Pacific Highway Upgrade: Woolgoolga to Ballina

Threatened Glider Construction Phase Spring 2016 Monitoring Surveys Sections 3-11 (Glenugie to Ballina)

Sandpiper Ecological

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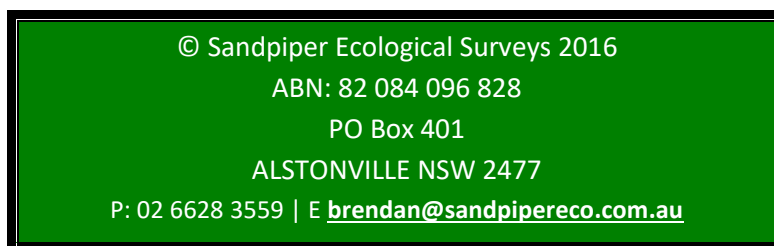Alstonville
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Cover Photo: Squirrel Glider (*Petaurus norfolcensis*) climbing the trunk of a scribbly gum (*Eucalyptus racemosa*).

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1.   Introduction

The Woolgoolga to Ballina (W2B) Pacific Highway Upgrade received State approval under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 24 June 2014 and the Federal approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 14 August 2014. The Threatened Glider Management Plan (TGMP) (RMS et al. 2015) was developed to meet the requirements of State Ministerial Condition of Approval (MCoA) D8 and components of MCoA D2. None of the glider species addressed in the plan are listed under the EPBC Act.

The TGMP identifies potential impacts of the upgrade on two threatened glider species - squirrel glider (*Petaurus norfolcensis*) and yellow-bellied glider (*P. australis*) (collectively referred to as 'threatened gliders'). Both species are listed as vulnerable by the NSW Threatened Species Conservation Act 1995 (TSC Act) and inhabit open forests and woodlands throughout the ranges and coastal areas of north-east NSW although the yellow-belled glider is largely absent from the highly fragmented alluvial floodplains and coastal heathlands. Numerous records of both species occur within 10km of the project alignment (RMS et al. 2015).

The TGMP proposes a number of mitigation measures aimed at ensuring the continued viability of squirrel glider (SqG) and yellow-bellied glider (YbG) populations in the project area. Such measures aim to:

- Minimise fragmentation and loss of habitat;
- Provide functional crossing opportunities (including crossing structures);
- Maintain connectivity for daily movements and gene flow;
- Minimise edge effects.

In order to assess the effectiveness of the proposed mitigation measures, the TGMP details a comprehensive monitoring program. A component of this program is glider population monitoring. The stated objective of glider population monitoring is:

> "To establish if there is a difference in occupational abundance of threatened gliders or activity levels before, during and after the project".

In order to achieve this objective, the TGMP states that population monitoring will occur at:

- Impact sites - mitigated sites such as widened medians and crossing structures within 100m of the road edge;
- Control sites - unmitigated sites within 100m of the road edge;
- Reference sites – sites >300m from the project.

The TGMP directs that baseline monitoring will occur before, during and after construction and that occupational abundance will be compared between these periods for impact, control and reference sites. Further, monitoring will be conducted every three months (four times annually) to sample for seasonal variability.

The current report refers to construction phase threatened glider baseline surveys conducted in Sections 3-11 (Glenugie to Ballina) carried out during Spring 2016. These surveys represent the first to be conducted during construction phase. Pre-construction baseline surveys within sections 3-11 were carried out over four seasons during 2015/16 and are reported on elsewhere (refer Sandpiper 2016).

1.1   Scope

Sandpiper Ecological was contracted by Roads and Maritime Services (RMS) in October 2016 to undertake spring 2016 threatened glider construction phase surveys at monitoring sites within Sections 3-11 of the W2B Pacific Highway upgrade. Monitoring sites occur within sections 3, 6 and 7 and are detailed in Table 1.

The scope for services included:

- Conduct construction phase surveys at mitigated/impact sites (20 transects), unmitigated/control sites (18 transects) and reference sites away from the road upgrade (10 transects) as described in the TGMP (Section 8) and reported on during baseline/pre-construction surveys (Sandpiper 2016);
- Complete two non-consecutive night surveys/transect during Spring 2016;
- Conduct yellow-bellied glider call playback followed by 30 minutes spotlighting for each survey;
- Record weather data and key habitat attributes, such as species flowering, during each survey.
- Submit draft report for review.

The following report presents results of construction phase threatened glider baseline surveys conducted during October/November 2016 within section 3, 6 and 7 of the W2B upgrade. The report includes a discussion of the results, particularly in relation to progress on mainline clearing.

Table 1: Location of impact, control and reference transects positioned in sections 3, 6 and 7 of the W2B Upgrade.

Section	Site Name	Transect ID	Approximate chainage at center of transect		
			Impact	Control	Reference
3	Glenugie South	GS-east	35700	34050	-
		GS-west	35700	34750	-
3	Glenugie North	GN-east	37050	38000	-
		GN-west	37050	38000	-
3	Glenugie Reference	G-r-north	-	-	35800
		G-r-south	-	-	33950
3	Tucabia South	TucS-east	48250	55250	-
		TucS-west	48250	55350	-
3	Tucabia Mid	TucM-east	-	63500	-
		TucM-west	-	61850	-
3	Tucabia North	TucN-east	54050	65300	-
		TucN-west	54050	65100	-
3	Tucabia Reference	Tuc-r-north	-	-	57900
		Tuc-r-south	-	-	57200
6	Mororo	Mor-east	99600	98500	-
		Mor-west	99600	98600	-
6	Mororo Reference	Mor-r-north	-	-	100100
		Mor-r-south	-	-	98100
6 & 7	Tabbimoble South	TabS-east	111350	101400	-
		TabS-west	111350	104550	-
7	Tabbimoble Mid	TabM-east	112350	113550	-
		TabM-west	112350	113550	-
7	Tabbimoble North	TabN-east	115950	114550	-
		TabN-west	115950	114550	-

7	Tabbimoble Veg Median	TabVM-east	117400	-	-
		TabVM-west	117400	-	-
7	Tabbimoble Land Bridge	TabLB-east	118850	-	-
		TabLB-west	118850	-	-
7	Tabbimoble Nature Reserve Reference	TabNR-r-nth	-	-	118700
		TabNR-r-sth	-	-	117300
7	Tabbimoble Double Duke State Forest Reference	TabDD-r-north	-	-	114750
		TabDD-r-south	-	-	114300
Total Transects			20	18	10

