Pacific Highway Upgrade: Woolgoolga to Halfway Creek.

Progress Report: Nest Box Monitoring – Year 1 – Summer 2016.

Version 2 - Final Report

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Cover Photo: Feathertail gliders in a plywood scansorial nest box.

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1. Introduction

1.1 Background

The Woolgoolga to Halfway Creek (W2HC) Pacific Highway Upgrade extends from the northern limit of the Sapphire to Woolgoolga Pacific Highway upgrade north for 14 kilometres to the southern extent of the Halfway Creek Pacific Highway upgrade. The alignment follows the existing highway in the south and north and deviates over the Corindi Floodplain and through Dirty Creek Range in the central section. W2HC forms section 1 of the 11 staged sections of the Woolgoolga to Ballina (W2B) upgrade.

Included in the W2B upgrade Ministerial Conditions of Approval (MCoA) was a requirement to prepare a Nest Box Management Plan (NBMP) to assist in managing displacement of hollow-dependent fauna (MCoA D6). The NBMP for the W2HC section was prepared by Biosis and approved in 2014. The primary objective of the W2HC NBMP is to outline measures to mitigate the impacts of vegetation clearing on hollow-dependent fauna (HDF). In so doing, it provides "guidance on the provision of nest boxes as a compensatory mechanism for the loss of habitat trees within the clearing area, inclusive of den, roosting and nesting resources" (Biosis, 2014). The NBMP directs that 70% of required nest boxes (i.e. 70% allocation) be installed prior to completion of the clearing phase of the project and that monitoring of these boxes should occur during summer and winter shortly after the installation period. Installation of the 70% allocation was completed in November 2015 and mainline clearing completed in December 2015.

In January 2016 Sandpiper Ecological Surveys (Sandpiper) was contracted by Pacific Complete to conduct a summer 2016 inspection of the 70% nest box allocation installed along the W2HC upgrade. The following report presents background information on the installation process, inspection methods and results of the inspection conducted during February 2016. The report discusses the implications of the results and proposes a number of management recommendations.

1.2 Nest Box Types

Prior to nest box installation, the NBMP was reviewed to determine the type of boxes required and installation sites. Upon review it was noted that the plan recommended installation of 22 boxes for common planigale (Planigale maculata) and 15 boxes for eastern pygmy possum (Cercartetus nanus). Common planigale is not an arboreal species and would not benefit from installation of nest boxes. Eastern pygmy possum is unlikely to occur in the study area due to a lack of suitable habitat. Although the Bionet database contains some local records of EPP the species is regarded as very rare in coastal northern NSW (Bowen & Goldingay 2000).

Concern regarding the designated target species was discussed with Roads and Maritime Services (RMS) and it was agreed that boxes designated for common planigale would target feathertail glider (Acrobates spp), *Antechinus* spp and microbats, whilst the eastern pygmy possum boxes would target that species if suitable habitat was present but would otherwise target the aforementioned species. Suitable habitat for eastern pygmy possum was regarded as Dry Eucalypt forest with a heath understorey dominated by *Banksia*, *Callistemon* and *Hakea* spp. The final number, type, dimensions and material of the 70% nest box allocation installed are described in Table 1.

Table 1: Number, type and dimensions of the 70% nest box allocation installed adjacent the W2HC upgrade. # = Chamber depth is floor to base of entrance hole. Box material: P = plywood; M = metal; H = hardwood.

Box Type	Inside Measurements	Chamber Depth #	Entrance Diameter	Box Material			Total Boxes
				Plywood	Metal	Hardwood	
Sugar/squirrel glider	150 x 250	300	45	11	6	0	17
Yellow-bellied glider	250 x 350	400	80	6	2	0	8
Brushtail/ringtail possum	250 x 200	300	85	6	6	0	12
Microbat	20 slot	400	30 hole	5	0	0	5
Scansorial small (Antechinus)	150 x 150	200	30	14	4	0	18
Scansorial small (Feathertail glider)	150 x 150	200-300	30	9	3	0	12
Scansorial small (Eastern pygmy possum)	150 x 150	300	30	1	1	0	2
Scansorial large (Brush-tailed phascogale)	150 x 200	300	50	10	8	0	18
Quoll	500 x 500	800	200	4	3	0	7
Cockatoo	300 x 400	1200	200	3	2	0	5
Masked Owl	250 x 300	500	100	2	1	0	3
Powerful Owl	500 x 500	800	200	3	1	0	4
Lorikeet	150 x 150	350	55	0	3	3	6
Treecreeper	150 x 150	350	60	0	2	14	16
Total				74	42	17	133

1.3 Installation Sites

The NBMP divided the alignment into 36 zones and identified a small number of private properties where access agreements had been finalised. Forests NSW provided consent to install boxes within 50m of the upgrade alignment in Wedding Bells and Newfoundland State Forests and the National Parks and Wildlife Service approved the installation of boxes in Yuraygir State Conservation Area. Whilst the abovementioned areas are suitable for nest boxes the number of boxes that could be installed in each area was dictated by the NBMP. There was limited opportunity to identify additional private properties prior to installation despite this being preferred by the installation team. Approval to install boxes on private property within 50m of the alignment was obtained between chainages 5500 and 6000.

In zones where there was no access to private or public land nest boxes were installed in the road reserve, which is not ideal. The road reserve typically lacks a variety of installation sites and boxes tend to be situated close to the carriageways where they are affected by noise and light. Installing boxes on the western side of the carriageway is constrained by light spill from southbound traffic.

Nest box installation zones were grouped into three Nest Box Installation Areas (NBIA) – south, middle, north (Figure 1a, 1b, 1c). The NBIA graded from floodplain (south) to foothills of Dirty Creek Range (middle) to Dirty Creek Range (north). The extent and number of nest boxes within each NBIA is detailed in Table 2.

Table 2: Location and landscape features of Nest Box Installation Areas (NBIA).

Nest Box Installation Area (NBIA)	Nest Box Zones	Chainage	No. of boxes	Landscape Type	ASL (m)
South	36-27	0-5000	41	Floodplain	8 - 25
Middle	25-21	5000-8000	39	Foothills	31 - 61
North	18-3	8000-17000	53	Range	69 - 154

