Targeted survey for the Shield-backed Trapdoor Spider *Idiosoma nigrum*

Proposed Upgrade Baandee North Road

Tape measure set out for survey of spider burrows (S. Smith)

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INTRODUCTION

Bamford Consulting Ecologists received a request from Steve Fry of Santaleuca Sandalwood Products, on behalf of the Shire of Kellerberrin, to conduct an assessment for significant fauna of Baandee North Road in the Kellerberrin Shire. This road goes through the North Baandee Nature Reserve, Reserve 33419, which is bisected in a north-western to south-eastern direction by Baandee North Road. The Shire propose to upgrade the road north of the reserve (**Error! Reference source not found.**) to a H eavy Vehicle Corridor which would necessitate the widening of the existing road by a few metres either side. The fauna survey was over approximately 20 hectares of roadside vegetation, and targeted fauna on the Federal Protected Matters list (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) matters of National Environmental Significance; Department of the Environment 2014) considered potentially present. The target species was the Shield-backed Trapdoor Spider (*Idiosoma nigrum*). Also of interest were Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and the Malleefowl (*Leipoa ocellata*). The project area was visited in July 2020 and found that the Shield-backed Trapdoor Spider was locally abundant, both along the road and particularly in the Baandee Nature Reserve at the southern end of the road upgrade area (Smith *et al.* 2020). As a result, a return visit was carried out to gather information on the distribution and abundance of the spider in order to inform the risk to the species from the proposed road upgrade. The spider is of high conservation significance (Endangered under state and federal legislation) and the Baandee population represents a slight range extension for the species.

METHODS

Dates and personnel

The project area was visited on 25-26 August 2020 by Sarah Smith (B. Sc. Biol.) and Peter Smith (Assoc Dip Agric.). Both of these ecologists have had considerable experience investigating trapdoor spiders (*Idiosoma sp*. and *Aganippe sp*.) in the Murchison, Mid-west and Yilgarn regions over the last 15yrs. Although no collection or disturbance of the spiders was intended, a permit under Section 40 of the *WA Biodiversity Conservation Act* (2016) was obtained to cover the activity (TFA2020-0086).

Approach to sampling

While the presence of the spider had previously been confirmed, the aim of the August survey was to obtain measures of abundance in the road reserve and in the Baandee Nature Reserve outside areas of impact. This was based upon a transect approach developed by Bamford Consulting in a long-term study of a related species, the Northern Shield-backed Trapdoor spider *Idiosoma clypeatum* (described in full in Bamford *et al.* 2013). The approach is based on surveying a transect 50m long by 2m wide with two people, each ecologist surveying 1m either side of a 50m tape measure laid out on the ground (see cover photo). The start point and direction of the transect are selected without reference to the presence of spiders to avoid bias. Where burrows are found, the distance along the tape measure is noted and a milliscope used to determine the presence and species of the spider. The Shield-backed Trapdoor Spider can be recognised as it usually presents its distinctive armoured abdomen to an intruder (such as the milliscope). Sampling was carried out in the Road Reserve and in the Baandee Nature Reserve.

In the Road Reserve, three paired transects were located in each of five vegetation and Substrate Associations (VSAs): VSA 1, Tall Woodland of Salmon Gum (*Eucalyptus salmonophloia)* and Gimlet (*E.salubris)* on heavy red clay/loam; VSA 2, York Gum Mallee (*E. loxophleba ssp. lissifolia)* on red clay loam; VSA 3, tall rough stocking mallee (various species) on red clay/loam; VSA 4, Tammar (*Allocasuarina acutivalvis*) and other mixed shrubs on yellow sand over shallow lateritic gravel; and VSA 5, smooth grey barked mallee on pale clay with calcrete nodules. One of each pair was located within the area proposed for disturbance (9m from centre of existing road) and the corresponding transect within each pair within the Road Reserve but outside the proposed disturbance area (greater than 9m from centre of existing road and up to approx 30m from centre of existing road). There were 30 transects in the Road Reserve, 15 in impact areas and 15 outside impact areas.

