

FEBRUARY 2019

Farmers Creek, Lithgow

Hybrid Habitat Hollows Installation

Prepared for:



NEOPHEMA
ENVIRONMENTAL



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Introduction

Neophema Environmental was engaged by Lithgow City Council in November 2018 to supply and install a range of habitat solutions for hollow dependent species within the Farmers Creek catchment, Lithgow. A total of 20 Hybrid Habitat Hollows, comprised of three separate designs, were selected in order to provide suitable habitat for a range of fauna known, or anticipated, to be present at the sites. All proposed works were based on recommendations from the ecological surveys carried out by CT Environmental on 3 October 2018.

The need for hollow supplementation

Tree hollows are a critical resource for animals worldwide, yet widespread habitat loss has drastically reduced the availability of large trees and tree hollows. Within Australia, tree hollows provide important habitat for more than 15% of vertebrate fauna as well as a range of invertebrates. Since these structures take a minimum of 80 years to form, populations of many animals are becoming increasingly reliant on nest boxes and other artificial structures. However, the effectiveness of nest boxes as even a short-term solution to tree hollow availability is questionable due to short lifespan, high microclimate variation, limited understanding of species requirements, inappropriate nest box design and ongoing maintenance requirements.

For these reasons it was considered that hollow augmentation (chainsaw hollows) may be appropriate at these sites rather than nest boxes. However, suitable trees for augmentation were not readily available and Hybrid Habitat Hollows were recommended.

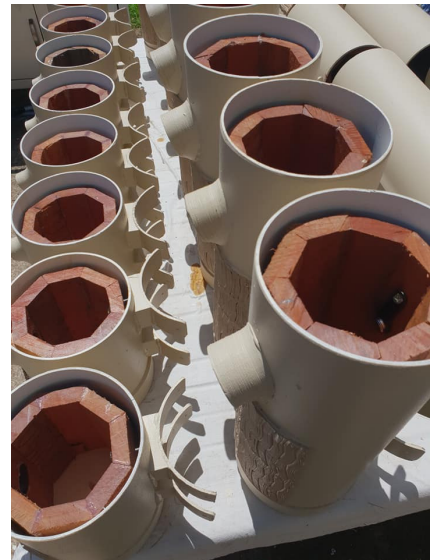


Hybrid Habitat Hollow



The Hybrid Habitat Hollow is the first genuine revolution in nest box design and construction. Neophema Environmental has developed a hardwood nestbox, with a unique drainage system, incorporated into a long-life PVC casing. The use of 3D printing technology allows us to provide custom made entrance spouts that mimic natural branch stub hollows. The Hybrid Habitat Hollow successfully provides a nest box alternative that addresses the many issues outlined above that result in traditional nest boxes being less successful than desired.

- A long-term solution: the use of Australian hardwood timber, encased in a PVC housing, and painted with Dulux Weathershield exterior paint provides a durable habitat solution that will long outlast any commercially available nest box on the market. All joints are double fixed with a combination of glue/screws, glue/nails, or glue/rivets to ensure that this product will last for decades.
- Designed by ecologists specifically for your target species: our team has customised the design and construction of your Hybrid Habitat Hollows to match the requirements of your target species. We base our designs on the best, most current science available to ensure the greatest possible chance of successful breeding by your target species.



- Furnished with natural 'Mud Guts': the use of PVC construction allows us to furnish each Hybrid Habitat Hollow with natural, sustainably sourced 'Mud Guts', the rotten heartwood that is present in natural tree hollows. This material provides a soft bedding substrate, assists in the regulation of temperature and humidity, masks odours of manufactured materials, and supports the natural processes that assist with the breakdown of waste materials within the nest.
- Thermal regulation: the combination of a hardwood timber insert, within a PVC casing provides double-walled insulation ensuring stable internal temperatures consistent with the thermal properties of natural hollows.



Our Team

Hybrid Habitat Hollows have been developed by a team comprised of specialists in ecology, ornithology, forestry and engineering. With a broad suite of skills and experience, we can provide site surveys, recommendations, installation, monitoring and maintenance.

