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Short-range Endemic Invertebrate Impact Assessment – Mulga Downs Project

Hancock Prospecting Pty Ltd

December 2012

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3	Brad Durrant	Morgan O'Connell	Ailan Tran	04/12/2012

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EXECUTIVE SUMMARY

The Mulga Downs Project of Hancock Prospecting Pty Ltd occurs within the Mulga Downs Pastoral Station, about 200km to the northwest of Newman. The mining operation covers two Project Areas; the Mine Footprint (MF) Project Area and the Abydos-Woodstock (AW) Project Area, with the former containing the Mining Disturbance Footprint (MDF).

Biologic Environmental Survey was commissioned by HPPL to undertake a cumulative impact assessment on terrestrial short-range endemics (SREs) in the Project Areas and in the wider Regional Impacts Area (RIA), taking into account other infrastructure projects within the region.

Neither Project Area intersects with any of the significant features or areas identified for the subregions they occur within, namely the Chichester and Fortescue subregions.

Two SRE surveys have been conducted previously in the Project Areas, both in the MF Project Area, and another seven SRE surveys have been previously conducted in the RIA.

Six known, six likely and 19 potential SRE fauna have been recorded from the RIA, with two potential SRE species recorded within close proximity to the AW Project Area.

The cumulative impact assessment considers the worst-case scenario of the complete clearing of the MDF and treats the two road options in the AW Project Area separately. It is unlikely that these areas will be completely cleared, and only one Abydos Woodstock road option and only one camp option (plus camp road) will be used.

The MDF, within the MF Project Area, will impact upon the Jamindie (0.3%), Newman (0.012%) and McKay (0.006%) land systems, all with a cumulative impact including other projects of 11.2%, 0.42% and 2.2% respectively. Likewise, the MDF will impact Beard's vegetation units 29 (0.07%) and 562 (0.07%), with cumulative impacts from other projects of 3.0% and 9.4% respectively. A system of ridges and gullies present in the northern section of the MF Project Area are the most likely SRE habitat present, but these are not directly impacted by the MDF. However, there is some potential impact to SRE fauna dispersal with the construction of a camp road.

The AW Project Area does not impact on any land systems or vegetation units that are considered likely to contain habitats prospective for SRE invertebrate fauna. Two potential SRE species have been recorded previously within close proximity to the disturbances in this area; however, one was recorded outside the extent of the area and the other has also been recorded further north of the RIA.

The lack of survey work in the system of ridges and gullies in the MF Project Area may be regarded as a data gap; however, these habitats are unlikely to be significantly impacted.

Likewise, there is a lack of knowledge of some other potentially prospective habitats (freshwater claypans and mulga woodlands) in the MF Project Area, but the former does not occur in the MDF and the latter is a largely continuous habitat through the Chichester Range, making it unlikely to harbour any restricted terrestrial invertebrates. The rocky outcrops in the AW Project Area are also prospective, but are not directly impacted by the Project.

1 INTRODUCTION

Hancock Prospecting Pty Ltd's (HPPL) Mulga Downs Project occurs within the Mulga Downs Pastoral Station, about 200km to the northwest of Newman (Figure 1.1). The proposed project covers two leases, mining lease 47/206, also known as Murray's Hill, and exploration lease 47/1244, also known as Mulga East. Both these tenements are hereafter, collectively, referred to as the Mine Footprint Project Area (MF Project Area). The Murray's Hill tenement contains the mine footprint and infrastructure associated directly with the mining operation, while Mulga East contains two mining camp options and infrastructure associated with transportation to the Great Northern Highway, all of which is hereafter referred to as the Mining Disturbance Footprint (MDF). The Abydos-Woodstock Stockyard area contains a stockyard and railway siding (which are part of the Roy Hill Infrastructure (RHI) Railway State Lease (SRL) Corridor and, as such, are not considered in this report) and two road options (Two Camel Access Road and Coonarie Access Road) for transportation from Great Northern Highway (Figure 1.2), which are being considered in this report. This area is hereafter referred to as the Abydos-Woodstock Project Area (AW Project Area).

Biologic Environmental Survey (Biologic) was commissioned by HPPL to undertake a preliminary impact assessment on terrestrial short-range endemic invertebrates (SREs) within the two Project Areas, to be used to support a Section 38 *Environmental Protection Act 1986* Referral to the Office of the Environmental Protection Authority and the *Environment Protection and Biodiversity Conservation Act* 1999 Referral to the Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC).

Several other infrastructure projects have been granted or are planned in the vicinity of the Project Area. As such, literature and database searches for this report were conducted at a larger spatial extent, a 94 x 185km rectangular area around the Project Area. This impact area, for other existing, planned or proposed projects, is herein referred to as the Regional Impacts Area (RIA) (Figure 1.3).

This report:

- Documents existing SRE data and habitat information;
- Provides a cumulative impact assessment; and
- Identifies the data gaps.

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YANDEYARRA INDIGENOUS RESERVE

YULE RIVER

PORT HEDLAND WITTENOOM ROAD

MUNGAROONA RANGE NATURE RESERVE

YANDEYARRA ABORIGINAL RESERVE

SCIENTIFIC RESERVE

ROEBOURNE WITTENOOM ROAD

FORTESCUE RIVER

NANUTARRA WITTENOOM ROAD

Wittenoom

MUNJINA WITTENOOM ROAD

GREAT NORTHERN HIGHWAY

Munjina

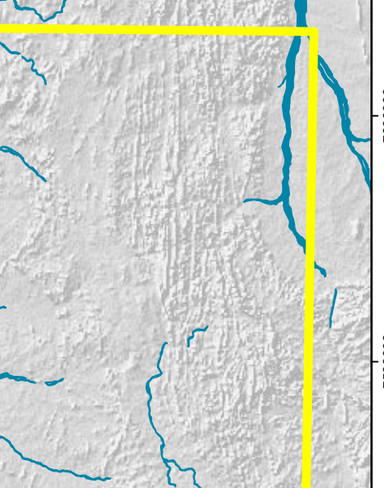
MUNJINA ROY HILL ROAD

FORTESCUE MARSH

KARIJINI NATIONAL PARK

Legend

- Mine Footprint Project Area
- Regional Impacts Area
- Mine Disturbance Footprint (MDF)
- Abydos-Woodstock Project Area
- Watercourses
- Roads
- Railways
- Watercourse Areas
- IndigenousReserve
- NatureConservationReserve



