Habitat Tree Survey and Nest Box Management Plan (Sections 10 & 11)

Woolgoolga to Ballina Pacific Highway upgrade

October 2014

Document Information

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Recipient:	Stuart Austin, Roads and Maritime Services
Author(s)	Dr Terry O'Dwyer
Approved by:	Glenn Muir

Executive Summary

Australian Museum Consulting (AM Consulting) was engaged by the NSW Roads and Maritime Services (RMS) to perform a survey of fauna habitat trees and prepare a Nest Box Management Plan (NBMP) for Sections 10 and 11 of the Woolgoolga to Ballina Pacific Highway upgrade (the "W2B upgrade"). The objectives of the survey were to record details of every hollow-bearing tree (HBT) within the project corridor and to mark each HBT in the field. The objectives of the NBMP were to determine the number of HBTs and tree hollows that would be lost as a result of the clearing of vegetation within the project corridor, assign each hollow to a suitable fauna group based on the hollow's characteristics, and design a hollow-replacement strategy to compensate for the loss of tree hollow resources.

To assist with the NBMP the project area was divided into 40 nest box zones along the length of the corridor. The area within the project boundary and an additional area of 5 m to both sides of the project boundary were traversed on foot by an ecologist between 8 July 2014 and 17 July 2014. Every tree within this area was inspected for potential tree hollows from the ground, using binoculars. All HBTs found were marked around the trunk with white spray paint and with a unique identifying number. A two-stage formula was used to calculate the number and type of replacement nest boxes required for each nest box zone. The number of nest boxes required for specific species/groups for each nest box zone was then derived based on the proportion of hollows of various size classes identified during surveys.

Tree hollows were recorded in 23 of the 40 nest box zones. A total of 155 HBTs were identified within the project corridor and a further 13 HBTs were recorded as being within 5 m of the project boundary. In total 314 potential tree hollows were identified within, or within 5 m of, the project boundary. Large hollows (>150 mm) were the most frequently observed size class and smaller hollows the least often observed. Limb hollows were the most commonly recorded type of hollow (172), followed by main stem hollows (103), and fissures (27). Ten crown hollows and two residual hollows were also recorded.

Fifteen of the 23 nest box zones where HBTs were recorded require replacement nest boxes due to the density of HBTs in adjacent habitat being less than 4 per hectare. In total, 71 nest boxes are required to compensate for the loss of hollows within the project corridor. A list of specific nest box types has been provided that compensates for the loss of hollows with a range of characteristics. The range of nest box types recommended should provide for the majority of fauna species/groups that are likely to occur in the area. The areas adjacent to some of the zones requiring replacement nest boxes have little or no suitable habitat to take replacement nest boxes and recommendations for alternative areas have been made. Also provided is a list of important nest box characteristics to consider when constructing or commissioning nest boxes. Guidelines for the installation and maintenance of nest boxes are also provided.

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1 Introduction

1.1 Background

The Woolgoolga to Ballina Pacific Highway upgrade (the "W2B upgrade") is a major infrastructure project to be undertaken by the NSW Roads and Maritime Services (RMS) on the north coast of NSW. The project will involve upgrades and realignments of approximately 155 km of highway, extending north from Woolgoolga to the southern outskirts of Ballina. The project has been divided into 11 sections, with Section 1 located at the southern end of the project and Section 11 at the northern end. A number of ecological studies are required prior to the commencement of construction of the project.

This report has been prepared in relation to some of the ecological studies required for Sections 10 and 11 of the W2B upgrade; these being the survey and recording of habitat trees and tree hollows, and the preparation of a Nest Box Management Plan (NBMP). These studies were commissioned by RMS and performed by Australian Museum Consulting (AM Consulting). AM Consulting also performed vegetation surveys in Sections 10 and 11 of the project and these are described in a separate report (Australian Museum Consulting 2014).

1.2 Scope of Works

This study involves the following components:

1. Identification and marking of all hollow-bearing trees (HBTs) and recording of tree hollow details for each HBT located within the project boundary;
2. Identification and marking of all hollow-bearing trees (HBTs) and recording of tree hollow details for each HBT located in the area up to 5 m from both sides of the project boundary;
3. Assessment of HBT density in areas adjacent to the project boundary;
4. Use of this data to prepare a NBMP;
5. Preparation of this report and submission of HBT data to RMS.