In the Baandee Nature Reserve, a pair of transects was located within each of four VSAs (VSAs 1, 2, 4 and 5). Thus there were eight transects in the Nature Reserve. Note that VSA 3, tall rough stocking mallee (various species) on red clay/loam, was not found in the Nature Reserve. All transects were located at least 30m from the centreline of the Road Reserve and were therefore outside the road reserve.

Start and end coordinates of each transect are given in Appendix 1 and locations are indicated on Figure 1.

RESULTS and DISCUSSION

Raw data from the transects are presented in Appendix 2 (Road Reserve) and Appendix 3 (Nature Reserve), with results summarised in

Table 1 (Road Reserve) and

Table 2 (Nature Reserve). Further summaries, examining impact and non-impact areas along the Road Reserve, and in the Nature Reserve, and comparing spider densities by VSA, are provided in Table 3 and Table 4. The locations of a few spiders found opportunistically outside transects are given in Appendix 4. In addition to the Shield-backed Trapdoor Spider, small numbers of other species were found, including a species of *Gaius,* which is not of conservation significance, and possibly a second species of *Idiosoma*, most likely *Idiosoma mcnamarai* or *Idiosoma kopejtkaorum*. *I. mcnamarai* is a Priority 1 species, and therefore is not listed under legislation, while *I. kopejtkaorum* is a Schedule 2 (Endangered) species under the WA Biodiversity Conservation Act (2016). A specimen of this second possible *Idiosoma* has been lodged with the WA Museum for identification. It was collected within the area proposed for clearing along the road (Transect 6) with two spiders within half a metre of each other.

Shield-backed Trapdoor Spiders were found throughout at highly variable densities, as is typical for the genus *Idiosoma.* This variability is a result of the distribution of the spiders being highly clumped around successful breeding females, with spiders often occurring in matriarchal clusters that can exceed 30 animals in a square metre (Bamford *et al.* 2013). Because such clusters appear to occur at random, encountering a cluster in a transect gives a very high density estimate, and therefore multiple transect replicates are required to provide a realistic density value. Larger samples would probably be required for robust statistical analyses to be conducted, but some general trends appear to exist (but recognising that the discovery of one more or less matriarchal cluster could affect results greatly).

Spiders were present in the Road Reserve both within and outside the area of proposed impact, and were also present in the Nature Reserve. The density was lower in the impact area of the Road Reserve than in either the non-impact area or in the Nature Reserve (Table 3). This could be due to levels of existing disturbance with spiders possibly affected by dust, vibration and road maintenance close to the existing road.

There were clear differences in the density of spiders in different VSAs, broadly forming two groups. VSAs 1, 2 and 3 had high spider densities, with the very high density in VSA 3 (Rough barked Mallee) probably partly an artefact of a small sample size and one of the transects including a large matriarchal cluster. Despite this, there is a degree of consistency in the densities calculated for VSAs 1, 2 and 3, while VSAs 4 and 5 clearly had lower but similar spider densities. VSAs 1, 2 and 3 are all part of the Wheatbelt Woodlands Threatened Ecological Community.

Spider populations can be roughly estimated based upon these calculated densities and where areas of each VSA are known. Within the Road Reserve, the application for clearing affects 1.84ha of VSAs 1, 2 and 3 combined. This has an overall mean density of 550 spiders/ha (taking account of all 21 transects in these VSAs), with a possible impact on 1,012 spiders. However, the density may be lower close to the road with a mean density in the impacted part of the Road Reserve in these VSAs (9 transects))within the proposed clearing area of just 87 spiders/ha, meaning that only 160 spiders could be impacted.

The application for clearing also affects 0.42 ha of VSAs 4 and 5 (Tammar on sand over gravel and Smooth barked mallee on pale clay) which have an overall mean density of 68.8 spiders/ha (16 transects) and 117 spiders/ha (6 transects in impact area). This represents as few as 29 or as many as 49 additional spiders. The number of impacted spiders is a minimum of 189 and a maximum of 1061.

