-	Possible, in dams on occasion.

Scientific Name	Common Name	Conservation Status		Known or predicted occurrence in region		Records from the locality			Survey records at the DCM or surrounds?	Potential occurrence in the Modification area or immediate surrounds
		TSC Act	EPBC Act	NSW OEH Database*	Protected Matters	Birdlife Australia	Atlas of NSW Wildlife	Australian Museum		
Ixobrychus flavicollis	Black Bittern	V	–	✓	–	–	–	–	–	Possible, in dams on occasion.
Ephippiorhynchus asiaticus	Black-necked Stork	E	–	✓	–	–	–	–	–	Possible.
Turnix maculosus	Red-backed Button-quail	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat and no recent nearby records.
Circus assimilis	Spotted Harrier	V	–	✓	–	–	–	–	✓	Possible.
Hieraaetus morphnoides	Little Eagle	V	–	✓	–	–	✓	–	–	Possible.
Lophoictinia isura	Square-tailed Kite	V	–	✓	–	–	–	–	–	Possible.
Falco subniger	Black Falcon	V	–	✓	–	–	–	–	–	Possible.
Pandion cristatus	Eastern Osprey	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Calidris alba	Sanderling	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Charadrius leschenaultii	Greater Sand-plover	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Charadrius mongolus	Lesser Sand-plover	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Calidris tenuirostris	Great Knot	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Gygis alba	White Tern	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Sternula albifrons	Little Tern	E	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Haematopus fuliginosus	Sooty Oystercatcher	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Haematopus longirostris	Pied Oystercatcher	E	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.

Scientific Name	Common Name	Conservation Status		Known or predicted occurrence in region		Records from the locality			Survey records at the DCM or surrounds?	Potential occurrence in the Modification area or immediate surrounds
		TSC Act	EPBC Act	NSW OEH Database*	Protected Matters	Birdlife Australia	Atlas of NSW Wildlife	Australian Museum		
Irediparra gallinacea	Comb-crested Jacana	V	-	✓	-	-	-	-	-	Unlikely. Limited potential habitat.
Limicola falcinellus	Broad-billed Sandpiper	V	-	✓	-	-	-	-	-	Unlikely. Limited potential habitat.
Xenus cinereus	Terek Sandpiper	V	-	✓	-	-	-	-	-	Unlikely. Limited potential habitat.
Calidris ferruginea	Curlew Sandpiper	E	-	✓	-	-	-	-	-	Unlikely. Limited potential habitat.
Limosa limosa	Black-tailed Godwit	V	-	✓	-	-	-	-	-	Unlikely. Limited potential habitat.
Rostratula australis	Australian Painted Snipe	E	V	✓	✓	-	-	-	-	Unlikely. Limited potential habitat.
Burhinus grallarius	Bush Stone-curlew	E	-	✓	-	-	-	-	-	Unlikely. Limited potential habitat.
Ptilinopus magnificus	Wompoo Fruit-Dove	V	-	✓	-	-	✓	-	-	Possible.
Ptilinopus regina	Rose-crowned Fruit-Dove	V	-	✓	-	-	✓	-	✓	Possible.
Ptilinopus superbus	Superb Fruit-Dove	V	-	✓	-	-	-	-	-	Possible.
Calyptorhynchus lathami	Glossy Black-cockatoo	V	-	✓	-	-	✓	-	✓	Possible.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	✓	-	-	✓	-	✓	Possible.
Glossopsitta pusilla	Little Lorikeet	V	-	✓	-	✓	-	-	-	Possible.
Neophema pulchella	Turquoise Parrot	V	-	✓	-	-	-	-	-	Possible.
Lathamus discolor	Swift Parrot	E	E	✓	✓	-	✓	-	✓	Possible.
Tyto longimembris	Eastern Grass Owl	V	-	✓	-	-	-	-	-	Unlikely. Limited potential habitat.
Tyto tenebricosa	Sooty Owl	V	-	✓	-	-	✓	-	✓	Possible.
Tyto novaehollandiae	Masked Owl	V	-	✓	-	-	-	-	-	Possible.

Scientific Name	Common Name	Conservation Status		Known or predicted occurrence in region		Records from the locality			Survey records at the DCM or surrounds?	Potential occurrence in the Modification area or immediate surrounds
		TSC Act	EPBC Act	NSW OEH Database*	Protected Matters	Birdlife Australia	Atlas of NSW Wildlife	Australian Museum		
Ninox strenua	Powerful Owl	V	–	✓	–	–	✓	–	✓	Possible.
Ninox connivens	Barking Owl	V	–	✓	–	–	–	–	–	Possible.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	–	✓	–	–	✓	–	✓	Possible.
Pyrrholaemus saggitatus	Speckled Warbler	V	–	✓	–	–	✓	–	✓	Recorded.
Anthochaera phrygia	Regent Honeyeater	CE	E	✓	✓	–	–	–	–	Possible.
Melithreptus gularis gularis	Black-chinned Honeyeater	V	–	✓	–	–	–	–	–	Possible.
Grantiella picta	Painted Honeyeater	V	–	✓	–	–	–	–	–	Unlikely, limited potential habitat and outside known range.
Epthianura albifrons	White-fronted Chat	V	–	✓	–	–	–	–	✓	Possible.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	–	✓	–	–	–	–	–	Possible.
Petroica phoenicea	Flame Robin	V	–	✓	–	–	–	–	–	Possible.
Petroica boodang	Scarlet Robin	V	–	✓	–	–	–	–	–	Possible.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	–	✓	–	✓	✓	–	✓	Possible.
Coracina lineata	Barred Cuckoo-shrike	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Daphoenositta chrysoptera	Varied Sittella	V	–	✓	–	–	✓	–	✓	Possible.
Stagonopleura guttata	Diamond Firetail	V	–	✓	–	–	–	–	–	Possible.

Scientific Name	Common Name	Conservation Status		Known or predicted occurrence in region		Records from the locality			Survey records at the DCM or surrounds?	Potential occurrence in the Modification area or immediate surrounds
		TSC Act	EPBC Act	NSW OEH Database*	Protected Matters	Birdlife Australia	Atlas of NSW Wildlife	Australian Museum		
MAMMALS										
Dasyurus maculatus maculatus (SE mainland population)	Spotted-tailed Quoll	V	E	✓	✓	–	✓	–	–	Possible.
Phascogale tapoatafa	Brush-tailed Phascogale	V	–	✓	–	–	✓	✓	✓	Recorded.
Planigale maculata	Common Planigale	V	–	✓	–	–	✓	–	✓	Possible.
Phascolarctos cinereus	Koala	V	–	✓	✓	–	✓	–	✓	Possible.
Cercartetus nanus	Eastern Pygmy-possum	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Petaurus australis	Yellow-bellied Glider	V	–	✓	–	–	✓	–	–	Unlikely. Limited potential habitat.
Petaurus norfolcensis	Squirrel Glider	V	–	✓	–	–	✓	–	✓	Recorded.
Aepyprymnus rufescens	Rufous Bettong	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE mainland)	V	V	✓	✓	–	–	–	–	Unlikely. Limited potential habitat.
Macropus parma	Parma Wallaby	V	–	✓	–	–	✓	–	–	Unlikely. Limited potential habitat.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	✓	✓	–	✓	–	–	Unlikely. Limited potential habitat.
Thylogale stigmatica	Red-legged Pademelon	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Syconycteris australis	Common Blossom-bat	V	–	✓	–	–	–	–	–	Unlikely. Limited potential habitat.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	✓	✓	–	✓	–	–	Possible.
Saccolaimus	Yellow-bellied	V	–	✓	–	–	–	–	–	Possible.