***"We believe in
sustainability and
innovation."***



Your Hybrid Habitat Hollows

Striated Pardalote

Pardalotus striatus

Design Specifications

- 200mm Height
- 28mm diameter entrance 'branch stub hollow'
- Furnished with 50mm depth 'mud guts'
- 100-110mm internal diameter

Also suitable for:
Feathertail glider (*Acrobates pygmaeus*)



Striated pardalote: courtesy of Birdlife Australia



Your Hybrid Habitat Hollows

White-throated treecreeper *Corombates leucophaea*

Design Specifications

- 400mm Height
- 40mm diameter entrance 'branch stub hollow'
- Furnished with 100mm depth 'mud guts'
- 100-110mm internal diameter

Also suitable for:

Other treecreepers (*Climacteris* spp.)

Sugar and Squirrel Gliders (*Petaurus* spp.)



White-thoated Treecreeper: courtesy of Birdlife Australia



Your Hybrid Habitat Hollows

Little Forest Bat

Design Specifications

- 800mm Height
- 100mm x 20mm vertical entrance slot
- 500mm above entrance for colony roosting/maternity den
- 200mm depth below entrance for guano accumulation/breakdown
- Furnished with 50mm depth 'mud guts
- 100-110mm internal diameter

Also suitable for:

Gould's long-eared bat (*Nyctophilus gouldi*) and other microbat species



Little Forest Bat: courtesy of Museums Victoria

Vespadelus vulturnus



Your Hybrid Habitat Hollows

PROJECT STATUS

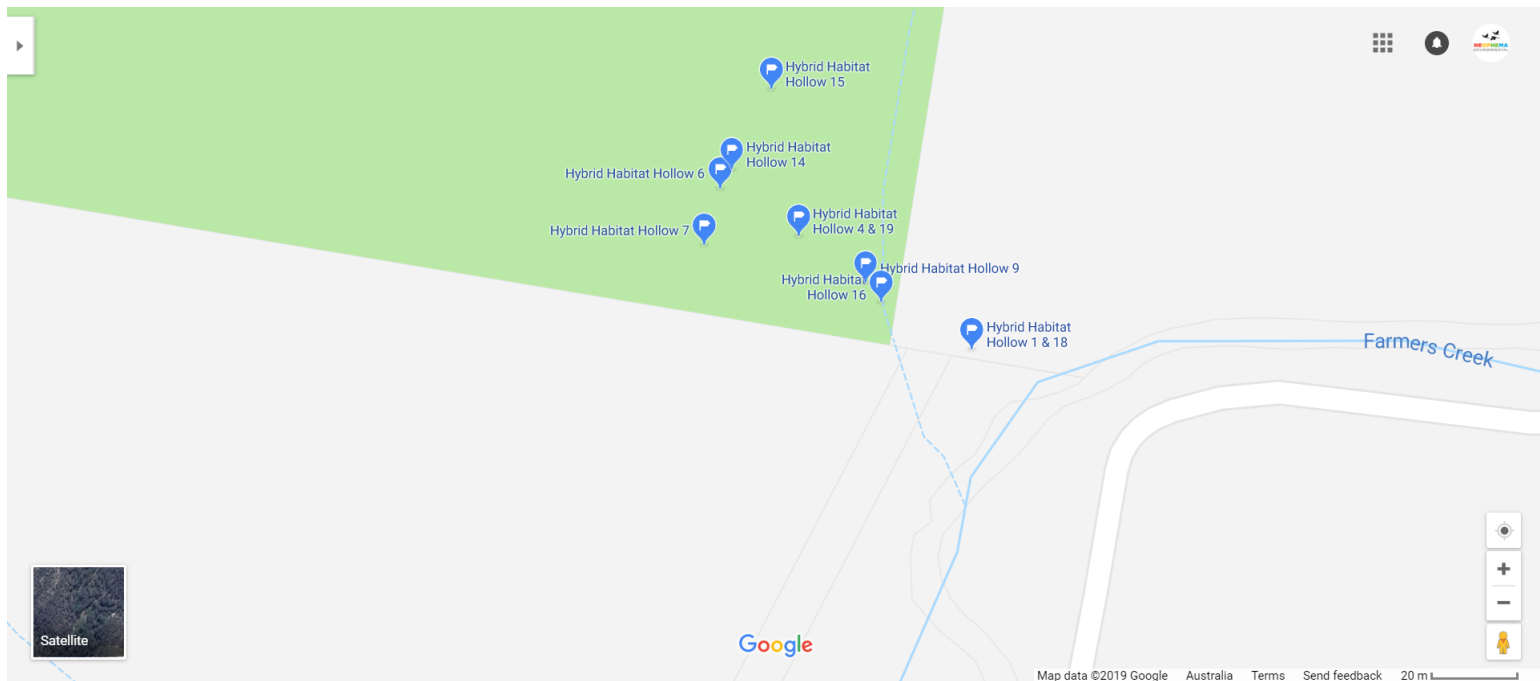
NAME OF PROJECT	FARMERS CREEK, LITHGOW
PROJECT ID	HYBRID HABITAT HOLLOWS PROJECT #0010
PERIOD COVERING	INSTALLATION: 12 & 13 FEBRUARY 2019

