

19 August 2014

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AGL Energy Limited  
235 Old Maitland Road  
Hexham NSW 2322

**Attention: Brett Hayward**

Email: bhayward@agl.com.au

**Subject: Nest Box Monitoring at Tomago, NSW**

## **Background**

In August 2012 a total of 100 nest boxes were installed on AGL owned land adjacent to the Newcastle Gas Storage Facility. The low number of large trees in regenerating native forest at the site required 80 boxes to be mounted on round timber posts which were cemented into the ground. The remaining boxes were placed in trees in mature forest. Four different box types were installed to provide shelter habitat for a variety of arboreal mammals including the following:

- 40 Sugar/Squirrel Glider boxes
- 15 Brushtail/Ringtail Possum boxes
- 15 Pygmy Possum boxes
- 30 Microchiropteran bat boxes

The Fauna Hollow Management Plan (AGL, 2012) specified annual inspections of boxes for a period of 5 years to evaluate whether they are being used by native fauna, and to ensure they remain operational and available for use. This report presents results of the first inspection of boxes since installation.

## **Methods**

Two Kleinfelder staff with experience and accreditation in handling animals and working at heights attended the site on the 17 and 18 July 2014. Daily temperatures leading up to and during the inspection period ranged from 7 to 18 degrees Celsius (**Table 1**), with some light rain and calm to light winds.

**Table 1 Weather conditions prior to and during the nest box inspection period (shaded)**

Date	Temperature		Rain	9:00 AM					3:00 PM				
	Min	Max		Temp	RH	Cld	Dir	Spd	Temp	RH	Cld	Dir	Spd
	°C	°C		°C	%	8th	km/h		°C	%	8th	km/h	
12/07/14	6.9	17.5	0	10.5	63	0	NW	19	16.8	34	1	SW	19
13/07/14	8.7	15.4	9	10	46	5	SW	9	15	59	5	SE	9
14/07/14	7	16.8	5.4	9.4	89	6	Calm	0	16	69	7	SE	4
15/07/14	8.8	16.5	1	10.9	97	7	Calm	0	16.4	77	8	Calm	0
16/07/14	10.2	18.4	1	12	74	8	Calm	0	17.5	65	4	NW	28
17/07/14	8.2	18.3	1.8	12	74	0	NE	4	16.7	45	5	NW	28
18/07/14	8.2	16.4	0	10.4	51	5	NW	19	16	36	5	SW	4

Source: Bureau of Meteorology, observations from Newcastle University Station 061390.

A handheld GPS, pre-loaded with co-ordinates, was used to locate nest boxes. Once a nest box was located a short 2m ladder was tethered to the host tree or pole. One observer climbed the ladder and used an inspection mirror mounted on a rigid arm to open the nest box lid and view inside the box from above. Observations of individual nest boxes were recorded as either:

- Occupied by fauna
- Signs of use by fauna
- No signs of use by fauna
- Not available for use by fauna
- Missing or destroyed by fire

If a box was found to be occupied, an attempt was made to capture the animal to enable positive species identification and evaluate the health of the animal.

