Biologic Environmental Survey Pty Ltd
PO Box 179
Floreat, WA, 6014

Friday, December 22, 2017

Attn: David Mickle

BHP Ltd

125 St Georges Tce

Perth, WA, 6000

Dear David,

This letter addresses one item outlined in the Scope of Works, provided by BHP Billiton Iron Ore on 7th September 2017 as follows:

1. The detailed flora/vegetation and level 2 fauna survey results (including data and maps);

An assessment of flora/ vegetation and vertebrate fauna values against the ten clearing principles are provided in a separate letter.

If you have any queries, please do not hesitate to contact either myself or Brad Durrant (0433 542 309).

Yours sincerely,

Morgan O'Connell
Director | Principal Zoologist
morgan@biologicenv.com.au
(08) 6142 7119 | 0433542309

Ministers North to Yandi Corridor

Single Phase Level 2 Fauna and Detailed Flora/Vegetation Survey

BHP Pty Ltd

December 2017

DOCUMENT STATUS				
Revision No.	Author	Review / Approved for Issue	Approved for Issue to	
			Name	Date
2	Dr Darren Brearley Brighton Downing	Morgan O'Connell Brad Durrant	David Mickle	22/12/17
Final	Dr Darren Brearley Brighton Downing	Brad Durrant	David Mickle	29/12/17

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In preparing this report we have made certain assumptions. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

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1 INTRODUCTION

1.1 Background

BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) commissioned Biologic Environmental Survey Pty Ltd (Biologic) and Onshore Environmental Consultants Pty Ltd (Onshore Environmental) to undertake a single phase level 2 vertebrate fauna and detailed flora/vegetation survey of the Ministers North to Yandi Corridor, hereafter referred to as the Study Area. The Study Area is situated directly south of BHP Billiton Iron Ore's Yandi mine (Figure 1.1) and approximately 90 km north-west of Newman, in the Pilbara region of Western Australia.

1.2 Objectives

The objective of this letter was to identify the occurrence of species of conservation significance and their supporting habitats within the Study Area. This was undertaken by;

- completing a comprehensive database review for the Study Area to determine the presence, or likely presence, of conservation significant species and communities. This included an assessment of the likelihood of potential conservation significant species (determined via the database searches) being present within the Study Area, i.e. based on available habitat;
- completing single phase level 2 first season vertebrate fauna survey
- completing a single phase detailed flora/vegetation survey; and
- characterising and mapping existing flora/vegetation as well as broad fauna habitats occurring across the Study Area.

An assessment of flora/vegetation and fauna values against the ten clearing principles is provided in a separate letter.

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Study Area

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BHP - Ministers North to Yandi Corridor

Single Phase Flora, Vegetation and Fauna Survey

Fig. 1.1: Location of the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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2 METHODOLOGY

2.1 Desktop Assessment – Vertebrate Fauna

Four databases were searched to obtain information on species previously recorded within the Study Area (Birdata, NatureMap and Threatened and Priority Fauna Search) and conservation significant species likely to occur within the Study Area (Protected Matters Database; Table 2.1).

- BirdLife Australia's Birdata Custom Bird List – to determine avifauna recorded from the region;
- Department of Biodiversity Conservation and Attractions' (DBCA) NatureMap database (DBCA 2017a) – to determine fauna recorded from the region;
- DBCA's Threatened and Priority Fauna Search (DBCA 2017b) - to determine threatened fauna recorded from the region and;
- Department of Environment and Energy's (DoEE) Protected Matters Database (DoEE 2017a) – to determine matters of national environmental significance recorded from the area.

Table 2.1 - Databases used for the vertebrate fauna review

Provider	Database	Parameters
BirdLife Australia	Birdata Custom Bird List Received 9 November 2017	Circle of radius 40 km centred on the point -22.78757, 119.07182
DBCA	NatureMap Accessed 23 October 2017, revised 23 November 2017	Circle of radius 10 km centred on the point -22.7875, 119.0719
DBCA	Threatened and Priority Fauna Search Received 10 October 2017	Study Area (shapefile) buffered by 25 km
DoEE	Protected Matters Database Search Tool Accessed 23 October 2017, revised 23 November 2017	Circle of radius 10 km centred on the point -22.78757, 119.07182

2.2 Field Survey

The field survey was undertaken from the 9th to the 13th of October 2017. This letter report details results from this survey.

2.2.1 Flora and Vegetation

The flora and vegetation field survey involved systematic sampling using quadrats (referred to as study sites). Relevé vegetation descriptions were made to increase the accuracy of vegetation mapping and targeted searches were completed in habitats where it was anticipated that significant flora might occur. A total of 32 study sites (50 m by 50 m) were assessed during the survey (Figure 2.1), all accessed by helicopter.