LOCATION MAP

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Kilometers

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Datum: GDA94

Projection: MGA Zone 50

HANCOCK PROSPECTING

Regional Location

FIG 1.1

GRIFFIN SPATIAL & MAPPING
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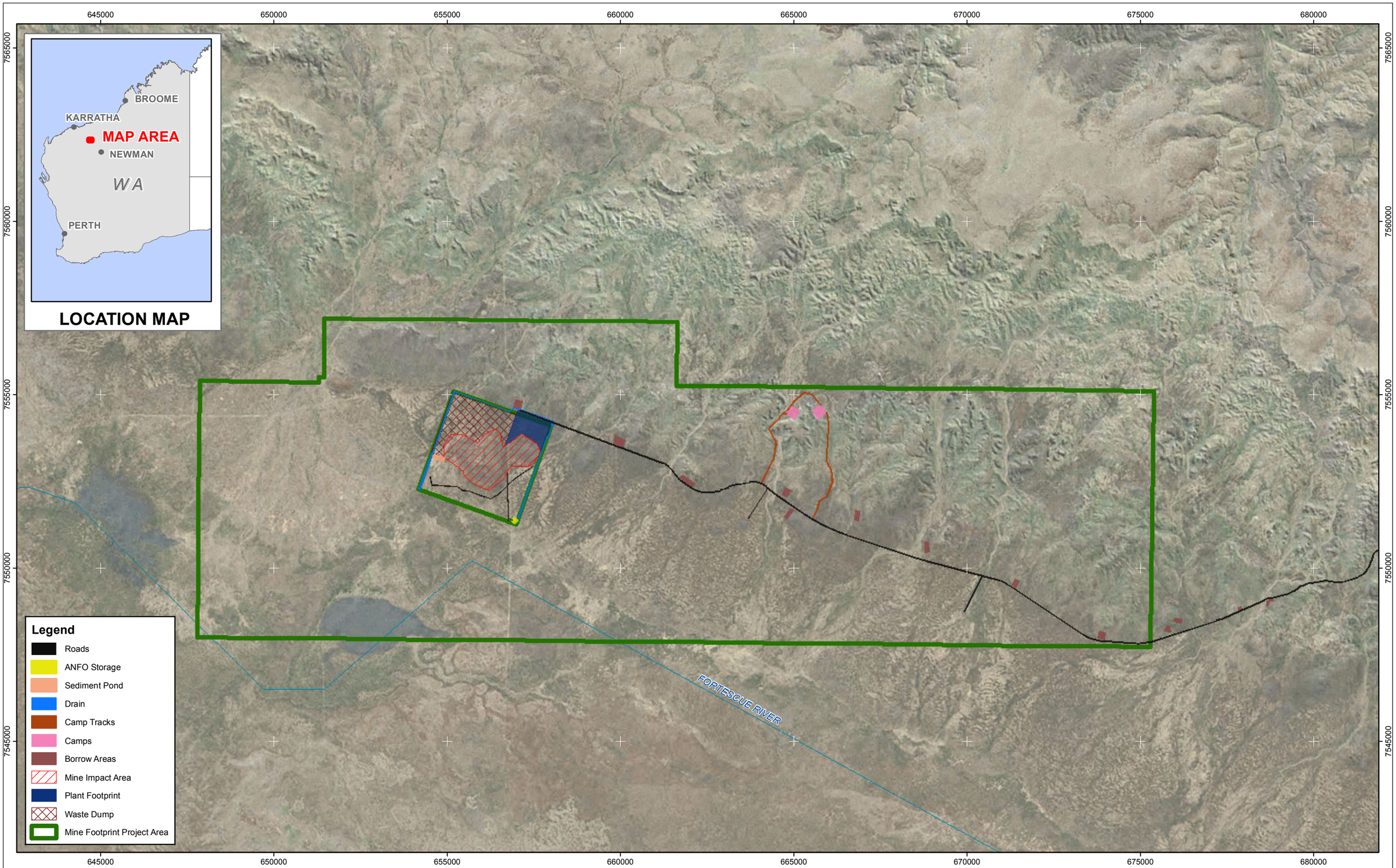

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Kilometers

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Datum: GDA94

Projection: MGA Zone 50

HANCOCK PROSPECTING

Detailed Mine Footprint Project Area

FIG 1.2

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684000 687000 690000 693000 696000

7608000 7605000 7602000

GREAT NORTHERN HIGHWAY

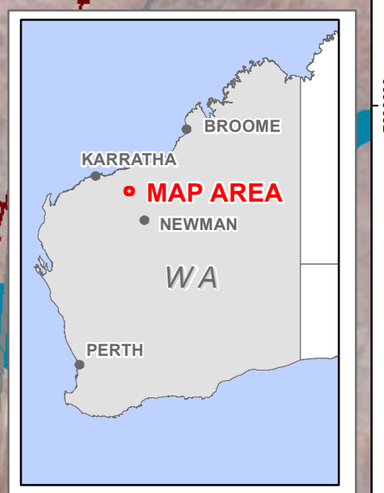
YULE RIVER

PORT HEDLAND WITTENOOM ROAD

Two Camel Access Road

Coonarrie Access Road

COONARRIE CREEK



LOCATION MAP

Legend

- Stockyard
- Siding
- Access Roads
- Watercourse Areas
- BHP Railway

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FIGURE:	1.3	Date:	19/10/2012
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Meters

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Datum: GDA94

Projection: MGA Zone 50

HANCOCK PROSPECTING

Abydos-Woodstock Project Area

FIG 1.3

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7600000 7580000 7560000 7540000 7520000 7500000

PORT HEDLAND WITTENOOM ROAD

ROEBOURNE WITTENOOM ROAD

NANUTARRA WITTENOOM ROAD

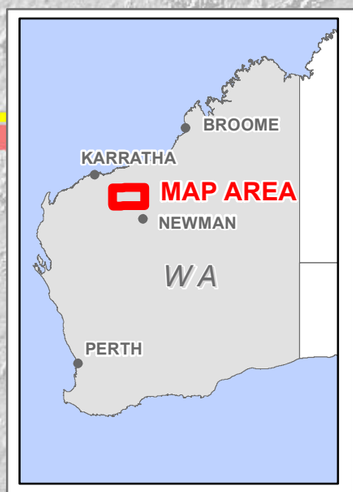
Wittenoom

MUNJINA WITTENOOM ROAD

GREAT NORTHERN HIGHWAY

Munjina

MUNJINA ROY HILL ROAD



LOCATION MAP

Legend

- Regional Impacts Area
- Mine Footprint Project Area
- Mine Disturbance Footprint (MDF)
- Abydos-Woodstock Project Area
- FMG Cloudbreak Project Area
- Brockman Rail
- FMG Solomon Railway
- RHI Railway
- QR National FNA
- Roads
- BHP Railway

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FIGURE:	1.4	Date:	23/11/2012
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Kilometers

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Datum: GDA94

Projection: MGA Zone 50

HANCOCK PROSPECTING

The Regional Impacts Area and Relevant Infrastructure Projects

FIG 1.4

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2 ENVIRONMENT

2.1 Biogeography

The RIA falls within the Pilbara biogeographical region as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway and Cresswell 1995). The Pilbara bioregion is subdivided into four components (subregions): the Chichester (PIL-1), Fortescue Plains (PIL-2), Hamersley (PIL-3) and Roebourne (PIL-4). Three of these subregions are covered by the RIA.

The majority of the RIA lies within the Chichester subregion. This subregion is the largest in the Pilbara and covers 47% of the region (McKenzie *et al*. 2011). The subregion is characterised by significant areas of undulating Archaean granite and basalt plains that support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, with *Eucalyptus leucophloia* tree steppes occurring on ranges (Kendrick and McKenzie 2001).

The Fortescue Plains subregion, spanning the lower half of the RIA, contains the Fortescue Marsh, which is listed as a nationally important wetland (Environment Australia 2001). Outside the Fortescue Marsh, this subregion is characterised by River Red Gum woodlands fringing drainage lines and deeply incised gorge systems (Kendrick 2001).

The northern extent of the Hamersley subregion lies within the south-west section of the RIA. The Hamersley subregion is a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (Kendrick 2001). The principal vegetation community comprises mulga low woodland over bunch grasses in valley floors, while *Eucalyptus leucophloia* over *Triodia brizoides* is dominant on the ranges.

However, the MF Project Area only spans the Chichester and Fortescue Plains subregions, and does not intersect any of the significant features or areas identified for these subregions. Likewise, the AW Project Area occurs only within the Chichester subregion and does not intersect any of the significant features or areas identified.

2.2 Climate

The Pilbara region has a semi-desert to tropical climate with highly variable, mostly summer, rainfall. The average annual rainfall over the broader Pilbara area ranges from about 200 to 350 millimetres (mm), although it may show wide inter-annual fluctuations (Australian Natural Resource Atlas 2008).

The Pilbara climate is heavily influenced by tropical cyclones that develop over the Indian Ocean to the north of Australia. These sometimes cross the north-west coastline, bringing heavy rainfall to inland regions of the Pilbara. Average maximum summer temperatures are

typically in the range of 35 degrees Celsius (°C) to 40 °C and winter maximum temperatures are generally between 22 °C and 30 °C (BOM 2011).

The RIA predominantly extends across an area with a 'persistently dry grassland' climate. However, a few small areas adjacent to the south east part of the RIA, within the Fortescue Plains subregion, experience a persistently dry 'desert' climate (McKenzie *et al*. 2009). Average climate data from the weather station at Wittenoom (Station # 5026), located close to the MF Project Area and within the RIA, is shown in Figure 1.3. However, given the relatively large area covered by the RIA, it is likely that there are significant variations in the local climate throughout the RIA.