HOLLOW NO.	SITE	LATITUDE	LONGITUDE
1	1	-33.46355	150.19452
2	3	-33.4705	150.17186
3	3	-33.47087	150.17155
4	1	-33.46331	150.19408
5	3	-33.47058	150.17183
6	1	-33.46321	150.19388
7	1	-33.46333	150.19384
8	3	-33.47091	150.17147

Your Hybrid Habitat Hollows

HOLLOW NO.	SITE	LATITUDE	LONGITUDE
9	1	-33.46341	150.19425
10	3	-33.47101	150.17145
11	3	-33.47075	150.17166
12	3	-33.47045	150.17183
13	3	-33.47059	150.17178
14	1	-33.46317	150.19391
15	1	-33.463	150.19401
16	1	-33.46345	150.19429
17	3	-33.47075	150.17166
18	1	-33.46355	150.19452
19	1	-33.46331	150.19408
20	3	-33.47046	150.17197

Your Hybrid Habitat Hollows



Map 1: Farmers Creek 1 site showing locations of Hybrid Habitat Hollows (consistent with mapping names from the Farmers Creek Precinct Master Plan)

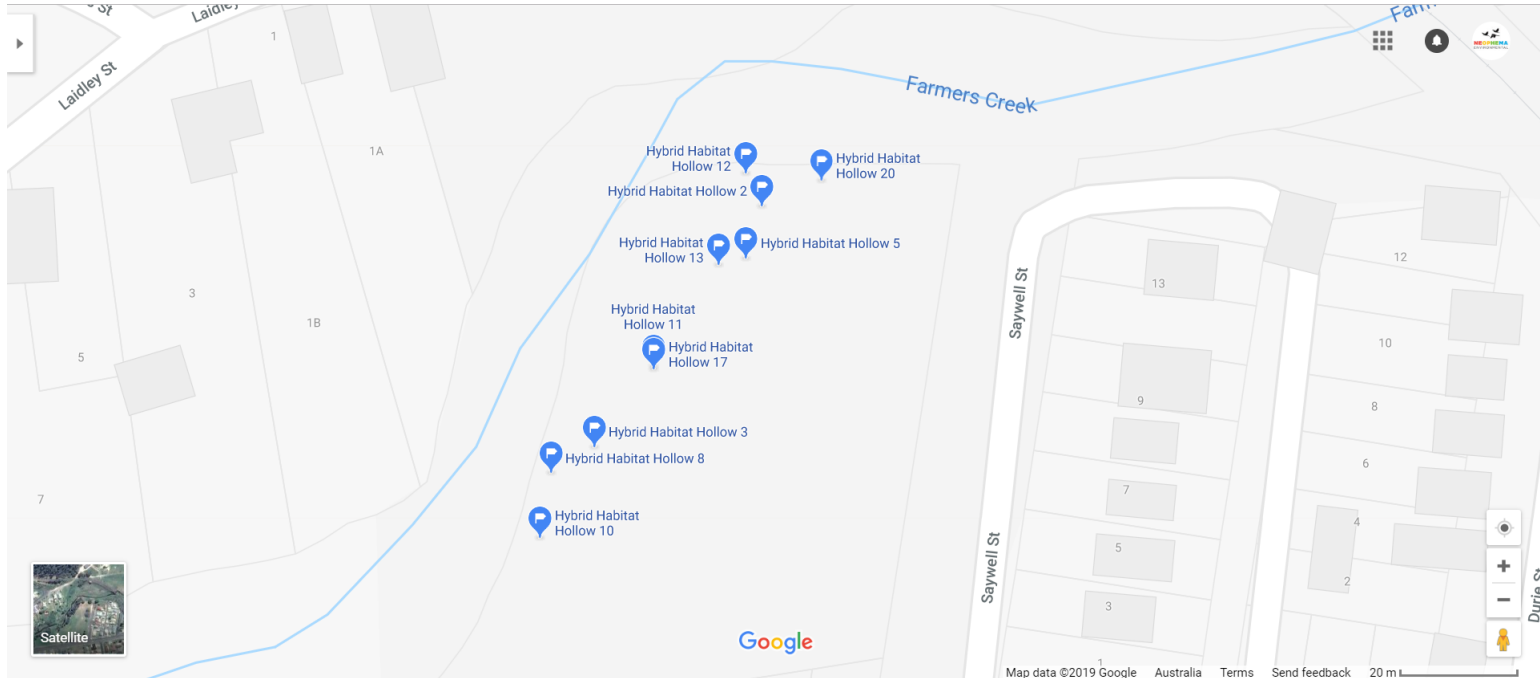


Map 2: Farmers Creek 1 site showing locations of Hybrid Habitat Hollows - satellite view

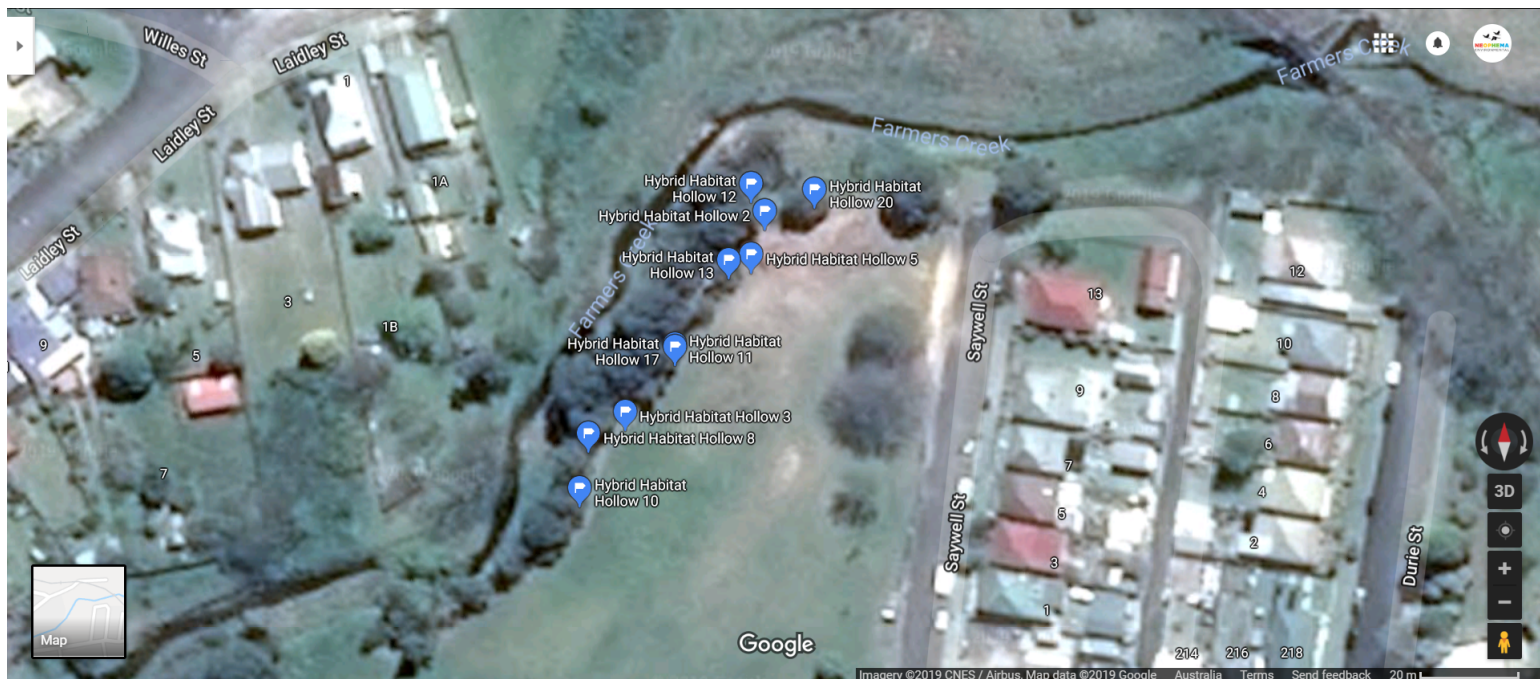
Maps 1 & 2 above show the locations of the ten Hybrid Habitat Hollows installed at this site. The installations follow an upper tributary of Farmers Creek and are out of range of the main vehicular and pedestrian tracks observed.