2. Methods

2.1 Study Area

The study area included sections 3, 6 and 7 of the W2B Pacific Highway upgrade, between Glenugie and Tabbimoble and habitat within 1km of the project alignment (impact and control sites) and habitat surrounding reference site areas up to 4km from the project alignment (Figures 1a-1g). The study area is located within the north coast bioregion and experiences a largely sub-tropical climate (NSW NPWS 2003).
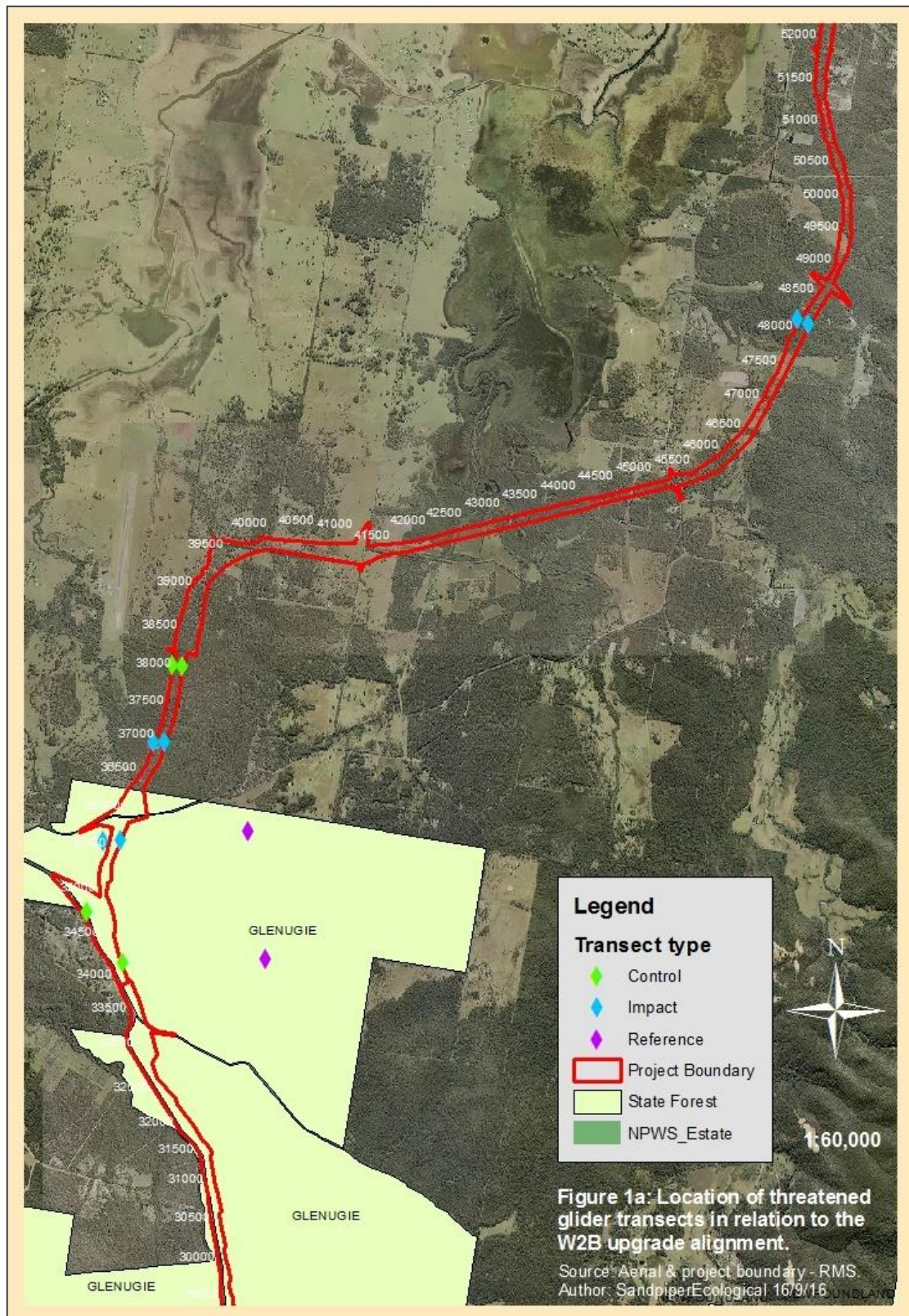
Figure 1a: Threatened glider impact, control and reference transects along sections 3-11 of the W2B Pacific Highway upgrade alignment.
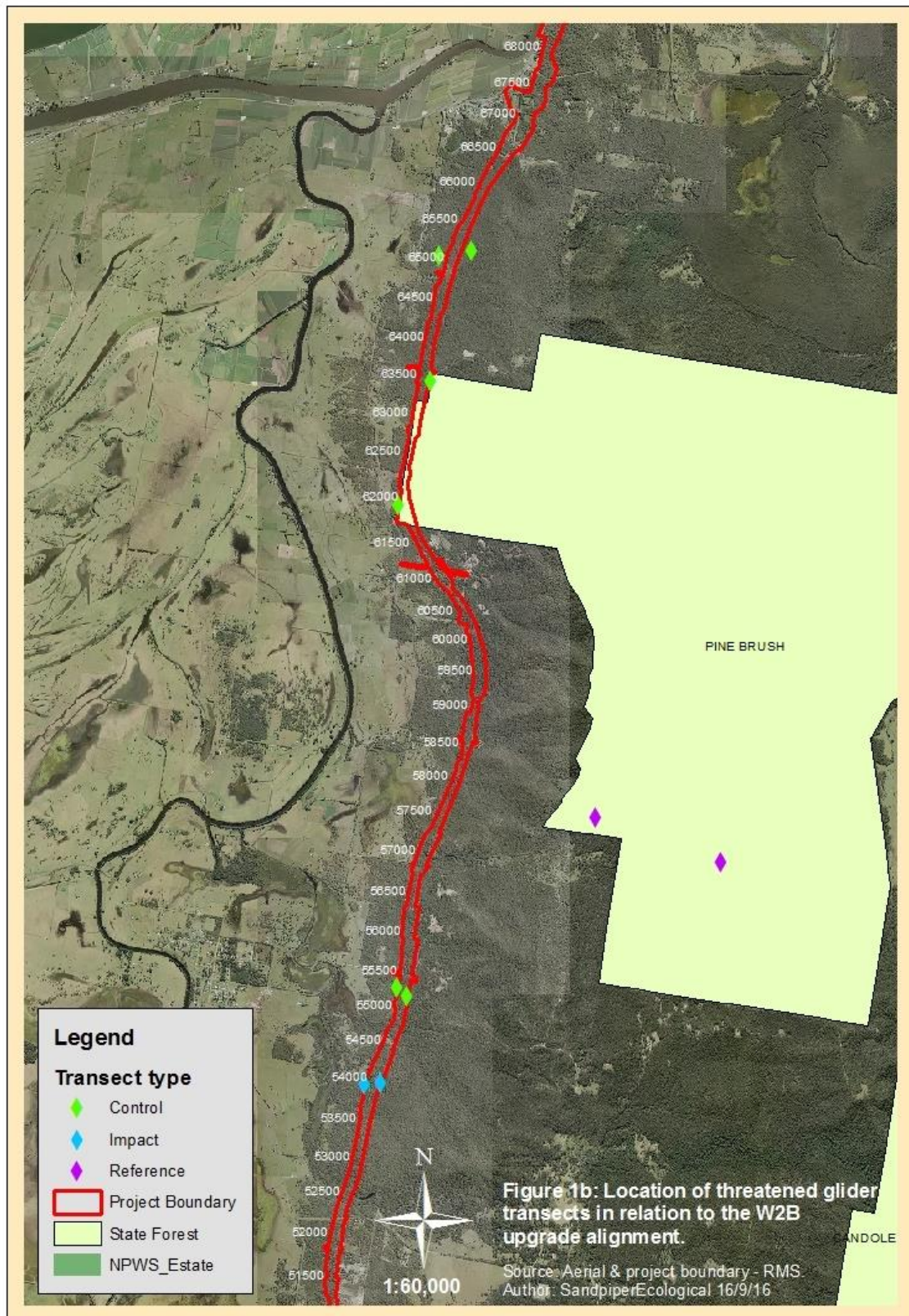
Figure 1b: Threatened glider impact, control and reference transects along sections 3-11 of the W2B Pacific Highway upgrade alignment.
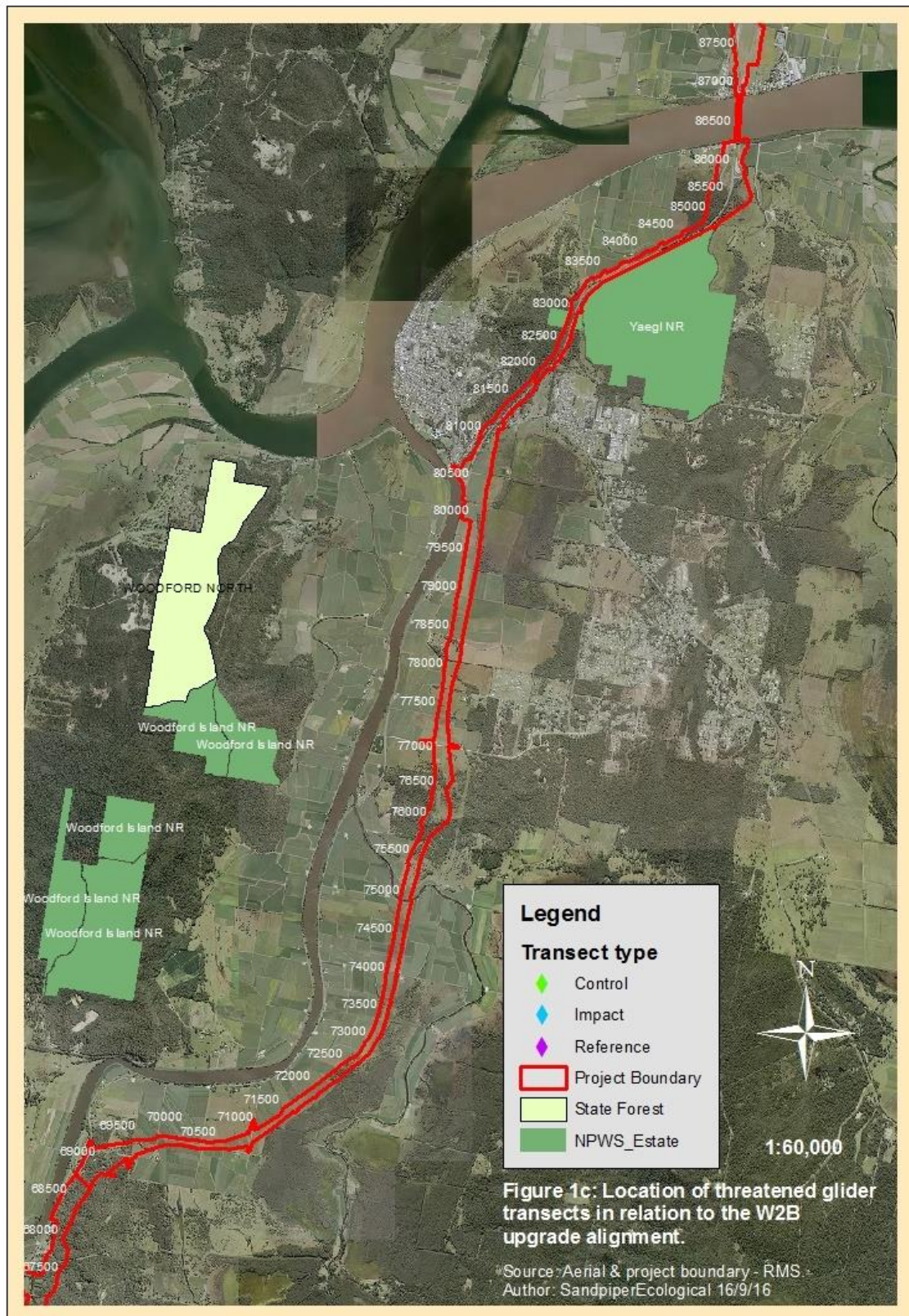
Figure 1c: Threatened glider impact, control and reference transects along sections 3-11 of the W2B Pacific Highway upgrade alignment.