In comparison with the number of spiders that could be impacted, there are spiders in the reserve outside the area proposed for clearing, and the Baandee Nature Reserve supports a substantial population. The botanical survey of the Nature Reserve (R 12329) and the adjoining gravel extraction reserve (R33419) shows 90ha of VSAs 1, 2 and 3 combined (the Wheatbelt Woodland Threatened Ecological Community (TEC), and 101ha of other vegetation types, consisting mostly of VSAs 4 and 5. With an overall mean density in VSAs 1, 2 and 3 of 550 spiders/ha, and in VSAs 4 and 5 of 68.8 spiders/ha, this suggests a spider population in the Nature Reserve and adjoining reserve of 56,449. While this value is clearly an estimate, it does suggest a substantial population in the reserve. There is a further 22ha area within the road reserve but outside the 1.84 ha over which the application for clearing applies. This consists mostly of VSAs 1, 2 and 3 and therefore a density of 550 spiders/ha can be assumed, giving an additional 12,100 spiders.

While the calculations above make many assumptions, the calculated impact of up to about 1,000 spiders represents about 1.5% of the local spider population, with the proportional impact likely to be less than this.

Table 1. Summary of spider data in Road Reserve.

VSA	Outside or within disturbance area	Transect Number	Number of I.nigrum burrows	Mean burrows per transect	Mean burrows per hectare
VSA 1. Salmon gum/Gimlet	Outside	T4	9	5.67	**566.67**
		T16	5		
		T18	3		
	Within	T15	0	0.00	0.00
		T17	0		
		T25	0		
VSA 2. *Eucalyptus loxophleba ssp. lissophloia*	Outside	T2	5	3.67	**366.67**
		T14	1		
		T28	5		
	Within	T1	4	2.33	233.33
		T3	3		
		T13	0		
VSA 3. Rough barked Mallee	Outside	T20	53	17.67	**1766.67**
		T22	0		
		T24	0		
	Within	T19	0	0.33	33.33
		T21	0		
		T23	1		
VSA 4. Tammar on sand over gravel	Outside	T7	0	0.67	**66.67**
		T8	2		
		T32	0		
	Within	T5	0	0.67	66.67
		T6	2		
		T31	0		
VSA 5. Smooth mallee on pale clay	Outside	T10	2	0.67	**66.67**
		T12	0		
		T30	0		
	Within	T9	5	1.67	166.67
		T11	0		
		T29	0		

Table 2. Summary of spider data in Nature Reserve.

VSA	Transect Number	Number of I.nigrum burrows	Mean burrows per transect	Mean burrows per hectare
VSA 1. Salmon Gum/ Gimlet	T26	0	4	400.00
	T27	8		
VSA 2. *Eucalyptus loxopleba ssp lissophloia*	T33	24	12	1200.00
	T34	0		
VSA 4. Tammar on Sand over gravel	T35	0	0	0.00
	T36	0		
VSA 5. Smooth barked Mallee on pale clay	T37	0	0	0.00
	T38	0		

Table 3. comparison of spider densities between road and nature reserve.

Area	N transects	Mean density/ha
Road reserve within impact	15	100
Road reserve outside impact	15	567
Nature Reserve	8	400

Table 4. comparison of spider densities between Vegetation and Substrate Associations.

VSA	N Transects	Mean density/ha
VSA 1. Salmon Gum/ Gimlet	8	312.5
VSA 2. *Eucalyptus loxopleba ssp lissophloia*	8	525
VSA 3. Rough barked Mallee	6	900
VSA 4. Tammar on Sand over gravel	8	50
VSA 5. Smooth barked Mallee on pale clay	8	87.5