2.2.2 Vertebrate Fauna

Twenty-three motion cameras were set throughout the Study Area. SongMeter2 (SM2) technology was used to detect conservation significant bat species in five locations throughout the Study Area. Ultrasonic recordings were then analysed by Bob Bullen (Bat Call WA). Two SongMeter4 (SM4) acoustic recorders were used to detect bird species in two locations throughout the Study Area. A total of 37 fauna habitat assessments were undertaken throughout the Study Area to define and delineate broad fauna habitats present. This included habitat assessments conducted at the 23 motion camera locations, four SM2 locations (as one SM2 recorder was deployed in the same location as a Motion Camera and thus did not require an independent habitat assessment), two SM4 locations, three targeted search locations and five additional habitat assessment locations (Figure 2.2). Opportunistic records of vertebrate species encountered during the survey were documented. Birds were recorded on a presence/absence basis, determined by call identification, visual identification and/or tracks and traces. No habitat was disturbed in the process.

2.3 Potential Limitations

A single season level 2 fauna survey and detailed flora survey were identified by BHP Billiton as the requirement for this survey and was completed by experienced botanists and zoologists. The entire Study Area was accessible by helicopter, thus the sampling techniques used during this survey were not constrained by accessibility or remoteness. However, the survey was conducted during a single season only (dry season) that reduced the ability to detect annuals and some fauna.

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- Study Area
- Quadrat Locations

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Single Phase Flora, Vegetation and Fauna Survey

Fig. 2.1: Flora Sampling Site Locations

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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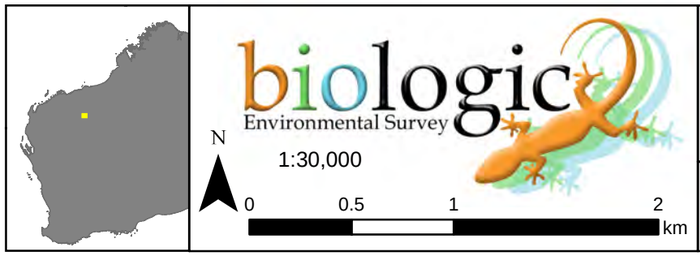
Study Area

Fauna Sampling Method

- Targeted Search
- Motion Camera
- Ultrasonic Recorder
- Acoustic Recorder
- Habitat Assessment



BHP - Ministers North to Yandi Corridor

Single Phase Flora, Vegetation and Fauna Survey

Fig. 2.2: Fauna Sampling Sites

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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3 ENVIRONMENT

The 2,025 hectare (20.25 km^2) Study Area is located within the Hamersley Botanical District, which is part of the Eremaean Province (Beard 1990). It is dominated by tree and shrub - steppe communities consisting mainly of *Eucalyptus* and *Acacia* species. *Triodia pungens, Triodia wiseana* and some Mulga (*Acacia aneura*) occur within valley areas and short grass plains occur on alluvia. The vegetation within the Study Area is classified as the following two vegetation associations (Figure 3.1), as mapped by Beard (1975) and later refined by Shepherd *et al.* (2001):

- 82: Hummock grasslands, low tree steppe; Snappy gum over *Triodia wiseana*; and
- 18: Low woodland; mulga (*Acacia aneura*).

While the Pre-European extent for each vegetation association is close to 100 percent, less than 10 percent of each association occurs within formal or informal reserves (Table 3.1).

Table 3.1 - Pre-European extent of vegetation associations occurring within the Study Area (Shepherd *et al*. 2001)

Vegetation Association	Description	Pre-Euro. Extent Remaining (ha)	Remaining area (ha) in IUCN Class I-IV Reserves	% remaining Other Reserves	% remaining in DBCA Managed PL
Hamersley - 82	Hummock grasslands, low tree steppe; Snappy gum over *Triodia wiseana*	2,290,910 (100%)	8.9	0.2	1.0
Hamersley - 18	Low woodland; mulga (*Acacia aneura*)	24,659,110 (99.9%)	2	0.3	2.5

A total of 102 land systems were defined in the Pilbara at a scale of 1: 250,000 (Van Vreeswyk *et al.* 2004), four of which occur within the Study Area (Table 3.2; Figure 3.2). The northern and southern halves of the study area are primarily comprised of ranges associated with the McKay and Newman land systems respectively. A localised area within the central sector of the Study Area supports mesas characteristic of the Robe land system, with stony plains of the Boolgeeda land system represented in the south-east corner of the Study Area (Figure 3.2).

Table 3.2 - Land systems represented within the Study Area (descriptions from Van Vreeswyk *et al.* 2004).

Land System	Representation in the Pilbara	Description
Boolgeeda	7,748 km2 or 4.3%	Stony plains with hard Spinifex grasslands or Mulga shrublands. The geology is quaternary colluvium.
McKay	4,202 km2 or 2.3%	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands.
Newman	14,580 km2 or 8.0%	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.
Robe	865 km2 or 0.5%	Low limonite mesas and buttes supporting soft spinifex (and occasionally hard spinifex) grasslands.