Figure 1d: Threatened glider impact, control and reference transects along sections 3-11 of the W2B Pacific Highway upgrade alignment.
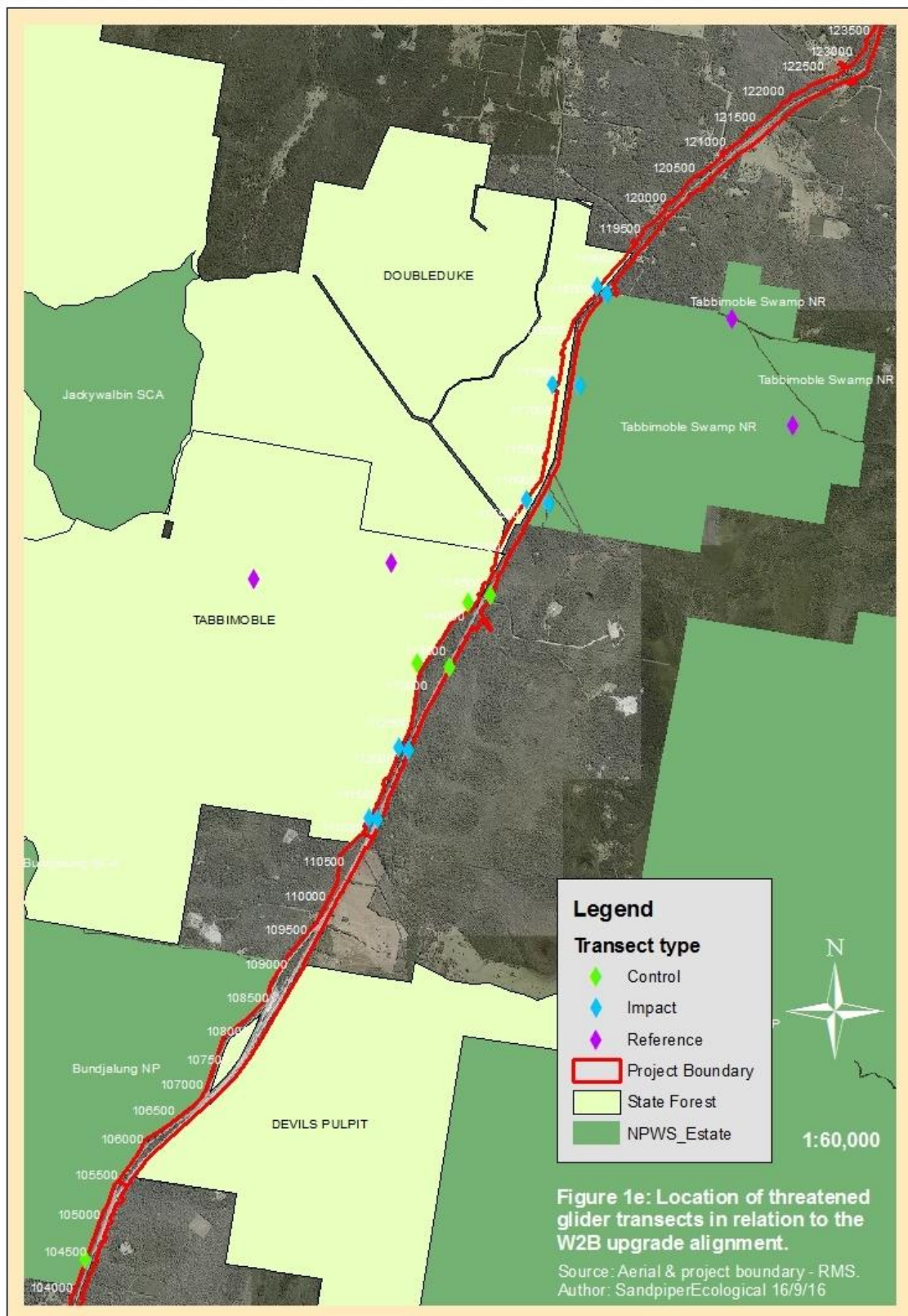
Figure 1e: Threatened glider impact, control and reference transects along sections 3-11 of the W2B Pacific Highway upgrade alignment.