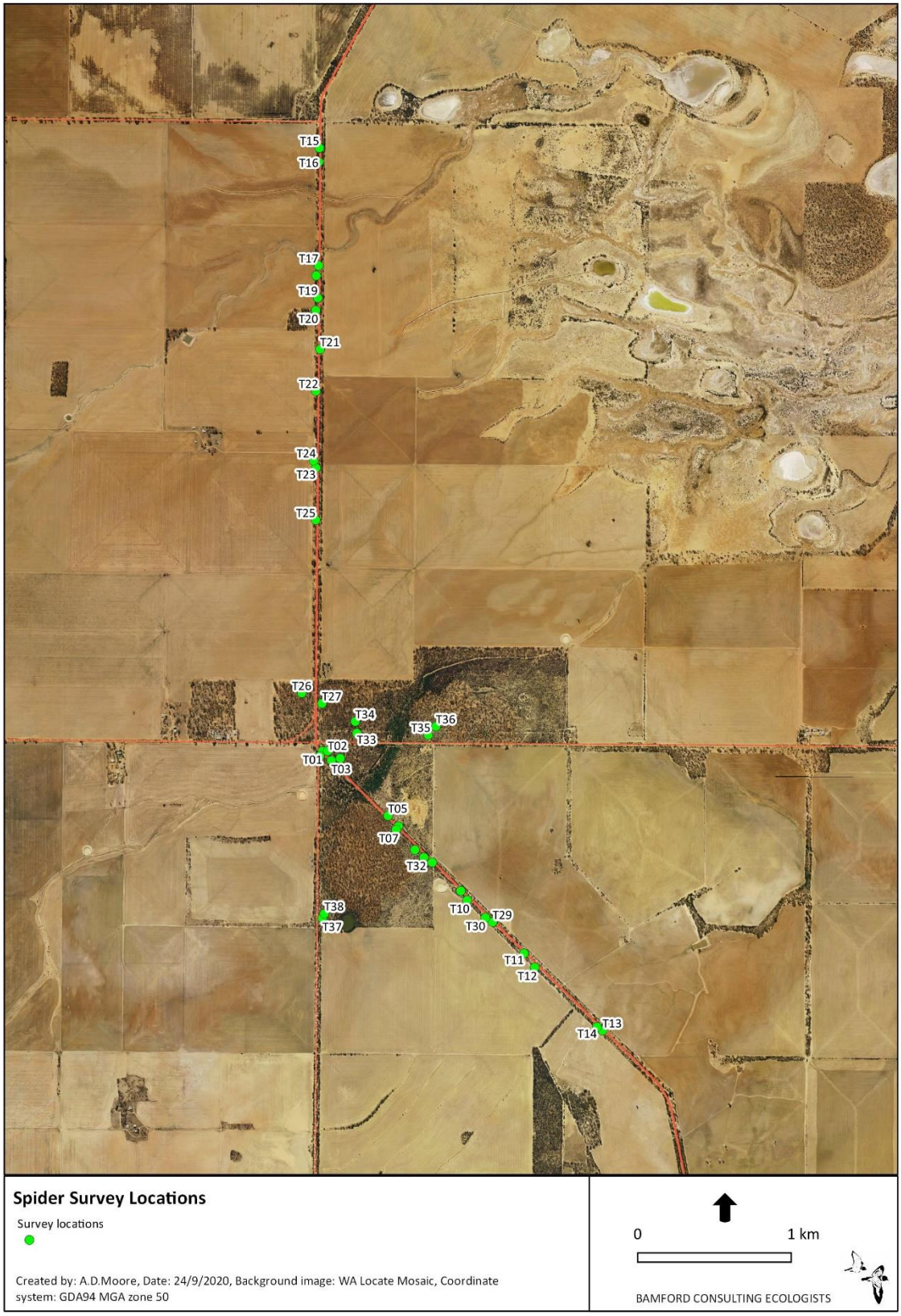

Figure 1. Locations of spider transects along the Road Reserve and in the Nature Reserve.

REFERENCES

Bamford, M., Dunlop, N., Gamblin, T. and Bamford, A. (2013). Fauna Sampling Manual. Guide to sampling techniques for wildlife research in Western Australia. Conservation Council of WA, Perth.

Smith, P., Smith, S., Bamford, M and Bamford, J. (2020). Significant Fauna Assessment for Kellerberrin Shire Road Upgrade. Baandee North Road SLK 23 to SLK 29.5. Unpubl. report to Shire of Kellerberrin by Bamford Consulting Ecologists, Kingsley.