Scientific Name	Common Name	Conservation Status		Known or predicted occurrence in region		Records from the locality			Survey records at the DCM or surrounds?	Potential occurrence in the Modification area or immediate surrounds
		TSC Act	EPBC Act	NSW OEH Database*	Protected Matters	Birdlife Australia	Atlas of NSW Wildlife	Australian Museum		
flaviventris	Sheathtail-bat									
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	✓	-	-	✓	-	✓	Possible.
Kerivoula papuensis	Golden-tipped Bat	V	-	✓	-	-	✓	-	-	Unlikely. Limited potential habitat.
Miniopterus australis	Little Bentwing-bat	V	-	✓	-	-	-	-	-	Possible.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	✓	-	-	✓	-	✓	Possible.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	✓	✓	-	-	-	-	Possible.
Myotis macropus	Southern Myotis	V	-	✓	-	-	✓	-	✓	Possible.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	✓	-	-	✓	-	-	Possible.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	✓	-	-	-	-	-	Possible.
Vespadelus troughtoni	Eastern Cave Bat	V	-	✓	-	-	-	-	-	Possible.
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	V	-	✓	-	-	-	-	-	Unlikely. Limited potential habitat.
Pseudomys novaehollandiae	New Holland Mouse	-	V	-	✓	-	✓	-	-	Possible.
Pseudomys oralis	Hastings River Mouse	E	E	-	✓	-	-	-	-	Unlikely. Limited potential habitat.

Notes: *Karuah Manning CMA sub-region, V = vulnerable, E = endangered, CE = critically endangered

Appendix B: Fauna species recorded

Class	Common Name	Scientific name	TSC Act[1]	EPBC Act[2]
Amphibia	Common Eastern Froglet	*Crinia signifera*	P	
	Brown-striped Frog	*Limnodynastes peronii*	P	
	Bibron's Toadlet	*Pseudophryne bibronii*	P	
	Eastern Dwarf Tree Frog	*Litoria fallax*	P	
	Broad-palmed Frog	*Litoria latopalmata*	P	
	Verreaux's Tree Frog (subsp)	*Litoria verreauxii verreauxii*	P	
Reptilia	Dark-flecked Garden Sunskink	*Lampropholis delicata*	P	
	Eastern Water Dragon	*Physignathus lesueurii*	P	
Mammalia	Short-beaked Echidna	*Tachyglossus aculeatus*	P	
	Brush-tailed Phascogale	*Phascogale tapoatafa*	V	
	Brown Antechinus	*Antechinus stuartii*	P	
	Sugar Glider	*Petaurus breviceps*	P	
	Squirrel Glider	*Petaurus norfolcensis*	V	
	Common Brushtail Possum	*Trichosurus vulpecula*	P	
	Eastern Grey Kangaroo	*Macropus giganteus*	P	
	Swamp Wallaby	*Wallabia bicolor*	P	
	Common Wallaroo	*Macropus robustus*	P	
	Red-necked Wallaby	*Macropus rufogriseus*	P	
	White-striped Freetail-bat	*Tadarida australis*	P	
		Mormopterus ridei	P	
	Little Forest Bat	*Vespadelus vulturnus*	P	
	Gould's Long-eared Bat	*Nyctophilus gouldi*	P	
	Gould's Wattled Bat	*Chalinolobus gouldii*	P	
	Chocolate Wattled Bat	*Chalinolobus morio*	P	
	Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V	
	Little Bentwing-bat	*Miniopterus australis*	V	
	Fox	*Vulpes vulpes*	I	
	Cat	*Felis catus*	I	
	Rabbit	*Oryctolagus cuniculus*	I	
	European cattle	*Bos taurus*	I	
Aves	King Quail	*Excalfactoria chinensis*	P	
	Australian Wood Duck	*Chenonetta jubata*	P	
	Grey Teal	*Anas gracilis*	P	
	Australasian Grebe	*Tachybaptus novaehollandiae*	P	
	Straw-necked Ibis	*Threskiornis spinicollis*	P	
	White-necked Heron	*Ardea pacifica*	P	
	White-faced Heron	*Egretta novaehollandiae*	P	
	Brown Falcon	*Falco berigora*	P	
	Pacific Baza	*Aviceda subcristata*	P	
	Black-shouldered Kite	*Elanus axillaris*	P	
	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	P	M
	Spotted Harrier	*Circus assimilis*	V	
	Wedge-tailed Eagle	*Aquila audax*	P	
	Masked Lapwing	*Vanellus miles*	P	
	Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	P	
	Rainbow Lorikeet	*Trichoglossus haematodus*	P	
	Musk Lorikeet	*Glossopsitta concinna*	P	
	Crimson Rosella	*Platycercus elegans*	P	
	Eastern Rosella	*Platycercus eximius*	P	