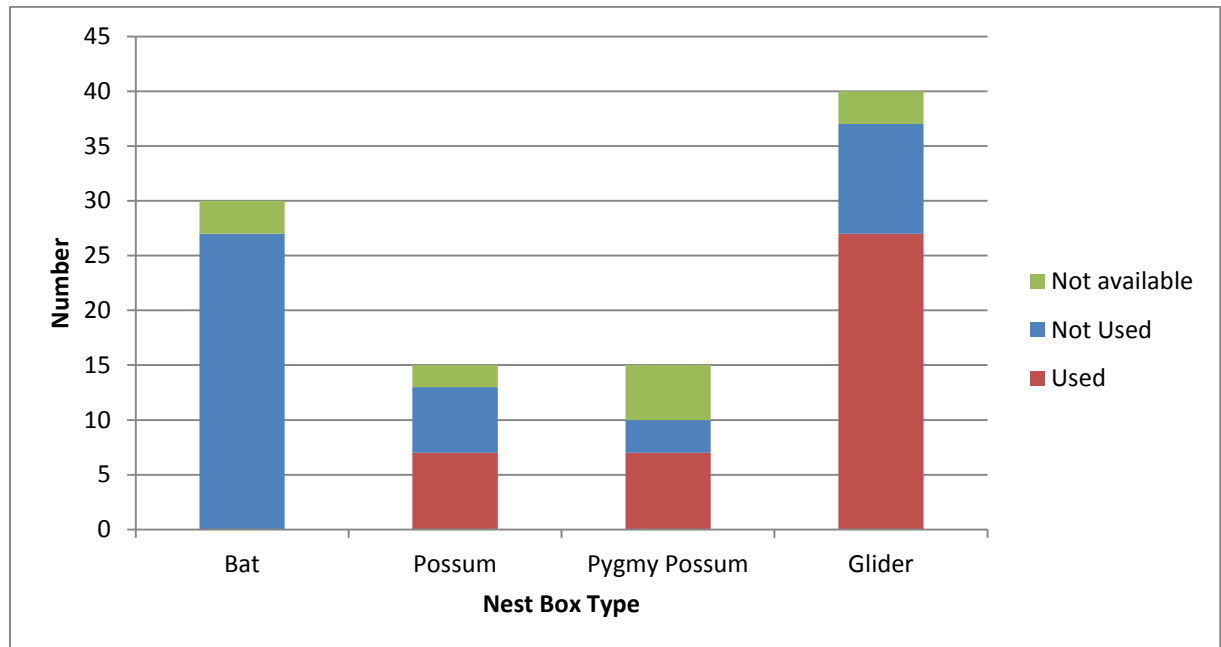
Signs of use include the presence of hair, scats or vegetative material used for nesting. Samples of hair and scats were collected for microscopic analysis to identify the species. Hair analysis was undertaken by Luke Foster following Brunner & Coman 1974.

Boxes which contained wasp nests were deemed to be not available for use by mammals. Bushfires in October 2013 burnt part of the area and resulted in the destruction of some boxes.

## Results

Of the one hundred boxes installed, eighty-seven were available to mammals for use. Those that unavailable were either destroyed by bushfire (n=8), contained wasp nests (n=4) or was missing and could not be found (n=1). Forty-seven per cent of all available boxes

contained evidence that they had been used by fauna since installation. More than half of the available Glider, Pygmy Possum and Possum boxes had evidence of use (73%, 70% and 54% respectively), however no bat boxes appeared to have been used (**Chart 1**).



**Chart 1 Overall usage rates for the four types of nest boxes installed**

Nineteen live animals were found occupying seven boxes during inspection (**Table 2**). All occupied boxes were mounted on posts to the south of the gas plant in an area of regenerating native forest. The four different mammal species observed in boxes were Brown Antechinus (*Antechinus stuartii*), Sugar Glider (*Petaurus breviceps*), Common Brushtail Possum (*Trichosurus vulpecula*), and Squirrel Glider (*Petaurus norfolcensis*) which is listed as Vulnerable under the *Threatened Species Conservation Act 1995* (NSW).

**Table 2 Animals found to be occupying nest boxes during the inspection period**

Species recorded occupying box	No. Individuals	Box Type	Mount Type	Box no.
Brown Antechinus ( <i>Antechinus stuartii</i> )	7	Pygmy Possum	Post	2
Sugar Glider ( <i>Petaurus breviceps</i> )	3	Glider	Post	20
Sugar Glider ( <i>Petaurus breviceps</i> )	1	Glider	Post	29
Sugar Glider ( <i>Petaurus breviceps</i> )	1	Glider	Post	33
Squirrel Glider ( <i>Petaurus norfolcensis</i> )	3	Glider	Post	50
Common Brushtail Possum ( <i>Trichosurus vulpecula</i> )	1	Possum	Post	56
Squirrel Glider ( <i>Petaurus norfolcensis</i> )	3	Glider	Post	59
<b>Total</b>	<b>19</b>			