Appendix 1. Start and end points of each spider transect. Zone 50, GDA 94.

Label		Easting	Northing
T01 End	Road Reserve	588963.8	6528899
T01 Start		588932.8	6528933
T02 End	Road Reserve	589003.1	6528896
T02 Start		588968.2	6528934
T03 End	Road Reserve	589029.8	6528842
T03 Start		588991.6	6528872
T04 End	Road Reserve	589079.9	6528848
T04 Start		589049.3	6528886
T05 End	Road Reserve	589390.2	6528480
T05 Start		589360.1	6528513
T06 End	Road Reserve	589462	6528415
T06 Start		589427.3	6528444
T07 End	Road Reserve	589448	6528391
T07 Start		589412.4	6528422
T08 End	Road Reserve	589568.2	6528257
T08 Start		589534.5	6528291
T09 End	Road Reserve	589866.6	6527990
T09 Start		589833.3	6528024
T10 End	Road Reserve	589904.9	6527928
T10 Start		589874.5	6527963
T11 End	Road Reserve	590277.4	6527579
T11 Start		590244.2	6527617
T12 End	Road Reserve	590283	6527564
T12 Start		590314.5	6527526
T13 End	Road Reserve	590718.8	6527152
T13 Start		590754.7	6527116
T14 End	Road Reserve	590688.2	6527173
T14 Start		590719.4	6527138
T15 End	Road Reserve	588917.9	6532807
T15 Start		588913.2	6532856
T16 End	Road Reserve	588906.7	6532715
T16 Start		588908.4	6532764
T17 End	Road Reserve	588904.7	6532039
T17 Start		588907.6	6532091
T18 End	Road Reserve	588893.2	6531975
T18 Start		588892.7	6532026
T19 End	Road Reserve	588899.5	6531832
T19 Start		588902.8	6531881
T20 End	Road Reserve	588887.9	6531753
T20 Start		588889.8	6531800
T21 End	Road Reserve	588918.9	6531498
T21 Start		588917.9	6531547
T22 End	Road Reserve	588886.6	6531224
T22 Start		588891.2	6531275
T23 End	Road Reserve	588892.4	6530818
T23 Start		588890.9	6530775

T24 End	Road Reserve	588878.9	6530780
T24 Start		588876.1	6530823
T25 End	Road Reserve	588889.5	6530387
T25 Start		588889.4	6530436
T26 End	Nature Reserve	588783.6	6529266
T26 Start		588798.8	6529311
T27 End	Nature Reserve	588938.2	6529194
T27 Start		588930	6529243
T28 End	Road Reserve	588945	6528863
T28 Start		588916.9	6528902
T29 End	Road Reserve	590005	6527856
T29 Start		590039.9	6527821
T30 End	Road Reserve	590030.6	6527816
T30 Start		589993.5	6527850
T31 End	Road Reserve	589611.2	6528242
T31 Start		589647.4	6528209
T32 End	Road Reserve	589562.1	6528279
T32 Start		589592.9	6528242
T33 End	Nature Reserve	589108.2	6529047
T33 Start		589157.5	6529050
T34 End	Nature Reserve	589196.6	6529128
T34 Start		589147	6529126
T35 End	Nature Reserve	589666.6	6529044
T35 Start		589621.6	6529039
T36 End	Nature Reserve	589625.1	6529106
T36 Start		589672	6529094
T37 End	Nature Reserve	588932.1	6527894
T37 Start		588932.9	6527846
T38 End	Nature Reserve	588980	6527853
T38 Start		588945.9	6527876