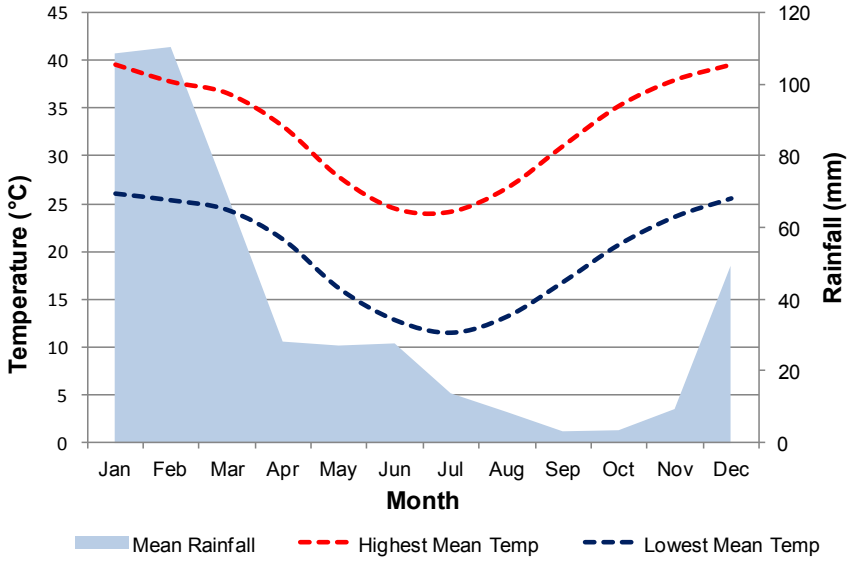

Figure 2.2 Average monthly temperature and rainfall observations at Wittenoom (BOM 2012).

2.3 Land Systems

Land systems are described as discrete units of landforms, soils, vegetation and geology, and those in the Pilbara region have been mapped and sub-divided into units based on the landforms on which they occur (Van Vreeswyk *et al*. 2004). The two Project Areas intersect ten of the 104 land systems in the bioregion (Payne 2004) (Figure 2.2), as described in Table 2.1.

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7600000 7580000 7560000 7540000 7520000 7500000

PORT HEDLAND WITTENOOM ROAD

ROEBOURNE WITTENOOM ROAD

NANUTARRA WITTENOOM ROAD

Wittenoom

MUNJINA WITTENOOM ROAD

GREAT NORTHERN HIGHWAY

Munjina

MUNJINA ROY HILL ROAD

BROOME
KARRATHA
MAP AREA
NEWMAN
WA
PERTH

LOCATION MAP

Legend

- Mine Disturbance Footprint (MDF)
- Mine Impact Area
- Abydos-Woodstock Project Area
- Regional Impacts Area
- FMG Cloudbreak Project Area
- Brockman Rail
- FMG Solomon Railway
- RHI Railway
- QR National FNA (QRN)
- BHP Railway
- Roads

IBRA Subregions

- Chichester
- Fortescue
- Hamersley

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Kilometers

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Projection: MGA Zone 50

HANCOCK PROSPECTING

IBRA Subregions of the Regional Impacts Area

FIG 2.1

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7600000 7580000 7560000 7540000 7520000 7500000

PORT HEDLAND WITTENOOM ROAD

ROEBOURNE WITTENOOM ROAD

NANUTARRA WITTENOOM ROAD

Wittenoom

MUNJINA WITTENOOM ROAD

GREAT NORTHERN HIGHWAY

Munjina

MUNJINA ROY HILL ROAD

KARIJINI DRIVE

MARANDOO ACCESS ROAD

Legend

- Regional Impacts Area
- Mine Footprint Project Area
- Mine Disturbance Footprint (MDF)
- Abydos-Woodstock Project Area
- FMG Cloudbreak Project Area
- BHP Railway
- Brockman Rail
- FMG Solomon Railway
- RHI Railway
- QR National FNA

Intersecting Land Systems

Mapping Unit, Land System

- RGEBGD, Boolgeeda Land System
- RGEBRO, Brockman Land System
- RGECAL, Calcrete Land System
- RGECOB, Coolibah Land System
- RGEHOY, Hooley Land System
- RGEJAM, Jamindie Land System
- RGEJUR, Jurrawarrina Land System
- RGEMAC, Macroy Land System
- RGEMCK, McKay Land System
- RGENEW, Newman Land System

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HANCOCK PROSPECTING

Land Systems of the Regional Impacts Area

FIG 2.2

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Table 2.1: Land Systems of the Project Areas (Van Vreeswyk *et al*. 2004)

Land System	Land Type	Landforms and Vegetation
Boolgeeda	Land Type 8: Stony plains with spinifex grassland.	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.
Brockman	Land Type 14: Alluvial plains with tussock grasslands or grassy shrublands.	Alluvial plains with cracking clay soils supporting tussock grasslands.
Calcrete	Land Type 18: Calcreted drainage plains with shrublands or spinifex grasslands.	Low calcrete platforms and plains supporting shrubby hard spinifex grasslands.
Coolibah	Land Type 17: River plains with grassy woodlands and shrublands, and tussock grasslands.	Flood plains with weakly gilgaied clay soils supporting coolabah woodlands with tussock grass understorey.
Hooley	Land Type 15: Alluvial plains with snakewood shrublands.	Alluvial clay plains supporting a mosaic of snakewood shrublands and tussock grasslands.
Jamindie	Land Type 12: Plain mosaic grassy shrubland.	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey.
Jurrawarrina	Land Type 12: Plain mosaic grassy shrubland.	Hardpan plains and alluvial tracts supporting mulga shrublands with tussock and spinifex grasses.
Macroy	Land Type 8: Stony plains with spinifex grasslands.	Stony plains and occasional tor fields based on granite supporting hard or soft spinifex grasslands.
McKay	Land Type 1: Hills and ranges with spinifex grassland.	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex
Newman	Land Type 1: Hills and ranges with spinifex grassland.	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.

2.4 Vegetation

Broadly, the Chichester subregion supports Snappy gum *Eucalyptus leucophloia* tree steppes, and dominated by a shrub steppe of Ranji bush *Acacia pyrifolia* over *Triodia pungens* hummock grasslands. Other spinifex species which may be present in the area include *T. basedowii*, *T. brizioides*, *T. lanigera*, *T. longiceps*, *T. epactia* and *T. plurinervata*. The Fortescue Plains subregion contains extensive salt marshes, Mulga-bunch grass and short grass communities on the plains, although this is more towards the east of the subregion. River red gum (*Eucalyptus camaldulensis*) and Coolabah (*E. victrix*) woodlands, with soft spinifex and Buffel grass (*Cenchrus ciliaris*) understorey, fringe the drainage lines and active floodplains. This is the northern limit of Mulga (*Acacia aneura*) in the Pilbara. In the Hamersley subregion, the principal vegetation community in the valley floors comprise low Mulga woodland over bunch grasses, while *Eucalyptus leucophloia* over *Triodia brizoides* is dominant on the ranges.

On a finer scale, vegetation mapping of the Pilbara has been undertaken by Burbidge (1959) and Beard (1975). This was refined by Shepherd *et al.* (2002) to account for clearing in the intensive land use zones. According to Beard (1975), the MF Project Area is located within the Fortescue Valley and Chichester Plateau, and the AW Project Area within the Abydos Plain. All three of these are within the Fortescue Botanical District, within the Eremaean Province of Western Australia. Broadly, the Project Areas cover three structural vegetation associations identified by Beard (1975) and updated by DAFWA (2011) (Table 2.2).

Table 2.2 Vegetation types within the Project Areas; Beard (1975) and DAFWA (2012)

Beard Code (Beard 1975)	Vegetation Association Code (DAFWA 2012)	Physiographic Regions	Broad Description
a1Lp	29	Fortescue Valley	Sparse Low Woodland; mulga, discontinuous in scattered groups.
a2Sr t1Hi	93	Abydos Plain	Hummock grasslands, shrub steppe; kanji over soft spinifex
a1Li/e16Lr t3Hi	562	Fortescue Valley	Mosaic: Low woodland; mulga in valleys / hummock grasslands, open low tree steppe; snappy gum over *Triodia wiseana*.