An additional thirty-four boxes contained hair, scats and nesting material indicating that they had been occupied by animals at some time since they had been installed. Sixteen samples

of hair or scats were collected from these boxes and from hair analysis it was determined that the species using the boxes included: Common Brushtail Possum (n=6 samples), Brown Antechinus (n=3), Squirrel Glider (n=1), and the introduced Black Rat (*Rattus rattus*) (n=1) (**Table 3**). Hair samples were also found of a glider and microbat which could not be identified to species level. The glider sample is likely to have been either Sugar or Squirrel Glider both of which have been recorded using boxes while the microbat was probably a Wattled Bat (*Chalinolobus* sp.) based on morphological characteristics of the hair sample.

**Table 3** Species detected in boxes from hair analysis

Box no.	Box Type	Mount Type	Sample collected	Identification result
23	Possum	Post	Hair and scat	Common Brushtail Possum ( <i>Trichosurus vulpecula</i> )
25	Glider	Post	Scats	No hair found
36	Pygmy Possum	Post	Scats	Squirrel Glider ( <i>Petaurus norfolcensis</i> )
41	Pygmy Possum	Post	Hair	Brown Antechinus ( <i>Antechinus stuartii</i> )
51	Glider	Post	Scat	No hair found
58	Glider	Post	Scat	Brown Antechinus ( <i>Antechinus stuartii</i> )
60	Glider	Post	Hair and scat	Common Brushtail Possum ( <i>Trichosurus vulpecula</i> )
64	Possum	Post	Hair	Common Brushtail Possum ( <i>Trichosurus vulpecula</i> )
67	Glider	Post	Scat	Unidentified Glider ( <i>Petaurus</i> sp.)
69	Glider	Post	Hair	Brown Antechinus ( <i>Antechinus stuartii</i> ) & Microbat
70	Possum	Post	Hair	Common Brushtail Possum ( <i>Trichosurus vulpecula</i> )
80	Glider	Tree ( <i>Eucalyptus robusta</i> )	Scat	No hair found
90	Glider	Tree ( <i>Melaleuca styphelioides</i> )	Scat	No hair found
94	Possum	Tree ( <i>Eucalyptus robusta</i> )	Scat	Common Brushtail Possum ( <i>Trichosurus vulpecula</i> )
97	Pygmy Possum	Tree ( <i>Angophora costata</i> )	Scat	Black Rat ( <i>Rattus rattus</i> )
102	Possum	Tree ( <i>Angophora costata</i> )	Hair	Common Brushtail Possum ( <i>Trichosurus vulpecula</i> )

## Discussion

Nearly half (47%) of all the available nest boxes were found to have been used by fauna since installation. This usage rate is likely to be an underestimate due to poor evidence of use being retained by bat boxes. Bat boxes contain an opening on the underside of the box and so scats and hair left by visiting micobats or other fauna fall out. This is indicated from this study as none of the bat boxes appeared to have been used however microbat hair found in Glider Box 69 confirmed that microbats are using boxes at the site.

Several boxes were found to have had their lids blown open by prevailing north-west winds at the site. Given that open boxes provide inferior shelter, the number of available boxes was probably less than estimated. The addition of a catch to box lids is recommended where this problem was noted.

The relatively high rate of nest box usage is consistent with other studies of nest boxes in young forest such as that conducted by Lindenmayer, and colleagues (2009) who found 58% of boxes in 20 year old regrowth were occupied. Boxes placed in mature forest are not thought to be as well used by fauna due to the availability of natural hollows.

The species recorded in boxes in this study is consistent with arboreal species detected during baseline fauna surveys for the gas storage facility in 2009 and 2010 (ecobiological 2010). Although the threatened Squirrel Glider was detected from only one capture during baseline surveys, it was recorded three times using both glider (n=2) and pygmy-possum (n=1) boxes at the site. Beyer and Goldingay (2006) reported that this species has been recorded using nest boxes in at least five other studies.