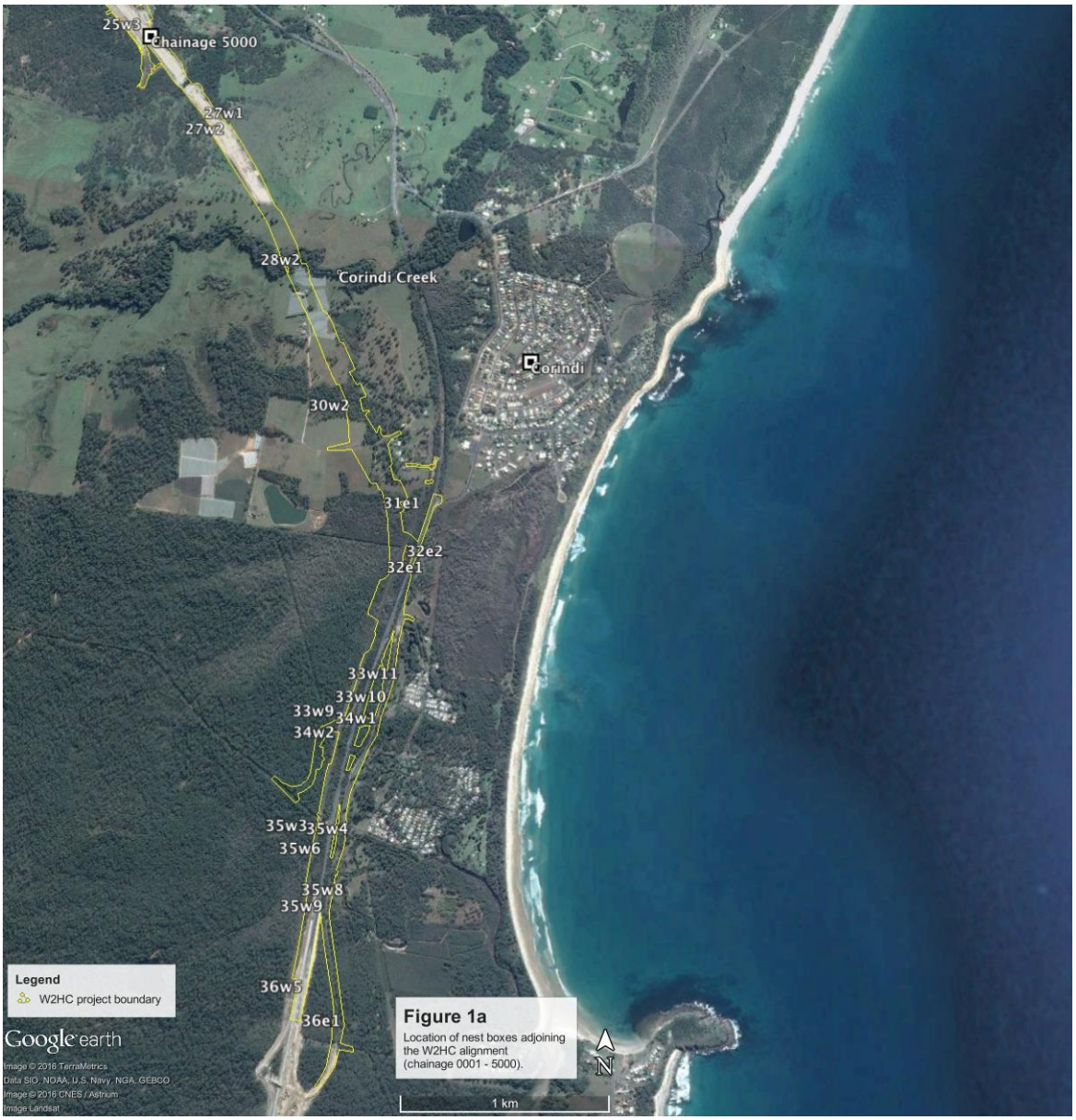

Figure 1a. Location of nest box zones within Nest Box Installation Area south (chainage 0-5000).

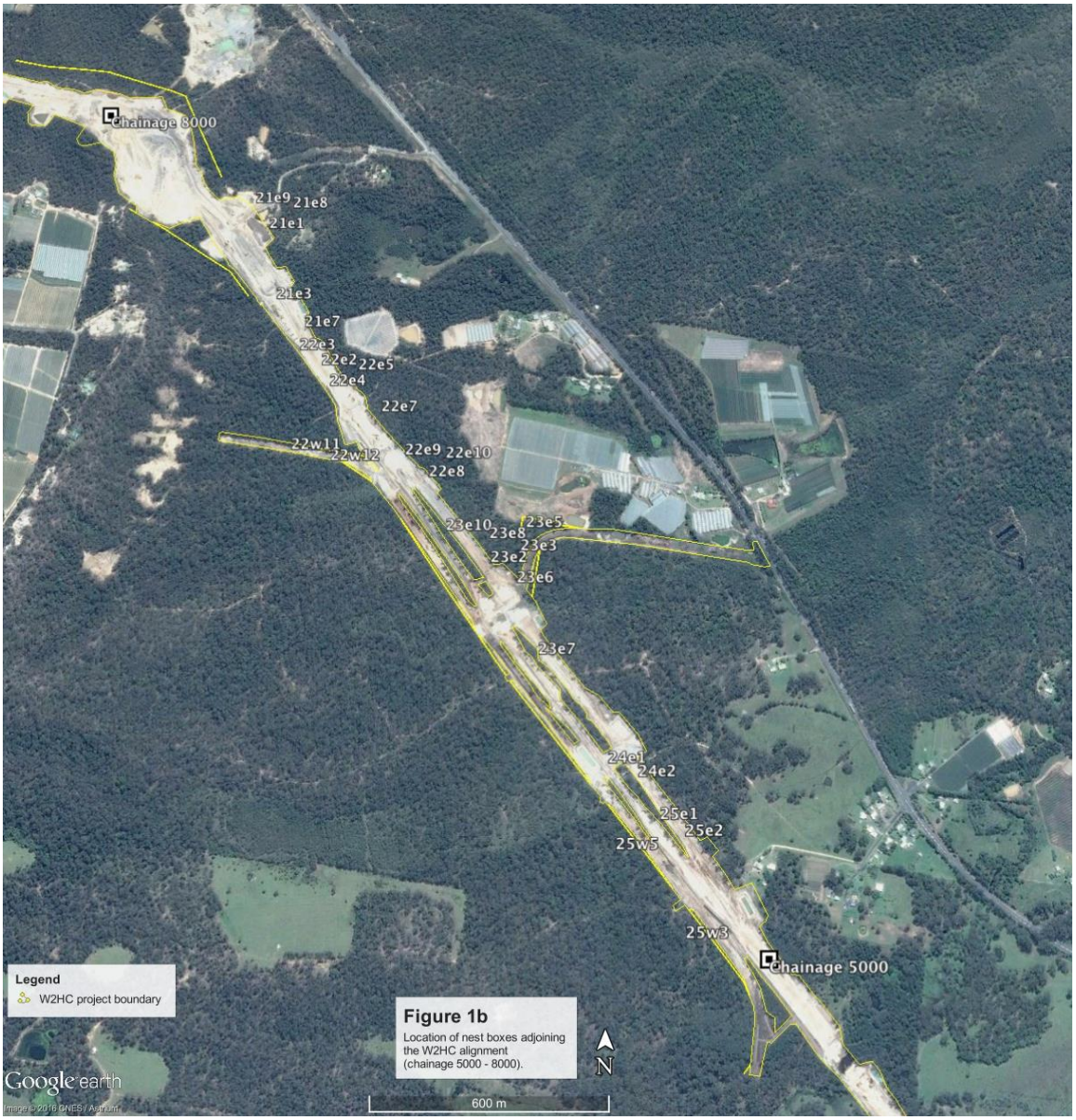

Figure 1b. Location of nest box zones within Nest Box Installation Area middle (chainage 5000-8000).

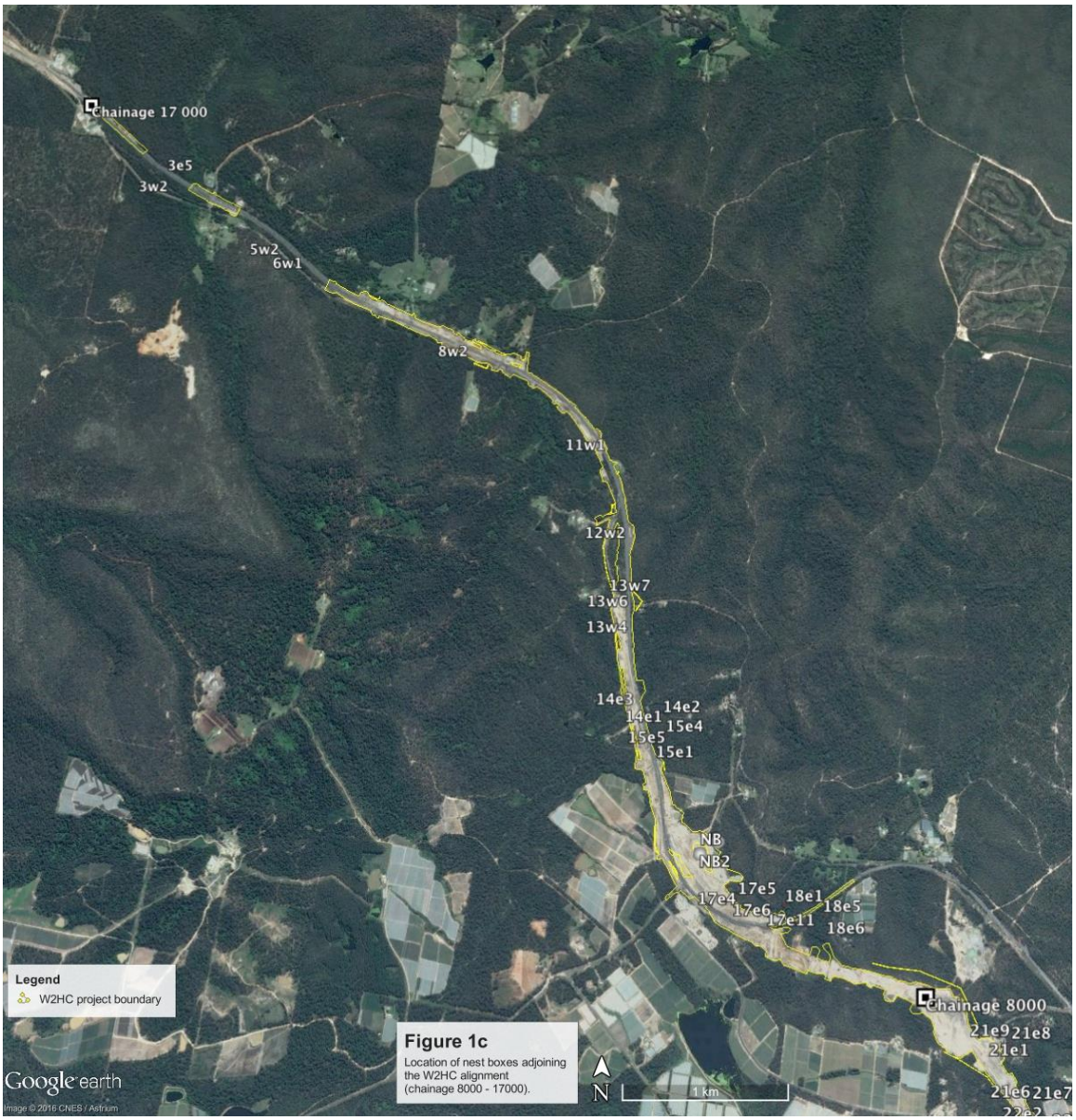

Figure 1c. Location of nest box zones within Nest Box Installation Area north (chainage 8000-17000).

