



Attn: Sarah Williamson  
BHP Billiton Iron Ore

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## **ADDENDUM FOR MODIFIED BOUNDARY Mining Area C and Southern Flank Troglifauna Environmental Impact Assessment**

### **Introduction**

This Addendum should be read in conjunction with Bennelongia's (2016) report '*Mining Area C – Southern Flank: troglifauna assessment*', which provides an assessment of the potential impacts on troglifauna associated with the Mining Area C Southern Flank Proposal. The Indicative Additional Impact Assessment Area for that assessment covered the proposed mine pits at Southern Flank and a small extension to the area of disturbance at R Deposit at Mining Area C.

BHP Billiton Iron Ore has subsequently provided an alternative, modified boundary for the Indicative Additional Impact Assessment Area (Figure 1). The Addendum outlines the differences in potential impacts on troglifauna species according to whether the boundary used for assessment is that in Bennelongia (2016) or the modified boundary. In the remainder of the Addendum, the two versions of the Indicative Additional Impact Assessment Area are referred to as the assessed IAIAA (used by Bennelongia 2016) and the modified IAIAA (reported on here). Differences between the two boundaries are small, with the modified IAIAA mostly representing a slight paring back of the IAIAA.

### **Summary of Differences**

Species recorded only from the modified IAIAA during field survey are *potentially restricted* to the modified IAIAA (i.e. there is not irrefutable evidence of them having a wider distribution). Three categories were used in Bennelongia (2016) to describe the likelihood of potentially restricted species actually being restricted to the assessed IAIAA. The same categories are used here in relation to the modified IAIAA:

- *Possibly*. The available information suggests there is  $\geq 40\%$  probability that the species is restricted.
- *Unlikely*. The available information suggests there is  $\leq 40\%$  probability that the species is restricted.
- *Uncertain*. There is insufficient information to assign a probability of the species being restricted. Given that the species is known only from the modified IAIAA, it is treated as likely to be restricted.

The difference between the assessed and modified IAIAA in relation to impacts on troglifauna is that there are seven fewer potentially restricted species in the modified IAIAA.

Fifty-one troglifauna species represented by 405 specimens occur within the assessed IAIAA and 50 species represented by 395 specimens occur within the modified IAIAA.

Twenty-one troglofauna species have been collected only from the assessed IAIAA, with five of these species being possibly restricted to the assessed IAIAA or of uncertain distributional status (Table 1).

Seventeen troglofauna species have been collected only from the modified IAIAA, with five of these species being possibly restricted or of uncertain distribution status (Table 1).

Fourteen species are common to both the list of species recorded only in the assessed IAIAA and the list for the modified IAIAA (Table 1). The differences in the boundary of the two areas means that seven species present in the assessed IAIAA occur outside the modified IAIAA boundary (Figure 2). The species are:

- *Draculoides* sp. B59-DNA
- *Prethopalpus maini*
- *Australoschendyla* sp. B06
- Chilenophilidae sp. B07
- Japygidae ,DPL005'
- Japygidae ,DPL007
- Parajapygidae sp. B25.

Three species occurred outside the assessed IAIAA but are known only from within the modified IAIAA. These are:

- *Draculoides* sp. B32
- ?Gnaphosidae sp. B01
- nr *Claviger* sp. B01.

### Information on Additional Species

Information about the likely distributions of the three species known from the modified IAIAA but not the assessed IAIAA is given below. The known occurrences of these species are shown in Figures 3-5, together with the occurrences of other species known only from the modified IAIAA.

#### *Schizomida* – *Draculoides* sp. B32

*Draculoides* sp. B32 was collected as four specimens from two visits to one drill hole within the modified IAIAA (Figure 6). Assessing the likely range of the species is difficult because, while five of the 11 *Draculoides* species at Mining Area C have known linear ranges  $\geq 10$  km, the other five with multiple records have ranges varying from 0.2-4.4 km with a mean of only 1.8km ( $\pm 1.1$  SE).

Detailed assessment of the likely habitat of *Draculoides* sp. B32 has not yet been undertaken but the species is assumed to utilise weathered BIF. While mineralised BIF is not continuous in the vicinity of drill hole SF0527R, where *Draculoides* sp. B32 was collected (Figure 3), the occurrence of hardcap is reasonably consistent (BHPBIO 2016) and suggests suitable habitat is continuous to the outside of the modified IAIAA. It is considered unlikely the species will be impacted by the current Proposal.

#### *Araneae* - ?*Gnaphosidae* sp. B01

The taxonomic placement of ?*Gnaphosidae* sp. B01 is uncertain; the species has very long legs and no guard hairs and is known from a single specimen collected in a scrape from drill hole SF1460R. Small ranges are typical of troglofaunal spiders in the Pilbara (Halse and Pearson 2014) but it is not possible to examine the ranges of species closely related to ?*Gnaphosidae* sp. B01 because of the uncertainty about its taxonomic relationships.