Class	Common Name	Scientific name	TSC Act[1]	EPBC Act[2]
	Fan-tailed Cuckoo	*Cacomantis flabelliformis*	P	
	Horsfield's Bronze-Cuckoo	*Chalcites basalis*	P	
	Southern Boobook	*Ninox novaeseelandiae*	P	
	Tawny Frogmouth	*Podargus strigoides*	P	
	Laughing Kookaburra	*Dacelo novaeguineae*	P	
	White-throated Treecreeper	*Cormobates leucophaea*	P	
	Superb Fairy-wren	*Malurus cyaneus*	P	
	Southern Emu-wren	*Stipiturus malachurus*	P	
	Spotted Pardalote	*Pardalotus punctatus*	P	
	Striated Pardalote	*Pardalotus striatus*	P	
	Speckled Warbler	*Chthonicola sagittata*	V	
	White-browed Scrubwren	*Sericornis frontalis*	P	
	Brown Thornbill	*Acanthiza pusilla*	P	
	Yellow Thornbill	*Acanthiza nana*	P	
	Striated Thornbill	*Acanthiza lineata*	P	
	Yellow-faced Honeyeater	*Lichenostomus chrysops*	P	
	Fuscous Honeyeater	*Lichenostomus fuscus*	P	
	Lewin's Honeyeater	*Meliphaga lewinii*	P	
	Bell Miner	*Manorina melanophrys*	P	
	Noisy Miner	*Manorina melanocephala*	P	
	Brown-headed Honeyeater	*Melithreptus brevirostris*	P	
	Eastern Spinebill	*Acanthorhynchus tenuirostris*	P	
	White-fronted Chat	*Epthianura albifrons*	V	
	Eastern Yellow Robin	*Eopsaltria australis*	P	
	Jacky Winter	*Microeca fascinans*	P	
	Rose Robin	*Petroica rosea*	P	
	Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	
	Varied Sittella	*Daphoenositta chrysoptera*	V	
	Golden Whistler	*Pachycephala pectoralis*	P	
	Rufous Whistler	*Pachycephala rufiventris*	P	
	Grey Shrike-thrush	*Colluricincla harmonica*	P	
	Grey Fantail	*Rhipidura albiscapa*	P	
	Willie Wagtail	*Rhipidura leucophrys*	P	
	Pied Butcherbird	*Cracticus nigrogularis*	P	
	Grey Butcherbird	*Cracticus torquatus*	P	
	Australian Magpie	*Cracticus tibicen*	P	
	Pied Currawong	*Strepera graculina*	P	
	White-bellied Cuckoo-shrike	*Coracina papuensis*	P	
	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	P	
	Olive-backed Oriole	*Oriolus sagittatus*	P	
	Australian Raven	*Corvus coronoides*	P	
	Common Myna	*Sturnus tristis*	I	
	Welcome Swallow	*Hirundo neoxena*	P	
	Mistletoebird	*Dicaeum hirundinaceum*	P	
	Tree Martin	*Petrochelidon nigricans*	P	
	Red-browed Finch	*Neochmia temporalis*	P	

Note: P = protected, V = vulnerable, I = introduced, M = migratory.

Appendix C: Migratory species known or potential occurrence within the study area and/or locality.

Scientific Name	Common Name	Conservation Status		Known or predicted occurrence in region	Records from the locality			Previous or current survey records at the DCM or surrounds
		TSC Act	EPBC Act	Protected Matters	Birdlife Australia	Atlas of NSW Wildlife	Australian Museum database	
Apus pacificus	Fork-tailed Swift	–	M	✓	✓	✓	–	–
Ardea alba	Great Egret	–	M	✓	–	–	–	–
Ardea ibis	Cattle Egret	–	M	✓	–	✓▪	–	–
Gallinago hardwickii	Latham's Snipe	–	M	✓	–	–	–	–
Haliaeetus leucogaster	White-bellied Sea-Eagle	–	M	✓	✓▪	✓	–	✓
Hirundapus caudacutus	White-throated Needletail	–	M	✓	–	✓	–	✓
Merops ornatus	Rainbow Bee-eater	–	M	✓	–	–	–	✓
Monarcha melanopsis	Black-faced Monarch	–	M	✓	–	–	–	✓
Monarcha trivirgatus	Spectacled Monarch	–	M	✓	–	–	–	–
Myiagra cyanoleuca	Satin Flycatcher	–	M	✓	–	–	–	–
Rhipidura rufifrons	Rufous Fantail	–	M	✓	–	–	–	✓
Rostratula benghalensis	Painted Snipe	E	M	✓	–	–	–	–

Note: E = endangered, M = migratory.

Appendix D: Assessments of Significance

Frogs

Aquatic habitat within the study area is limited to a few small, ephemeral drainage lines that were dry at the time of the survey and a small dam and creek that occur outside of the Modification footprint. No frogs were considered to have the potential to occur due to a lack of potential habitat and, with the exception of the Giant Barred Frog (*Mixophyes iteratus*), due to a lack of records of threatened amphibians in the locality (Appendix A). The Giant Barred Frog has been recorded at a number of locations to the south-east of the DCM along Mammy Johnsons River (Figure 5; EcoBiological 2009a; Biosphere Environmental Consultants 2013, 2012) and is considered further below.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Habitat for the Giant Barred Frog within the Study Area is considered marginal at best and the species is considered unlikely to occur there at any stage of its lifecycle. The proposed Modification is therefore unlikely to result in any direct impacts on this species. The Giant Barred Frog has been recorded within Mammy Johnsons River to the south-east DCM (Figure 5; EcoBiological 2009a; Biosphere Environmental Consultants 2013, 2012). There are also numerous records for the species throughout the locality from previous fauna surveys (EcoBiological 2009b), monitoring for the Giant Barred Frog Management Plan (Biosphere Environmental Consultants 2013, 2012) and the *Atlas of NSW Wildlife* (OEH 2014b). Potential indirect impacts on this species as a result of the Duralie Extension Project were therefore considered in the EIS for that project and the subsequent Court decision. Measures to mitigate potential indirect impacts on this species were included in the consent conditions for the DCM and the Giant Barred Frog Management Plan was developed (DCPL, 2012). Given that the same mitigation and management measures are implemented for the Modification, it is considered unlikely that the proposed Modification would have any additional impacts on the lifecycle of this threatened species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

There are unlikely to be any direct impacts on habitat for this species given that habitat for the Giant Barred Frog within the Study Area is considered marginal at best. There is unlikely to be any significant increase in indirect impacts to the species' habitat on Mammy Johnsons Creek as a result of the Modification.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Giant Barred Frog occurs from southeast Queensland to the Blue Mountains and is not at the limit of its known distribution (OEH 2014a).

Reptiles

The only threatened reptile species with the potential to occur in the study area are the Pale-headed Snake (*Hoplocephalus bitorquatus*) and Stephen's Banded Snake (*Hoplocephalus stephensii*). The Pale-headed Snake has not previously been recorded in the locality and neither species has been recorded during surveys of the DCM. There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Study Area contains only limited habitat for these species. The Pale-headed Snake is found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas. It shelters during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees (OEH 2014a). Stephen's Banded Snake is found in rainforest and eucalypt forests and rocky areas. It is nocturnal, and shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day (OEH 2014a).

The Modification would result in the loss of approximately 0.7 ha of dry eucalypt forest that is mostly regrowth with few features such as hollow trunks and limbs that would provide potential habitat for these species. The Study Area does not contain rocky outcrops and loose surface rock is rare or absent. These habitat resources are likely to be in greater abundance within the proposed offset area.

On the basis of current evidence (Section 2.2.1) it is considered that neither of these species is likely to occur within the Study Area and the proposed Modification is unlikely to affect the life cycle of these two threatened reptile species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposed Modification would result in the removal of approximately 0.7 ha of eucalypt forest, which is mostly regrowth with few features such as hollow trunks and limbs. Neither species was recorded within this habitat in the Study Area during the AM Consulting surveys and neither species has previously been recorded within the DCM.