1.4 Box Installation

An ecologist selected nest box trees and the location of the box within each tree (i.e. height and orientation). Each tree was marked with tape and its location logged using a handheld GPS. Critical data such as box type, installation height, orientation and box number was recorded on the tape and onto an iPad. Other data recorded included tree species and installation date. Tree climbers installed all nest boxes. Boxes were installed during three periods, 5-8 May 2015 (prior to clearing), 27 and 28 August 2015 (during clearing) and 10 November 2015 (during clearing).

2. Methods

2.1 Nest Box Inspections

Year one construction phase summer nest box inspections were carried out between 16 -19 February 2016. One hundred and thirty-three boxes were inspected during the period. Inspections were conducted by a team of two ecologists. Each box was initially inspected visually from the ground with binoculars to determine its condition followed by inspection of the box contents using a GoPro Hero3 camera mounted to a telescopic extension pole. Boxes installed above 8m (n = 26) were inspected by tree climbers with the GoPro camera. Images from the GoPro camera were wirelessly streamed to an iPad and a photo(s) of the box contents was recorded. The data recorded for each nest box included: species present, number of individuals, age (juvenile or adult), signs e.g. nesting/denning material, scats, hair and condition of box and supporting wire.

Identification of fauna was based on the ecologist's experience with reference to standard field guides (e.g. Menkhorst & Knight 2004; Churchill 2008; Tyler & Knight 2009) as required. With the exception of some insectivorous bats, most fauna can be confidently identified from viewing photographs/video footage. The identification of fauna signs was based on previous experience of nest characteristics of hollow dependent fauna (HDF) and published information. Where there was sufficient evidence, such as distinct nests/denning material, a probability rating of possible (60-75% certainty), probable (75-90% certainty) or definite (>90% certainty) was assigned to the likely fauna species.

3. Results

3.1 Use of Nest Boxes

Five vertebrate species were observed occupying nest boxes during the 2016 summer inspection and a further three species were probable users based on nesting evidence (Table 3; Table A1, Appendix A). Common brushtail possum (Trichosurus vulpecula) was the most common species occupying boxes and were recorded in possum, quoll and yellow-bellied glider boxes. Squirrel glider (Petaurus norfolcensis) and feathertail glider (Acrobates pygmaeus) were the next most commonly detected species and each occurred in two boxes (Plates 1 & 2). Squirrel glider is listed as vulnerable by the NSW *Threatened Species Conservation Act* (*TSC* Act) 1995. Both squirrel glider and feathertail glider occupants featured juveniles, though exact numbers could not be determined. Squirrel gliders occupied a squirrel/sugar glider box and

a large scansorial box. Both feathertail glider observations occurred in small scansorial boxes with one box containing nine individuals (Plate 1). The single record of a sugar glider (Pet. breviceps) was of an individual exiting a large scansorial box prior to inspection with the pole camera. The only reptile observation was of a brown tree snake (Boiga irregularis). It was observed in a metal cockatoo box lying on a probable yellow-bellied glider or greater glider leaf nest (Plate 2).

Table 3: The number and type of nest boxes occupied and/or showing evidence of use during inspections conducted in summer 2016. Qu = Quoll; Tc = Treecreeper; ScS = Scansorial Small (i.e. feathertail, eastern pygmy possum, antechinus); ScL = Scansorial Large (i.e. brush-tailed phascogale); SS = SqG/SuG glider; MO = Masked Owl; Ct = Cockatoo; Po = Brushtail/Ringtail Possum; Yb = Yellow-bellied Glider; Lo = Lorikeet; ^ = juveniles present. Likelihood of use based on evidence were all scored as 'probable'.

Species/Group	No. occupied (total individuals)	No. with evidence of use	Box type used
Antechinus sp.		3	ScS=2; MO=1
Common brushtail possum	3 (3)		Po=1; Qu=1; Yb=1
Brushtail possum sp.		1	Po=1
Feathertail glider	2 (10^)	14	ScS=7; ScL=4; SS=2; Lo=1; Tc=1; Po=1
Sugar glider	1 (1)		ScL=1
Squirrel glider	2 (7^)		SS=1; ScL=1
Sugar/squirrel glider		7	SS=3; ScL=1; Tc=2; Lo=1
Yellow-bellied glider/ Greater glider		4	Ct=3; Yb=1
Brown tree snake	1 (1)		Ct=1
Owlet nightjar		1	Po=1
Unidentified vertebrate		1	Tc=1
European bees	*1*		*SS=1*
Ants	*5*		*ScS=2; ScL=2; Tc=1*
Total vertebrate use	9 (22)	31	40
Proportion used by vertebrates (total boxes = 133)	6.8 %	23.3 %	30.1 %

Plate 1: Squirrel gliders were observed in large scansorial and squirrel boxes (L). Feathertail gliders often den in large family groups, including nine individuals observed in a small scansorial box (R).

Plate 2: Individual common brushtail possums were observed in yellow-bellied glider, possum and quoll nest boxes (left). A brown tree snake was observed on a probable yellow-bellied glider/greater glider nest within a metal cockatoo box (R).

In addition to occupied boxes, a further 23.3% of boxes contained evidence of use by vertebrates (Table 3). Nests of *Antechinus* sp. (either brown antechinus, A.stuartii, or yellow-footed antechinus, A.flavipes) featuring their distinctive scat latrines and leaf material were evident in small scansorial and a masked owl box (scats only) (Plate 3). The distinct eucalypt leaf nests of sugar/squirrel gliders and feathertail gliders were recorded in seven and 14 boxes respectively (Plate 3). Large flattened eucalypt leaf nests, probably attributable to either greater glider (Petauroides volans) or yellow-bellied glider (Petaurus australis), were recorded in cockatoo and yellow-bellied glider boxes (Plate 3). The only evidence of bird use was scattered leaf material in a powerful owl box, which was attributed to an owlet nightjar (Aegotheles cristatus) (Plate 3). Overall, 30.1% of boxes were either occupied or showed evidence of use by vertebrates.

Plate 3: Antechinus typically create 'latrines' by depositing scats in the corner of a nest box (top L). Feathertail gliders generally construct loose leaf domes (top R) whereas large flattened eucalypt leaf nests are suggestive of either yellow-bellied glider or greater glider (bottom L). Owlet nightjars are often recorded in larger nest boxes and typically feature scattered leaves/twigs on bark material inserted during installation (bottom R).

European beehives (Apis sp.), which are often encountered occupying nest boxes, were only detected on one occasion. An active hive was seen occupying a squirrel glider box (Plate 4). No other signs of European bee activity were evident (e.g. abandoned or eaten-out hives). Arboreal ants (probable Polyrachis sp.) were observed in five small volume boxes (i.e. scansorial and treecreeper). Ants occurred in all three box material types (i.e. plywood, hardwood, metal).

Plate 4: An active European beehive was recorded in a squirrel glider box (L). *Polyrachis sp*. ants were evident in five nest boxes, mostly small volume scansorial boxes (R).

3.2 Spatial Use of Nest Boxes

Use of nest boxes varied amongst the three NBIA (Table 4). Overall use was highest amongst the floodplains of the southern area (51.2%) and lowest for the middle area (17.9%) around the foothills of Dirty Creek Range. Nest boxes located in the north area on the range plateau was also low with 22.6% overall use.

Table 4: Nest box occupation and use according to Nest Box Installation Area (NBIA).

Nest Box Installation Area (No. of boxes)	No. Occupied	No. Evidence of Use	No. Overall Use	% Overall Use
South (41)	6	15	21	51.2
Middle (39)	1	6	7	17.9
North (53)	2	10	12	22.6

Nest box use varied with distance from the LOC boundary (Figure 2). The highest rate of use (60%) was evident for boxes located 51-100m from the LOC followed by 26-50m (30.6%). Boxes located closest to the LOC (0-25m) reported 24.6% overall use. No use was recorded for boxes located between 101-200m from the LOC.