Figure 1f: Threatened glider impact, control and reference transects along sections 3-11 of the W2B Pacific Highway upgrade alignment.
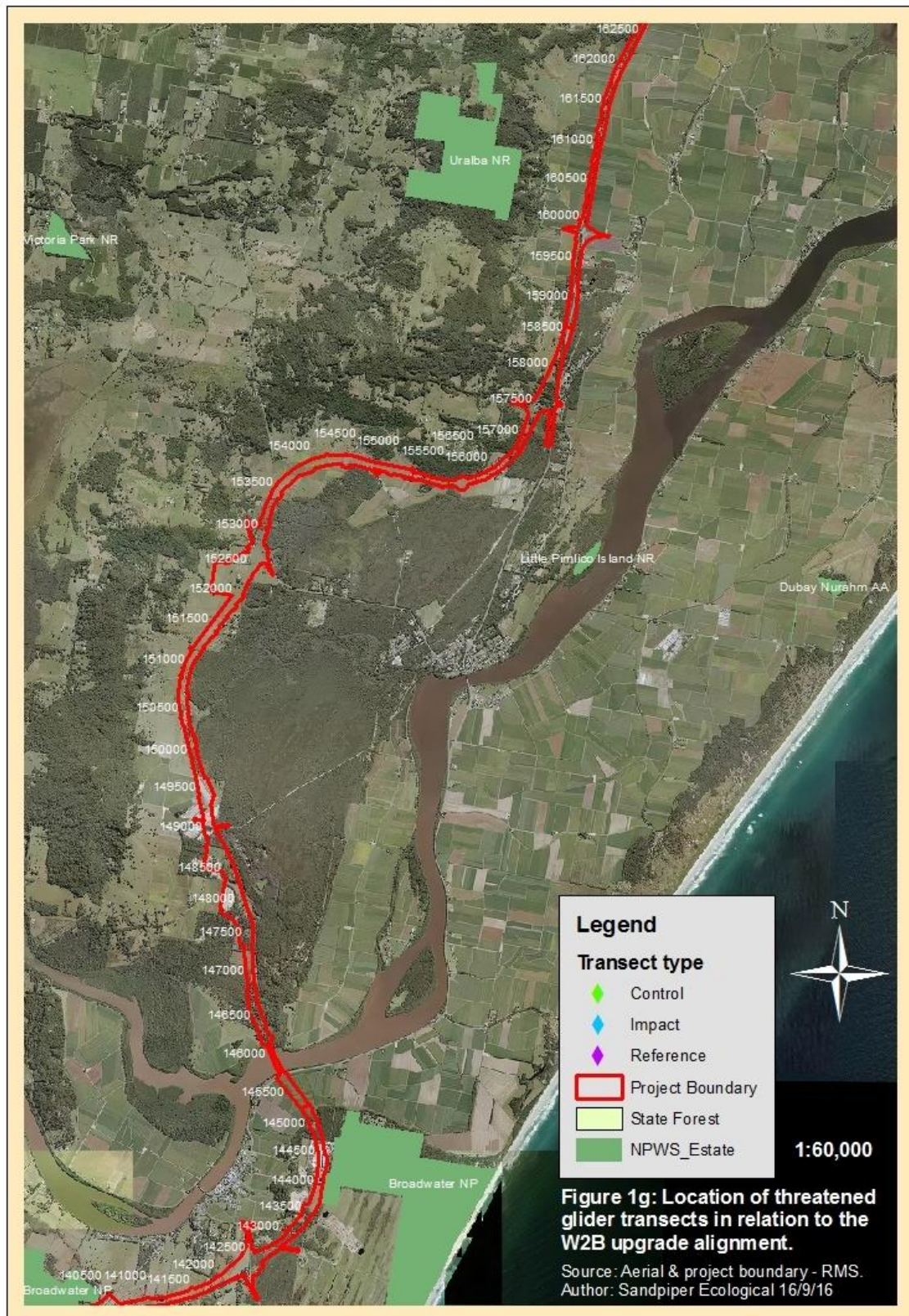
Figure 1g: Threatened glider impact, control and reference transects along sections 3-11 of the W2B Pacific Highway upgrade alignment.

2.2   Spotlight Surveys

Spotlight and call playback surveys were conducted on all transects from 24 October to 2 November 2016. Each transect was surveyed on two non-consecutive nights during the survey period. Two experienced ecologists conducted the surveys concurrently on nearby transects (i.e. one observer/transect) and the order and allocation of transects was rotated to avoid bias. GS-ie and GS-iw impact transects (adjacent Picaninny Creek, Glenugie) were not surveyed due to access restrictions.

Spotlight surveys were of 30 minutes' duration and preceded by YbG call playback. Playback included a five-minute listening period, five minutes of playback followed by spotlighting. Surveys began at least 45-60 minutes after sunset and were completed by 0100hrs Eastern Standard Time (EST). Surveys were conducted between third quarter and first quarter moon phases to avoid the period around the full moon. Weather conditions were fine during surveys with occasions of moderate winds during early evening. Full details of survey weather conditions and effort are provided in Table A1 Appendix A.

3.   Results

3.1   Arboreal Mammal Detections

Eight arboreal mammal species were detected across the 46 transects during the two spring surveys (Figure 2). A greater proportion of reference transects featured arboreal mammals (8 of 10 transects; 80%), followed by impact transects (13 of 18 transects; 72%) and control transects (11 of 18 transects; 61%). Feathertail glider (*Acrobates spp*.) was the most commonly detected species and was recorded on 15 transects (32.6% of all transects). It was followed by greater glider (*Petauroides volans*) on 12 transects (26.1%), squirrel glider (*Petaurus norfolcensis*) on nine transects (19.6%), common brushtail possum (*Trichosurus vulpecula*) on 8 transects (46%), common ringtail possum (Pseudocheirus peregrinus) on six transects (13%), sugar glider (*Petaurus breviceps*) on five transects (10.9%), yellow-bellied glider (*Petaurus australis)* on four transects (8.7%) and short-eared brushtail possum (*Trichosurus caninus*) on one transect (2.2%).