Your Hybrid Habitat Hollows



Map 3: Farmers Creek 3 site showing locations of Hybrid Habitat Hollows (consistent with mapping names from the Farmers Creek Precinct Master Plan)



Map 4: Farmers Creek 3 site showing locations of Hybrid Habitat Hollows - satellite view

Maps 3 & 4 above show the locations of the ten Hybrid Habitat Hollows installed at this site. The installations are located within a previous revegetation site that is hollow depauperate. This site will be suitable for community education events.



Your Hybrid Habitat Hollows

Hollow #1

Details

- Site: Farmers Creek 1
- 6.3m high at entrance hole
- Installed in *Eucalyptus fastigata* (DBH 44.0cm)
- Trunk diameter at attachment point 33.5cm
- Aspect: SW - 234 degrees

Striated Pardalote



Hollow #2

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in *Eucalyptus viminalis* (DBH 28.5cm)
- Trunk diameter at attachment point 22.9cm
- Aspect: SW - 220 degrees

Striated Pardalote



Your Hybrid Habitat Hollows

Hollow #3

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in *Eucalyptus viminalis* (DBH 40.5cm)
- Trunk diameter at attachment point 22.7cm
- Aspect: N - 10 degrees

Striated Pardalote



Hollow #4

Details

- Site: Farmers Creek 1
- 6.0m high at entrance hole
- Installed in *Eucalyptus fastigata* (DBH 50.0cm)
- Trunk diameter at attachment point 42.4cm
- Aspect: SE - 126 degrees

Striated Pardalote



Your Hybrid Habitat Hollows

Hollow #5

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in *Eucalyptus viminalis* (DBH 38.0cm)
- Trunk diameter at attachment point 30.2cm
- Aspect: SSE - 152 degrees

Striated Pardalote



Hollow #6

Details

- Site: Farmers Creek 1
- 6.0m high at entrance hole
- Installed in *Eucalyptus piperita* (DBH 66.5cm)
- Trunk diameter at attachment point 55.1cm
- Aspect: NNW - 345 degrees

Striated Pardalote



Your Hybrid Habitat Hollows

Hollow #7

Details

- Site: Farmers Creek 1
- 4.0m high at entrance hole
- Installed in *Eucalyptus fastigata* (DBH 33.8cm)
- Trunk diameter at attachment point 33.3cm
- Aspect: NE - 32 degrees

Striated Pardalote



Hollow #8

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in *Eucalyptus pauciflora* (DBH 27.0cm)
- Trunk diameter at attachment point 18.8cm
- Aspect: NNE - 22 degrees

Striated Pardalote



Your Hybrid Habitat Hollows

Hollow #9

White-throated Treecreeper

Details

- Site: Farmers Creek 1
- 4.0m high at entrance hole
- Installed in Eucalyptus piperita (DBH 47.0cm)
- Trunk diameter at attachment point 38.5cm
- Aspect: SW - 240 degrees



Hollow #10

White-throated Treecreeper

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in Eucalyptus haemastoma (DBH 29.5cm)
- Trunk diameter at attachment point 23.6cm
- Aspect: E - 100 degrees



Your Hybrid Habitat Hollows

Hollow #11

White-throated Treecreeper

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in *Eucalyptus viminalis* (DBH 73.0cm)
- Trunk diameter at attachment point 22.7cm
- Aspect: WSW - 252 degrees



Hollow #12

White-throated Treecreeper

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in *Eucalyptus haemastoma* (DBH 21.5cm)
- Trunk diameter at attachment point 18.0cm
- Aspect: SE - 125 degrees