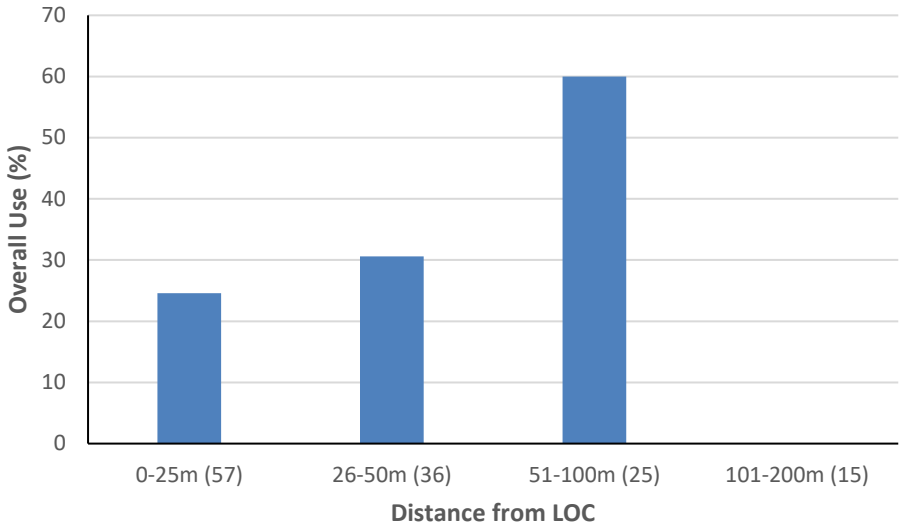

Figure 2: Overall use of nest boxes according to distance from Limit of Clearing (LOC). Number of nest boxes installed in each distance category is shown in parenthesis.

3.3 Fauna Displaced During Clearing and Nest Box Use

Twenty-one vertebrate species were recovered from hollows in trees removed during the clearing phase (Sandpiper 2016a). Of the species recovered, 23.8% (five species; all mammals) were recorded using nest boxes (Table 3). The five mammal species represent 71% of mammal species recovered from hollows. No frog, reptile or bird species recovered during clearing were recorded using nest boxes. Three species not recovered during clearing were recorded using nest boxes – yellow bellied glider/greater glider (probable), brown tree snake and owlet nightjar.

Table 5: Species of vertebrate retrieved from hollows during the clearing phase of the W2HC upgrade (Sandpiper unpub. data) and species detected in nest boxes during summer 2016 inspections. O = species occupying nest box; E = species identified from evidence in nest box; Pr = Probable.

Scientific Name	Common Name	No. Individuals detected in hollows	Detected in Nest Boxes
Antechinus spp.	Antechinus species	2	E (pr)
Antechinus flavipes	Yellow-footed antechinus	1	
Trichosurus caninus	Short-eared brushtail possum	1	
Trichosurus vulpecula	Common brushtail possum	7	O
Trichosurus spp.	Brushtail possum sp.		E (pr)
Acrobates pygmaeus	Feathertail glider	30	O; E (pr)
Petaurus norfolcensis V	Squirrel glider	2	O
Petaurus breviceps	Sugar glider	29	O; E (pr)
Petaurus australis/Petaruroides volans	Yellow-bellied glider/Greater glider	Not recorded	E (pr)
Chalinolobus gouldii	Gould's wattled bat	1	
Microbat sp.		1	
Litoria caerulea	Common green tree frog	1	
Litoria Dentata	Bleating tree frog	2	
Litoria peronii	Peron's tree frog	4	
Oedura lesueurii	Lesueur's velvet gecko	14	
Dendrelaphis punctulata	Common green tree snake	13	
Boiga irregularis	Brown tree snake	Not recorded	O
Egernia mcpheei	Eastern crevice skink	3	
Morelia spilota	Carpet python	5	
Hemisphaeriodon gerrardii	Pink tongue lizard	5	
Varanus varius	Lace monitor	7	
Ramphotyphlops nigrescens	Blackish blind snake	2	
Hoplocephalus stephensii V	Stephens banded snake	2	
Eulampris tenuis	Bar-sided skink	15	
Aegotheles chrisoptus	Owlet nightjar	Not recorded	E (pr)
Trichoglossus chlorolepidotus	Scaly-breasted lorikeet	4	

3.4 Nest Box Condition, Material and Occupation

All nest boxes and attachment wire were in good repair except the outer wall of the plywood squirrel glider box containing European bees was delaminating (Plate 4). No boxes showed evidence of termite activity. The lids of a number of metal boxes were difficult to open due to the strong adhesiveness of the Velcro strips used to adhere lids closed. The lid hinges of some metal boxes were loose and may require future maintenance.

Nest box use according to material type was highest for plywood boxes (32.4%) followed by hardwood (29.4%) and metal (26.2%) (Figure 3). No hardwood boxes were occupied during the inspection whereas 6.7% and 9.5% of plywood and metal boxes respectively contained fauna.

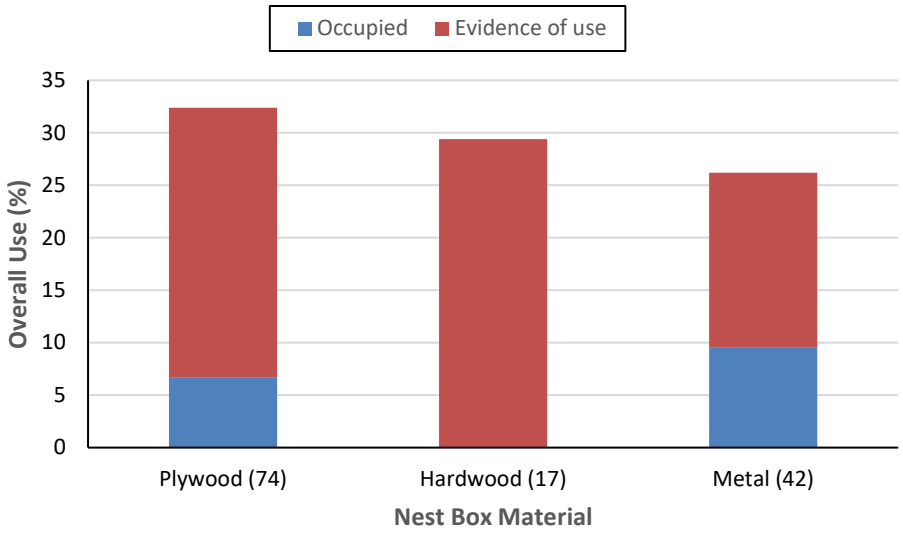

Figure 3: Comparison between nest box material and use of 133 nest boxes installed adjacent the W2HC alignment. Number of each box material type is shown in parenthesis.

4. Discussion

4.1 Use of Nest Boxes

Five vertebrate species were confirmed using nest boxes and a further three, possibly four, species were probable users based on nesting evidence. Users included *Antechinus* sp. (brown or yellow-footed antechinus), common brushtail possum, yellow-bellied glider and/or greater glider (probable), squirrel glider, sugar glider, feathertail glider, brown tree snake and owlet nightjar (probable). The possible yellow-bellied glider and/or greater glider record is particularly noteworthy as there are few records of their use of nest boxes (R.Goldingay, pers. comm.; A.Franks, Hollow Log Homes, pers.com.). Both species are known to occur in the study area (Sandpiper unpub. data) and the yellow-bellied glider is listed as vulnerable on the NSW *Threatened Species Conservation Act* (*TSC* Act) 1995 and the greater glider is listed as vulnerable on the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. The other recorded species are known to readily use nest boxes in areas where they occur.

The rate of occupation (6.8%) is lower than that reported on highway upgrades at Sapphire to Woolgoolga (S2W) (8.5-15%), Coopernook to Heron's Creek (C2HC) (13-16%) and Branxton (22-29%) (Sandpiper 2013, 2015, 2016b). Similarly, the overall rate of use (i.e. sum of boxes occupied and those featuring evidence of use) for the current inspection (30.1%) is lower than that reported at S2W (51-64%), C2HC (65-74%) and Branxton (47-67%) (Sandpiper 2013, 2015, 2016b). Admittedly, the current inspection has occurred only 3-9 months post-installation and overall rate of use will rise with subsequent inspections. However, the relatively low rate of occupation and use may be attributed to a number of factors. Firstly, the clearing data shows that fauna occupation and evidence of use of felled hollow bearing trees (HBT) was substantially lower than that reported at other north coast Pacific Highway upgrades (Sandpiper 2009, 2010, 2012, 2014, 2015, 2016a; BEM 2007; 2011). In particular, the rate of occupation and evidence of

use for HBT removed at the nearby S2W upgrade was more than twice that recorded at W2HC (BEM 2011). Secondly, a large proportion of boxes (i.e. 43%) were installed within 50m of the LOC, which featured a low rate of use (see below). Thirdly, the current inspection occurred during the summer period when high daytime temperatures resulting in elevated nest box temperatures may discourage use (see Goldingay 2015).