**Table 1.** Details of troglofauna species restricted to the two versions of the IAIAA.  
Species highlighted in grey have been recorded only in the modified IAIAA.

Higher Group Species	Assessed IAIAA	Modified IAIAA	No. of Animals	No. of Holes	Likely Range (km)	Restriction Category
<b>Arachnida</b>						
<b>Pseudoscorpiones</b>						
<i>Indohya</i> 'PSE005'	x	x	9	9	21	Unlikely
<i>Tyrannochthonius</i> sp. B14	x	x	1	1	-	Unlikely
<b>Schizomida</b>						
<i>Draculoides</i> sp. B20	x	x	4	4	10.0	Unlikely
<i>Draculoides</i> sp. B59-DNA	x		2	1	-	Unlikely
<i>Draculoides</i> sp. B32		x	4	1	-	Unlikely
<b>Araneae</b>						
?Gnaphosidae sp. B01		x	1	1	-	Unlikely
<i>Prethopalpus julianneae</i>	x	x	1	1	-	Possibly
<i>Prethopalpus maini</i>	x		5	5	17.8	Unlikely
<i>Prethopalpus</i> sp. B15	x	x	1	1	-	Possibly
<i>Prethopalpus</i> sp. B24	x	x	1	1	-	Unlikely
<b>Malacostraca</b>						
<b>Isopoda</b>						
nr <i>Andricophiloscia</i> sp. B16	x	x	1	1	-	Possibly
Philosciidae sp. B03	x	x	17	1	-	Possibly
Philosciidae sp. B15	x	x	1	1	-	Unlikely
<i>Troglarmadillo</i> sp. B14	x	x	12	2	11.2	Unlikely
<b>Symphyla</b>						
<b>Cephalostigmata</b>						
<i>Australoschendyla</i> sp. B06	x		2	2	6.6	Unlikely
Chilenophilidae sp. B07	x		1	1	-	Unlikely
<i>Hanseniella</i> sp. B07	x	x	7	5	24.1	Unlikely
<i>Hanseniella</i> sp. B34	x	x	1	1	-	Unlikely
<b>Entognatha</b>						
<b>Diplura</b>						
Japygidae 'DPL005'	x		2	2	14.5	Unlikely
Japygidae 'DPL007'	x		3	2	5.7	Unlikely
Parajapygidae 'DPL023'	x	x	2	2	3.1	Unlikely
Parajapygidae 'DPL024'	x	x	1	1	-	Uncertain
Parajapygidae sp. B25	x		1	1	-	Unlikely
<b>Insecta</b>						
<b>Coleoptera</b>						
nr <i>Claviger</i> sp. B01		x	1	1	-	Unlikely
<b>TOTAL</b>	<b>21</b>	<b>17</b>				

Detailed assessment of the likely habitat of ?Gnaphosidae sp. B01 has not been undertaken but the species is assumed to utilise weathered BIF. While mineralised BIF is not continuous in the vicinity of drill hole SF0527R, where ?Gnaphosidae sp. B01 was collected (Figure 3), the occurrence of hardcap is reasonably consistent (BHPBIO 2016) and suggests suitable habitat is continuous to the outside of the modified IAIAA and it is considered unlikely that the species will be impacted by the current Proposal.

### *Coleoptera* - nr *Claviger* sp. B01

At least six species of troglofaunal staphylinid spiders in the subfamily Pselaphinae have been recorded from the Pilbara. Based on current understanding, but without genetic assessment, Pselaphinae sp. B01 and Pselaphinae sp. B02 are both widespread, with known linear ranges of 340 and 79 km, respectively. The other four species, including nr *Claviger* sp. B01, are known from one or two records at single boreholes and their likely ranges are unclear, although beetles tend to have relatively large ranges for troglofauna (Halse and Pearson 2014).

Detailed assessment of the likely habitat of nr *Claviger* sp. B01 has not yet been undertaken but the species is assumed to utilise weathered BIF. While mineralised BIF is not continuous in the vicinity of drill hole SF0531R, where nr *Claviger* sp. B01 was collected (Figure 5), the occurrence of hardcap is reasonably consistent (BHPBIO 2016) and suggests suitable habitat would be continuous to the outside of the modified IAIAA. For this reason, combined with the expectation the species may have a moderately large range, it is considered unlikely that nr *Claviger* sp. B01 will potentially be impacted by the Proposal.