The record of an introduced Black Rat from scat samples left in nest boxes is noteworthy. This species was not detected during baseline surveys and is often associated with human habitation, tending to occupy more disturbed environments. Its presence in this area may be a result of colonisation of the area following the development of the gas storage facility. The Black Rat is thought to compete and displace the native Bush Rat (*Rattus fuscipes*) (Stokes *et al.* 2009).

Fifteen pygmy possum boxes were installed at the site as the area was thought to be suitable habitat for this species. Eastern Pygmy Possum are difficult to survey using conventional trapping and spotlighting techniques and it has been suggested that nest boxes may provide greater opportunities to detect this species through indirect evidence such as characteristic nests or hairs (Beyer and Goldingay 2006). No Eastern Pygmy Possum or their signs were detected during this survey.

Nest boxes at the site were installed consistently on warmer north-easterly aspects and so it is assumed that this would make them more likely to be occupied in winter. Other factors such as the presence of canopy shade may also influence the microclimate within the boxes.

Most boxes are spaced approximately 20 metres apart and their close proximity may mean that animals move between multiple boxes depending on the availability of food resources or seasonal conditions. Although annual inspections should be consistently conducted in winter to enable valid between year comparisons, additional inspections at other times of the year would also be of interest for evaluating relative use between seasons.

## Recommendations

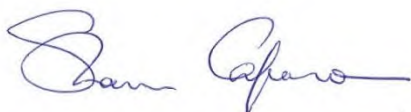
The following recommendations are provided in response to findings of this study:

- In accordance with the NGSF Fauna Hollow Management Plan the second annual nest box inspection be scheduled for July 2015. It is important that the timings of annual inspections are consistent to enable valid between year comparisons of results.
- The nine nest boxes found to be destroyed or missing be replaced to ensure a full complement of nest boxes remain available. Missing boxes include 3 pygmy possum, 2 bat, 2 glider, and 2 possum.
- Boxes found to be blown open by prevailing north-west winds be retrofitted with a simple latch to keep them closed and to ensure that they are available for use by fauna.

Attached is a selection of photos from the field inspection. Please contact me if you have any questions about the results or recommendations.

Sincerely,

**Kleinfelder Australia Pty Ltd**



**Shawn Capararo**

Senior Ecologist – GIS Specialist

## References

AGL Energy Ltd, 2012. Fauna Hollow Management Plan – Newcastle Gas Storage Facility Document Number NGSF-AGL-ISBL-EN-PLN-0002, 07 August 2012.