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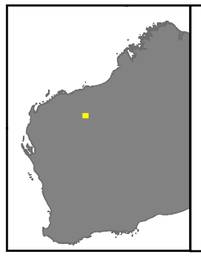
Study Area

Vegetation Association

Hamersley - 18

Hamersley - 82



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Single Phase Flora, Vegetation and Fauna Survey

Fig. 3.1: Pre-European Vegetation Represented Within the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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Study Area

Land Systems

- Disturbed Land
- Boolgeeda
- McKay
- Newman
- River
- Robe

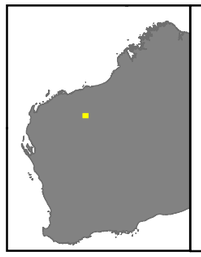

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Fig. 3.2: Land Systems Occuring Within the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A3. Created 4/12/2017

4 RESULTS

4.1 Flora and Vegetation

A total of 260 plant taxa (including varieties and subspecies) from 44 families and 127 genera were recorded from the study area. Species representation was greatest among the Fabaceae, Poaceae, Malvaceae, Asteraceae, Amaranthaceae, Convolvulaceae and Myrtaceae families. The most speciose genera were *Acacia* (20 taxa), *Sida* (12 taxa), *Ptilotus* (9 taxa), *Senna* (9 taxa), *Tephrosia* (7 taxa) and *Hibiscus* (6 taxa).

None of the plant taxa recorded from the Study Area were gazetted as Threatened Flora pursuant to subsection (2) of section 23F of the Wildlife Conservation Act 1950 (WC Act), or listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Three Priority flora taxa were recorded from the study area (Figure 4.1); *Goodenia nuda* (Priority 4), *Rostellularia adscendens* var*. latifolia* (Priority 3) *and Sida* sp. Barlee Range (S. van Leeuwen 1642) (Priority 3). Additionally, one species of interest was recorded within the study area; *Hibiscus cf. campanulatus (*potentially Priority 1*).*

A total of eight introduced weed species were recorded from the study area (Figure 4.2); **Bidens bipinnata, *Cenchrus ciliaris, *Conyza bonariensis, *Flaveria trinervia, *Malvastrum americanum, *Rumex vesicarius, *Setaria verticillata* and **Sonchus asper*. None of these taxa were listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act).

A total of 12 vegetation associations classified as seven broad floristic formations were described and mapped from the Study Area (Figure 4.3). None of the vegetation associations within the Study Area had any affiliation with Federal or State listed Threatened Ecological Communities (TECs) or State listed Priority Ecological Communities (PECs), and all are well represented regionally.

Vegetation condition was rated as *excellent* across the majority of the Study Area, with the remainder of the area classified as *very good* (Figure 4.4). Minor disturbances included weed invasion, cattle grazing, old access tracks and fire.

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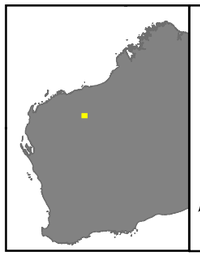
Study Area **Significant Flora Species**

- *Goodenia nuda*
- *Hibiscus* sp.
- *Rostellularia adscenden* var. *latifolia*
- *Sida* sp. Barlee Range (S. van Leeuwen 1642)



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Single Phase Flora, Vegetation and Fauna Survey

Fig. 4.1: Significant Flora Observations

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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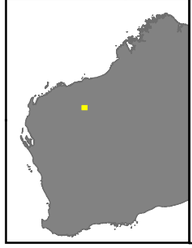
Study Area

Introduced Flora Species

- *Bidens bipinnata*
- *Cenchrus ciliaris*
- *Conyza bonariensis*
- *Flaveria trinervia*
- *Malvastrum americanum*
- *Rumex vesicarius*
- *Setaria verticillata*
- *Sonchus asper*



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Single Phase Flora, Vegetation and Fauna Survey

Fig. 4.2: Introduced Flora Observations

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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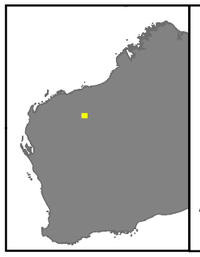
- Study Area

Vegetation Code

- FP Tp ChHallEv TefcApy
- GG CfEll AtpAnl TtErmuCya
- HC ErmuCyaTt CfEll Tw
- HC Tp AprEll ErllGrwh
- HC TsTw Ell Grwh
- HC Tw Ell AbAanc
- HS TwTbr Ai Inr
- MA EcEv Cyv SoplTtEua
- MA Ev TefcCocrApy TtSoplCya
- ME TtCyaEnl Cyv AcpEvCh
- MI AmAmaGoro TtCyaPamu ChEll
- SP Tw AiAtenAads Ch