The Modification is unlikely to increase habitat fragmentation for these threatened reptiles, given that the habitat would be removed from the edge of a mine pit. Connectivity with other areas of habitat within the locality would remain to the north and to the west.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Stephen's Banded Snake occurs along the coast and ranges from Southern Queensland to Gosford in NSW (OEH 2014a). The Pale-headed Snake occurs patchily from north-east Queensland to Sydney (OEH 2014a).

Wetland-associated Birds

Seven threatened wetland bird species have the potential to occur in the Study Area:

- Blue-billed Duck *Oxyura australis*
- Freckled Duck *Stictonetta naevosa*
- Magpie Goose *Anseranas semipalmata*
- Australasian Bittern *Botaurus poiciloptilus*
- Black Bittern *Ixobrychus flavicollis*
- Black-necked Stork *Ephippiorhynchus asiaticus*
- White-fronted Chat *Epthianura albifrons.*

There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

All seven of the threatened birds listed above are known or predicted to occur in the region (Appendix A). Six of these species are considered to have the potential to occur on occasion in dams to the north of Modification area, but only the seventh, the White-fronted Chat, which forages on grassy ground in wetland areas (OEH 2014a), has been recorded in the vicinity of the DCM.

No water bodies would be directly impacted by the proposed Modification. Potential indirect impacts on the dam and creek to the north of the Modification area are likely to be limited and would be mitigated by the management and mitigation measures implemented for the approved DCM. Given that the same management and mitigation measures are applied to the Modification, the proposed Modification is unlikely to affect the lifecycle of these threatened species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No water bodies would be directly impacted by the proposed Modification. There is a dam and creek downstream from the northern impact area; however, potential indirect impacts on these would be mitigated by the current management practices of the DCM.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the threatened waterbird species listed above are at the limit of their known distribution (OEH 2014a).

Birds of Prey

Four threatened bird of prey species have the potential to occur in the Study Area:

- Spotted Harrier *Circus assimilis*
- Little Eagle *Hieraaetus morphnoides*
- Square-tailed Kite *Lophoictinia isura*
- Black Falcon *Falco subniger.*

There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

All four birds of prey have been recorded or are predicted to occur in the region. There is a record for the Little Eagle for the locality, but only the Spotted Harrier has been recorded in the DCM or surrounds, on one occasion to the south-west of the DCM (Figure 4; Appendix A). The proposed Modification has the potential to affect these species through the loss of 2.5 ha of potential habitat consisting of Dry Sclerophyll Forest and Cleared Land with Scattered Trees.

The potential habitat that would be lost is a very small proportion of the potential habitat in the locality and is mostly regrowth with few mature tree features. These birds of prey build stick nests, typically in large trees (OEH 2014a) and while potential nest trees exist within the disturbance area, there is more extensive and more suitable nesting habitat in the surrounding areas. Thus the areas that would be affected by the proposed Modification are small and are likely to constitute mostly foraging and possibly occasional roosting habitat for these species.

None of these birds of prey have previously been recorded in the Study Area, the potential habitat within the Study Area is more likely to be used for foraging than breeding, and the potential habitat within the Study Area is a very small proportion of the available habitat within the locality. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of these threatened species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. The habitat that would be removed is regrowth with few old growth features such as large mature trees. Therefore, while the habitat that would be lost may provide a small area of foraging habitat for these species, only marginal nesting habitat would be affected.

The proposed Modification is not likely to result in habitat fragmentation for these wide-ranging species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the threatened bird of prey listed above are at the limit of their known distribution (OEH 2014a).

Fruit-Doves

Three threatened species of fruit-dove have the potential to occur in the Study Area:

- Wompoo Fruit-Dove (*Ptilinopus magnificus*)
- Rose-crowned Fruit-Dove (*Ptilinopus regina*)
- Superb Fruit-Dove (*Ptilinopus superbus*)

There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

All three Fruit-Dove species are known or predicted to occur in the region. There is a record for the Wompoo Fruit-Dove and the Rose-crowned Fruit-Dove for the locality (Appendix A). Neither of these species has been recorded within the DCM but the Rose-crowned Fruit-Dove was recorded in 1996 to the east of the DCM along Mammy Johnsons River, within the Southern Offset Area (Figure 5; Woodward-Clyde 1996).

All three species of fruit-dove are entirely frugivorous and occur in rainforests or wet eucalypt forests and may forage in other habitat types where there are fruit-bearing trees (OEH 2014a). The Superb Fruit-Dove is most often seen in mature forest, where the food supply is most plentiful (OEH 2014a). The same can be expected for the other two species as a mature forest supplies a larger and more stable supply of fruit than young forest. At least part of the population of these birds are thought to be nomadic or migratory following the distribution of ripening fruit (OEH 2014a).

Potential habitat for these species in the Study Area is predominantly Dry Sclerophyll Forest and is considered marginal at best. There is some potential for the species to utilise parts of the Cleared Land with Scattered Trees. The vegetation is mostly regrowth with few fruit-bearing trees.

The Modification would result in the loss of approximately 0.7 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees. Areas of better habitat would remain to the north, west and south of the Modification, including along Mammy Johnsons River within the Southern Offset, in which one of these species was recorded and all are considered more likely to occur. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of these threatened species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. The potential habitat is considered marginal, is mostly regrowth vegetation, and few fruit-bearing trees occur. Better habitat exists along Mammy Johnsons River where all three species are considered more likely to occur. The proposed Modification is not likely to increase habitat fragmentation for these species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Wompoo Fruit-Dove occurs along the coast and ranges of eastern NSW and although rare south of Coffs Harbour has a known distribution that extends to the Hunter River, NSW. The Rose-crowned Fruit-Dove occurs along the coast and ranges of eastern NSW from south of Newcastle to Cape York. The Superb Fruit-Dove occurs mainly in a coastal band from Brisbane, QLD to Sydney, NSW and is less common south of Sydney. None of the fruit-doves are at the limit of their known distribution (OEH 2014a).

Glossy Black-cockatoo

The Glossy Black-cockatoo (*Calyptorhynchus lathami*) is known from the vicinity and some feed trees were recorded within the Study Area.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Glossy Black-cockatoo was recorded in 2009 in the Southern Offset Area and chewed *Allocasuarina* cones were observed in several locations (Figure 5; EcoBiological 2009b, AMBS 2011). The Glossy Black-cockatoo has not previously been recorded within the Study Area or the DCM mining lease and was not recorded during the current surveys.

Glossy Black-cockatoos generally inhabit open forest and woodlands of the coast and the Great Dividing Range where stands of she-oak occur. The species feeds almost exclusively on the seeds of she-oaks, in particular Black She-oak (*Allocasuarina littoralis*) and Forest She-oak (*A. torulosa*) are considered important. They require large tree hollows for nest sites (OEH 2014a).