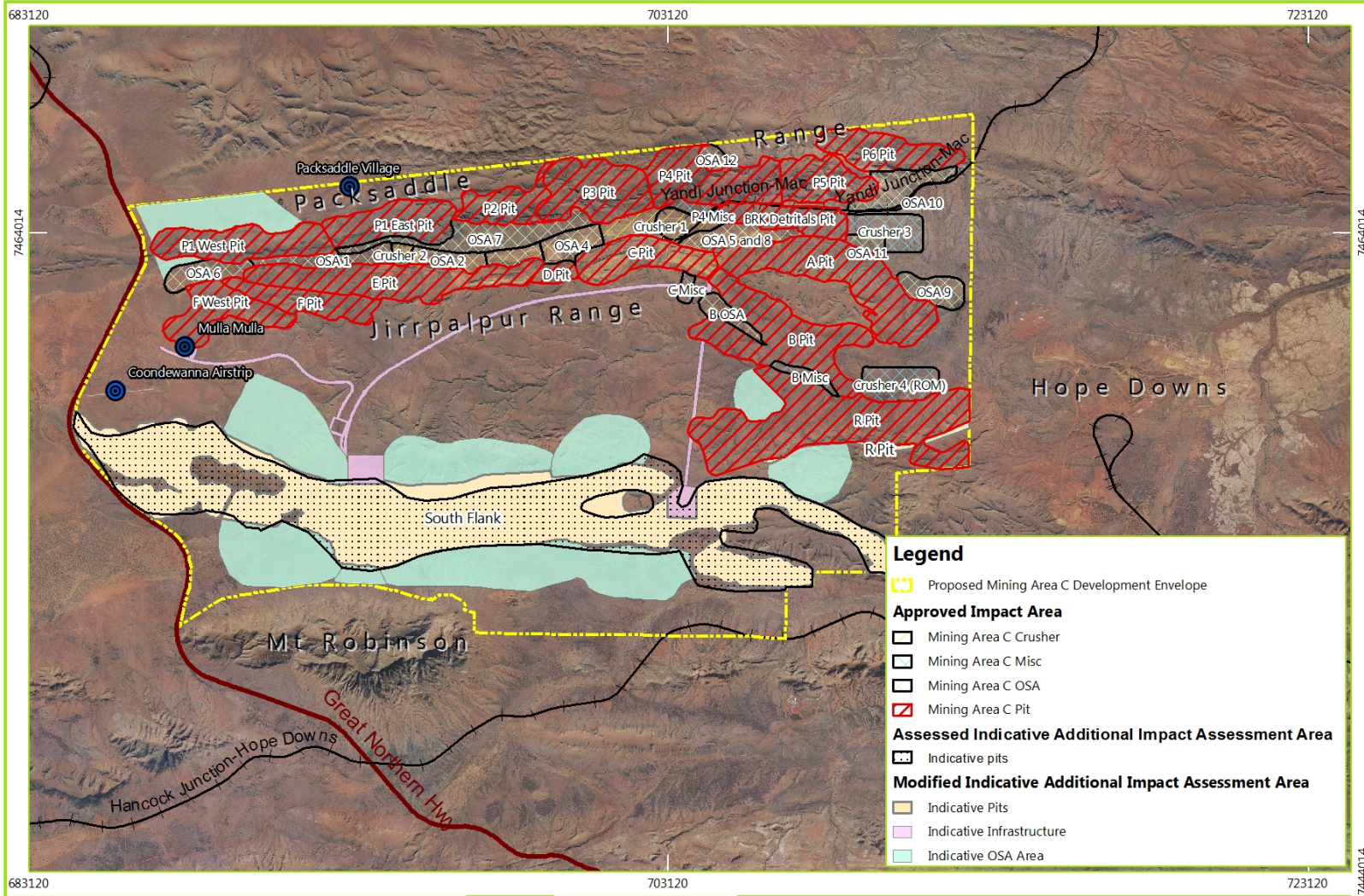
### **Assignment of Species as Possibly Restricted or Uncertain**

The known occurrences of the five troglofauna species considered to be of uncertain status or possibly restricted to the modified IAIAA are mapped in Figure 6. As was emphasized in Bennelongia (2016), which provides information on the approach taken to assessment, the determination of species' ranges is accompanied by uncertainty, particularly when species are known from single drill holes. As such, the results of assessment represent a best estimate, based on available information, of the likely ranges of the species collected within the modified IAIAA.

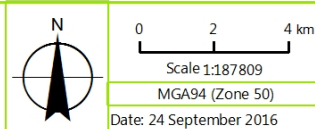
### **References**

- Bennelongia (2016) Mining Area C – Southern Flank: troglofauna assessment. Report 275. Bennelongia Pty Ltd, Jolimont, 41 pp.
- BHPBIO (2016) South Flank troglofauna habitat assessment. BHP Billiton Iron Ore Pty Ltd, Perth, 82 pp.
- Halse, S.A., and Pearson, G.B. (2014) Troglofauna in the vadose zone: comparison of scraping and trapping results and sampling adequacy. *Journal of Subterranean Biology* **13**, 17-34.