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BHP - Ministers North to Yandi Corridor

Single Phase Flora, Vegetation and Fauna Survey

Fig. 4.3: Vegetation Associations

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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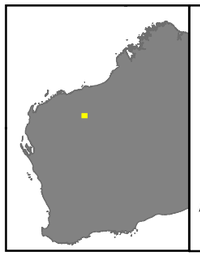
Study Area **Vegetation Condition**

Excellent

Very Good



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BHP - Ministers North to Yandi Corridor

Single Phase Flora, Vegetation and Fauna Survey

Fig. 4.4: Vegetation Condition

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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4.2 Vertebrate Fauna

From the desktop assessment, five conservation significant fauna species have been recorded within the vicinity (i.e. within 10 km) of the Study Area; Ghost Bat (*Macroderma gigas*); Rainbow Bee-eater (*Merops ornatus*); Pilbara Olive Python (*Liasis olivaceus barroni*), Common Greenshank (*Tringa nebularia*) and Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*). Given their close proximity to the Study Area, these species may be present within the Study Area but have not been recorded as of yet for a number of reasons, including: the species are nomadic or have large home ranges so may not have been present in the Study Area during the time of survey; some of these species (i.e. dasyurids) are considered to be 'boom or bust' species and so may only occur in the Study Area during good to excellent seasonal conditions when food and other resources are available; and/or some species are very cryptic or difficult to survey (e.g. Pilbara Olive Python). These species, along with an assessment of their likely presence in the Study Area (based on available habitat), are listed in Table 4.2

Moreover, the Northern Quoll (*Dasyurus hallucatus*) has been recorded from Yandi Mine on two occasions (once observationally and once as road kill; Morgan O'Connell pers obs). The Northern Quoll is listed as Endangered under the EPBC Act and Schedule 2 (Endangered) under the WC Act. The species was once widely distributed across northern Australia, although is now restricted to three isolated populations; the Pilbara, the Kimberley and Northern Territory, and Queensland, in addition to a number of islands along the north coast (DoE, 2016).

Finally, one locally significant species was found within NatureMap (DBCA 2017a); the Chocolate Wattled Bat (*Chalinolobus morio*). This species has a restricted distribution in the southern part of Western Australia (Churchill 2008). Weeli Wolli Spring and Marillana Creek represent the only two locations in the Pilbara where this species has been recorded and are the most northern records for this species (McKenzie & Bullen 2009). Given its geographic separation from the main population in Western Australia, the Pilbara population may be genetically distinct. Therefore, although not formally listed as a conservation significant species, it is considered locally significant.

From the field survey, a total of 59 vertebrate fauna species representing 35 families were recorded from the Study Area. Thirty-five species of avifauna, 14 species of mammals (including one introduced species; *Felis catus*) and 10 species of herpetofauna were recorded during the survey (Table 4.1).

None of the fauna species recorded from the Study Area were gazetted as Threatened Fauna pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). One Priority fauna species was recorded from the Study Area (Figure 4.5); *Pseudomys chapmani* (Priority 4). The Western Pebble-mound Mouse is currently listed as Priority 4 by the DBCA. This species has experienced a significant decline in its range through the Gascoyne and Murchison, and is now considered endemic to the Pilbara and Little Sandy Desert (Van Dyck and Strahan

2008). This species almost exclusively occurs on the gentler slopes of rocky ranges where the ground is covered with a stony mantle and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs (Van Dyck and Strahan 2008).

Table 4.1 - Summary of Vertebrate Fauna Recorded During the Current Survey

Fauna Group	Number of Species	Number of Families
Avifauna	35	22
Non-volant mammals (Native)	7	4
Non-volant mammals (Introduced)	1	1
Bats	6	3
Amphibians	0	0
Reptiles	10	5
Total	**59**	**35**

Additionally, the Rainbow Bee-eater (*Merops ornatus*) was recorded ~0.5 km north-east of the Study Area (Figure 4.5). This species is listed as Migratory under the EPBC Act and Schedule 5 under the WC Act. The Rainbow Bee-eater is a common and widespread species in Western Australia, except in the drier interior of the State and the far south-west. The demographics of the species are complex, with populations in Western Australia being resident, breeding visitors, post-nuptial nomads, passage migrants and winter visitors (Johnstone and Storr 1998) with many individuals moving northwards to overwinter in Indonesia. The Rainbow Bee-eater prefers lightly wooded, preferably sandy habitat near water (Johnstone and Storr 1998).