Most observations were of single individuals although some transects featured two or three individuals. The most individuals of a single species detected on a transect was five feathertail gliders recorded at Tabbimoble land bridge impact east (TabLB-ie), within the Tabbimoble Nature Reserve. Full details of spotlight surveys are provided in Table B1, Appendix B.
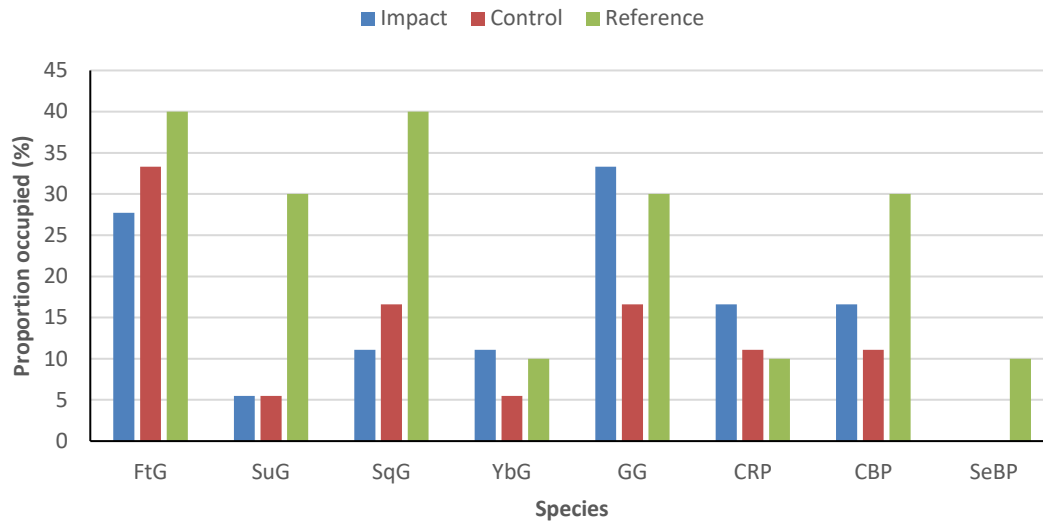
Figure 2: Proportion of impact, control and reference transects where arboreal mammal species were detected. Survey data pooled for two surveys. FtG = feathertail; SuG = sugar glider; SqG = squirrel glider; YbG = yellow-bellied glider; GG = greater glider; CRP = common ringtail possum; CBP = common brushtail possum; SeBP = short-eared brushtail possum.

3.2   Threatened Glider Detections

During the two spring surveys, SqG were detected on nine (19.6%) and YbG detected on four (8.7%) of the 46 transects (Table 2). Combined, either or both species of threatened glider were detected on 22.2% of impact and control transects and 50% of reference transects. The Glenugie area recorded the highest rate of detection with either or both species of threatened glider detected on 50% of eight transects, followed by Tucabia (41.7% of 12 transects), Tabbimoble (25% of 20 transects) and Mororo (16.7% of six transects). All detections were of single individuals except two SqG that were observed at Tucabia reference north (Tuc-rn).

Table 2: Threatened glider detections during two Spring 2016 surveys. YbG = yellow-bellied glider; SqG = squirrel glider. <u>Transect</u>: i = impact, c = control, r = reference; <u>Position</u>: e = east, w = west, n = north, s = south. * = possible squirrel glider

Transect Type & Name	SqG		YbG	
	Survey 1	Survey 2	Survey 1	Survey 2
Impact				
TabLB-ie	1	1		
TabLB-iw				
TabVM-ie				
TabVM-iw				
TabN-ie				
TabN-iw				1
TabM-ie				
TabM-iw			1	
TabS-ie				
TabS-iw				
Mor-ie				
Mor-iw				
TucN-ie				
TucN-iw				
TucS-ie				
TucS-iw				
GN-ie				
GN-iw	1*			
GS-ie	Not surveyed due to access restrictions			
GS-iw	Not surveyed due to access restrictions			
Control				
TabN-ce				
TabN-cw				
TabM-ce				
TabM-cw				
TabS-ce				
TabS-cw				
Mor-ce				
Mor-cw				
TucN-ce				
TucN-cw	1	1		
TucM-ce		1		
TucM-cw				
TucS-ce				
TucS-cw				
GN-ce				
GN-cw			1	1
GS-ce	1			
GS-cw				
Reference				
TabNR-rn		1		
TabNR-rs				
TabDD-rn	1			
TabDD-rs				
Mor-rn				
Mor-rs			1	
Tuc-r-n	2			
Tuc-r-s				
G-r-n				
G-r-s		1		

3.3   Threatened Glider Site Occupancy

Transects where YbG or SqG were detected during either of the two surveys have been scored as 'occupied' by that species for the spring 2016 construction phase survey. SqG occupied two (11.1%) of 18 impact transects, three (16.6%) of 18 control transects and four (40%) of 10 reference transects (Figure 3). By comparison, YbG occupied two (11.1%) of 18 impact transects, one (5.5%) of 18 control transects and one (10%) of 10 reference transects.

Figure 3: Impact, control and reference site occupation rates for yellow-bellied gliders (YbG) and squirrel gliders (SqG). Data are pooled for the two spring 2016 surveys.

3.4   Vegetation Clearing Progress and Fire

During the time of spotlight surveys, mainline vegetation clearing had only occurred near TabN-cw, in the vicinity of Glencoe Road, adjacent Tabbimoble State Forest. The limit of clearing was parallel to and approximately 30-40m to the east of the transect (Plate 1). A greater glider was observed during the second survey on that transect. It was located 40m to the west of the southern end of the transect.

Plate 1: At the time of the surveys, mainline clearing had only occurred adjacent one transect, TabN-cw, in the vicinity of Glencoe Road at the edge of Tabbimoble State Forest. Both plates show the 40m-wide forest strip remaining between the transect and mainline clearing.

Recent bushfires affected several impact, control and reference transects within Tabbimoble State Forest. Moderately intense fires evidently affected the mid to upper canopy of the entire TabS-iw and TabDD-rs transects (Plate 2). Two sugar gliders and a greater glider were detected on TabS-iw and no arboreal mammals were detected on TabDD-rs during spring 2016 spotlight surveys.

Evidence of less intense, patchy fire was apparent across TabN-cw, TabDD-rn, TabM-cw and TabM-iw, largely affecting up to the level of mid-canopy (Plate 3). Arboreal mammals were detected on all four of these transects, including a SqG on TabDD-rs and a YbG on TabM-iw.

Plate 2: Recent bushfires within Tabbimoble State Forest affected mid-upper canopy in places along TabS-iw (L) and TabDD-rs (R) transects.

Plate 3: A further four transects within Tabbimoble State Forest were affected by moderate, patchy bushfires which burnt up to the level of mid canopy along parts of the transect, including the eastern side of TabN-cw (above).

4. Discussion

4.1   Construction Phase Threatened Glider Site Occupancy

The current survey data represent the first season of construction phase surveys. As such, it requires the complement of a further three survey seasons (i.e. one year/four seasons) to enable meaningful comparison with pre-construction data and should, therefore, be regarded as an incomplete dataset. Indeed, based on the accumulation curve generated from the four seasons of baseline spotlight surveys, only 53% of transects featuring SqG detections and 73% of transects featuring YbG detections were recorded after two of the eight baseline surveys (Sandpiper 2016). For the current surveys, SqG were detected on nine (19.6%) and YbG detected on four (8.7%) of the 46 transects (Table 2) which is similar to the number of transect detections recorded during spring 2015 surveys (i.e. 8 and 4 respectively).