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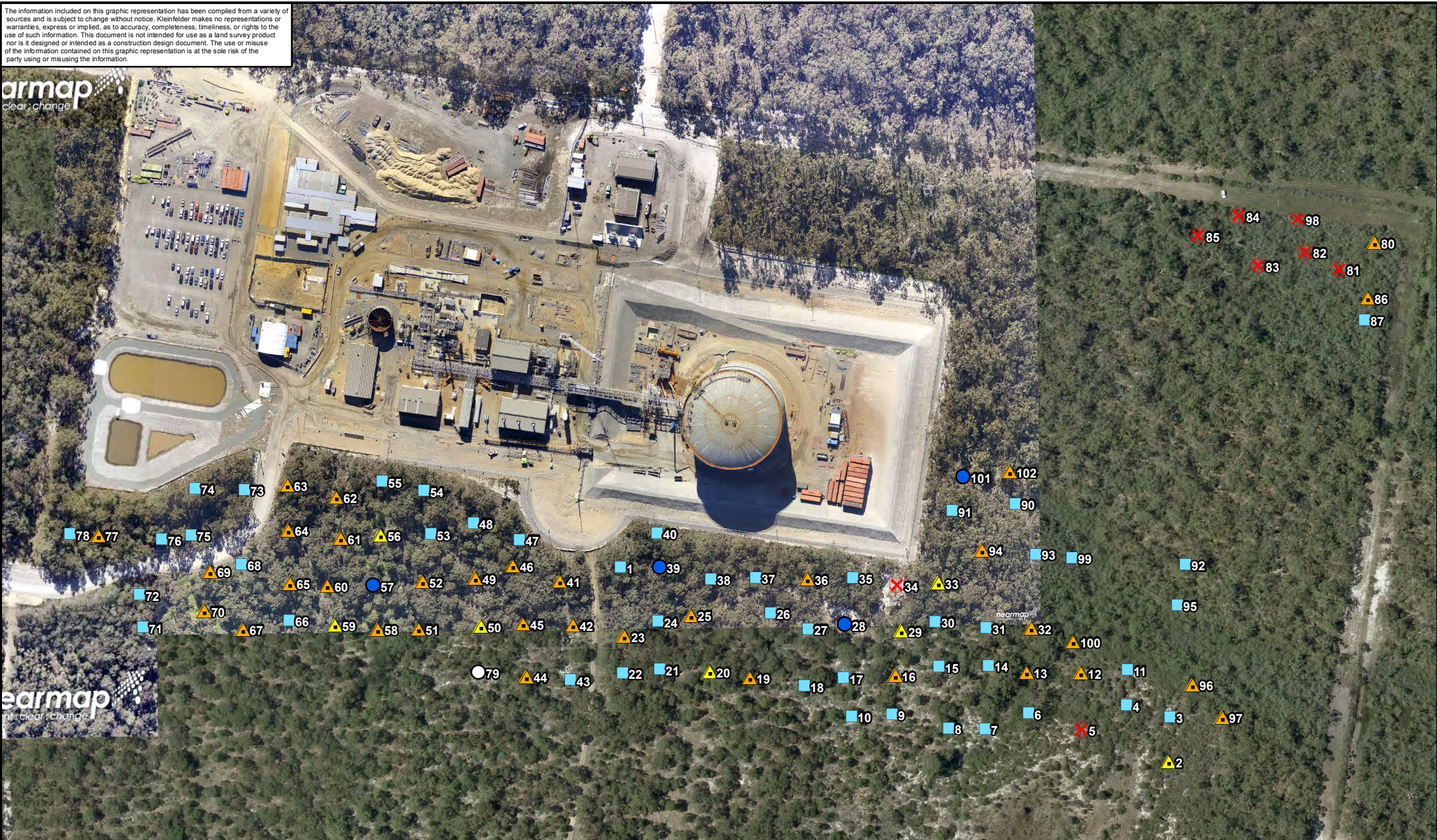
Kleinfelder, 2012. Completion of nest box installation, Letter to Aaron Clifton, 31 October 2012.

Stokes VL, Banks PB, Pech RP, and Williams RL, 2009. Invasion by *Rattus rattus* into native coastal forests of south-eastern Australia: are native small mammals at risk? *Austral Ecology* **34(4)**, pp 395-408.

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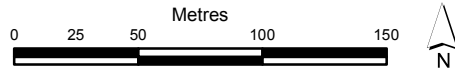
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**Legend**

- ▲ Occupied
- ▲ Signs of use
- No signs of use
- ✕ Destroyed by fire
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PROJECT REFERENCE: 89263\_20151563

DATE DRAWN: 28/07/2014 18:08 Version 1

DRAWN BY: scapararo

DATA SOURCE:  
LPI - 2009

**Nest box usage - Winter 2014**

AGL Energy Ltd  
Nest Box Monitoring  
Newcastle Gas Storage Facility  
Old Punt Road Tomago

FIGURE:

**1**





**Plate 1**      **Seven Brown Antechinus (*Antechinus stuartii*) were found in Nest Box 2**



**Plate 2**      **A burnt post remaining at Nest Box 5**



**Plate 3** Three Sugar Gliders (*Petaurus breviceps*) were found in a leaf nest in Nest Box 20



**Plate 4** One of three Squirrel Gliders (*Petaurus norfolcensis*) found in Nest Box 50



**Plate 5**      **A Common Brushtail Possum (*Trichosurus vulpecula*) found in Nest Box 56**