Potential habitat for this species in the Study Area predominantly consists of Dry Sclerophyll Forest, although there is some potential for the species to utilise parts of the Cleared Land with Scattered Trees. This habitat is likely to be limited to foraging habitat, as the vegetation is mostly regrowth and few hollows were observed. Forest She-oak (*Allocasuarina torulosa*) was present in small numbers as mid-storey trees within the Modification area, but no evidence of foraging was observed.

The Modification would result in the loss of approximately 0.7 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees. Areas of potential habitat would remain to the north, west and south of the Modification, including within the Southern Offset, in which the species was recorded.

The Glossy Black-cockatoo has not been recorded in the Study Area, the potential habitat within the Study Area is more likely to be used for foraging than breeding, and the potential habitat within the Study Area is a very small proportion of the available habitat within the locality. The species has been recorded foraging in the Southern Offset area, which would not be affected by the proposed Modification. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of this species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. Forest She-oak (*Allocasuarina torulosa*) was present in small numbers as mid-storey trees within the Modification area, but no evidence of foraging was observed. This habitat is likely to be limited to foraging habitat, as the vegetation is mostly regrowth and few hollows were observed.

The proposed Modification is not likely to increase habitat fragmentation for this wide-ranging species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Glossy Black-cockatoo is widespread throughout suitable forest and woodland habitats, from central Queensland to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW. A small population occurs in the Riverina and an isolated population exists on Kangaroo Island, South Australia (OEH 2014a). Within the locality the species is therefore not at the limit of its known distribution.

Cockatoos, Parrots and Lorikeets

In addition to the Glossy Black-cockatoo, which has been assessed above, the following threatened parrots are considered to have the potential to occur within the Study Area:

- Gang-gang Cockatoo *Callocephalon fimbriatum*
- Little Lorikeet *Glossopsitta pusilla*
- Turquoise Parrot *Neophema pulchella*.

There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

All three of these species have been recorded in the region but only the Gang-gang Cockatoo has been recorded in the vicinity of the DCM, approximately 1 km to the east near Peach Tree Mountain (Figure 5; Appendix A). The proposed Modification has the potential to affect these species through the loss of 2.5 ha of potential habitat consisting of Dry Sclerophyll Forest and Cleared Land with Scattered Trees.

The Gang-gang Cockatoo is generally found in tall mountain forests and woodlands but it moves to lower altitudes in winter, preferring more open eucalypt forests and woodlands (OEH 2014a). It feeds on seeds and fruit of native trees as well as insect larvae. Gang-gang Cockatoos favours old growth attributes for nesting and roosting (OEH 2014a). Little lorikeets feed primarily on nectar and pollen and open eucalypt forest and woodland and nest in hollows in the limbs or trunks of smooth-barked eucalypts (OEH 2014a). The Turquoise Parrot lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. They prefer to feed in the shade of a tree and spend most of the day on the ground searching for seeds or vegetable matter. This species nests in tree hollows, logs or posts (OEH 2014a).

The potential habitat that would be lost is a very small proportion of the potential habitat in the locality and is mostly regrowth with few mature tree features. Thus the areas that would be affected by the proposed Modification are small and are likely to constitute mostly foraging habitat for these species. Tree hollow abundance is likely to be greater within the proposed offset area.

None of these species have been recorded in the Study Area, the potential habitat within the Study Area is more likely to be used for foraging than breeding, and the potential habitat within the Study Area is a very small proportion of the available habitat within the locality. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of these threatened species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area.

The areas that would be lost represent potential foraging and breeding habitat for these threatened parrot species. However, in comparison to the amount of habitat in the surrounding area, including the existing and proposed offset areas, only a small amount of habitat would be lost. This habitat is regrowth with few tree hollows. Thus any loss of potential breeding habitat is expected to be minimal.

The proposed Modification is not likely to increase habitat fragmentation for these wide-ranging species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

These threatened parrot species have widespread distributions in NSW and are not at the limits of their known distributions (OEH 2014a).

Large Forest Owls

The proposed Modification has the potential to affect the following threatened owl species:

- Sooty Owl *Tyto tenebricosa*
- Masked Owl *Tyto novaehollandiae*
- Powerful Owl *Ninox strenua*
- Barking Owl *Ninox connivens.*

There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?
There are regional records for all four large forest owl species and the Sooty Owl and the Powerful Owl have been previously recorded in the locality and in the DCM or surrounds (Figure 5; Appendix A). The proposed Modification has the potential to affect these large forest owl species through the clearing of native vegetation and the loss of potential foraging habitat consisting of cleared land with scattered trees. The 2.5 ha of potential habitat that would be lost is mostly regrowth Dry Sclerophyll Forest and cleared land and contains few features such as hollows in large old trees, which these owl species rely for breeding (OEH 2014a). It is possible that some tree hollows of suitable size exist in the Modification area; however, these are likely to be rare. Tree hollow abundance is likely to be greater within the proposed offset area

The potential habitat for owls within the Study Area is more likely to be used for foraging than breeding, and the potential habitat within the Study Area is a very small proportion of the available habitat within the locality. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of these threatened species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. The habitat that would be removed is regrowth with few features such as large mature trees with large hollows, on which these species rely for breeding. Thus the habitat that would be removed as a result of the proposed Modification is likely to consist mostly of foraging and roosting habitat only.

The proposed Modification is not likely to increase habitat fragmentation for these wide-ranging species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the threatened large forest owl species listed above are at the limit of their known distribution (OEH 2014a).

Speckled Warbler

The Speckled Warbler (*Pyrrholaemus sagittatus*) has been recorded in the Study Area and the proposed Modification has potential to impact on this species.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Speckled Warbler was recorded by Ecobiological during surveys for the Duralie Extension Project in the DCM area, in the footprint of the Duralie Extension Project and also approximately 1 km to the east of the DCM (within the Southern Offset Area) (Figure 5; EcoBiological 2009a, 2009b). The species has also recently been observed by AM Consulting in the Northern Offset Area (AM Consulting 2014). During the current surveys the species was recorded within the Modification area (Figure 4).

The Speckled Warbler inhabits a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies (OEH 2014a). Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Pairs are sedentary and occupy a breeding territory of about 10 ha, with a slightly larger home-range when not breeding (OEH 2014a).

The Speckled Warblers that were found in the Modification area are currently occupying the remnants of a 45 ha patch of native vegetation that is being progressively cleared for the approved DCM. Once this clearing is complete the vegetation patch would be much reduced in area and the ability of the species to persist in the small remnant that would remain within and adjacent to the Modification area is questionable. However, the species is considered likely to persist in the Southern Offset Area and the Northern Offset Area. The proposed Modification would include approximately 9 ha of potential habitat for this species as an offset, adjacent to the Northern Offset Area.