Occupation rates for the current surveys (i.e. impact / control / reference) were 11.1% / 16.6% / 40% for SqG and 11.1% / 5.5% / 10% for YbG. This compares to an overall pre-construction phase occupation rate of 35% / 33% / 60% for SqG and 30% / 17% / 20% for YbG (Figure 4). YbG shows a similar trend in occupation across site type between the current surveys and pre-construction with highest occupation rate for impact followed by reference and control. Similarly, SqG followed the trend of highest occupation rate for reference sites but occupation was next highest for control then impact sites. It is unlikely that this slight data anomaly for SqG is an artefact of construction phase activity, particularly as clearing was only occurring adjacent one transect. However, construction phase data may be somewhat confounded by the recent bushfires that affected six transects within Tabbimoble State Forest. Although these fires were evidently moderate, mid to upper canopy of the entire TabS-iw and TabDD-rs transects were affected. Little is known about the effect of wildfire on SqG and YbG although Quinn (1995) reported an increase in SqG mortality and dispersal after wildfire burnt through large areas of his study site. Lindenmayer *et al.* (2013) suggests that most arboreal marsupials will be adversely affected by wildfire, depending on its severity and extent. Possible impacts of the fires in Tabbimoble State Forest may become more apparent with subsequent surveys.
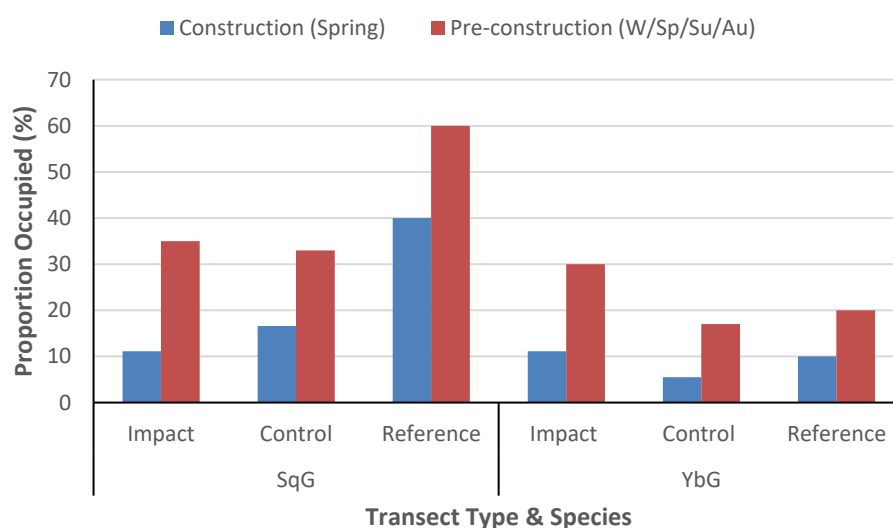
Figure 4: Comparison between impact, control and reference site occupation rates for SqG and YbG during the current construction phase (Spring) surveys and pre-construction (four seasons) baseline surveys. (Pre-construction data from Sandpiper 2016).

4.3   Other Arboreal Mammals

Six other species of arboreal mammal were detected across the 46 transects during the two surveys. Of particular note were continued records across transect types for greater glider. The greater glider was recently listed as Vulnerable by the Commonwealth *EPBC Act*. The records of these and other arboreal mammals will be useful in subsequent comparisons, particularly if they reveal similar population responses to the highway upgrade as SqG and YbG. Arboreal mammal records from impact sites will also assist in assessing use and effectiveness of crossing structures during the operational phase.

5.   Recommendations

1. Threatened glider occupation rates derived from section 1 and 2 surveys should be combined with occupation rate data from sections 3, 6 and 7 surveys to generate a more robust dataset with which to assess population responses to the highway upgrade.
2. Threatened glider records obtained during the clearing phase should be made available to parties completing the construction phase monitoring.

6.   References

Lindenmayer, D.B. Blanchard, W. McBurney, L. Blair, D. Banks, S.C. Driscoll, D. Smith, A.L. Gill (2013). Fire severity and landscape context effects on arboreal marsupials. *Biological Conservation* 167, 137-148

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W2BPA (2012). *Upgrading the Pacific Highway – Woolgoolga to Ballina Upgrade: biodiversity assessment - Final*. Report prepared for NSW Roads and Maritime Services.

Appendix A – Survey Effort and Weather Conditions

Table A1: Survey effort and weather data from spring 2016 construction phase monitoring surveys for threatened gliders in sections 3, 6 and 7 of the W2B upgrade.

Transect	Date	Order	Observer	Temp	Humidity	Cloud %	Wind	Rain	Moon	Start	Finish
TabLB-ie	27/10/16	2	BT	21	53	100	nil	last 24hr	3/4	2030	2101
	2/11/16	3	NP	19.1	75	50	nil	nil	0/4	2145	2215
TabLB-iw	27/10/16	2	NP	21	53	100	nil	last 24hr	3/4	2030	2101
	2/11/16	3	BT	19.1	75	50	nil	nil	0/4	2145	2215
TabNR-rn	27/10/16	1	NP	21	53	100	nil	last 24hr	3/4	1948	2020
	2/11/16	2	BT	19.8	66	50	nil	Nil	0/4	2104	2134
TabNR-rs	27/10/16	1	BT	21	53	100	nil	last 24hr	3/4	1948	2020
	2/11/16	2	NP	19.8	66	50	nil	Nil	0/4	2104	2134
TabVM-ie	27/10/16	3	BT	21.6	46	100	nil	last 24hr	3/4	2118	2150
	2/11/16	4	NP	19.1	75	50	nil	nil	0/4	2235	2305
TabVM-iw	27/10/16	3	NP	21.6	46	100	nil	last 24hr	3/4	2118	2150
	2/11/16	4	BT	19.1	75	50	nil	nil	0/4	2235	2305
TabN-ie	27/10/16	4	BT	21.6	46	100	nil	last 24hr	3/4	2158	2230
	2/11/16	1	NP	19.8	66	50	nil	Nil	0/4	2005	2035
TabN-iw	27/10/16	4	NP	21.6	46	100	nil	last 24hr	3/4	2158	2230
	2/11/16	1	BT	19.8	66	50	Nil	Nil	0/4	2005	2035
TabN-ce	26/10/16	7	BT	18.4	85	90	msb	nil	3/4	2433	o102
	1/11/2016	3	NP	21.8	94	90	msb	past 24h	O/4	2140	2212
TabN-cw	26/10/16	7	NP	18.4	85	90	msb	nil	3/4	2433	o102
	1/11/2016	3	BT	21.8	94	90	msb	past 24h	O/4	2140	2212
TabDD-rn	26/10/16	6	BT	18.4	85	90	msb	nil	3/4	2350	2421
	1/11/2016	2	NP	20.9	98	90	Nil	past 24h	O/4	2052	2125
TabDD-rs	26/10/16	6	NP	18.4	85	90	msb	nil	3/4	2350	2421
	1/11/2016	2	BT	20.9	98	90	Nil	past 24h	O/4	2052	2125
TabM-ce	26/10/16	5	BT	20.5	77	90	Msb	nil	3/4	2300	2332
	1/11/2016	6	NP	19.9	99	10	Still	Nil	o/4	2356	2428
TabM-cw	26/10/16	5	NP	20.5	77	90	Msb	nil	3/4	2300	2332
	1/11/2016	6	BT	19.9	99	10	Still	Nil	o/4	2356	2428
TabM-ie	26/10/16	4	BT	20.5	77	90	Msb	nil	3/4	2215	2247
	1/11/2016	5	NP	19.9	99	10	msb	Nil	o/4	2313	2344
TabM-iw	26/10/16	4	NP	20.5	77	90	Msb	nil	3/4	2215	2247
	1/11/2016	5	BT	19.9	99	10	msb	Nil	o/4	2313	2344
TabS-ie	26/10/16	3	BT	21.1	78	100	Msb	nil	3/4	2120	2150