The current and pre-European extents of these three vegetation associations in the Pilbara IBRA region are compared in Table 2.3. The table shows that all three vegetation associations are estimated to have more than 99.88% of their pre-European extent still remaining. Also provided, are the amounts remaining in reserves, and the prioritisation for reservation for each (Kendrick 2001; Kendrick & McKenzie 2001).

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7600000 7580000 7560000 7540000 7520000 7500000

ROEBOURNE WITTENOOM ROAD

NANUTARRA WITTENOOM ROAD

Wittenoom

MUNJINA WITTENOOM ROAD

GREAT NORTHERN HIGHWAY

Munjina

MUNJINA ROY HILL ROAD

PORT HEDLAND WITTENOOM ROAD

KARIJINI DRIVE

MARANDOO ACCESS ROAD

Legend

- Regional Impacts Area
- Mine Footprint Project Area
- Mine Disturbance Footprint (MDF)
- Abydos - Woodstock Stockyard Area
- FMG Cloudbreak Project Area
- BHP Railway
- Brockman Rail
- FMG Solomon Railway
- QR National FNA
- RHI Railway

Pre- European Vegetation System, Vegetaion Association

- ABYDOS PLAIN - CHICHESTER, 619
- ABYDOS PLAIN - CHICHESTER, 93
- CHICHESTER PLATEAU, 173
- CHICHESTER PLATEAU, 175
- FORTESCUE VALLEY, 175
- FORTESCUE VALLEY, 29
- FORTESCUE VALLEY, 562

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FIGURE:	2.3	Date:	23/11/2012
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HANCOCK PROSPECTING

Beard's Vegetation of the Regional Impacts Area

FIG 2.3

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Table 2.3 Pre-European and current extent of vegetation types within the Project Areas

Vegetation Association Code	Pre-European Extent (ha) by Pilbara IBRA Bioregion and Vegetation Association	Current Extent (ha) by Pilbara IBRA Bioregion and Vegetation Association	Remaining (%)	Current Extent Protected (IUCN 1-4) for Conservation (proportion of pre-European extent) (%)	Prioritisation for Reservation in the Fortescue Plains Subregion (Kendrick, 2001)	Prioritisation for Reservation in the Chichester Subregion (Kendrick & McKenzie, 2001)
29	1,133,219.76	1,132,939.21	99.98	1.91	Low	High
93	3,042,114.08	3,038,471.63	99.88	0.42	Moderate	Low
562	103,606.82	103,606.82	100.00	0.00	Moderate	Moderate

2.5 Geology and Soils

Geologically, the Pilbara region contains one of the most complete and best exposed Archaean to Early Proterozoic rock records in the world (Blake and Meakins 1993). These Archaean to Proterozoic rocks of the Pilbara Craton, and Fortescue and Hamersley Groups, dominate the region and are overlain by Tertiary to Holocene regolith and rock units. The RIA comprises Phanerozoic and Archaean-Proterozoic rocks in the south and Archaean rocks in the north (Kendrick & McKenzie 2001).

Hennig (2004) identified 21 broad soil groups from the Pilbara and interpreted their occurrence according to the regions geomorphology. Generally, stony soils dominate the hilly terrain, whereas red shallow loams, red deep sandy duplexes and red sandy earths are associated with the stony foot slopes and plains beneath basaltic hills. The alluvial plains, including those of the Fortescue River, and the numerous drainage lines, comprise red loamy earths, red/brown non-cracking clays and red loamy earths. Moreover, there are localised areas of gilgai cracking clays associated with the basalts of the Chichester Range.

The Pilbara region contains 10 soil-landscape zones, of which four are within the RIA (Table 1.3).

Table 2.4 Geology of the RIA and the surrounds (Blockley *et al*. 1993)

Age	Group	Formation	Member	Notes
Tertiary				Alluvium, colluvium and calcrete
Archean to Early Proterozoic	Hamersley Group	Brockman Iron	Yandicoogina Shale	BIF, chert and shale
			Joffre	
			Whaleback Shale	
			Dales Gorge	
		Mount McRae Shale		Shale, dolomite, BIF and chert
		Mount Sylvia		
		Wittenoom	Bee Gorge	Dolomite, (dolomitic) argillite, chert, carbonate and volcaniclastic rock
			Paraburdoo	
			West Angela	
		Marra Mamba Iron	Mount Newman	BIF, shale and chert
			MacLeod	
			Nammuldi	
Archean	Fortescue Group	Jeerinah		Pelite, chert and meta-sandstone
		Maddina		Metabasalt and breccia
		Tumbiana		Metamorphic mafic and intermediate volcaniclastic metabasalt and breccia, chert
			Meentheena	Stromatolitic dolomite and limestone, carbonate-rich tuff, mudstone and siltstone
		Kylena		Metabasaltic lava flows
	Yule Granitoid	Yule Granitoid		Leucogranite with pegmatites

Table 2.5 Soil-landscape zones included in the RIA, according to Tille (2006)

Zone	Code	Characteristics
Abydos Plains and Hills Zone	283	Stony plains (with some hills) on granitic rocks of the Pilbara Craton (East Pilbara Terrane). Red deep sandy duplexes and Red shallow loams with Stony soils, Red sandy earths and Red loamy earths. Spinifex grasslands with Kanji and some tussock grasslands.
Nullagine Hills Zone	280	Hills and ranges (with some stony plains) on volcanic and sedimentary rocks of the Pilbara Craton (including the Hamersley Basin). Stony soils with Red shallow loams and sands. Spinifex grasslands with Kanji and Snappy gum.
Chichester Ranges Zone	282	Hills and dissected plateaux (with some stony plains) on basalt and sedimentary rocks of the Hamersley Basin. Stony soils with some Red shallow loams and Hard cracking clays. Spinifex grasslands with Kanji and Snappy Gum.
Fortescue Valley Zone	284	Alluvial plains, hardpan wash plains and sandplains (with stony plains, floodplains and some salt lakes) on alluvial deposits over sedimentary rocks of the Hamersley Basin. Red deep sands, Red loamy earths and Red/brown non-cracking clays with some Red shallow loams and Hard cracking clays. Mulga shrublands and spinifex grasslands with some tussock grasslands and halophytic shrublands.

2.6 Hydrology

The Pilbara region is an area of hydrologic extremes, with droughts of over three years on the same rivers that have floods equivalent to world peak flows. The region is also characterised by a transition from combined small winter and larger summer flows in the west to only summer flows in the east (Ruprecht 1996). However, there are numerous permanent pools maintained by subsurface inflows and/or springs.

The most prominent watercourse within the RIA is the Fortescue Marsh. This wetland is recognised as being of national significance (ANCA 1996; Environment Australia 2001), due to it:

- representing a good example of a wetland type in Australia;
- having an important ecological and a hydrological role;
- providing important habitats/refuges for animal taxa; and
- having outstanding historical or cultural significance.

2.7 Land use

The dominant land tenure within the RIA includes pastoral leases, aboriginal reserves, conservation reserves and unallocated crown land, and the major land uses include grazing and mining. Pastoral leases account for 60% of the land area within the Pilbara, and a significant part of the RIA. Land degradation associated with fire frequencies, Buffel Grass

(*Cenchrus ciliaris*) and overgrazing is a common feature of the region (McKenzie *et al.* 2009). The Pilbara is the leading mineral resources sector region in WA, thus several mines and their associated infrastructure are currently active in the Central Pilbara, some of which are within or in close proximity to the RIA. Tourism is also becoming an increasingly important industry in the Pilbara region.

3 METHODS

3.1 Literature and database review

Two SRE fauna surveys have previously been conducted within the MF Project Area:

- HPPL Murray Hills short range endemic pilot survey (Ecologia 2009); and
- Short-range endemic invertebrate fauna survey at Murray's Hill transport corridor (Phoenix 2010).