In summary, the proposed Modification is likely to result in the displacement or mortality of any individuals of this species that remain within the 0.3 ha area of Dry Sclerophyll Forest within the Modification area in the northern part of the Study Area after the vegetation clearing for the approved DCM is complete. However, the proposed Modification is not likely to result in the extirpation of the entire local population and is unlikely to affect the lifecycle of that part of the population that occurs in the offset areas.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. Areas of potential habitat for the species would remain to the north, west and south of the Modification, which connect with larger areas of potential habitat in nearby areas, including the Northern Offset Area where the species has been recorded. It is likely the species would be capable of persisting within these areas, given they remain reasonably well-connected across the landscape with other areas of potential habitat.

With the exception of a small 10 metre wide drainage diversion channel, all areas of potential habitat impacted by the Modification would be removed from the edge of the existing disturbance area, thus habitat fragmentation is likely to be minor. A 10 metre wide vegetated drainage channel is not likely to be a major barrier to the Speckled Warbler.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians (OEH 2014a). The species is not at the limit of its known distribution.

Woodland Birds

The following threatened woodland birds have the potential to occur within the Study Area:

- Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*
- Black-chinned Honeyeater *Melithreptus gularis gularis*
- Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*
- Flame Robin *Petroica phoenicea*
- Scarlet Robin *Petroica boodang*
- Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*
- Varied Sittella *Daphoenositta chrysoptera*
- Diamond Firetail *Stagonopleura guttata.*

There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

All eight woodland species listed above have been recorded or are predicted to occur in the region but only the Brown Treecreeper, the Varied Sittella and the Grey-crowned Babbler have been recorded in the DCM and Surrounds (Figure 5; Appendix A). The Brown Treecreeper and Grey-crowned Babbler were recorded in the footprint of the Duralie Extension Project by Ecobiological in 2009 (Figure 5), but were not recorded in the Study Area during the current surveys. The Grey-crowned Babbler was recorded in the proposed offset area during the current surveys (Figure 4). The Varied Sittella was recorded in the western part of the Modification area during the current surveys (Figure 4).

These species typically inhabit dry eucalypt forests or woodlands (OEH 2014a) and could potentially use the Modification area and similar habitat throughout the locality and region for foraging and breeding on occasion. The Modification area represents a very small amount of the potential habitat in the locality. Approximately 35 ha of similar habitat is currently conserved in the Northern Offset Area and approximately 9 ha of native vegetation (mainly Dry Sclerophyll Forest) and approximately 3.5 ha of grassland would be included in an offset as part of the proposed Modification. It is therefore considered unlikely that the proposed Modification would impact the lifecycle of these threatened birds to the extent that a viable local population would be placed at risk of extinction.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area.

The proposed Modification is not likely to increase habitat fragmentation for these wide-ranging species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

All eight of these species have wide distributions in NSW and none are at the limit of their known distribution (OEH 2014a).

Regent Honeyeater and Swift Parrot

The following birds are considered to have the potential to occur within the Study Area:

- Swift Parrot *Lathamus discolor*
- Regent Honeyeater *Anthochaera phrygia*

There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Swift Parrot was recorded in 2008, close to the Modification area and within the current study area (Figure 5; EcoBiological 2009a). The Regent Honeyeater has not been recorded within the DCM or surrounds, and there are no database records for the species within the locality (Appendix A).

The Swift Parrot is a non-breeding autumn-winter migrant to mainland Australia (breeds in Tasmania), where they forage primarily on nectar from winter flowering plants (OEH 2014a). Similarly, within NSW the Regent Honeyeater is known to breed in the Capertee Valley and the Bundarra-Barraba regions during spring and summer, but can move large distances during the non-breeding season to forage on winter nectar resources (OEH 2014a). Both species would forage lerp and/or insects when nectar resources are scarce. There vegetation within the Modification is therefore limited to potential foraging habitat for both species.

The proposed Modification has the potential to affect these species through the loss of 2.5 ha of potential habitat consisting of Dry Sclerophyll Forest, Cleared Land with Scattered Trees. Winter-flowering eucalypts were recorded within the study area (e.g. spotted gums), but were also present in the surrounding areas, often in higher abundance. There is potential for these species to occur within the study area on occasion for foraging, as a non-breeding winter migrant. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of these threatened species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. Winter-flowering eucalypts were recorded within the Modification area in low numbers (e.g. spotted gums), but were also present in the surrounding areas in higher abundance. The potential foraging habitat is considered a relatively minor resource for these species, given they are both non-breeding migrants.

The proposed Modification is not likely to increase habitat fragmentation for these wide-ranging species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Within the Study Area, neither of these species are at the limits of their known distribution (OEH 2014a).

Spotted-tailed Quoll

The Spotted-tailed Quoll (*Dasyurus maculatus*) has the potential to occur within the Study Area.

There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Spotted-tailed Quoll is known to occur in the region and there are records for the locality. The species has not been recorded within the DCM or surrounds (Appendix A).

The Spotted-tailed Quoll occurs in a variety of habitats and vegetation types and feeds on a variety of prey including other mammals, birds, insects, domestic fowl, and carrion (OEH 2014a). The species use old growth features such as hollow tree trunks and limbs, fallen logs as well as rock shelters, caves as den sites (OEH 2014a). They are generally found more frequently in vegetated areas with an abundance of old growth habitat features (OEH 2014a).

The proposed Modification has the potential to affect the Spotted-tailed Quoll through the clearing of native vegetation and the loss of potential foraging habitat consisting of cleared land with scattered trees. The 2.5 ha of potential habitat that would be lost is mostly regrowth Dry Sclerophyll Forest and cleared land and contains few features such as hollows in large old trees, logs or rock shelters, which the species relies on for den sites (OEH 2014a). It is possible that some tree hollows of suitable size exist in the Modification area; however, these are likely to be rare. Tree hollow abundance is likely to be greater within the proposed offset area.

The potential habitat for the species within the Study Area is more likely to be used for foraging than breeding, and the potential habitat within the Study Area is a very small proportion of the available habitat within the locality. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of the Spotted-tailed Quoll.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest, and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. The habitat that would be removed is regrowth with few features such as large mature trees with large hollows, logs or rock shelters, which the species relies on for den sites. Thus the habitat that would be removed as a result of the proposed Modification is likely to consist of foraging habitat only.

The proposed Modification is not likely to increase habitat fragmentation for the Spotted-tailed Quoll.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Spotted-tailed Quoll occurs in a broad coastal band from the Gold Coast, QLD to south of Canberra, ACT (OEH 2014a). Thus, the species is not at the limit of its known distribution.