Appendix 2. Results of spider transects surveys in the Road Reserve

Transect Number	Within or outside proposed disturbance	VSA	Distance along tape (m)	Burrow opening size	Checked with milliscope	notes
T1	Within disturbance	*Eucalyptus loxophleba ssp. lissophloia*	27	medium	Yes	I.nigrum present
			26.3	small	No	
			27.3	medium	Yes	fan, no lid, no spider
			31	medium	No	
T2	Outside disturbance	*Eucalyptus loxophleba ssp. lissophloia*	7.4	big		
			7.7	small		
			8.4	big		
			7.6	medium large		
			7.5	small		
T3	Within disturbance	*Eucalyptus loxophleba ssp. lissophloia*	35.2	small		
			35.3	big	Yes	I.nigrum present
			35.8	small		
T4	Outside disturbance	*Eucalyptus salmonophloia/ E. salubris* woodland	36.9	medium		
			36.9	small		
			39.8	large		
			36.1	small		
			35.6	large		
			37.8	medium		
			31.8	small		
			29.2	medium		
			29.2	large		
T5	Within disturbance	Tammar on Sand over shallow lateritic gravel			NA	
T6	Within disturbance	Tammar on Sand over shallow lateritic gravel	12	large	Yes	Suspect Idiosoma but different lid structure, twisted burrow unable to see spider. One collected for WAM
			11.9	large	Yes	
			46.4	large	Yes	Gaius sp.
T7	Outside disturbance	Tammar on Sand over	48.7	large	Yes	Gaius sp.

Transect Number	Within or outside proposed disturbance	VSA	Distance along tape (m)	Burrow opening size	Checked with milliscope	notes
		shallow lateritic gravel				
T8	Outside disturbance	Tammar on Sand over shallow lateritic gravel	36.3	large	Yes	Gaius sp.
			7.1	medium	Yes	I.nigrum present
			5.7	medium	Yes	I.nigrum present
T9	Within disturbance	Smooth barked mallee on pale clay loam	29.5	large	Yes	I.nigrum present
			29.4	medium		
			29.4	small		
			29.3	small		
			28.3	small		
T10	Outside disturbance	Smooth barked mallee on pale clay loam	48.6	medium	Yes	
			49.1	medium	Yes	
			9.2	large		Gaius sp.
T11	Within disturbance	Smooth barked mallee on pale clay loam			NA	Up slope, sandier
T12	Outside disturbance	Smooth barked mallee on pale clay loam			NA	Up slope, sandier
T13	Within disturbance	*Eucalyptus loxophleba ssp. lissophloia*			NA	
T14	Outside disturbance	*Eucalyptus loxophleba ssp. lissophloia*	38.8	Large	Yes	I.nigrum
T15	Within disturbance	*Eucalyptus salmonophloia/ E. salubris* woodland				
T16	Outside disturbance	*Eucalyptus salmonophloia/ E. salubris* woodland	4.5	Large	Yes	I.nigrum
			11.6	medium	Yes	I.nigrum
			11.4	Large	Yes	I.nigrum
			10.7	medium	Yes	I.nigrum
			10.8	medium	Yes	I.nigrum
T17	Within disturbance	*Eucalyptus salmonophloia/ E. salubris* woodland				
T18	Outside disturbance	*Eucalyptus salmonophloia/ E. salubris* woodland	15.9	medium	Yes	I.nigrum
			15.9	medium	Yes	I.nigrum
			15.8	small	Yes	I.nigrum

Transect Number	Within or outside proposed disturbance	VSA	Distance along tape (m)	Burrow opening size	Checked with milliscope	notes
T19	Within disturbance	Rough grey stocking tall mallee, red loam clay flat				
T20	Outside disturbance	Rough grey stocking tall mallee, red loam clay flat	7.1	small		
			6.9	big	Yes	I.nigrum
			7.7	small		
			7.3	big	Yes	I.nigrum
			7.4	small		
			8	small		
			8.3	small		
			14.5	big		
			15.1	small		
			15	small		
			15	small		
			15.1	small		
			15	big	Yes	I.nigrum
			15	medium	Yes	I.nigrum
			15	small		
			18.1	big		
			18.1	medium		
			18.1	small		
			18	medium		
			26.7	small		
			26	medium		
			26	big		
			26	big		
			26.8	medium		
			26.8	small		
			25.6	medium		
			25.6	medium		
			25.6	small		
			25.6	small		
			25.4	big	Yes	I.nigrum
			25.4	small		
			25.4	medium		
			25.2	big	Yes	I.nigrum
			25.2	medium		
			25	big		
			25	medium		
			25	medium		
			24.7	medium		
			24.7	medium		
			24.7	big		
			24.7	medium		
			24.7	medium		