	1/11/2016	4	NP	21.8	94	90	msb	past 24h	O/4	2226	2300
TabS-iw	26/10/16	3	NP	21.1	78	100	Msb	nil	3/4	2120	2150
	1/11/2016	4	BT	21.8	94	90	msb	past 24h	O/4	2226	2300
TabS-ce	26/10/16	2	BT	21.4	84	100	Still	nil	3/4	2030	2102
	1/11/2016	1	NP	21.8	94	90	msb	past 24h	O/4	1955	2026
TabS-cw	26/10/16	2	NP	21.4	84	100	Still	nil	3/4	2030	2102
	1/11/2016	1	BT	21.8	94	90	msb	past 24h	O/4	1955	2026
MOR-ie	25/10/16	6	BT	16.6	84	0	Still	nil	3/4	2405	2436
	27/10/16	5	NP	20.8	52	90	Msb	last 24hr	3/4	2259	2330
MOR-iw	26/10/16	1	NP	21.4	84	100	Still	nil	3/4	1943	2012
	31/10/16	6	BT	17.7	79	10	nil	nil	o/4	2445	115
MOR-ce	25/10/16	5	BT	17.3	75	0	Msb	nil	3/4	2312	2345
	27/10/16	6	NP	20.8	52	90	MLB	last 24hr	3/4	2345	2420
MOR-cw	26/10/16	1	BT	21.4	84	100	Still	nil	3/4	1943	2012
	31/10/16	6	NP	17.7	79	10	nil	nil	o/4	2445	115
MOR-rn	25/10/16	6	NP	16.6	84	0	Still	nil	3/4	2405	2436
	27/10/16	5	BT	20.8	52	90	Msb	last 24hr	3/4	2259	2330
MOR-rs	25/10/16	5	NP	16.6	84	0	Still	nil	3/4	2312	2345
	27/10/16	6	BT	20.8	52	90	MLB	last 24hr	3/4	2345	2420
TucN-ce	25/10/16	4	BT	17.3	75	0	Msb	nil	3/4	2205	2235
	31/10/16	5	NP	17.7	79	10	nil	nil	o/4	2329	2402
TucN-cw	25/10/16	4	NP	17.3	75	0	Msb	nil	3/4	2205	2235
	31/10/16	5	BT	17.7	79	10	nil	nil	o/4	2329	2402
TucM-ce	25/10/16	3	BT	17.3	75	0	Msb	nil	3/4	2109	2142
	31/10/16	4	BT	18.8	74	10	nil	nil	o/4	2240	2311
TucM-cw	25/10/16	3	NP	17.3	75	0	Msb	nil	3/4	2109	2142
	31/10/16	4	BT	18.8	74	10	nil	nil	o/4	2240	2311
Tuc-r-n	24/10/16	6	BT	11.8	83	10	Still	nil	3/4	O101	o131
	31/10/16	1	NP	19.9	72	50	mlb	Nil	o/4	1950	2022
Tuc-r-s	24/10/16	6	NP	11.8	83	10	Still	nil	3/4	O101	o131
	31/10/16	1	BT	19.9	72	50	mlb	Nil	o/4	1950	2022
TucS-ce	25/10/16	2	BT	20.4	61	0	Msb	nil	3/4	2014	2048
	31/10/16	2	NP	18.8	74	10	nil	nil	o/4	2050	2122
TucS-cw	25/10/16	2	NP	20.4	61	0	Msb	nil	3/4	2014	2048
	31/10/16	2	BT	18.8	74	10	nil	nil	o/4	2050	2122
TucN-ie	25/10/16	1	BT	20.4	61	0	Still	nil	3/4	1937	2006
	31/10/16	3	NP	18.8	74	10	nil	nil	o/4	2140	2212
TucN-iw	25/10/16	1	NP	20.4	61	0	Still	nil	3/4	1937	2006
	31/10/16	3	BT	18.8	74	10	nil	nil	o/4	2140	2212
TucS-ie	24/10/16	5	BT	12.5	82	10	Msb	nil	3/4	2412	2445
	30/10/16	1	NP	21.4	84	80	MLB	nil	0/4	1958	2030
TucS-iw	24/10/16	5	NP	12.5	82	10	Msb	nil	3/4	2412	2445
	30/10/16	1	BT	21.4	84	80	MLB	nil	0/4	1958	2030

GN-ce	24/10/16	3	BT	15.5	75	10	Msb	nil	3/4	2138	2210
	30/10/16	2	NP	22.9	72	80	MLB	nil	0/4	2110	2142
GN-cw	24/10/16	3	NP	15.5	75	10	Msb	nil	3/4	2138	2210
	30/10/16	2	BT	22.9	72	80	MLB	nil	0/4	2110	2142
GN-ie	24/10/16	4	BT	15.5	75	10	Msb	nil	3/4	2225	2259
	30/10/16	3	NP	22.9	72	80	MLB	nil	0/4	2200	2232
GN-iw	24/10/16	4	NP	15.5	75	10	Msb	nil	3/4	2225	2259
	30/10/16	3	BT	22.9	72	80	MLB	nil	0/4	2200	2232
GS-ie		Not surveyed due to access restrictions									
GS-iw		Not surveyed due to access restrictions									
GS-ce	24/10/16	2	BT	16.5	63	20	Msb	nil	3/4	2045	2118
	30/10/16	4	NP	19.9	79	70	msb	nil	0/4	2516	2448
GS-cw	24/10/16	2	NP	16.5	63	20	Msb	nil	3/4	2045	2118
	30/10/16	4	BT	19.9	79	70	msb	nil	0/4	2516	2448
G-r-n	24/10/16	1	BT	16.5	63	20	Msb	nil	3/4	1948	2018
	30/10/16	5	NP	19.9	79	70	msb	nil	0/4	2327	2359
G-r-s	24/10/16	1	NP	16.5	63	20	Msb	nil	3/4	1948	2018
	30/10/16	5	BT	19.9	79	70	msb	nil	0/4	2327	2359

Appendix B – Baseline Survey Fauna Detections

Table B1: Results of Spring 2016 spotlighting and call playback on monitoring transects in sections 3, 6 & 7 of the W2B upgrade. YbG = yellow-bellied glider; SqG = squirrel glider; SuG = sugar glider; GG = greater glider; FtG = Feathertail Glider; CBP = common brushtail possum; SeBP = short-eared brushtail possum; CRP = common ringtail possum; PO = powerful owl; MO = masked owl; BB = boobook owl; ON = owlet nightjar; WtN = white-throated nightjar; TF = tawny frogmouth; GhFF = grey-headed flying fox; LRFF = little red flying fox. HM = heard movement, HC = heard call; HL = heard glide-land on tree; SE = saw eyeshine; SG = saw glide; SM = saw movement. Easting/Northing = center point of transect.