Table 4.2 - Conservation significant species occurring or potentially occurring within the Study Area

Name	State listing	Fauna Records within or in close proximity to the Study Area	Potential habitats within the Study Area	Likelihood
Species occurring within the Study Area				
Western Pebble-mound Mouse *Pseudomys chapmani*	DBCA Priority 4	Inactive mounds belonging to this species were recorded at three locations within the Study Area during the current survey, along with one recently inactive and one active mound 580 m from the Study Area (Figure 4.5). Two records (secondary evidence) of the species within the Study Area near the southern border and a further 44 within 10 km of the Study Area (DBCA 2017b).	All three inactive mounds recorded during the survey were within the Hillcrest/ Hillslope habitat. This habitat type was the most common and widespread habitat type occurring across the Study Area (Figure 4.6). The remaining habitat types are unlikely to provide significant habitat for the species.	Known to occur
Conservation significant fauna recorded up to 5 km from the Study Area				
Pilbara Olive Python *Liasis olivaceus barroni*	EPBC Act Vulnerable WC Act Schedule 1	This species was not recorded during the current survey. However, the closest record of this species exists 4.35 km north of the Study Area (DBCA 2017b). Another record has been documented ~15 km SW of the Study Area and a further 5 records have been documented 12.5 km – 16 km NEE to SE (DBCA 2017b). The presence of preferred habitats (Gorge/ Gully and Breakaway/ Cliffs) suggests the species is likely to occur within the Study Area.	The Gorge/ Gully habitat and Breakaway/ Cliff habitat types may provide suitable habitat for the species, especially where pools are present (Figure 4.6). The Breakaway/ Cliff habitat is patchy the north-west, around the Major Drainage Line (runs north-east to south-west in the central portion of the Study Area) and floodplain area in the south-eastern portion of the Study Area. Gorge/ Gully habitat is also present in the north-western and south-eastern sections of the Study Area (Figure 4.6).	Likely to occur

Name	State listing	Fauna Records within or in close proximity to the Study Area	Potential habitats within the Study Area	Likelihood
Rainbow Bee-eater *Merops ornatus*	EPBC Act Migratory WC Act Schedule 3	A single Rainbow Bee-eater was recorded 525 m outside the Study Area during this survey. According to DBCA (2017b), two records (of seven individuals) have been recorded within 10 km of Study Area (one to the north and the other to the north-west).	The Rainbow Bee-eater prefers lightly wooded, preferably sandy country near water (Johnstone and Storr 1998). The Major Drainage Line present within the Study Area (running north-east to south-west in the central portion of the Study Area) and the Drainage Area/ Floodplain provide suitable nesting and foraging habitat for the species, although the species may occasionally forage over all habitats within the Study Area.	Likely to occur
Northern Quoll *Dasyurus hallucatus*	EPBC Act Endangered WC Act Schedule 1 IUCN Endangered	This species is regarded as likely to occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a). Two Northern Quoll have been observed at Yandi Mine (Morgan O'Connell, pers obs). Furthermore, numerous records have been documented by DBCA (2017b) more than 19km north of the Study Area. Three records were also documented 18.7 km south of the Study Area (DBCA 2017b).	Rocky habitats tend to support higher densities of Northern Quoll, as they offer protection from predators and are generally more productive in terms of availability of resources (Braithwaite & Griffiths 1994; Oakwood 2000). Other microhabitat features important to the species include: rock cover; proximity to permanent water and time-since last fire (Woinarski *et al*. 2008). Given that Northern Quoll was not picked up on motion camera and no scats were observed, it would be unlikely that a permanent population occurs within the Study Area. Dispersing males may occasionally pass through from the north west, suggesting that if a number of consecutive good rainfall years improved habitat productivity then a population could be established.	May Occur

Name	State listing	Fauna Records within or in close proximity to the Study Area	Potential habitats within the Study Area	Likelihood
Conservation significant fauna recorded 5-10 km from the Study Area				
Ghost Bat *Macroderma gigas*	DBCA Priority 4 IUCN Vulnerable	The nearest record of Ghost Bat is approximately 10 km south of the Study Area (DBCA 2017b). A further 28 records have been documented <25 km south of the Study Area. The species is known to occur within the region and may forage across most of the Study Area.	Ghost Bats roost in deep, complex caves beneath bluffs of low, rounded hills, granite rock piles and abandoned mines (Armstrong and Anstee 2000). These features often occur within habitats including Gorge/ Gully, Hillcrest/ Hillslope and low hills. The Breakaway/ Cliff, Gorge/ Gully, Major Drainage Line and drainage floodplain habitats throughout the Study Area provide suitable foraging habitat for the species; however, it is considered likely that this species would only occur in the Study Area occasionally when dispersing or foraging through the landscape given that no caves were recorded during this survey.	Unlikely to Occur