4.2 Spatial Use of Nest Boxes

Use of nest boxes was clearly more prevalent along the southern floodplain (51.2%) compared to either the Dirty Creek range foothills (17.9%) or the range plateau in the northern section of the alignment (22.6%). The general receiving environment amongst the floodplain area features fewer hollow resources thereby making nest boxes an attractive resource. Further, the least used area (middle) features a receiving environment with relatively higher abundance of HBT as well as the highest density of nest boxes (i.e. 39 boxes spaced along ~3000m of alignment). The combination of these two factors would create less competition for hollow resources and less dependence on nest boxes. Further, the prevalence of fauna within HBT cleared in the middle and northern areas was less than that recorded in the southern area (Sandpiper 2016a).

Another feature of the spatial pattern of nest box use is the positive relationship between distance from LOC and rate of use. This relationship is clearly evident up to 100m but not for the 101-200m from LOC zone. The low rate of use in close proximity to the LOC may be indicative of an edge effect whereby activity of some hollow-dependent fauna diminishes with proximity to the LOC. This may be due to deterioration in habitat quality, construction activity or noise and initial displacement after clearing. Subsequent nest box inspections will determine the persistence of this relationship.

4.3 Displaced Fauna Use of Nest Boxes

A primary objective of the W2HC NBMP is to provide “guidance on the provision of nest boxes as a compensatory mechanism for the loss of habitat trees within the clearing area, inclusive of den, roosting and nesting resources” (Biosis, 2014). As such, the success of the nest box program is largely determined by the level of uptake by displaced species. Of the 21 vertebrate species recovered from hollows during the clearing phase, five (23.8%) were recorded using nest boxes. The five species, all mammals, represented 71% of mammal species recovered from hollows. Yellow-bellied glider and/or greater glider, neither of which were recovered during clearing but are known to occur in the study area, were also probable nest box users. The other three mammal species recovered during clearing – short-eared brushtail possum, yellow-footed antechinus and Gould’s wattled bat – are known to use nest boxes but were not recorded during the current inspection period. Albeit, only a single individual of each of the three species was recovered during clearing.

No displaced frog species and only one reptile, a brown tree snake (not recovered from hollows during clearing), were recorded during the nest box inspection. No nest box designs specifically target either hollow-using frogs or reptiles although they have been recorded in a range of nest box designs (e.g. Sandpiper 2013). With the exception of lace monitors, hollow-using frogs and reptiles appear to be infrequent users of nest boxes (e.g. Sandpiper 2009, 2013, 2015) and we are unaware of any nest box records of the threatened Stephen’s banded snake, which was recovered during clearing. Frogs and reptiles do not readily leave signs of use, such as nesting material and are therefore difficult to detect

unless present. Further, reptiles may conceal themselves under nesting material making detection difficult.

The only hollow-nesting bird retrieved during clearing (scaly-breasted lorikeet) was not detected using nest boxes. The only bird species recorded, based on probable nesting material, was an owlet nightjar. Owlet nightjars were not recovered during clearing but are often recorded using nest boxes. Infrequent use of nest boxes by birds has been reported in other nest box programs associated with highway upgrades (e.g. Sandpiper 2013, 2015) and in forest landscapes (e.g. Menkhorst 1984). Infrequent use of nest boxes by birds may indicate that adequate hollow resources for these species exist in the local landscape. It may also be the case that high summer temperatures and limited insulation capacity of nest boxes inhibit nesting birds. Moreover, some species may prefer natural hollows to nest boxes and only use nest boxes as temporary roosting sites (Lindenmayer et al. 2009). Temporary use of nest boxes by roosting birds is difficult to detect as signs may not be readily apparent (e.g. guano/faeces) or may be covered by mammal leaf nests. Low use may also be indicative of competitive interactions from other species, which may negatively affect bird usage (see Goldingay and Stevens 2009). For example, individuals or family groups of possums and gliders may utilise several nearby boxes and exclude other species (Menkhorst 1984).

4.4 Pests, Condition and Material of Nest Boxes

European bees regularly establish hives in nest boxes (Beyer and Goldingay 2006; Lindenmayer *et al.* 2009). For the current inspection period, only one active and no abandoned hives was observed. The active hive occurred in a plywood squirrel glider box. European bees typically abandon small volume nest boxes, such as squirrel glider boxes, which are often then re-colonised by sugar and/or squirrel gliders (e.g. Sandpiper 2009, 2013). Whilst the reasons for abandonment are unclear, it appears that nest box volume is a limiting factor as hive failure is more likely for smaller sized boxes (Goldingay et al. 2007; A. Franks, pers. comm.). Based on previous experience no action is recommended regarding the existing hive but this would be reassessed during subsequent inspections.

Arboreal ants were prevalent in five (3.8%) nest boxes during the summer inspection. Ants were only observed in small-volume boxes which included all three material types. Little is known about the potential competitive interactions between ants and native vertebrates although Dobson (2002 cited in Beyer and Goldingay 2006) reported that squirrel gliders were not deterred by the presence of ants and feathertail gliders have been observed in bat boxes containing ants. During the current inspection, vertebrate fauna were not observed in boxes containing ants. However, recent nest box inspections at S2W revealed that 38% of nest boxes featuring ants in summer showed subsequent evidence of use by native vertebrates in winter, including sugar/squirrel gliders, feathertail gliders and probably owlet nightjars (Sandpiper 2016b).

All nest boxes and attachment wire were in good repair, which is expected less than a year since installation. The exception to this was delamination of the outer wall of a plywood squirrel glider box containing European bees. This box will require replacement. The difficultly in opening the lids of a number of metal boxes and the looseness of some of the metal box lids may present a future maintenance issue. It is likely that the amount of Velcro stripping used to adhere the lids shut is excessive. Less Velcro and/or use of magnets would have been a preferable alternative. Further, the structural integrity of some of the metal boxes is questionable and may deteriorate over time. Beyer and Goldingay

(2006) suggest that most boxes will persist for ~5 years but concede few data exist on how habitat type, designs or materials may affect this. At C2HC, the majority of boxes required replacing eight years after installation (Sandpiper Ecological 2015). Indeed, use of three material types for nest boxes at W2HC presents an opportunity to gauge possible differences in longevity and rates of structural deterioration.

Interpreting the data on overall nest box use according to material type is somewhat confounded by differences in the proportion of each box type. For example, hardwood boxes only featured two types - lorikeet and treecreeper; plywood boxes did not feature any lorikeet or treecreeper designs; and metal boxes featured few owl designs and no microbat boxes. Despite this, differences in usage rates are worth noting and may become more apparent with subsequent inspections. That is, plywood boxes showed the highest rate of overall use (32.4%) followed by hardwood (29.4%) then metal (26.2%).

Our assessment of the metal boxes is that they provide a highly 'artificial' internal environment; present a very smooth/stiff external surface that may be difficult to gain traction on; and feature extremely hot outer surfaces when exposed to direct sunlight. Indeed, a recent comparison of internal nest box temperatures reported that metal boxes demonstrated the least insulating capacity compared to hardwood or plywood, including recording daytime internal box temperatures in excess of 7^0C above the ambient during late summer (Sandpiper unpub. data). Conversely, hardwood boxes performed the best at moderating daytime maximum temperatures. The internal temperature extremes exhibited by metal boxes may inhibit use by some hollow-using fauna and should be further investigated (see Goldingay 2015).

5. Performance Indicators

The W2HC NBMP provides four performance indicators with which to assess the nest box program against (Biosis, 2014). The following addresses each of the four indicators:

1. *Use of nest boxes by a wide range of native fauna*

   The W2HC nest box program has provided nesting resources for at least 23.8% of hollow-using vertebrate fauna species, including the threatened squirrel glider, displaced during clearing and construction. A further three and possibly four species – yellow-bellied glider and/or greater glider, owlet nightjar and brown tree snake - that were not recorded as displaced fauna, were detected using nest boxes. Importantly, the yellow-bellied glider, a threatened species, has rarely been detected using nest boxes.