Seven previous SRE fauna surveys had boundaries overlapping the RIA:

- Short-range endemic invertebrate survey of Solomon Project: Kings mining area and reference sites (Phoenix 2010);
- Cloudbreak Short-range endemic invertebrate survey (Ecologia 2011);
- Assemblage of the proposed FMG Stage B rail corridor and Mindy Mindy, Christmas Creek, Mt Lewin and Mt Nicholas mine areas (Biota 2005);
- Christmas Creek Life of Mine Project: Terrestrial SRE invertebrate survey. (Subterranean Ecology 2011);
- Assessment of short-range endemic invertebrates from the Fortescue Marsh section of the BFS 1 and 2 rail option (Bennelongia 2010);
- Short-range endemic invertebrates in the Abydos – Woodstock rail corridor (Bennelongia 2011); and
- Level 2 SRE fauna survey for the Roy Hill Infrastructure – Bonney Downs rail alignment (Phoenix 2011).

Information on the SRE assemblages present or potentially present in the RIA was searched in four databases:

- DSEWPaC's Protected Matters Search Tool – to determine matters of national environmental significance or other matters protected by the *Environment Protection and Biodiversity Conservation Act* 1999 that are likely to occur in the RIA (DSEWPaC, 2012);
- DEC's NatureMap – to determine threatened SRE fauna recorded from the region which also incorporates the results of the Pilbara Biological Survey (DEC 2011);
- WA Museum's database – to determine SRE fauna species lodged in the museum's collection from within or adjacent to the survey area; and
- Atlas of Living Australia – to compile records of SRE species recorded by data providers (museums, community groups, government departments, individuals and universities).

Details of these database searches are given in Table 3.1.

Table 3.1 **Databases searched and parameters used**

Source	Database	Parameters
Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC, 2012)	Protected Matters Search Tool. *Accessed 1 August 2012.*	Following rectangle with no buffer -21.621615, 117.945221 -22.451334, 117.942597 -22.447793, 119.758427 -21.618474, 119.757435
Department of Environment and Conservation (DEC 2012)	NatureMap. *Accessed 31 July 2012*	NW –21.598611 and 118.426111 SE –22.190278 and 119.267778
Western Australian Museum (WAM 2012)	Museum records. *Accessed 1 August 2012*	NW –21.598611 and 118.426111 SE –22.190278 and 119.267778
Australian Government	Atlas of Living Australia. *Accessed 31 July 2012*	NW –21.598611 and 118.426111 SE –22.190278 and 119.267778

The information in this report has been compiled using publically available records and literature available to Biologic. It is possible that other projects occur in the RIA that Biologic is not aware of, or data is not available. Hence, some caution should be exercised in interpreting the calculations presented in this report.

3.2 Mapping prospective SRE habitats

In lieu of an on-site habitat assessment, aerial imagery was used to identify areas of prospective SRE habitat, in particular ridges, gullies and isolated areas of heavy vegetation. Prospective habitats were then mapped and considered for impacts within the Project Areas.

4 DATABASE AND LITERATURE SEARCH RESULTS

4.1 Threatened Fauna

4.1.1 Commonwealth Environment Protection and Biodiversity Act 1999 (EPBC Act)

A search of the EPBC Act Protected Matters Search Tool (DSEWPAC 2012) was carried out for the RIA. There are no EPBC listed terrestrial invertebrate fauna found within the search area.

4.1.2 Western Australian Wildlife Conservation Act 1950 (WC Act)

A search of NatureMap (DEC 2007) was carried out for the RIA. There are no WC Act listed terrestrial invertebrate fauna found within the search area.

4.1.3 State Priority Fauna List

Three Priority terrestrial invertebrate species are known to occur in the Pilbara region; the land snail *Dupucharopa millestriata* and two species of dragonfly, *Antipodogomplus hodgkini* (Pilbara Dragon) and *Nosoticta pilbara* (Pilbara Threadtail). All three species are listed as Priority Two (WC Act), but none have been recorded within the RIA.

The land snail, *D. millestriata*, is only known from Depuch Island, 180 kms north-west of the Project, and 2.5 km off the Pilbara coast. Very little is known about this species; however, it can be regarded as highly unlikely to occur in the RIA.

The two dragonfly species (*A. hodgkini and N. pilbara*) have both been recorded from the Fortescue River, but 90 km to the west of the RIA, around Millstream Spring. *Nosoticta pilbara* was listed on the IUCN Red List (IUCN 2012) as endangered in 1999, due to its extremely small distribution and the threat of water extraction from nearby mining related activities, which has "considerably lowered the water level of the Millstream Spring" (Hawking 1999). It is regarded as one of the most restricted of any Australian dragonfly, but is abundant where they occur (Watson and Theischinger 1984). It occurs on streams and riverine pools, with larvae found under stones in running water (Theischinger and Hawking 2006). This reliance on permanent, flowing water for reproduction makes it unlikely that this species will occur in the MF Project Area.

Little is known about *A. hodgkini*, and it is not listed in the IUCN Red List. However, it may well be similarly restricted to permanent water, as is the case with *N. pilbara*, as dragonfly larvae require freshwater for laying eggs, and the larvae tend to have precise habitat requirements. As such, it may be the isolation of Millstream Spring that has created the endemism associated with *N. pilbara*. It can therefore be regarded as likely that *A. hodgkini*

has a similar restriction in distribution and is therefore unlikely to be present in the MF Project Area.

4.2 SRE Fauna Recorded within the Project Areas

Ecologia (2009) recorded no invertebrate fauna that can be considered a SRE, or likely to be. Phoenix (2010) recorded three species that were determined as either likely or possible SRE fauna, however, all three can be considered unlikely to be SRE for the following reasons:

- *Synothele* 'MYG127' (trapdoor spider): One male specimen was recorded within the Murray's Hill Transport Corridor (within the MF Project Area), a breakaway habitat outside of the disturbance footprint. Phoenix (2010) also reports that this species is known from Roy Hill station (140kms to the southeast) and is highly likely to be found across the Chichester Range. The Chichester Range continues beyond both Murray's Hill and Roy Hill station and, therefore, the distribution for this species can be regarded as likely to cover this entire length, approximately 400km. As such, this species can be considered unlikely to be a SRE.
- *Synothele* 'MYG160' (trapdoor spider): Three male specimens were recorded at three sites, including two outside of the disturbance footprint. All three were recorded within low-lying grass plains and lower stony flats, most likely dispersing in search of a mate. However, it is highly likely that the species will follow a similar pattern to that of *Synothele* 'MYG127' (above), as the most prospective SRE habitats in the MF Project Area are likely to be consistent throughout the Chichester Range. As such, this species can be considered unlikely to be a SRE.
- *Beierolpium* sp. 8/3 (pseudoscorpion): Twelve specimens were recorded from a range of habitats, predominantly associated with the lower slopes containing sparse *Eucalypts*, low mixed *Acacia* shrubs and spinifex grasslands (Phoenix 2010). The genus *Beierolpium* requires taxonomic revision, as the current state makes it difficult to determine the SRE status of individual taxa, however, the nature of the habitats where the specimens were recorded make it likely that this species will occur throughout much of the Chichester Range. As such, this species can be considered unlikely to be a SRE.

4.3 SRE Fauna Recorded within the RIA

4.3.1 Known SREs

Six species that are known to be SREs have been recorded in the RIA (Table 3.1), two millipedes, two selenopid spiders, one isopod and one land snail. None of these species have been recorded within, or adjacent to, either Project Area (Figure 4.1).