Source: Infrastructure supplied by Client:  
 - South Flank Potential Pits OSA 20160825  
 - Mining Area C EMP Pits OSAs Rev6 20150821  
 Imagery: World Imagery (ESRI 2016)

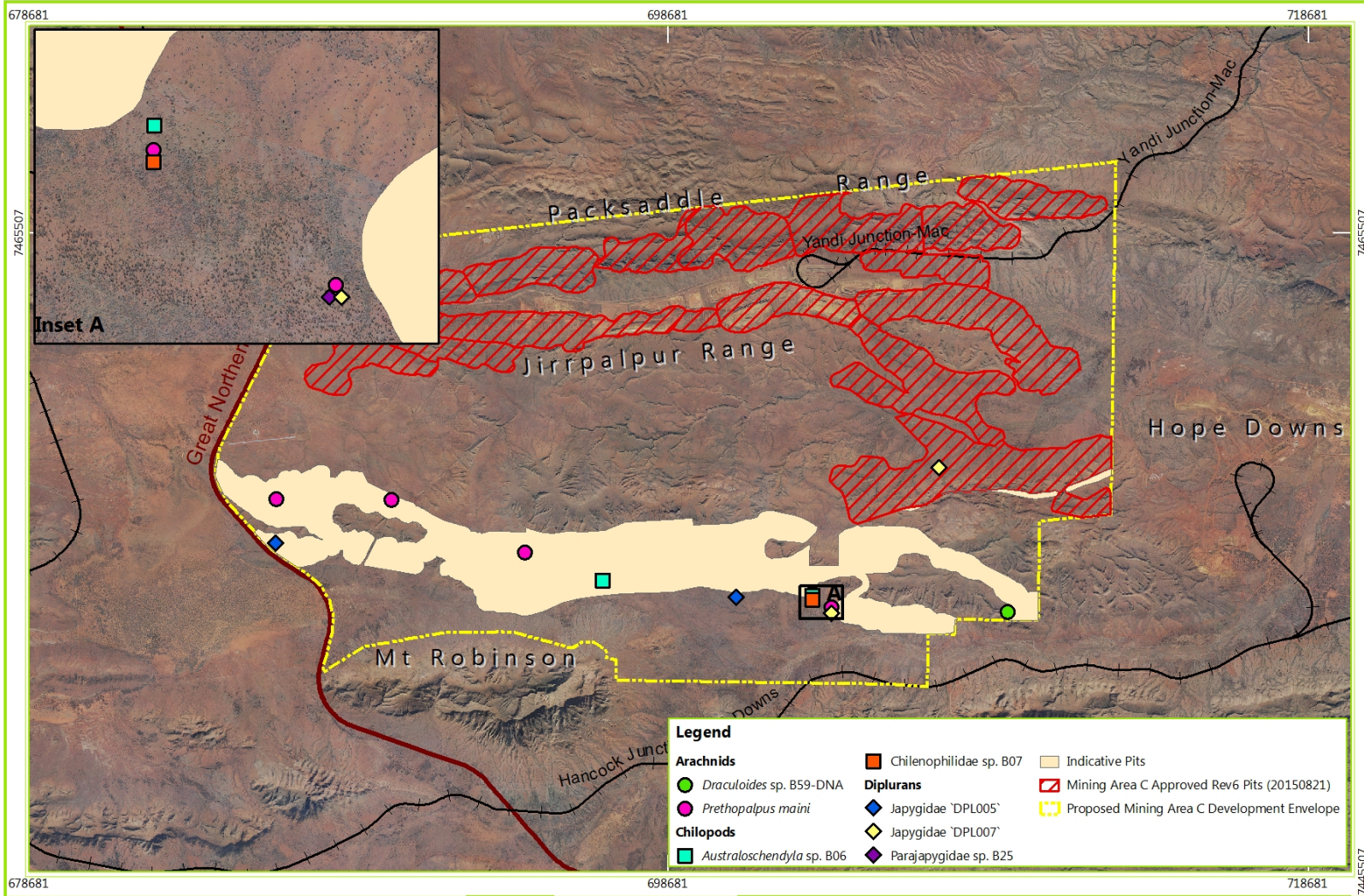


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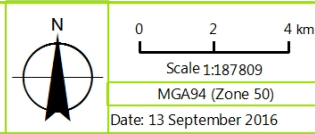
**Modified Indicative  
 Additional Impact  
 Assessment Area**

Figure:  
**1**





Source: Infrastructure supplied by Client  
 Imagery: World Imagery (ESRI 2016)  
 South Flank Potential Pits 20160825  
 In the inset, points are slightly offset for display purposes





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**Assessed species  
 outside the  
 modified IAIAA**

Figure:  
**2**