   In addition to confirmed users, it is likely that more species have utilized the nest boxes but were not detected. This is particularly the case for some birds, frogs, reptiles, and microbats. It has also been acknowledged that a limitation of pole and camera-based inspections is difficulty in detecting cryptic or concealed fauna. Whereas rates of occupation and overall use are less than at other Pacific Highway upgrade sites, it should be acknowledged that it is only 3-9 months since installation and usage rates will rise for subsequent inspections.

2. *Use of nest boxes designed for target species by those species*

Fourteen nest box designs targeting specific fauna were installed along the W2HC alignment (Table 1). Six of the 14 target species were confirmed using the specific boxes – *Antechinus* sp. (brown or yellow-footed antechinus), common brushtail possum, feathertail glider, sugar glider, squirrel glider, yellow-bellied glider (probable). Target species such as masked owl, powerful owl, cockatoo, lorikeet, treecreeper and brush-tailed phascogale are very infrequent users of nest boxes. The spotted-tailed quoll has not been reported using a nest box; eastern pygmy possum is probably not present in the study area; and microbats do not leave roosting signs but are likely to have used the nest boxes since their installation. Subsequent inspections may record use by target species not yet recorded.

3. *Low rates of exotic fauna using nest boxes*

   European bees (in a single squirrel glider box) were the only exotic species confirmed using the nest boxes. This is regarded as a very low rate of exotic use.

4. *Reduced maintenance requirements*

   The NBMP recommends that maintenance should occur in line with the monitoring schedule. Though not clearly defined in the NBMP, we interpret maintenance to include replacement of screws, replacement of hinges and replacement of wire (i.e. those requiring replacement). Further, the NBMP states that fallen, damaged or degraded boxes should be replaced. As such, basic maintenance should be conducted during inspections and replacement of boxes or lids should occur shortly after completion of inspections once an inventory of box condition including those requiring replacement is known. This should follow discussion with Pacific Complete/RMS staff. With regards the current inspection, the plywood squirrel glider box featuring European bees has delaminated and will require replacement at some stage. We recommend leaving the damaged box in place and placing a replacement box in a nearby tree.

   Further box maintenance will emerge during subsequent inspections, particularly in the later stages of the 8-year monitoring program. A recent inspection of 8-year old nest boxes along the highway upgrade at Coopernook reported 69% of boxes requiring either full replacement or lid replacement (Sandpiper 2015). Metal boxes, in particular, require close attention in subsequent inspections as questions about their structural integrity have been raised.

6. Recommendations

1. Replace damaged plywood squirrel glider box at the next inspection (winter 2016).

2. Closely monitor structural integrity and performance of metal nest boxes.

3. Conduct year 3, 4, 6 and 8 inspections during autumn and spring rather than winter and summer. Autumn inspections are preferable to summer because high temperatures during summer may inhibit use by some species. Spring is preferable to winter as there is greater likelihood of detecting bird nesting activity and possum and glider breeding.

4. Future highway nest box programs should endeavor to install nest boxes >25m from the LoC.

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Appendix A – Nest Box Inspection Field Data

Table A1: Data for summer inspection of W2HC nest boxes conducted 16-19 February 2016.CBP = common brushtail possum; SeBP = short-eared brushtail possum; BP = brushtail possum sp.; CRP = common ringtail possum; YbG = yellow-bellied glider; GG = greater glider; SqG = squirrel glider; SuG = sugar glider; Sug/SqG = sugar or squirrel glider; FtG = feathertail glider; ONj = owlet nightjar. Pr = probable; Po = Possible

Zone/SoC /Box No.	Tree species	Box no.	Box type	Ht	Orient ation	Easting	Northing	Date installed	Material	Check date	Fauna	Signs	Box Condition	Notes
36e1	Blackbutt	1	Cockatoo	10	Ne	517887	6674740	5/5/15	Ply	19/2/16	Nil	Nil	Good	Too high-Climber
36e2	Blackbutt	2	Possum T10	8	N	517876	6674754	5/5/15	Ply	16/2/16	CBP	Nil	Good	
36e3	Red mahogany	3	Squirrel Glider T08	10	Ne	517881	6674744	5/5/15	Ply	19/2/16	Nil	Entry chewed; few Euc lvs; sqg/sug(pr)	Good	Too high-Climber
36e4	Pink Bloodwood	4	Scan (ant) T07	4	N	517885	6674761	5/5/15	Ply	16/2/16	Nil	Nil material; scats on floor-A'chinus prob	Good	2 extra SG Hwood boxes nearby(who installed?); have inc them with S2W boxes(pic:408-411@1201)
36w5	Blackbutt	5	YB glider T09	8	NE	517690	6674899	5/5/15	Ply	16/2/16	Nil	Nil	Good	
35w1	Tallowwood	17	Microbat	8	WNE	517824	6675620	5/5/15	Ply	16/2/16	Nil	Nil	Good	
35w2	Mahogany	18	Squirrel glider T08	8	NE	517808	6675621	5/5/15	Ply	16/2/16	Nil	Old flouncy euc leaf nest-FtG prob	Good	

35w3	Tallowwood	19	Scan (ant) T07	5	NE	517803	6675610	5/5/15	Ply	16/2/16	Nil	Old euc leaf nest/scats at edge-A'chinus prob; chewed entr	Good	
35w4	Tallowwood	20	Scan (ftg) T07	8	NE	517794	6675595	5/5/15	Ply	16/2/16	Nil	Old euc leaf nest-FtG prob; chewed entr	Good	
35w5	Mahogany	21	Powerful owl	15	NNW	517765	6675548	5/5/15	Metal	19/2/16	Nil	Nil	Good	Too high -climber; Foam debris in box;
35w6	As above	22	Possum T10	6	NNE	517765	6675548	5/5/15	Ply	19/2/16	Nil	Nil	Good	
35w7	Mahogany	23	Scan (ant) (T07)	4	NE	517782	6675569	5/5/15	Metal	16/2/16	Nil	Nil	Good	Difficult to open lid
35w8	BL paperbark	24	Quoll	2	NW	517776	6675305	10/11/15	Ply	16/2/16	Nil	Nil	Good	
35w9	BL paperbark	25	Lorikeet (hh)	8	NE	517779	6675275	10/11/15	Hwood	16/2/16	Nil	Nil	Good	Difficult to open lid
34w1	Tallowwood	26	Quoll	2	NE	517923	6676177	4/5/15	Ply	16/2/16	Nil	Nil	Good	
34w2	Mahogany	27	Scan (ftg)	6	N	517821	6676108	28/8/15	Ply	18/2/16	Nil	Heavy entr chewing (prob by sug/sqg); wood bits on floor; no evidence of use inside so NOT scored as evid of use	Good	
33e1	Tallowwood	6	Squirrel glider	7	E	518093	6676192	5/5/15	Ply	16/2/16	SqG x3	Thick Euc leaf nest	Good	
33e2	Mahogany	7	Scan (btp)	5	NE	518081	6676202	5/5/15	Ply	16/2/16	Nil	Old flouncy euc leaf nest-FtG prob	Good	

33e3	Tallowwood	8	Treecreeper	7	E	518087	6676214	5/5/15	HWood	16/2/16	Nil	Few euc lvs (unid vert)	Good	Difficult to open lid
33e4	Grey ironbark	9	Scan (btp)	5	NE	518123	6676310	4/5/15	Ply	16/2/16	Nil	Old flouncy euc leaf nest-FtG prob	Good	
33e5	Grey ironbark	10	Treecreeper	7	E	518119	6676322	4/5/15	HWood	16/2/16	Nil	Nil	Good	Difficult to open lid
33e6	Grey iron bark	11	Scan (ftg)	8	NE	518119	6676322	4/5/15	Ply	16/2/16	Nil	Old flouncy euc leaf nest-FtG prob	Good	
33w7	Grey ironbark	12	Cockatoo	13	NE	517941	6676221	4/5/15	Ply	19/2/16	Nil	Thick Euc leaf nest/flat-YbG/GG (pr); entr chewing	Good	Too high-Climber
33w8	Mahogany	13	Scan (ant)	4	NE	517936	6676229	4/5/15	Ply	16/2/16	Nil	Old flouncy euc leaf nest-FtG prob; chewed entr	Good	
33w9	Tallowwood	14	Squirrel glider	7	NE	517919	6676212	4/5/15	Ply	16/2/16	Nil	Thick euc leaf nest-SqG/SuG prob	Good	
33w10	Mahogany	15	Possum	6	NE	517921	6676234	4/5/15	Ply	16/2/16	Nil	Few euc leaf nest-BP sp prob	Good	
33w11	Red mahogany	16	Squirrel glider	8	NE	517980	6676348	4/5/15	Ply	16/2/16	Nil	Old euc leaf nest-SqG/SuG prob	Good	
32e1	Forest red gum	134	Treecreeper	8	E	518260	6676929	28/8/15	HWood	19/2/16	Nil	Nil	Good	No lip; no pop lid; Climber attached arm;
32e2	Melaleuca quin	82	Scan	5	NW	518268	6676963	28/8/15	Ply	16/2/16	Nil	Nil	Good	
31e1	Blackbutt	28	Scan (ant)	5	NE	518240	6677259	28/8/15	Ply	16/2/16	Nil	Nil	Good	
31e2	Red Mahogany	29	Scan (not Mb box)	3	NW	518251	6677280	28/8/15	Ply	19/2/16	Nil	Nil	Good	