Table 4.1: Known SRE fauna from the RIA

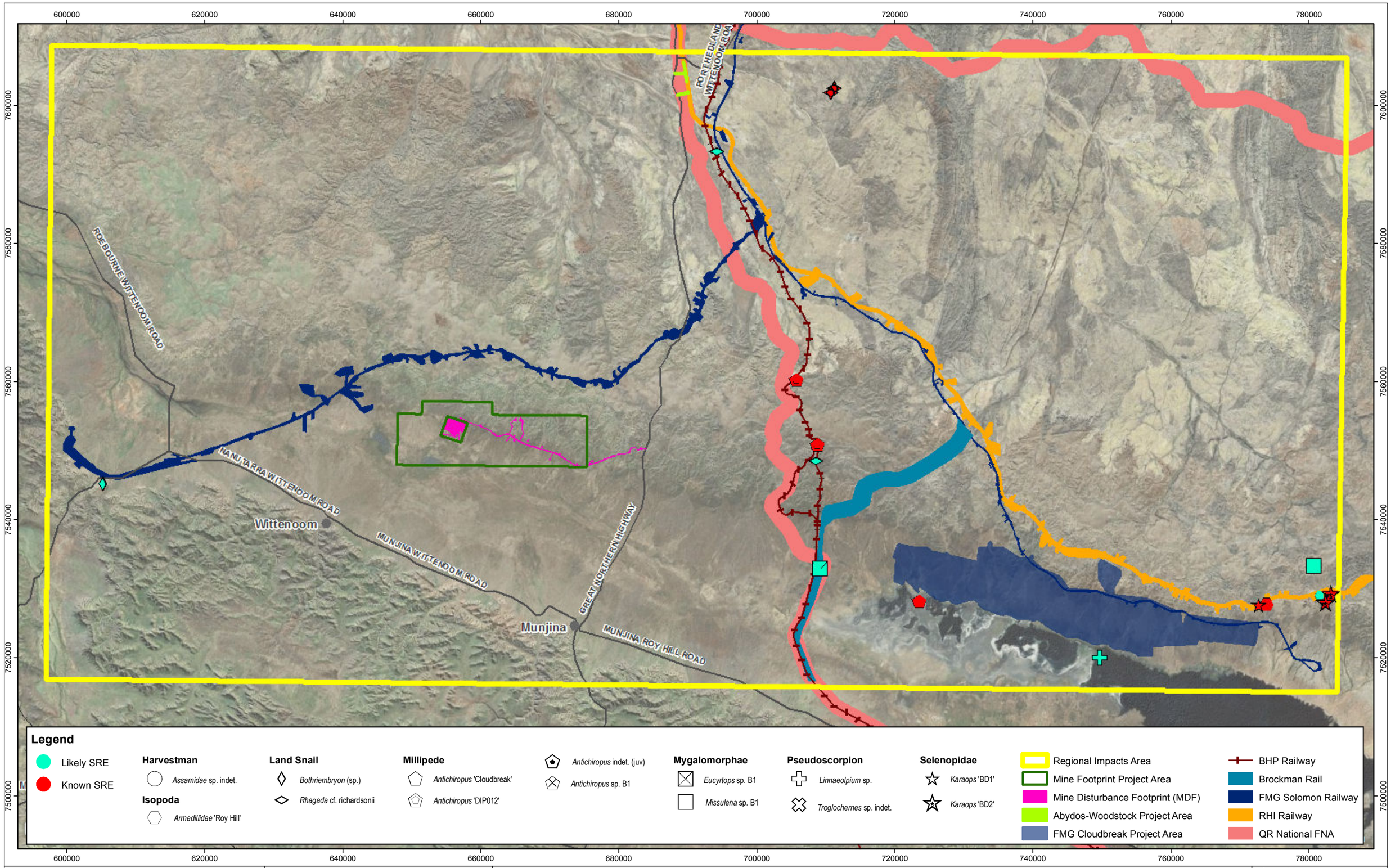
Group	Species	Habitat
Millipede	*Antichiropus* 'Cloudbreak'	Creekline
Millipede	*Antichiropus* 'DIP012'	Unknown
Isopoda	Armadillidae 'Roy Hill'	South-facing ridge
Selenopidae	*Karaops* 'BD1'	South-facing ridge
Selenopidae	*Karaops* 'BD2'	South-facing ridge
Land snail	*Quistrachia turneri*	Unknown

4.3.2 Likely SREs

Six species that are regarded as likely to be SREs have been recorded in the RIA (Table 3.2), two mygalomorph spiders, two land snails, one harvestman and one pseudoscorpion. None of these species have been recorded within, or adjacent to, either Project Area (Figure 4.1).

Table 4.2: Likely SRE fauna from the RIA

Group	Species	Habitat
Mygalomorph spider	*Missulena* sp. B1	Creekline Mulga woodland
Mygalomorph spider	*Eucyrtops* sp. B1	Mulga woodland Hill spinifex
Harvestman	Assamidae sp. indet.	South-facing ridge
Pseudoscorpion	*Linnaeolpium* sp.	Mulga woodland
Land snail	*Bothriembryon* sp.	Gorge/gully
Land snail	*Rhagada* cf. *richardsonii*	Unknown



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HANCOCK PROSPECTING

Known and Likely SRE Species in the Regional Impacts Area

FIG 4.1

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4.3.3 Potential SREs

Nineteen species that are regarded as potential SREs have been recorded in the RIA (Table 3.3), five isopods, four centipedes, four mygalomorph spiders, three pseudoscorpions, two scorpions and one millipede. Two of these species (*Buddelundia* sp.12 and *Sedepenophilus* sp. B1) have been recorded within close proximity to the AW Project Area (Figure 4.2). Both species are only known from these locations and were both recorded on rocky outcrops.

Table 4.3: Potential SRE fauna from the RIA

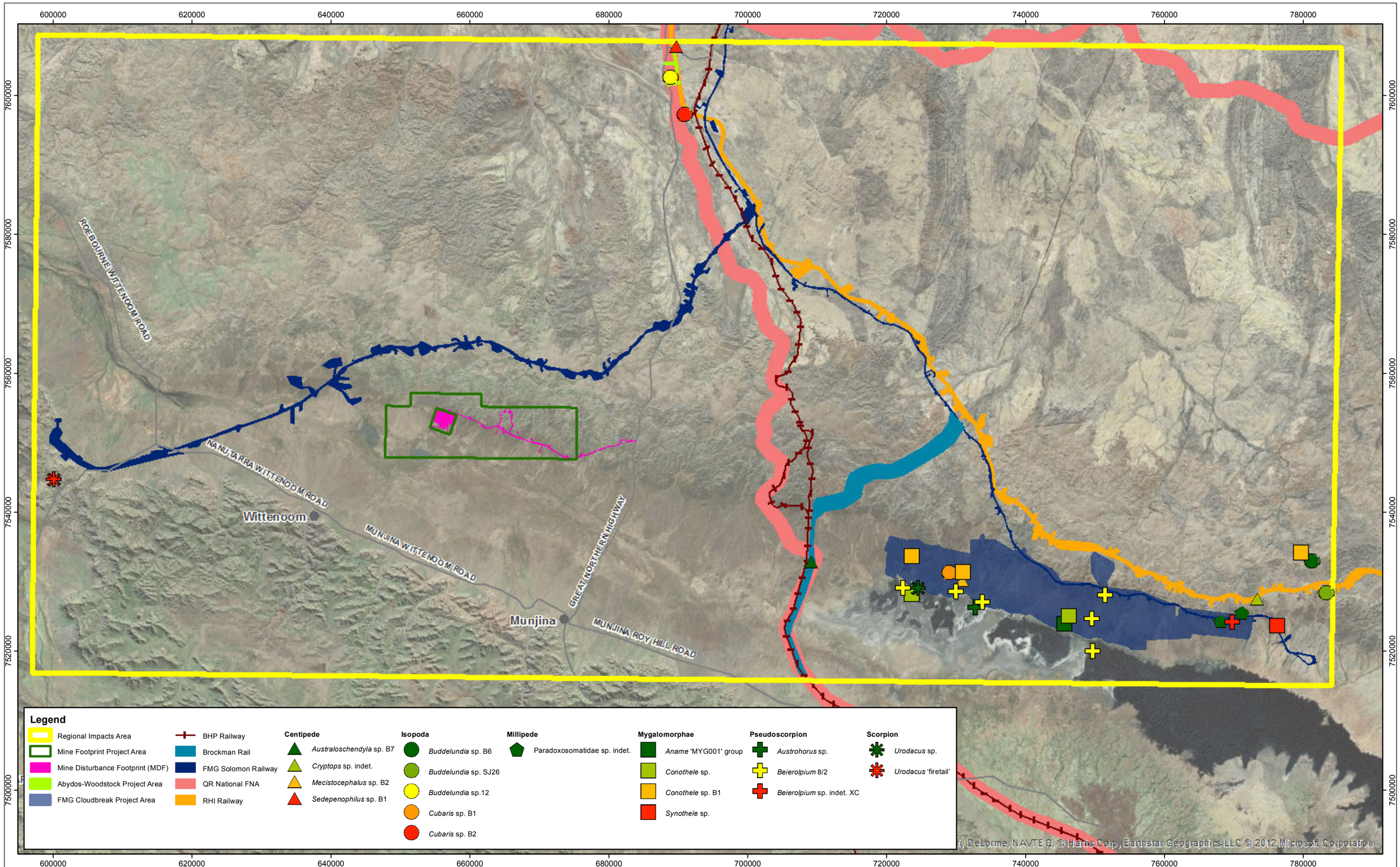
Group	Species	Habitat
Isopoda	*Buddelundia* sp. B6	Creekline
Isopoda	*Buddelundia* sp. SJ26	Creekline South-facing ridge
Isopoda	*Buddelundia* sp. 12	Rocky outcrop
Isopoda	*Cubaris* sp. B1	Creekline
Isopoda	*Cubaris* sp. B2	Creekline
Centipede	*Australoschendyla* sp. B7	Hill spinifex
Centipede	*Cryptops* sp. indet.	Creekline Mulga woodland South-facing ridge Gully
Centipede	*Mecistocephalus* sp. B2	Creekline
Centipede	*Sedepenophilus* sp. B1	Rocky outcrop
Millipede	Paradoxosomatidae sp. indet.	Creekline Alluvial/colluvial plain Rocky gully Gorge
Mygalomorph	*Aname* 'MYG001' group	Hummock grassland
Mygalomorph	*Conothele* sp.	Creekline
Mygalomorph	*Conothele* sp. B1	Creekline