Transect	Date	Fauna	Comments	Flowering	Clearing progress and Fire	Easting	Northing
TabLB-ie	27/10/16	SqG, FtG x2	SqG: se&450n10e, FtG x2:sm@300n20w	Red mahog	nil	527582	6773203
	2/11/16	SqG, SqG/SuG, FtGx5, GHFF	SqG: HC@400s0 FtGx5:SM@400-500s5w, SqG/SuG: SE@450s5w				
TabLB-iw	27/10/16	GG, FtG, GHFF	GG:se@400n10e, FtG:sm@100n5e	Red mahog	nil	527452	6773308
	2/11/16	GG, FtG, GHFF	GG: SE@500n30e, FtG: sm@250n20e	Nbk stringybark			
TabNR-rn	27/10/16	ONj		nil	na	529178	6772891
	2/11/16	SqG, ONj	HM@500s20w;				
TabNR-rs	27/10/16	ONj		nil	na	529960	6771525
	2/11/16	GG, FtG, WtNj, ONj	GG; se@50s30e, FtG: SM@400s10e				
TabVM-ie	27/10/16	Nil		red mahog	Nil	527232	6772031
	2/11/16	ONj					
TabVM-iw	27/10/16	Nil		red mahog	Nil	526888	6772045
	2/11/16	Nil					
TabN-ie	27/10/16	Nil		i bk	Nil	526826	6770530
	2/11/16	ONj					
TabN-iw	27/10/16	Nil		red mahog	Nil	526550	6770577
	2/11/16	YBG, FTG	YBG: HC@10s70w, FtG: SM@250s10e	Ibk			
TabN-ce	26/10/16	nil		wh mahog	nil	526094	6769344
	1/11/2016	nil					
TabN-cw	26/10/16	nil		T wood, I bk	Cleared on E side of tsect to 40m away; fire burnt up to mid story W side of tsect	525803	6769255
	1/11/2016	GG	Se400s40w				
TabDD-rn	26/10/16	SqG, GG, SuG x3	SqG. Se@250n5e; GG. Se@40n50e; SuGx3: Se@200n 20w(den tree)	wh mahogany	nil; fire burnt up to mid story E side of tsect	524826	6769767

	1/11/2016	ONj					
TabDD-rs	26/10/16	Nil			nil; fire burnt up to mid-upper story of full tsect	523057	6769560
	1/11/2016	ONj					
TabM-ce	26/10/16	nil		wh mahog	nil	525557	6768428
	1/11/2016	nil					
TabM-cw	26/10/16	Nil			nil; fire burnt up to mid story W side of tsect	525151	6768474
	1/11/2016	CBP x2	Se.300s3e				
TabM-ie	26/10/16	GG	se@450n50e	red mahog: I bk, spot gum	nil	525033	6767369
	1/11/2016	GG	se400n2w				
TabM-iw	26/10/16	YbG	hc@150n40w	wh mahog	nil; fire burnt up to mid story of full tsect	524907	6767395
	1/11/2016	Nil					
TabS-ie	26/10/16	nil			Nil	524651	6766470
	1/11/2016	CRP	Se400n7e				
TabS-iw	26/10/16	SuG x2; GG	SuG:hc @40s5w &sm @400n5w; GG:se@450n0w		nil; fire burnt mid-upper story of full tsect	524533	6766500
	1/11/2016	Nil					
TabS-ce	26/10/16	FtG	sm@350n5w	ibk, t'wood	nil	521327	6757919
	1/11/2016	ONj					
TabS-cw	26/10/16	Nil			nil	520905	6760849
	1/11/2016	FtG x2	sm5n5w&490n10e				
MOR-ie	25/10/16	FtG	sm400n20w	twood, i Bk	nil	522418	6756590
	27/10/16	CRP	se@100n5w				
MOR-iw	26/10/16	nil		ibk, t'wood	nil	522276	6756457
	31/10/16	Nil					
MOR-ce	25/10/16	FtG x2, GHFF	sm@250n10W &20n10e	grey ibk	nil	522970	6755546
	27/10/16	nil					
MOR-cw	26/10/16	nil		ibk, t'wood	nil	522700	6755572
	31/10/16	CRP	se180n10w				
MOR-rn	25/10/16	Nil			NA	523152	6757392

	27/10/16	CBP	se@100s20w				
MOR-rs	25/10/16	YbG, SuG, ONj, GHFF	YbG: hc@450n60e, SuG:hc@sm@450n40w	grey ibk , spot gum, wh mahog	NA	524147	6755441
	27/10/16	SuG, GG, FtG	SuG:se100n40w; GG:se450n50e; FtG: sm 50n10e				
TucN-ce	25/10/16	ONj			nil	513756	6727507
	31/10/16	ONj					
TucN-cw	25/10/16	SqG	hc@40n10w		nil	513342	6727435
	31/10/16	SqG, CRP, ONj	SqG:hm100n10w, CRP:se50n40e				
TucM-ce	25/10/16	ONj			Nil	513240	6725830
	31/10/16	SqG, CBP	SqG: hc350n40e, CBP:se5n10w				
TucM-cw	25/10/16	ONj			nil	512830	6724245
	31/10/16	Nil					
Tuc-r-n	24/10/16	SqG x2; FtG; WtNj, ONj	SqG: hc@10n30e & 350n40w; FtG: sm@300n15w		NA	515344	6720259
	31/10/16	ONj, WtNj					
Tuc-r-s	24/10/16	SuG, ONj	hc@450e50n		NA	516956	6719676
	31/10/16	SeBP, CBP x2	SeBP: se10n40w, CBP:se250n5e	ibk			
TucS-ce	25/10/16	Nil			Minor tracks	512932	6717966
	31/10/16	ONj					
TucS-cw	25/10/16	ONj			Minor tracks	512812	6718078
	31/10/16	ONj					
TucN-ie	25/10/16	ONj; WtNj			Minor tracks	512595	6716859
	31/10/16	PO					
TucN-iw	25/10/16	FtG	Hl@300n2w	Ibk	Minor tracks	512402	6716841
	31/10/16	nil					
TucS-ie	24/10/16	CRP, BbO			0.5ha at track xroad	511823	6711239
	30/10/16	GG	se450s15w				
TucS-iw	24/10/16	GG, ONj	se@400s5w	twood	0.5ha at track xroad	511679	6711293
	30/10/16	CBP x2	se250s20w				
GN-ce	24/10/16	FtG	sg@450s20w	I bk	Nil	503802	6706855
	30/10/16	GG	se350s15w				

GN-cw	24/10/16	YbG, FtG, TF, SuG	YbG:hc@350s30w, FtG:sg @250s5w; SuG: hm@550s5w	I bk	Nil	503680	6706878
	30/10/16	YbG, GG	YbG: hc150s50w; GG:se200s10e				
GN-ie	24/10/16	CBP x3	se@300n20e,400n10e(x2)	I bk	Nil	503577	6705891
	30/10/16	GHFF					
GN-iw	24/10/16	SuG/SqG	se@100s5e	I bk	Nil	503440	6705889
	30/10/16	CBP, GG	GG:se200s30w; CBP:se100s40w				
GS-ie						503004	6704630
GS-iw						502783	6704623
GS-ce	24/10/16	SqG; GHFF	hm@450n20e		Nil	503049	6703073
	30/10/16	FtG, ONj	sg450n10w				
GS-cw	24/10/16	GHFF			Nil	502577	6703722
	30/10/16	GHFF					
G-r-n	24/10/16	WtNj		B-l ibk	NA	504645	6704742
	30/10/16	GHFF					
G-r-s	24/10/16	CRP x2; FtG; ONj; WtNj	CRP: se@250n20e; FtG:sg@50n10e	B-l ibk	NA	504872	6703121
	30/10/16	SqG, CBP x2	SqG: se400Mn30w(Forage flwr ibk); CBP: se200n40e				