Name	State listing	Fauna Records within or in close proximity to the Study Area	Potential habitats within the Study Area	Likelihood
Pilbara Leaf-nosed Bat *Rhinonicteris aurantia*	EPBC Act Vulnerable WC Act Schedule 1	One record of Pilbara Leaf-nosed Bat has been documented by DBCA (2017b) approximately 10 km north-west of the Study Area. A further 175 records have been documented by DBCA (2017b) more than 18 km north of the Study Area. Only one record has been documented south of the Study Area (20 km). The species may potentially forage over the Study Area.	Pilbara Leaf-nosed Bat requires deep humid caves for roosting. The species will forage across numerous habitats within the Study Area including Gorge/ Gully, Hillcrest/ Hillslope and low hills. The Breakaway/ Cliff habitat is patchy in the north-west, around the Major Drainage Line (runs north-east to south-west in the central portion of the Study Area) and floodplain area in the south-eastern portion of the Study Area; however, it is considered likely that this species would only occur in the Study Area occasionally when dispersing or foraging through the landscape given that no caves were recorded during this survey.	Unlikely to Occur
Common Greenshank *Tringa nebularia*	EPBC Act Migratory WC Act Schedule 5	The Common Greenshank is a migratory wader that frequents Western Australian north-west during the monsoonal wet season. The species may possibly occur as an irregular visitor within the Major Drainage Line habitats in the Study Area during periods of inundation.	The Common Greenshank can be found in a wide variety of inland wetlands and sheltered coastal habitats (typically with large mudflats and saltmarsh, mangroves or seagrass) of varying salinity (Johnstone *et al*. 2013). The species may irregularly visit Major Drainage Line habitats within the Study Area, during periods of inundation, although is not reliant on such habitats.	Unlikely to Occur

Name	State listing	Fauna Records within or in close proximity to the Study Area	Potential habitats within the Study Area	Likelihood
Other conservation significant fauna identified in DoEE's Protected Matters Database				
Fork-tailed Swift *Apus pacificus*	EPBC Act Migratory WC Act Schedule 3	This species is regarded as likely to occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a). One record (with a count of 9) has been documented 16.7 km NEE of the Study Area along with one record 22.6 SE of the Study Area (DBCA 2017b)	The Fork-tailed Swift inhabits dry/open habitats, inclusive of riparian woodlands and tea-tree swamps, low scrub, heathland or saltmarsh, as well as treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes (DoEE 2017b).	Possible to Occur
Night Parrot *Pezoporus occidentalis*	EPBC Act Endangered, Migratory WC Act Schedule 1 IUCN Critical	This species as likely to occur within the Study Area or within the vicinity of the Study Area (<10 km according to DoEE (2017a).	The Night Parrot prefers sandy/stony plain habitat (TSSC, 2016) with old-growth spinifex (*Triodia*) for roosting and nesting in conjunction with native grasses and herbs for foraging (DBCA, 2017c). However, no stony/sandy plains were documented during the current survey. Therefore, it is unlikely that this species occurs in the Study Area.	Unlikely to Occur
Great Egret *Ardea modesta*	WC Act Migratory Schedule 5	This species as likely to occur within the Study Area or within the vicinity of the Study Area (<10 km according to DoEE (2017a)). One record was documented by DBCA (2017b) 23.7km NEE of the study area.	This species has been reported in a variety of wetland habitat including swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs (DoEE 2017b). The species may irregularly visit Major Drainage Line habitats within the Study Area, during periods of inundation, although is not reliant on such habitats.	Unlikely to Occur

Name	State listing	Fauna Records within or in close proximity to the Study Area	Potential habitats within the Study Area	Likelihood
Curlew Sandpiper *Calidris ferruginea*	EPBC Act Critically Endangered, Migratory, WC Act Schedule 3 and Schedule 5 IUCN Near Threatened	This species may occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	The Curlew Sandpiper inhabits intertidal mudflats in sheltered coastal areas (i.e. estuaries, bays, inlets and lagoons). This rare species generally roosts on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands (DoEE 2017b). Therefore, this species is unlikely to occur within the Study Area due to the lack of suitable habitat.	Unlikely to Occur
Australian Painted Snipe *Rostratula australis*	EPBC Act Endangered WC Act Schedule 2 IUCN Endangered	This species may occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	The Australian Painted Snipe generally occupies shallow terrestrial freshwater wetlands (i.e. temporary and permanent lakes, swamps and claypans) with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire. The Australian Painted Snipe breeding habitat requirements are quite specific. They require shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. This species requires suitable wetland areas even in drought conditions (DoEE 2017b). Therefore, it is unlikely that this rare species occurs within the Study Area.	Unlikely to Occur
Cattle Egret *Ardea ibis*	WC Act Migratory Schedule 5	This species may occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	The Cattle Egret prefers tropical and temperate grasslands, wooded lands and terrestrial wetlands and is therefore a rare visitor of the Pilbara (DoEE 2017b).	Unlikely to Occur