Group	Species	Habitat
		Mulga woodland
Mygalomorph	*Synothele* sp.	Stony plain
Pseudoscorpion	*Austrohorus* sp.	Hummock grassland
Pseudoscorpion	*Beierolpium* 8/2	Creekline Mulga woodland Hummock grassland
Pseudoscorpion	*Beierolpium* sp. indet. XC	Alluvial/colluvial plains Vegetation grove Rocky gully
Scorpion	*Urodacus* sp.	Creekline Mulga woodland
Scorpion	*Urodacus* 'Firetail'	Stony plain

4.4 Threatened and Priority Ecological Communities

One state-listed TEC and three state-listed PECs are found within the RIA, although none of them are known to be important habitats for SRE invertebrates. However, they could potentially encourage short-range endemism due to their unique habitat features and isolated nature. Each of these communities are briefly discussed below with respect to their location and, if applicable, their potential to be important SRE habitats. There are no federally protected ecological communities in the RIA (DSEWPAC 2012).

- The TEC Themeda Grasslands does not occur in either Project Area but the eastern extent of this TEC's buffer falls just within the boundaries of the RIA, approximately 57km south-west of the MDF.
- The Priority 1 PEC 'Four plant assemblages of the Wona Land System' occurs to the north of the MF Project Area, with one buffer extending into the eastern section of the Mulga East tenement. This PEC consists of a series of community types over gilgai plains, also known as cracking clay communities. These habitats are not prospective for SRE fauna as they have little protection from exposure and are seasonally disturbed/flooded by rain events. Any invertebrate fauna that may utilise them are most likely to be those that are highly mobile and short-lived, which allows them to utilise the habitat quickly during favourable conditions.



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Projection: MGA Zone 50

HANCOCK PROSPECTING

Potential SRE Species in the Regional Impacts Area

FIG 4.2

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- The Priority 1 PEC 'Freshwater claypans of the Fortescue Valley' occur along the Fortescue River, with one occurrence in the south-west of the MF Project Area. The buffer for this occurrence does extend close to, but not within, the MDF. This habitat is similar to the 'Four plant assemblages of the Wona Land System', in that it undergoes short periods of inundation and increased flora and fauna activity. However, little is known about the importance of these habitats for terrestrial invertebrates, and given the high degree of isolation that they exhibit, they can be regarded as potentially important for SRE invertebrates.
- The Priority 1 PEC 'Fortescue Marsh (Marsh Land System)' is found to the south of the MDF, outside of the MF Project Area.

4.5 Ecosystems at Risk

Four ecosystems within the Fortescue Plains subregion (Kendrick 2001) and seven within the Chichester subregion (Kendrick and McKenzie 2001) are regarded as "at risk" to threatening processes. Of these, only one occurs within the Project Areas; .the grove-intergrove mulga communities at the southern end of the northern apron of the Hamersley Range intersects with the MDF.

Mulga communities are potentially important for SREs; however, there have been no studies investigating this. They do provide protection from exposure, in the form of canopy cover and leaf litter, and the soils are usually conducive to burrowing SRE fauna, such as trapdoor spiders and scorpions. However, they are often widespread and have enough continuity to allow terrestrial invertebrate fauna to maintain intraspecies connections.

4.6 Other SRE Habitats

In the Pilbara region, the typical SRE habitats include south-facing ridges and gullies, and areas of isolated, heavy vegetation. These have the potential to provide shaded areas during the hottest time of the year, and areas of moisture retention, which, in turn, can allow more species rich areas of vegetation to persist. In the northern section of the MF Project Area there are a series of ridges and gullies that appear to be suitable as SRE habitats (Figure 4.3). This system of potential SRE habitat is skirted by the MDF, but it appears unlikely to directly impact upon it. However, the construction of roads may impact on the ability of fauna to move between these potentially significant habitats, hindering gene flow through the system. These habitats have not been surveyed for SRE invertebrate fauna, which may be regarded as a data gap.

654000 657000 660000 663000 666000 669000 672000 675000

7557000 7554000 7551000 7548000 7545000

Legend

- Mine Footprint Project Area
- Ridges and Gully Habitat
- Roads
- ANFO Storage
- Sediment Pond
- Drain
- Camp Tracks
- Camps
- Plant Footprint
- Borrow Areas
- Mine Disturbance Footprint (MDF)
- Waste Dump

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HANCOCK PROSPECTING

Ridge and Gully Habitat

FIG 4.3

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5 CUMULATIVE IMPACTS ASSESSMENT

The following impact assessment considers the worst-case scenario of the complete clearing of the MDF and treats the two road options in the AW Project Area separately. It is unlikely that these areas will be completely cleared, and only one Abydos Woodstock road option and only one camp option (plus camp road) will be used.

The other infrastructure projects, as listed below, have also been taken into account, again based on worst-case scenarios.

- Roy Hill Infrastructure Pty Ltd (RHI) granted SRL corridor;
- Fortescue Metals Group Ltd (FMG1) granted SRL corridor;
- Fortescue Metals Group Ltd (FMG2) granted Cloudbreak Project Area;
- BHP Billiton Iron Ore Pty Ltd (BHP) 100m wide potential corridor;
- Queensland Rail National Ltd (QRN) 500m wide potential corridor; and
- Brockman Resources Ltd (BRO) 500m wide potential corridor.

The calculations for this cumulative impacts assessment (Table 5.1) covers all land systems and vegetation associations that intersect with the Project Areas, but the discussion only considers those that are considered to have some potential for SRE fauna.

5.1 Impacts to SRE Fauna

The only SRE fauna recorded within close proximity of either Project Area are the isopod *Buddelundia* sp.12 and the centipede *Sedepenophilus* sp. B1. Both species were recorded close to the AW Project Area within rocky outcrops, but neither within the disturbance footprints. *Buddelundia* sp.12 has also been recorded further north of the RIA.

5.2 Impacts to Land Systems

5.2.1 MF Project Area

Three land systems within the MF Project Area are likely to contain habitat that is suitable for SRE invertebrate fauna, Jamindie, Newman and McKay, and all three are impacted by the MDF.

The Jamindie LS consists of stony hardpan plains and rises, supporting groved mulga shrublands. The importance of mulga communities to SRE invertebrates is largely unknown, as discussed in section 4.6, but they do have a number of qualities that highlight them as potential habitats. This LS will be directly impacted by the MDF (612 ha). Each of the other infrastructure projects in the RIA also directly impact Jamindie, to a combined area of 22,456 ha, which makes a total cumulative impact of 23,169 ha. The total area of this LS in the Pilbara is calculated at 207,400 ha, which puts the total impact at 11.17% (0.3% from HPPL impacts and 10.9% from other projects).