1.3 Objectives of the Nest Box Management Plan

Clearing of vegetation containing tree hollows has the potential to impact animals that rely on tree hollows for a part of their life cycle. The objectives of the NBMP are therefore to identify the number of tree hollows that would be lost as a result of vegetation clearing within the project corridor, assign each hollow to a suitable fauna group based on the hollow's characteristics, and design a hollow-replacement strategy to compensate for the loss of tree hollow resources.

1.4 Survey Limitations

Limitations to identifying tree hollows from the ground include the likelihood that some hollows, particularly small hollows, may not be able to be observed from the ground due to obstruction of views by foliage, tree limbs etc. It can also be difficult from the ground to accurately assess the quality and characteristics of some hollows and it is generally impossible to assess the depth or volume of a hollow. Additionally, some 'hollows' identified from the ground may turn out upon closer inspection to be blind or otherwise unsuitable as fauna habitat.

HBTs within the project corridor and also within 5 m of the project corridor were recorded and mapped. However, in heavily vegetated areas the accuracy of GPS recordings was often 8-10 metres. Therefore, we cannot be certain that the recorded status (i.e. whether inside or outside the project boundary) is always accurate for HBTs recorded near the edge of the project boundary.

Five properties through which the project area passes were not able to be surveyed due to access limitations. Four of these properties contained vegetation that may contain HBTs. The properties are listed in Table 1.1 and shown on Figure 2.2.

The inspection of a paddock tree in Nest Box Zone 3 was interrupted by an aggressive dog before the assessment could be completed. The preliminary inspection indicated that the tree was likely to contain hollows but no details were able to be recorded. The location of the tree was E542599, N6792657.

Property access restrictions and the presence of the dog in Nest Box Zone 3 prevented the assessment of HBT density in some areas adjacent to the project corridor (Table 1.1). Surveys of Lots containing HBTs should be performed once property acquisition is complete, with areas scheduled to be cleared first given priority. The results of those surveys and a replacement strategy for any additional hollows recorded will be attached to this report as an addendum.

Table 1.1 Lots that could not be surveyed due to access restrictions

Lot/DP	Nest Box Zone	Comment
Lot 21/DP755691	3	Has potential HBTs
Lot 232/DP755691	4 & 5	Has potential HBTs
Lot 72/DP755691	13 & 14	Has potential HBTs
Lot 158/DP755731	15	Has potential HBTs
Lot 1/DP733934	19 & 20	No potential HBTs

2 Survey Background

2.1 Existing Environment

The project boundary for Sections 10 and 11 of the W2B upgrade is shown on Figure 2.1. Section 10 extends northwards 13.5 km from the southern side of the Richmond River just east of Broadwater to the proposed interchange at Coolgardie Road, Wardell. Section 11 extends northwards 5.4 km from Coolgardie Road to the tie-in with the Pimlico to Teven project. The total length of both Sections is approximately 18.9 km.

The study area is located on the far north coast of NSW. This part of NSW has been extensively cleared and used for a number of agricultural practices, most notably the growing of sugar cane. Sections 10 and 11 pass through some agricultural and some forested lands, with the majority being agricultural. Section 11 follows the existing Pacific Highway and passes mainly through cleared farmland, while section 10 forges a new route south from the existing highway at Coolgardie Road through a mostly cleared valley to Back Channel Road adjacent to the Richmond River.

The majority of the study area is located between 4 and 7 km from the coast on coastal plains or valley floors. The substrate in these locations is predominantly unconsolidated sediments. Sedimentary rocks are the next most common substrate followed by metasediments and basic volcanics. Sedimentary rocks of the Triassic Clarence Moreton basin outcrop form low hills above the coastal plains (Northern Rivers Regional Biodiversity Management Plan: Appendix 9). These unconsolidated sediments were deposited from 1.8 million years ago and consist of alluvial and estuarine deposits on the river floodplains and estuaries, and coastal sand masses of marine and Aeolian origin. Pleistocene sands deposited during this time across the study area formed dunes, swales, strand plains and back-barrier flats (Northern Rivers Regional Biodiversity Management Plan).