Your Hybrid Habitat Hollows

Hollow #13

White-throated Treecreeper

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in *Casuarina cunninghamiana* (DBH 36.5cm)
- Trunk diameter at attachment point 22.4cm
- Aspect: WSW - 254 degrees



Hollow #14

White-throated Treecreeper

Details

- Site: Farmers Creek 1
- 4.0m high at entrance hole
- Installed in *Eucalyptus piperita* (DBH 62.0cm)
- Trunk diameter at attachment point 45.7cm
- Aspect: NNE - 24 degrees



Your Hybrid Habitat Hollows

Hollow #15

White-throated Treecreeper

Details

- Site: Farmers Creek 1
- 4.0m high at entrance hole
- Installed in Eucalyptus piperita (DBH 50.5cm)
- Trunk diameter at attachment point 45.6cm
- Aspect: SSW - 192 degrees



Hollow #16

White-throated Treecreeper

Details

- Site: Farmers Creek 1
- 4.0m high at entrance hole
- Installed in Eucalyptus piperita (DBH 50.5cm)
- Trunk diameter at attachment point 43.4cm
- Aspect: NNE - 22 degrees



Your Hybrid Habitat Hollows

Hollow #17

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in *Eucalyptus viminalis* (DBH 47.0cm)
- Trunk diameter at attachment point 38.7cm
- Aspect: S - 176 degrees

Little Forest Bat



Hollow #18

Details

- Site: Farmers Creek 1
- 4.0m high at entrance hole
- Installed in *Eucalyptus fastigata* (DBH 44.0cm)
- Trunk diameter at attachment point 36.4cm
- Aspect: SW - 240 degrees

Little Forest Bat



Your Hybrid Habitat Hollows

Hollow #19

Details

- Site: Farmers Creek 1
- 4.0m high at entrance hole
- Installed in *Eucalyptus piperita* (DBH 50.0cm)
- Trunk diameter at attachment point 44.8cm
- Aspect: SE - 126 degrees

Little Forest Bat



Hollow #20

Details

- Site: Farmers Creek 3
- 4.0m high at entrance hole
- Installed in *Eucalyptus viminalis* (DBH 32.5cm)
- Trunk diameter at attachment point 26.3cm
- Aspect: SW - 217 degrees

Little Forest Bat



Project Monitoring

Hygrochron Dataloggers

Hygrochron dataloggers have been installed in each Hybrid Habitat Hollow as part of the Farmers Creek project. Each datalogger was set to begin recording temperature and humidity every half hour from Thursday 14 February 2019. Additionally, an external datalogger has been installed at each site to record the ambient temperature outside of the Hybrid Habitat Hollows. Temperature and humidity will be recorded for a period of six weeks.

Upon removal of the hygrochron dataloggers, temperature and humidity within the Hybrid Habitat Hollows will be compared with ambient temperatures from external loggers and meteorological records.

Temperature & Humidity



Hygrochron installed in back of hollow



External hygrochron installed below hollow

Remote Sensing Cameras

Reconnyx HC600 remote sensing cameras have been installed with each Hybrid Habitat Hollow in order to monitor the use of the newly installed hollows. These cameras are motion activated and will take three rapid fire images each time they are activated. The cameras have been installed above the hollows looking down to minimise the impact of leaves blowing in the wind which will trigger the cameras.

The cameras will be installed for a period of six weeks after which the images will be reviewed in order to ascertain if there has been any use in the early stages of deployment. While the breeding season for most species is now complete, it is possible that species such as gliders, microbats and reptiles may utilise this new habitat during this period.

Fauna Use



Remote sensing camera installed above Hybrid Habitat Hollow



Additional Information

Farmers Creek, Site 2

Initially it was planned to install Hybrid Habitat Hollows at Farmers Creek site 2, rather than site 3 as was completed. However, upon a site inspection on the day it was noted that some of the trees that had previously been identified as suitable for installation had been marked with yellow crosses consistent with tree removal identification. Additionally, other trees that had been identified as suitable were difficult to access with land tenure issues. As discussions with former Landcare Coordinator, Rechelle Fisher, had also indicated potential for community engagement, it was clear that site 3 was better suited for installation due to habitat availability and access purposes.