The Newman and McKay LSs contain ridge and gully habitats, which are regarded as typical SRE invertebrate habitats in the Pilbara. The Newman LS will be directly impacted by the MDF (178 ha). Each of the other infrastructure projects also impact directly on this LS, to a combined impact of 5,962 ha, and a total cumulative impact in the RIA of 6,141 ha. This LS is one of the most extensive in the Pilbara region, covering 1,458,000 ha. The MDF will impact on 0.012% of this, with the other projects potentially impacting on 0.42%.

The McKay LS will be directly impacted by the MDF (26 ha). Again, each of the other infrastructure projects will also directly impact this LS, to a combined impact of 9,239 ha. This equates to 2.2% of the 420,200 ha that this LS covers in the Pilbara region, with 0.006% from the MDF and 2.2% from the other projects.

5.2.2 AW Project Area

The AW Project Area only impacts on the Macroy LS, which does not appear likely to contain restricted habitats supporting SRE fauna.

5.3 Impacts to Beard's Vegetation

5.3.1 MF Project Area

Two vegetation types, which are likely to be impacted within the RIA, contain habitats that can be regarded as suitable for SRE invertebrate fauna; Fortescue Valley types 29 and 562.

Vegetation types 29 and 562 both contain mulga woodlands, which has potential as a SRE habitat, as discussed in section 4.6. The former covers the majority of the MDF, with 772 ha to be directly impacted. Five of the other infrastructure projects will also impact this vegetation type, to a combined total of 33,183 ha. Of the 1,132,939 ha that this vegetation types covers in the Pilbara, the MDF will impact on 0.07% and the other projects on 2.93%, combining for 3.0% impact.

Vegetation type 562 is also impacted by the MDF (69 ha). All six of the other infrastructure projects impact upon 9,681 ha of this vegetation type, which covers 103,607 ha of the Pilbara region. This makes a total impact of 9.4% on the Pilbara extent of this vegetation type, 0.07% from the MDF and 9.3% from other infrastructure projects.

5.3.2 AW Project Area

The AW Project Area only impacts on vegetation type 93, which is not considered likely to contain restricted habitats supporting SRE fauna.

Table 5.1: Cumulative Impacts on Land Systems and Vegetation Types

	HPPL (ha)			Other Projects (ha)						Total Areas Impacted (ha)		Total Area (ha)	[3]Impacts (%)		
	[1]AW1	[1]AW2	MDF	BHP	BRO	[1]FMG1	[1]FMG2	QRN	RHI	Other Projects	[2]Cumulative impacts	Pilbara	[2]HPPL	Other projects	Cumulative
Beard's Vegetation Associations															
29	0	0	761	263	1,504	1,961	28,165	1,290	0	33,183	33,944	1,132,939	0.067	2.929	2.996
562	0	0	69	157	1,538	898	3,941	302	2,845	9,681	9,750	103,607	0.066	9.344	9.410
93	7.2	7.1	0	537	125	3,434	0	3,724	5,635	13,455	13,462	3,038,472	0.0002	0.443	0.443
Land Systems (DAFWA 2009)															
Boolgeeda	0	0	12.7	0	0	2,404	0	0	0	2,404	2,417	774,800	0.002	0.310	0.312
Coolibah	0	0	0.3	0	0	327	0	0	0	327	327	101,035	0.0003	0.324	0.324
Jamindie	0	0	612	63	386	543	21,060	473	32	22,556	23,169	207,400	0.295	10.876	11.171
Macroy	7.2	7.1	0	497	100	2,456	0	1,968	4,194	9,215	9,222	1,309,500	0.0006	0.704	0.704
McKay	0	0	26	146	2,361	1,061	806	636	4,229	9,239	9,265	420,200	0.006	2.199	2.205
Newman	0	0	178	119	1,058	559	3,910	191	125	5,962	6,141	1,458,000	0.012	0.409	0.421

[1] AW1 refers to the Two Camel Access Rd option; AW2 refers to the Coonarie Access Rd option; FMG1.refers to the Solomon Rail Line and FMG2 refers to the Cloudbreak Project Area

[2] This refers to the combined areas of the MDF and one of the AW options. As both the AW options disturb the same amount of area, the combined totals are the same for each option.

[3] The percentage impact is based on the total area of each vegetation association and land system in the Pilbara bioregion.

5.4 Impacts to Typical SRE Habitats

The ridges and gully habitats within the Project Area are congruent with the Newman and McKay land systems, and vegetation type 562. The ridge and gully habitats themselves only constitute a small part of these systems but they are connected within systems that cover larger areas, as indicated in Figure 3.3. The MDF does not directly impact on any of this habitat, however, there may be some disruption to SRE fauna dispersal given the close proximity of the camp road options to the ridges and gullies.

6 DATA GAPS

6.1 Data Gaps

6.1.1 MF Project Area

Two SRE invertebrate fauna surveys have been conducted within the MF Project Area; a SRE fauna pilot survey (one season) at Murray's Hill undertaken by Ecologia in April/May 2009 (Ecologia 2009) and a one season SRE fauna survey of the Murray's Hill Transport Corridor undertaken by Phoenix in August/September 2009 (Phoenix 2010).

The systems of ridges and gullies (Figure 3.3) have not been surveyed, and this may be regarded as a data gap. However, it appears unlikely that any of these habitats will be directly impacted on.

Likewise, the freshwater claypans have not been surveyed. This may be regarded as a data gap, given our lack of knowledge of this type of habitat with SRE fauna. However, given that this habitat does not occur within the MDF, it will not be directly impacted.

The mulga woodland within the MF Project Area has had limited survey work, with Phoenix (2010) sampling at one site within this habitat. This may also be regarded as a data gap, but the continuous nature of the habitat beyond the MF Project Area makes it unlikely to harbour any restricted terrestrial invertebrates.

6.1.2 AW Project Area

The AW Project Area has had very limited survey work (three sites within close proximity by Bennelongia [2011]) but the overall lack of potential SRE habitat in the area makes further work unlikely to be required. The recording of two potential SRE fauna in the area does raise the possibility of pockets of rocky outcrops potentially harbouring SRE fauna, but both species are found outside of the extent of the disturbance footprint, and likely occur across a wide area.

7 CONCLUSIONS

There are no known, likely or potential SRE fauna recorded from, or within the vicinity of, the MF Project Area. The survey work that has been conducted within the MF Project Area is limited to the general area of the MDF. A system of ridges and gullies are present in the northern section of the MF Project Area, and parts of the MDF skirt these habitats. These habitats have not been surveyed for SRE invertebrates but the only impact is likely to be indirectly as a result of the creation of potential dispersal barriers. The AW Project Area has had limited survey work, but the level of prospectivity for SRE fauna is low, with only some rocky outcrops likely to be prospective, as identified by the presence of two potential SRE species recorded by Bennelongia (2011), although neither recorded within the disturbance footprints.

The MDF, within the MF Project Area, will impact upon the Jamindie (0.3%), Newman (0.012%) and McKay (0.006%) land systems, all with a cumulative impact including other projects of 11.2%, 0.42% and 2.2% respectively. Likewise, the MDF will impact Beard's vegetation units 29 (0.07%) and 562 (0.07%), with cumulative impacts including other projects of 3.0% and 9.4% respectively. A system of ridges and gullies present in the northern section of the MF Project Area are the most likely SRE habitat present, but these are not directly impacted by the MDF. However, there is some potential impact to SRE fauna dispersal with the construction of camp roads.

The AW Project Area does not impact on any land systems or vegetation units that are considered likely to contain habitats prospective for SRE invertebrate fauna. Two potential SRE species have been recorded previously within close proximity to the disturbances in this area; however, one was recorded outside the extent of the area and the other has also been recorded further north of the RIA.

The lack of survey work in the system of ridges and gullies in the MF Project Area may be regarded as a data gap; however, these habitats are unlikely to be significantly impacted. Likewise, there is a lack of knowledge of some other potentially prospective habitats (freshwater claypans and mulga woodlands) in the MF Project Area, but the former does not occur in the MDF and the latter is a largely continuous habitat through the Chichester Range, making it unlikely to harbour any restricted terrestrial invertebrates. The rocky outcrops in the AW Project Area are also prospective, but are not directly impacted by the Project.

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