31e3	Red Mahogany	30/104	Treecreeper	9	E	518243	6677263	28/8/15	HWood	19/2/16	Nil	Nil		Too high-Climber
30w1	Tallowwood	31	Scan (ant)	5	NE	517871	6677774	5/5/15	Ply	17/2/16	Nil	Old flouncy euc leaf nest-FtG prob	Good	
30w2	Mahogany	32	Scan (ant)	8	NE	517861	6677766	5/5/15	Metal	17/2/16	FtG	flouncy euc leaf nest	Good	
30w3	Blackbutt	33	Scan (btp)	6	NE	517854	6677773	5/5/15	Metal	17/2/16	SqG x4	thick Euc leaf nest	Good	
28w1	Bloodwood	68	Scan (btp)	5	N	517604	6678550	10/11/15	Ply	17/2/16	Nil	Nil	Good	
28w2	Blackbutt	69	Scan (ftg)	6	NE	517587	6678544	10/11/15	Ply	17/2/16	Nil	Nil	Good	
28w3	Bloodwood	70	Scan (not Mb box)	5	W	517608	6678541	10/11/15	Ply	17/2/16	Nil	Nil	Good	
28w4	Brush box	71	Quoll	8	NNE	517580	6678554	10/11/15	Metal	17/2/16	CBP(sub adult)	Nil	Good	
27w1	Blackbutt	66	Squirrel glider	7	N	517158	6679308	10/11/15	Ply	17/2/16	Nil	Nil	Good	
27w2	Blackbutt	67	Scan (ftg)	7	NE	517161	6679270	10/11/15	Ply	17/2/16	FtG x9	Few Euc lvs	Good	
25e1	Tallowwood	129	Scan (phas)	7	N	516693	6680109	28/8/15	Ply	17/2/16	Nil	Nil	Good	
25e2	Tallow wood	130	Lorikeets	7	N	516708	6680092	28/8/15	Metal	17/2/16	Nil	(Tom bark)	Good	
25w3	Blackbutt	131	Sq glider	7	SE	516709	6679838	28/8/15	Ply	17/2/16	Europ bees		Minor box deter-Delam. of box walls	
25w4	Forest oak	132	Scan (phas)	4	SW	516515	6680068	28/8/15	Ply	17/2/16	Nil	Nil	Good	
25w5	Blackbutt	133	Treecreeper	5	SW	516531	6680059	28/8/15	HWood	17/2/16	Nil	Nil	Good	

24e1	Ironbark	126	Sq glider	6	NE	516560	6680278	27/8/15	Metal	17/2/16	Nil	Nil	Good	Difficult to open lid
24e2	Blood wood	127	Cockatoo	10	N	516588	6680243	27/8/15	Metal	19/2/16	Nil	(Tom bark)	Good	Too high-Climber ; SqG emerged from hollow on tree & glided off
24e3	As above	128	Possum	5	N	As above		27/8/15	Metal	17/2/16	Nil	Mud wasp	Good	Difficult to open lid
23e1	Turpentine	115	Quoll	2	N	516236	6680819	27/8/15	Metal	17/2/16	Nil	Nil	Good	
23e2	Blackbutt	116	YBG	8	NE	516194	6680814	27/8/15	Ply	19/2/16	Nil	Nil	Good	Too high-Climber
23e3	Mahogany	117	Scan (ant)	3	NE	516225	6680820	27/8/15	Ply	17/2/16	Nil	Nil	Good	
23e4	Blackbutt	118	Squirrel	8	N	516229	6680826	27/8/15	Ply	17/2/16	Nil	Nil	Good	
23e5	Blackbutt	119	Scan (microbat)	5	NW	516240	6680885	27/8/15	Ply	17/2/16	Nil	Nil	Good	Difficult to see inside
23e6	Blackbutt	120	Lorikeets	7	N	516266	6680758	27/8/15	HWood	19/2/16	Nil	Nil	Good	No lip; no pop lid; Climber attached arm;
23e7	Blackbutt	121	Scan (phas)	6	NE	516324	6680564	27/8/15	Metal	17/2/16	Nil	Nil	Good	
23e8	Blackbutt	122	LFO	10	NNE	516241	6680854	27/8/15	Ply	19/2/16	Nil	Nil	Good	Too high-Climber
23e9	As above	123	Possum	5	NE	As above		27/8/15	Metal	17/2/16	Nil	Nil	Good	
23e10	Mahogany	124	Sq glider	8	NE	516083	6680903	27/8/15	Metal	17/2/16	Nil	Nil	Good	

23e11	Mahogany	125	Tree creeper	5	E	516070	6680914	27/8/15	HWood	19/2/16	Nil	Nil	Good	No lip; no pop lid; Climber attached arm;
22e1	Spotted gum	43	Lorikeet	8	NE	515715	6681382	6/5/15	Metal	17/2/16	Nil	Few Euc lvs (sqg/sug (pr))	Good	
22e2	Grey ironbark	44	Scan (btp)	7	NE	515714	6681373	6/5/15	Ply	17/2/16	Nil	Old euc leaf nest-SuG/Sqg (pr)	Good	
22e3	Mahogany	45	Scan (ant)	5	E	515703	6681390	6/5/15	Metal	17/2/16	Nil	Nil	Good	
22e4	Sf grey gum	46	YB glider	9	E	515739	6681313	5/5/15	Ply	17/2/16	CBP	Nil	Good	
22e5	Stringybark	47	Scan (ftg)	6	NE	515768	6681332	5/5/15	Ply	17/2/16	Nil	Nil	Good	
22e6	Mahogany	48	Treecreeper	8	NE	515897	6681243	5/5/15	HWood	19/2/16	Nil	Old euc leaf nest-SuG/SqG (pr)	Good	No lip; no pop lid; Climber attached arm;
22e7	Mahogany	49	Squirrel glider	9	N	515885	6681239	5/5/15	Metal	19/2/16	Nil	Old euc leaf nest-Ftg (pr)	Good	Too high-Climber
22e8	BL paperbark	50	Quoll	4	E	516020	6681055	6/5/15	Metal	17/2/16	Nil	Nil	Good	
22e9	Pink Bloodwood	51	Powerful owl	14	NE	516004	6681090	6/5/15	Ply	19/2/16	Nil	Nil	Good	Too high-Climber
22e10	Mahogany	52	Possum	6	N	516016	6681081	6/5/15	Metal	17/2/16	Nil	Nil	Good	
22w12	Swamp mahogany	54	Scan btp	8	NE	515694	6681126	6/5/15	Metal	17/2/16	Nil	Nil	Good	

22w11	Blackbutt	53	YBG	7	E	515654	6681131	6/5/15	Metal	17/2/16	Nil	Nil	Good	
21e1	Bloodwood	34	Scan (btp)	8	NE	515547	6681787	5/5/15	Ply	17/2/16	Nil	Old flouncy euc leaf nest-FtG (pr)	Good	
21e2	Needle bark stringy	35	Scan (epp)	6	E	515542	6681801	4/5/15	Ply	17/2/16	Nil	Nil	Good	
21e3	Mahogany	36	YB glider	9	E	515578	6681571	6/5/15	Ply	17/2/16	Nil	Nil	Good	
21e4	As above	37	Scan (ftg)	5	NE	515578	6681571	6/5/15	Metal	17/2/16	Nil	Nil	Good	
21e6	Ironbark	39	Scan (ftg)	7	NE	515653	6681494	6/5/15	Ply	17/2/16	Nil	Nil	Good	
21e7	Ironbark	40	Treecreeper	8	N	515661	6681487	6/5/15	Metal	17/2/16	Nil	Nil	Good	
21e8	Blackbutt	41	Masked owl (T02)	13	N	515563	6681824	5/5/15	Ply	19/2/16	Nil	Scats-Antech (pr)	Good	Too high-Climber
21e9	Blackbutt	42	Possum	6	NE	515556	6681839	4/5/15	Ply	17/2/16	Nil	Nil	Good	Lid was open
18e1	Swamp box	72	Scan (ant)	5	NE	514209	6682626	7/5/15	Ply	18/2/16	Nil	Nil	Good	
18e2	Blackbutt	73	Treecreeper	10	NE	514203	6682630	7/5/15	HWood	19/2/16	Nil	Nil	Good	No lip; no pop lid; Climber attached arm;
18e3	Blackbutt	62	Scan (ftg)	7	NE	514207	6682629	7/5/15	Metal	18/2/16	Nil	Nil	Good	
18e4	Blackbutt	75	Scan (mb)	7	NE	514452	6682565	7/5/15	Ply	18/2/16	Nil	Few Ants	Good	
18e5	Blackbutt	76	Treecreeper	8	NE	514445	6682563	7/5/15	HWood	19/2/16	Nil	Ants	Good	No lip; no pop lid; Climber attached arm;
18e6	Tallowwood	77	Scan (btp)	6	NE	514467	6682552	7/5/15	Metal	18/2/16	Nil	Few Ants	Good	
17e1	Spotted Gum	55	Lorikeet	8	E	513856	6682742	7/5/15	Metal	18/2/16	Nil	flouncy euc leaf nest-FtG (pr)	Good	