Name	State listing	Fauna Records within or in close proximity to the Study Area	Potential habitats within the Study Area	Likelihood
Barn Swallow *Hirundo rustica*	EPBC Act Migratory, WC Act Schedule 5	May occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	The Barn Swallow is a non-breeding summer visitor to the Pilbara. It favors areas near water (Johnstone *et al.* 2013). This vagrant species may irregularly visit Major Drainage Line habitats or waterbodies within the Study Area, during periods of inundation, although is not reliant on such habitats.	Unlikely to Occur
Grey Wagtail *Motacilla cinerea*	EPBC Act Migratory, WC Act Schedule 5	May occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	The Grey Wagtail is associated with fast-flowing mountain streams and rivers with riffles and exposed rocks or shoals, often in forested areas. It is also found in more lowland watercourses and even canals (BirdLife International 2017a). Therefore, this vagrant species is unlikely to occur in the Study Area.	Unlikely to Occur
Yellow Wagtail *Motacilla flava*	EPBC Act Migratory, WC Act Schedule 5	May occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	This species occupies a range of damp or wet habitats with low vegetation (i.e. meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra; BirdLife International 2017b). Therefore, it is unlikely that this rare species occurs within the Study Area.	Unlikely to Occur

Name	State listing	Fauna Records within or in close proximity to the Study Area	Potential habitats within the Study Area	Likelihood
Common Sandpiper *Actitis hypoleucos*	EPBC Act Migratory, WC Act Schedule 5	May occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	The Common sandpiper inhabits estuaries and deltas of streams, as well as banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans. The muddy margins utilised by the species are often narrow, and may be steep. The species often utilises mangroves as roost sites (DoEE 2017b). Therefore, this species is unlikely to occur in the Study Area.	Unlikely to Occur
Sharp-tailed Sandpiper *Calidris acuminata*	EPBC Act Migratory, WC Act Schedule 5	May occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	The sharp-tailed Sandpiper is a migratory wader that frequents the Western Australian north-west during the monsoonal wet season. The species could possibly occur as an irregularly visitor within the Major Drainage Line habitats within the Study Area during periods of inundation.	Unlikely to Occur
Pectoral Sandpiper *Calidris melanotos*	EPBC Act Migratory, WC Act Schedule 5	May occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	The Pectoral Sandpiper inhabits coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. It prefers wetlands with open fringing mudflats and low, emergent or fringing vegetation. Furthermore, they forage in shallow water or soft mud at the edge of wetlands (DoEE 2017b). Therefore, this species is unlikely to occur in the Study Area.	Unlikely to Occur

Name	State listing	Fauna Records within or in close proximity to the Study Area	Potential habitats within the Study Area	Likelihood
Oriental Plover *Charadrius veredus*	EPBC Act Migratory WC Act Schedule 3	May occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	When the Oriental Plover first arrives on Australian soil, it typically inhabits coastal habitats including estuarine mudflats and sandbanks, on sandy or rocky ocean beaches, nearby reefs, or in near-coastal grasslands. It then disperses farther inland to flat, open, semi-arid or arid grasslands, where the grass is short and sparse, and interspersed with hard, bare ground, such as claypans, dry paddocks, playing fields, lawns and cattle camps or open areas that have been recently burnt (DoEE 2017b). Therefore, this species is unlikely to occur in the Study Area.	Unlikely to Occur
Greater Bilby *Macrotis lagotis*	EPBC Act Vulnerable WC Act Schedule 1 IUCN Vulnerable	May occur within the Study Area or within the vicinity of the Study Area (<10 km) according to DoEE (2017a).	The Greater Bilby typically inhabits sandy plains and thus is unlikely to occur in the Study Area.	Unlikely to Occur

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715000
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7480000
7477500

Legend

Study Area **Fauna of Conservation Significant Species**

- Rainbow Bee-eater, Individual (allive)
- Western Pebble-mound Mouse, Mound (active)
- Western Pebble-mound Mouse, Mound (recently inactive)
- Western Pebble-mound Mouse, Mound (inactive)

biologic Environmental Survey

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1:30,000

0 0.5 1 2 km

BHP - Ministers North to Yandi Corridor

Single Phase Flora, Vegetation and Fauna Survey

Fig. 4.5: Fauna of Conservation Significance Recorded in the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A3. Created 4/12/2017

Seven fauna habitats have been identified within the Study Area: Basalt Outcrop, Breakaway/ Cliff, Gorge/ Gully, Hillcrest/ Hillslope, Major Drainage Line, Minor Drainage Line and Drainage Area/ Floodplain (Figure 4.6). Hillcrest/hillslopes is the most common habitat within the Study Area. The least common fauna habitats include the Major Drainage Line, Breakaway/ Cliff (small areas located in the north-western, central and south-eastern portions of the Study Area), Gorge/ Gully (small areas located in the north-western and south-eastern portions of the Study Area), Basalt Outcrops and Minor Drainage Lines (Table 4.3). Only two Hillcrest/ Hillslope sites in the north-western portion of the Study Area exhibited signs of cattle grazing; Motion Camera Sites 4.4 and Site A1.1/A50 (Figure 2.2).