Brush-tailed Phascogale

The Brush-tailed Phascogale (*Phascogale tapaotafa*) has been recorded in the Study Area.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Brush-tailed Phascogale has been recorded within the DCM and nearby surrounds on several occasions since 1996 (Figure 5; Woodward-Clyde 1996, EcoBiological 2009a, AMBS 2011). The species has been recorded previously near both the northern and western sections of the Modification area, elsewhere within the currently approved mine area, within the Northern Offset area and along Mammy Johnsons River. During the current surveys two individuals were recorded to the west of the open pit, within the forested corridor west of the Modification area and one individual was also recorded from a remote monitoring camera within the proposed offset area (Figure 4). The species was not detected during the current surveys in the northern part of the Modification area.

The Brush-tailed Phascogale generally inhabits dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter (OEH 2014a). They preferentially forage in rough-barked trees feeding on arthropods, invertebrates, nectar and sometime small vertebrates. They require hollows for nesting and shelter, and use many different hollows within their home range over a short time span (OEH 2014a). Within the study area, the species was recorded in locations which contained abundant fallen timber and a greater number of old growth features.

Potential habitat for the Brush-tailed Phascogale in the Study Area consists mainly of Dry Sclerophyll Forest, although there is potential for the species to utilise parts of the Cleared Land with Scattered Trees. The proposed Modification would remove a small amount of potential habitat for this species in the western part of the Study Area (0.4 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees) and approximately 0.3 ha of Dry Sclerophyll Forest in the northern part of the Study Area. This vegetation is mostly regrowth and few old growth features were observed. Better habitat for this species occurs within the Study Area outside of the Modification area and in the surrounding landscape, in particular the forested corridor to the west of the open pit, the Northern Offset Area and the proposed offset area.

Brush-tailed Phascogales have been recorded to the west of the proposed Modification, in the Northern Offset Area and the proposed offset area; these areas contain all of the features likely to be required during all stages of the lifecycle of this species and the proposed Modification is unlikely to have any effect on their ability to persist in these locations. Approximately 35 ha of similar habitat is currently conserved in the Northern Offset Area and approximately 9 ha of native vegetation (mainly Dry Sclerophyll Forest) and approximately 3.5 ha of grassland would be included in an offset as part of the proposed Modification. The proposed Modification is not likely to affect the lifecycle of the Brush-tailed Phascogale to the extent that a local population of the species would be placed at risk of extinction.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. Areas of potential habitat for the species would remain to the north, west and south of the Modification, which connect with larger areas of potential habitat in nearby areas, including the Northern Offset Area and proposed offset area, where the species has been recorded. It is likely the species would be capable of persisting within these areas, given they remain reasonably well-connected across the landscape with other areas of potential habitat.

With the exception of a small 10 metre wide drainage diversion channel, all areas of potential habitat impacted by the Modification would be removed from the edge of the existing disturbance area, thus habitat fragmentation is likely to be minor. A 10 metre wide vegetated drainage channel is not likely to be a major barrier to the Spotted-tailed Quoll.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

In eastern Australia, the Brush-tailed Phascogale has a patchy distribution around the coast from north Queensland to southern Victoria. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide (OEH 2014a). The species is not at the limit of its known distribution.

Common Planigale

The Common Planigale (*Planigale maculata*) has the potential to occur within the Study Area.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Common Planigale is known to occur in the region and records exist from the locality (Appendix A). There is one record of the species from 2003 within the DCM: a single Common Planigale was trapped within the DCM within an Elliott trap during a pre-clearance survey (Cenwest Environmental Services and Resource Strategies 2010).

The Common Planigale is found in a variety of habitat including rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover (OEH 2014a). They are usually found in the vicinity of water (OEH 2014a). The species is carnivorous and feeds on a variety of insects and small vertebrates. They require crevices, hollow logs, loose bark or rocks as nesting sites (OEH 2014a).

The proposed Modification has the potential to affect the Common Planigale through the clearing of native vegetation and the loss of potential foraging and shelter habitat. The 2.5 ha of potential habitat that would be lost is mostly regrowth Dry Sclerophyll Forest and cleared land and contains few shelter resources such as rocks, logs and hollows. It is possible that some suitable features occur within the Modification area; however, these are likely to be rare. A greater abundance of ground cover features such as logs, were recorded in locations outside the Modification area, such as the forested corridor west of the open pit, and the proposed offset area.

The potential habitat within the Study Area is a very small proportion of the available habitat within the locality. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of the Common Planigale.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. The habitat that would be removed is regrowth with few features such as such as rocks, logs and hollows, which the species relies on for shelter. The potential habitat within the Study Area is a very small proportion of the available habitat within the locality.

The proposed Modification is not likely to increase habitat fragmentation for the Common Planigale.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Common Planigale has a coastal distribution extending from the Gold Coast, QLD to Sydney, NSW (OEH 2014a). Thus the species is not at the limits of its known distribution.

Koala

The Koala (*Phascolarctos cinereus*) has the potential to occur within the Study Area.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Koala is known to occur in the region and records exist from the locality (Appendix A). There are two records for the species from the surrounds of the DCM, one from 1996 to the south of the DCM proposed offset area (Figure 4; ERM Mitchell McCotter 1996, Wood-ward-Clyde 1996), and one from 2009 within the proposed offset area (EcoBiological 2009a). Koala scats have also recently been observed by AM Consulting in the Northern Offset Area during October 2013 (AM Consulting 2014).

Koalas occur in eucalypt woodlands and forests. They feed on the foliage of a variety of different trees, mostly Eucalyptus species. Within a given area koalas are highly selective with regard to browse tree species. Preferred food trees recorded within the Study Area included Tallowwood (*E. microcrys*), Forest Red Gum (*E. tereticornis*), and Large-fruited Grey Gum (*E. canaliculata*), which were scattered throughout. Few food trees were recorded in the Modification Area.

The proposed Modification has the potential to affect the Koala through the loss of 2.5 ha of potential habitat consisting of Dry Sclerophyll Forest and Cleared Land with Scattered Trees. The potential habitat that would be lost is a very small proportion of the potential habitat in the locality. There is a scarcity of preferred food trees within the Modification area, and better habitat exists elsewhere, including within the proposed offset area. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of this species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. The potential habitat for the Koala that would be removed is small and does not represent preferred habitat for the species due to the scarcity of preferred food trees. Better habitat exists in nearby areas.

The proposed Modification is not likely to result in habitat fragmentation for the Koala.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Koala has a broad but fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia (OEH 2014a). The species is not at the limits of its known distribution.

Squirrel Glider

The Squirrel Glider (*Petaurus norfolkensis*) has been recorded in the Study Area.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Squirrel Glider has been recorded within the DCM and nearby surrounds on several occasions since 2003 (Figure 5; EcoBiological 2009a, 2009b, AM Consulting 2014). The species has been recorded previously near the northern section of the Modification area, elsewhere within the currently approved mine area, within the Southern Offset Area and Northern Offset area. During the current surveys one individual was recorded near the Modification area north of the open pit, and two individuals were recorded within the proposed offset area (Figure 4).