Example of tree marked for removal



Difficult access and unclear land tenure

Further Reporting

Upon completion of all data collection and assessment another brief report will be provided to Lithgow City Council in order to provide you information on the thermal properties of the Hybrid Habitat Hollows, as well as details of any use during the initial six week period of installation.

Further, this data may be used for research purposes in the future in order to demonstrate the suitability of Hybrid Habitat Hollows as an alternative to traditionally constructed nest boxes.

Should any research be published in scientific journals that includes the data collected from this project, Lithgow City Council will be forwarded a copy of the research paper.



Hybrid Habitat Hollow #16 in the field



Frequently Asked Questions

Should we be putting more plastic into the environment?

Single use plastics are recognised, quite rightly, for their negative impact on the environment. Plastic can cause the death of fauna when consumed, through choking or otherwise obstructing movement. There are many issues with plastics and the majority are to do with the longevity of plastic in the environment.

While we recognise the issues surrounding plastic, we also are deeply aware of the issues surround the current crisis regarding tree hollows globally. As the vast majority of nest boxes will fail within ten years, and many faster than that, we needed to find a new solution. The ability of plastic materials to last for many decades in the Australian bush was exactly the reason we chose PVC pipe as the casing for Hybrid Habitat Hollows. When paired with Dulux Weathershield paints, we anticipate that these habitat solutions will last many decades and have the ability to make a genuine difference to hollow dependent fauna outcomes.

Further, the 3D printed components that are used to create the Hybrid Habitat Hollows are produced from PLA filaments. PLA is a plastic that is derived from plant starch and is degradable. Additionally, the 3D printed "bark" and entrance are produced using PLA that is combined with natural wood residues further reducing the amount of plastic material required. This material is greatly suited to our purposes as it is noticeably softer than than standard PLA plastic and allows for animals to get a firm grip with their claws in the same manner as natural bark. The big difference is that our "bark" product will last for decades and thanks to the combination of exterior grade glue and rivets, won't peel from the hollow and fall to the ground.

While every attempt has been made to utilise plastics in an environmentally friendly and long term manner, we recognise that unforeseen circumstances may still arise. Fire, storms, lightning strikes, vandalism and tree failures are all realities of life that may impact on the longevity of the Hybrid Habitat Hollows. We encourage all of our customers to provide regular monitoring of your hollows. Where the product has failed, or the tree supporting the hollow has been damaged, we encourage you to dispose of the plastic components responsibly.



Frequently Asked Questions

Won't plastic get awfully hot and smelly?

The design of the Hybrid Habitat Hollow has been developed by a team of ecologists and engineers in order to provide a light-weight, yet well insulated nesting/den environment for our native fauna. The octagonal timber insert is constructed from 15mm thick Australian hardwood timber. This is encased in a PVC sleeve which creates an air pocket in between for further insulation, much the same as the concept behind double glazed windows.

The 3mm PVC walls are increased in thickness in areas where our 3D printed "bark" is attached, adding an additional 4mm of surface width. Painting of the external surfaces with light coloured paints increases reflectivity and reduces heat absorption during exposure to direct sun. Our aim is to ensure that the internal environment mimics that of natural tree hollows - a very stable temperature throughout the day and night, without major fluctuations.

Traditional timber nest boxes have been scientifically demonstrated to be significantly hotter than ambient temperatures during the heat of the day, and cooler than ambient temperatures during the night. While this doesn't impact negatively on all species - many nest boxes are successfully used by a range of animals - it is considered that this is the reason many other native species don't use nest boxes. We are aiming to change this.

Inside the Hybrid Habitat Hollow, the animals will be surrounded by Australian hardwood timber. The bedding material provided is natural 'mud guts' - the rotting heartwood timber from natural tree hollows - sustainably sourced from local arborists. This material assists with thermal regulation and provides the organic environment to assist with waste material breakdown within the hollow. The 'mud guts' also contributes to a natural hollow smell.

Why aren't there any ventilation holes?

As outlined above, our intention is to create a well insulated environment that provides a buffer from the fluctuations of the ambient temperatures outside. The addition of ventilation holes beyond the entrance would only facilitate the transfer of hot/cold air from outside of the Hybrid Habitat Hollow, altering the internal thermal profile. While no ventilation holes are included, we do have a unique drainage system that allows excess moisture to escape, while excluding light penetration or air flow within the hollow.





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