Table 4.3 - Actual Area (ha) and Percentage Area Occupied within the Study Area by the Seven Fauna Habitats

Habitat	Hectares	Percentage
Major Drainage Line	33	1.63
Breakaway/ Cliff	36	1.78
Gorge/ Gully	40	1.98
Basalt Outcrops	41	2.03
Minor Drainage Line	63	3.11
Drainage Area/ Floodplain	253	12.51
Hillcrest/ Hillslope	1557	76.96
TOTAL	**2023**	**100**

Three waterbodies were recorded during the current survey (Figure 4.6). A tiny seep (0.03 m wide and 0.001 m long) was recorded near the southern border of the Study Area and was not deemed to be permanent. A river pool (3 m wide, 15 m long and ~1 m deep) was recorded in the north-western portion of the Study Area. This waterbody is semi-permanent but likely to hold water for most of the year. It is also fringed with Typha (reeds). Finally, a semi-permanent rock pool in the central portion of the Study Area is likely to hold water following rain. Water sources are a limiting factor for many ecosystems (James *et al.* 1995) particularly within arid-zone ecosystems such as the Pilbara (Burbidge *et al*. 2010; Doughty *et al*. 2011), and often represent areas of comparatively high productivity (Murray *et al*. 2003). While temporary water sources may be abundant during and following the wet season, important features are those which provide resources for most of the year. These features were highlighted because they may provide important sources of shelter, food and water for species of conservation significance.

710000

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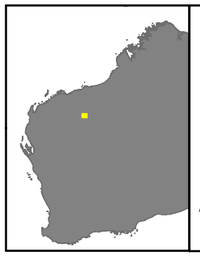
Legend

Fauna Habitats

- Basalt Outcrops
- Breakaway/ Cliff
- Drainage Area/ Floodplain
- Gorge/ Gully
- Hillcrest/ Hillslope
- Major Drainage Line
- Minor Drainage Line
- Study Area
- Waterbodies



biologic Environmental Survey

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BHP - Ministers North to Yandi Corridor

Single Phase Flora, Vegetation and Fauna Survey

Fig. 4.6: Fauna Habitats and Habitat Features Within the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A3. Created 4/12/2017

4.3 Conclusions

A single phase level 2 targeted vertebrate fauna and detailed flora/vegetation survey of the Study Area was completed in October 2017 to detail and map existing flora/vegetation as well as broad fauna habitats occurring across the Study Area and to identify the occurrence of conservation significant species.

A total of 260 plant taxa from 44 families and 127 genera were recorded from the study area. Three Priority flora taxa were recorded from the study area; *Goodenia nuda* (Priority 4), *Rostellularia adscendens* var. *latifolia* (Priority 3) *and Sida* sp. Barlee Range (S. van Leeuwen 1642) (Priority 3). Additionally, one species of interest was recorded within the study area; *Hibiscus cf. campanulatus (*potentially Priority 1*).* Moreover, eight introduced weed species were recorded from the study area, none of which were listed as a Declared Pest under the BAM Act (2007). Finally, a total of 12 vegetation associations classified as seven broad floristic formations were described and mapped from the Study Area. None of the vegetation associations within the Study Area had any affiliation with Federal or State listed Threatened Ecological Communities (TECs) or State listed Priority Ecological Communities (PECs), and all are well represented regionally. Vegetation condition was rated as *excellent* across the majority of the Study Area, with the remainder of the area classified as *very good*.

From the field survey, a total of 59 vertebrate fauna species representing 35 families were recorded from the Study Area. None of the fauna species recorded from the Study Area were gazetted as Threatened Fauna pursuant to the EPBC Act (1999). One Priority fauna species was recorded from the Study Area; *Pseudomys chapmani* (Priority 4). Additionally, the *Merops ornatus* (Migratory, Schedule 5) was recorded ~0.5 km north-east of the Study Area. From the desktop assessment, a further six conservation significant fauna species have been recorded within the vicinity (i.e. within 10 km) of the Study Area of which the Pilbara Olive Python was deemed likely to occur within the Gorge/ Gully habitat and Breakaway/ Cliff habitat types, particularly where pools are present.

Seven fauna habitats have been identified within the Study Area including Basalt Outcrop, Breakaway/ Cliff, Gorge/ Gully, Hillcrest/ Hillslope, Major Drainage Line, Minor Drainage Line and Drainage Area/ Floodplain. In addition, three waterbodies (two of which are semi-permanent) were recorded during the current survey that may provide important sources of shelter, food and water for species of conservation significance.

There are ten clearing principles that apply to the clearing of native vegetation in Western Australia. An assessment of assess these flora/vegetation and fauna values against the ten clearing principles are addressed in a separate letter. Provided semi-permanent waterbodies are avoided, the project will not be at variance with the clearing principles.

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