Squirrel Gliders generally inhabit mature or old growth dry sclerophyll forest, particularly Box, Box-Ironbark woodlands and River Red Gum forest (OEH 2014a). They tend to prefer mixed species stands with a shrub or Acacia midstorey. Abundant tree hollows are required for refuge and nest sites.

Potential habitat for these species in the Study Area mainly consists of Dry Sclerophyll Forest, although there is potential for the species to utilise parts of the Cleared Land with Scattered Trees. The Modification would remove a small amount of potential habitat for this species in the northern part of the Study Area (0.7 ha of Dry Sclerophyll Forest and approximately 1.8 ha of Cleared Land with Scattered Trees in the western part of the Study Area. This vegetation is mostly regrowth and few old growth features were observed.

Squirrel Gliders have been recorded to the in the Northern Offset Area, Southern Offset Area, and the proposed offset area; these areas contain all of the features likely to be required during all stages of the lifecycle of this species and the proposed Modification is unlikely to have any effect on their ability to persist in these locations. Approximately 9 ha of native vegetation (mainly Dry Sclerophyll Forest) and approximately 3.5 ha of grassland would be included in an offset as part of the proposed Modification. The proposed Modification is not likely to affect the lifecycle of the Squirrel Glider to the extent that a local population of the species would be placed at risk of extinction.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area. Areas of potential habitat for the species would remain to the north, west and south of the Modification, which connect with larger areas of potential habitat in nearby areas, including the Northern Offset Area and proposed offset area, where the species has been recorded. It is likely the species would be capable of persisting within these areas, given they remain reasonably well-connected across the landscape with other areas of potential habitat.

With the exception of a small 10 metre wide drainage diversion channel, all areas of potential habitat impacted by the Modification would be removed from the edge of the existing disturbance area, thus habitat fragmentation is likely to be minor. A 10 metre wide vegetated drainage channel is not likely to be a major barrier to the Squirrel Glider.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Squirrel Glider is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria (OEH 2014a). The species is not at the limit of its known distribution.

Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) has the potential to occur within the Study Area.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Grey-headed Flying-fox is known to occur in the region and records exist for the locality. The species has not been recorded within the DCM or surrounds (Appendix A).

Grey-headed Flying-foxes feed on nectar and pollen of native trees as well as fruits, and occur in a wide range of habitats (OEH 2014a). During the day individuals aggregate in camps, which are important for mating, giving birth and rearing young. Camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy (OEH 2014a). The Grey-headed Flying-fox can travel large distances (up to 50 km) from their camp to forage (OEH 2014a).

No camps were observed within or near the study area. The proposed Modification has the potential to affect the Grey-headed Flying-fox through the loss of 2.5 ha of potential habitat consisting of Dry Sclerophyll Forest and Cleared Land with Scattered Trees. The potential habitat that would be lost is a very small proportion of the potential habitat in the locality and is mostly regrowth. The species is more likely to occur along Mammy Johnsons River where there is a greater abundance of fruit-bearing trees. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of the Grey-headed Flying-fox.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area.

The areas that would be lost represent potential foraging only, as no camp sites occur within the study area. In comparison to the amount of habitat in the surrounding area, only a small amount of habitat would be lost, with better habitat occurring elsewhere, particularly along the Mammy Johnsons River.

The proposed Modification is not likely to increase habitat fragmentation for this highly mobile and wide-ranging species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Grey-headed Flying-fox occurs in a 200 km broad band along the east coast of Australia from Bundaberg, QLD to Melbourne, VIC (OEH 2014a). Thus, the species is not at the limits of its known distribution.

Microbats

The following nine microbat species are considered to have the potential to occur within the Study Area:

- Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*
- Eastern Freetail-bat *Mormopterus norfolkensis*
- Little Bentwing-bat *Miniopterus australis*
- Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*
- Large-eared Pied Bat *Chalinolobus dwyeri*
- Southern Myotis *Myotis macropus*
- Greater Broad-nosed Bat *Scoteanax rueppellii*
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*
- Eastern Cave Bat *Vespadelus troughtoni*

There have been numerous surveys conducted within and surrounding the DCM (see Section 2.2.1) and despite this, many species which have not been previously recorded were conservatively considered for assessment.

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

All nine microbat species occur or are predicted to occur in the region. The Eastern Bentwing-bat and Eastern Freetail-bat have been recorded in several locations within the DCM and surrounds, including areas within the current approved development area, and the Southern Offset Area (Figure 5). The Southern Myotis has been recorded mainly along the Mammy Johnsons River, but also in adjacent grassland (Figure 5). There Greater Broad-nosed Bat has database records within the locality, while the Little Bentwing-bat has records approximately 1 km outside the locality. During recent surveys AM Consulting recorded the Eastern Bentwing-bat and Little Bentwing-bat (Figure 4). The proposed Modification has the potential to affect these species through the loss of 2.5 ha of potential habitat consisting of Dry Sclerophyll Forest and Cleared Land with Scattered Trees.

The Yellow-bellied Sheathtail-bat, Eastern Freetail-bat, Greater Broad-nosed Bat, Eastern False Pipistrelle, and Southern Myotis roost in tree hollows, while the Little Bentwing-bat, Eastern Bentwing-bat, Large-eared Pied Bat, and Eastern Cave Bat roost in caves (Churchill 2008). The potential habitat that would be lost is a very small proportion of the potential habitat in the locality and is mostly regrowth with few mature tree features, and no caves. Thus the areas that would be affected by the proposed Modification are small and are likely to constitute mostly foraging habitat for these species. The potential habitat within the Study Area is a very small proportion of the available habitat within the locality. Accordingly, the proposed Modification is considered unlikely to significantly affect the lifecycle of these threatened species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

To the north of the open pit approximately 0.3 ha of Dry Sclerophyll Forest would be removed from the edge of the existing disturbance area. To the west of the open pit approximately 0.4 ha of Dry Sclerophyll Forest and 1.8 ha of Cleared Land with Scattered Trees would be removed, from the edge of the existing disturbance area.

The areas that would be lost represent potential foraging and breeding habitat for these threatened microbat species. However, in comparison to the amount of habitat in the surrounding area, only a small amount of habitat would be lost. This habitat is regrowth with few tree hollows. Thus any loss of potential breeding habitat is expected to be minimal. Tree hollow abundance is likely to be greater within the proposed offset area.

The proposed Modification is not likely to increase habitat fragmentation for these wide-ranging species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Eastern Cave Bat is known or predicted to occur in the region, but is rarely found south of the upper north coast of NSW and the species has not been recorded within the locality (OEH 2014a, Churchill 2008). The remaining threatened microbat species have widespread distributions in NSW (Churchill 2008) and are not at the limits of their known distribution.