17e2	Rough barked Angophora	56	Scan (btp)	4	E	513858	6682746	7/5/15	Metal	18/2/16	Nil	Sand/Debris/ants	Good	
17e3	Rough barked Angophora	57	YB Glider	5	NE	513847	6682753	7/5/15	Ply	18/2/16	Nil	Nil	Good	
17e4	Stringybark	58	Scan (btp)	7	NE	513905	6682673	7/5/15	Ply	18/2/16	Nil	Nil	Good	
17e5	Stringybark	59	Microbat	5	NW	513912	6682674	7/5/15	Ply	18/2/16	Nil	Nil	Good	
17e6	Stringybark	60	Scan (ftg)	7	N	514001	6682604	7/5/15	Ply	18/2/16	Nil	Nil	Good	
17e7	Blackbutt	61	Squirrel glider	8	NE	514008	6682611	7/5/15	Metal	18/2/16	Nil	Nil	Good	
17e8	Angophora	74	Scan (ant)	7	E	514089	6682628	7/5/15	Metal	18/2/16	Nil	Nil	Good	
17e9	Blackbutt	63	Quoll	4	E	514092	6682618	7/5/15	Ply	18/2/16	Nil	Nil	Good	
17e10	Blackbutt	64	Squirrel glider	9	NE	514081	6682626	7/5/15	Ply	18/2/16	Nil	Nil	Good	
17e11	Mahogany	65	Treecreeper	12	N	514091	6682603	7/5/15	HWood	19/2/16	Nil	Nil	Good	Too high-Climber
16e1	Spotted gum	98	Lorikeet	7	NE	513792	6683002	7/5/15	HWood	17/2/16	Nil	Nil	Good	Difficult to open lid
16e2	Grey Ironbark	99	Microbat	7	W	513799	6682968	7/5/15	Ply	17/2/16	Nil	Nil	Good	
16e3	Stringybark	100	Scan (btp)	8	NE	513782	6682979	7/5/15	Ply	17/2/16	SuG	Light chew around entr	Good	Came out of box
16e4	Stringybark	101	Scan (ftg)	4	NE	513771	6683004	7/5/15	Metal	17/2/16	Nil	flouncy euc leaf nest-FtG (pr)	Good	Small wasp nest on outside

16e5	Tallowwood	102	Scan (ant)	3	N	513801	6682922	7/5/15	Ply	17/2/16	Nil	Nil	Good	
16e6	Stringybark	103	Scan (btp)	7	E	513812	6682917	7/5/15	Metal	17/2/16	Nil	Thin euc leaf nest-FtG (pr)	Good	
15e1	Mahogany	105	Squirrel glider	8	NE	513541	6683568	7/5/15	Metal	18/2/16	Nil	Nil	Good	
15e2	Tallowwood	106	Scan (ant)	4	N	513537	6683578	7/5/15	Ply	18/2/16	Nil	Nil	Good	
15e3	Mahogany	107	Treecreeper	8	NE	513519	6683596	7/5/15	Metal	18/2/16	Nil	Nil	Good	
15e4	Mahogany	108	Squirrel glider	8	NE	513483	6683667	7/5/15	Ply	18/2/16	Nil	Nil	Good	
15e5	Mahogany	109	Scan (btp)	6	N	513486	6683659	7/5/15	Metal	18/2/16	Nil	Nil	Good	
15e6	Mahogany	110	Treecreeper	9	NE	513570	6683735	7/5/15	HWood	18/2/16	Nil	Nil	Good	A sm stick in box
14e1	Mahogany	111	Masked owl	11m	NE	513468	6683789	7/5/15	Ply	19/2/16	Nil	Nil	Good	Too high-Climber
14e2	As above	112	Possum	5	NE	513468	6683789	7/5/15	Metal	18/2/16	Nil	Nil	Good	
14e3	Blackbutt	113	YB glider	8	E	513163	6683899	8/5/15	Ply	18/2/16	Nil	Thick euc leaf nest, flat/broad-YbG/GG (pr)	Good	
13w1	SF grey gum	88	Powerful owl	13.5	NNE	513114	6684384	8/5/15	Ply	19/2/16	Nil	euc leaf nest on Toms bark-Owlet N'jar(pr)	Good	Too high-Climber
13w2	As above	89	Possum	5	E	513114	6684384	8/5/15	Metal	18/2/16	Nil	Nil	Good	
13w3	Stringybark	90	YB glider	7	E	513118	6684369	8/5/15	Metal	18/2/16	Nil	Nil	Good	
13w4	Stringybark	91	Scan (btp)	5	NE	513115	6684358	8/5/15	Ply	18/2/16	Nil	Nil	Good	
13w5	Grey ironbark	92	Treecreeper	7	N	513134	6684516	8/5/15	HWood	18/2/16	Nil	flouncy euc leaf nest-FtG (pr)	Good	

13w6	Grey ironbark	93	Squirrel glider	8	NE	513122	6684524	8/5/15	Metal	18/2/16	Nil	Nil	Good	
13w7	Tallowwood	94	Scan (btp)	6	E	513131	6684564	8/5/15	Metal	18/2/16	Nil	Nil	Good	
12w1	Sm-bk Angoph	86	Cockatoo	13	NNE	513124	6685001	8/5/15	Metal	19/2/16	Br tree snake	euc leaf nest - YbG/GG (pr)	Good	Too high-Climber
12w2	SF grey gum	87	Possum	8	E	513114	6684978	8/5/15	Ply	18/2/16	Nil	flouncy euc leaf nest-FtG prob	Good	
11w1	Mahogany	95	Masked owl	13	N	512990	6685583	8/5/15	Metal	19/2/16	Nil	Nil	Good	Too high-Climber
11w2	Blackbutt	96	Possum	6	N	512989	6685591	8/5/15	Ply	18/2/16	Nil	Nil (bark strip fell in during check)	Good	
8w2	Flooded Gum	97	Microbat	8	W	512090	6686250	8/5/15	Ply	18/2/16	Nil	Nil	Good	Only partial view inside
6w1	Bloodwood	83	Microbat	5	NW	510929	6686893	8/5/15	Ply	18/2/16	Nil	Nil	Good	
5w1	Blackbutt	84	Cockatoo	15.5	ENE	510865	6686934	8/5/15	Ply	19/2/16	Nil	thick euc leaf nest - YbG/GG (pr)	Good	Too high-Climber
5w2	Blackbutt	85	Possum	8	NE	510869	6686928	8/5/15	Metal	18/2/16	Nil	Nil	Good	
5w3	Bloodwood	114	Tree creeper	8	N	510853	6686948	8/5/15	HWood	19/2/16	Nil	Thick euc leaf nest, SqG/SuG (pr)	Good	No lip; no pop lid; Climber attached arm;
3w1	Red Mahogany	78	Scan (epp)	4	E	509931	6687485	8/5/15	Metal	18/2/16	Nil	Ants	Good	
3w2	Blackbutt	79	Squirrel glider	7	E	509946	6687483	8/5/15	Ply	18/2/16	Nil	Nil	Good	
3w3	Tallowwood	80	Treecreeper	7	NE	509963	6687490	8/5/15	HWood	18/2/16	Nil	Nil	Good	

3e4	Blackbutt	81	Quoll	6	E	510124	6687688	10/11/15	Ply	18/2/16	Nil	Nil	Good	
3e5	Bloodwood	82	Scan (ftg)	6	NE	510125	6687647	10/11/15	Ply	18/2/16	Nil	Nil	Good	