Transect Number	Within or outside proposed disturbance	VSA	Distance along tape (m)	Burrow opening size	Checked with milliscope	notes
			24.5	small		
			21.5	big	Yes	I.nigrum
			21.5	big		
			21.5	small		
			19.7	small		
			18.2	small		
			18.1	big	Yes	I.nigrum
			18.1	medium		
			18.1	small		
			15.3	big	Yes	I.nigrum
			1.4	small		
T21	Within disturbance	Rough grey stocking tall mallee, red loam clay flat				degraded
T22	Outside disturbance	Rough grey stocking tall mallee, red loam clay flat				degraded
T23	Within disturbance	Rough grey stocking tall mallee,red loam clay flat	0.2	small	Yes	I.nigrum
T24	Outside disturbance	Rough grey stocking tall mallee, red loam clay flat				
T25	Within disturbance	*Eucalyptus salmonophloia/ E. salubris* woodland				
T28	Outside disturbance	*Eucalyptus loxophleba ssp. lissophloia*	27.4	big	Yes	I.nigrum
			27.4	small		
			27.6	medium		
			27.6	small		
			23.3	big		
T29	Within disturbance	Smooth barked mallee on pale clay loam	0		NA	
T30	Outside disturbance	Smooth barked mallee on pale clay loam				
T31	Within disturbance	Tammar on sand over lateritic gravel	39.2			Gaius sp.

Transect Number	Within or outside proposed disturbance	VSA	Distance along tape (m)	Burrow opening size	Checked with milliscope	notes
T32	Outside disturbance	Tammar on sand over lateritic gravel	0.8			Gaius sp.

Appendix 3. Results of spider transects surveys in Baandee Nature Reserve

Transect Number	VSA	Distance along tape (m)	Burrow opening size (mm)	Checked with milliscope	Notes
T26	*Eucalyptus salmonophloia/ E. salubris* woodland	0		NA	
T27	*Eucalyptus salmonophloia/ E. salubris* woodland	45	small		
		43.6	big		cluster continues outside transect
		43.6	big	Yes	I.nigrum
		43.6	small		
		43.6	small		
		43.6	small		
		16.2	big		
		45.2	medium		
T33	*Eucalyptus loxophleba ssp. lissophloia*	2.6	medium		
		2.5	small		
		2.4	big		
		2.1	medium		
		49.9	big	Yes	I.nigrum
		49.9	big		
		14.3	medium		
		31.8	big		
		27.3	small		
		30.4	big		
		30.3	medium		
		30.1	medium		
		22.7	big		
		31.3	medium		
		20.6	small		
		20.6	small		
		16.7	medium		
		35.6	small		

Transect Number	VSA	Distance along tape (m)	Burrow opening size (mm)	Checked with milliscope	Notes
		14	big	Yes	I.nigrum
		14	small		
		13.4	small		
		14.3	small		
		10.9	medium		
		10.9	small		
T34	*Eucalyptus loxophleba ssp. lissophloia*	0		NA	
T35	Tammar on sand over shallow lateritic gravel	16.8			Gaius sp.
T36	Tammar on Sand over shallow lateritic gravel	0		NA	
T37	Smooth barked mallee on pale clay loam	0		NA	
T38	Smooth barked mallee on pale clay loam	0		NA	

Appendix 4. Locations of spiders found outside transects in Baandee Nature Reserve

Species	Easting	Northing
Gaius	589458.6	6528417
I.nigrum	589007.7	6528924
I.nigrum	588984.6	6528903
I.nigrum	589078.1	6528845
I.nigrum	589538.1	6528291
I.nigrum	589434.4	6528438
I.nigrum	589435.2	6528437