The dynamic mix of these unconsolidated sediments of alluvium and sand has had a significant influence on the vegetation and fauna habitat types within the study area and, although much of the original vegetation has been cleared, it is still possible to see these influences. Within relatively short distances vegetation formations can change from rainforest to forested wetlands, heathlands, grassy woodlands and wet or dry sclerophyll forest, depending on the various combinations of alluvium, sand, moisture and salinity levels.

2.2 Fauna Habitats

Ten broad fauna habitat types exist within the project boundary and are listed in Table 2.1. The distributions of the fauna habitat types are shown on Figures 2.3 to 2.6.

Table 2.1 Broad habitat types within the project corridor

Habitat Type	Area (ha)	Biometric community^	AMC (2014)*
Dry Sclerophyll Forests (mainly dominated by Scribbly Gum)	6.2	Scribbly Gum - Needlebark Stringybark heathy open forest of coastal lowlands of the northern North Coast	31 Scribbly Gum–Red Mahogany–Brush Box dry sclerophyll Open to Closed Forest
Forested Wetlands (forests dominated mainly by swamp oaks and paperbarks)	28.9	Swamp Oak swamp forest of the coastal lowlands of the North Coast	8 Swamp Oak king-tide swamp sclerophyll forest
		Swamp Mahogany swamp forest of the coastal lowlands of the North Coast	11 Broad-leaved Paperbark–Pink-flowered Doughwood Swamp Sclerophyll Open Forest
		Paperbark swamp forest of the coastal lowlands of the North Coast	12 Broad-leaved Paperbark–Swamp Oak Ferny Swamp
		Paperbark swamp forest of the coastal lowlands of the North Coast	40. Lower Richmond Mesic Successional wet/swamp Sclerophyll Forest/Rainforest
		Paperbark swamp forest of the coastal lowlands of the North Coast	20 Swamp Box–Broad-leaved Paperbark–rush/fern Swamp Sclerophyll Forest
		Paperbark swamp forest of the coastal lowlands of the North Coast	4 Swamp Oak–Broad-leaved Paperbark Estuarine and Alluvial Plain Swamp Sclerophyll Forest
Wet Sclerophyll Forests (mainly dominated by Blackbutt, Ironbark, Turpentine)	12.3	Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the North Coast	32 Blackbutt–Turpentine Open Forest Complex
		Blackbutt grassy open forest of the lower Clarence Valley of the North Coast	55 Grey Ironbark–Pink Bloodwood–White Mahogany Dry Grassy Open Forest
Rainforests	3.7	White Booyong - Fig subtropical rainforest of the North Coast	43 Brunswick–Tweed Brush Box Gully Rainforest on Metasediments
		White Booyong - Fig subtropical rainforest of the North Coast	44 Tweed–Brunswick Valley Blue Quandong Subtropical Rainforest
		White Booyong - Fig subtropical rainforest of the North Coast	45 Tweed–Brunswick Valleys Bangalow Palm–Lilly Pilly
Saline Wetlands (Mangroves)	0.3	Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregions	5 Milky Mangrove–Swamp Oak–Grey Mangrove King-Tide
		Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregions	62 River Mangrove–Grey Mangrove–Black Mangrove–
Grassy Woodlands	15.6	Narrow-leaved Red Gum woodlands of the lowlands of the North Coast	58 Pink Bloodwood–Grey Ironbark–Swamp Box–Forest
Cleared Lands	182.3	n/a	n/a
Regrowth	1.1	n/a	n/a
Areas dominated by *Cinnamomum camphora*	1.6	n/a	n/a
Water Bodies	1.98	n/a	n/a

^ http://www.environment.nsw.gov.au/resources/nature/BioMetric_Vegetation_Type_CMA.xls

* Australian Museum Consulting (2014). Vegetation survey of Sections 10 and 11 of the Woolgoolga to Ballina Pacific Highway upgrade. Consultancy report to NSW Roads and Maritime Services (in prep.)

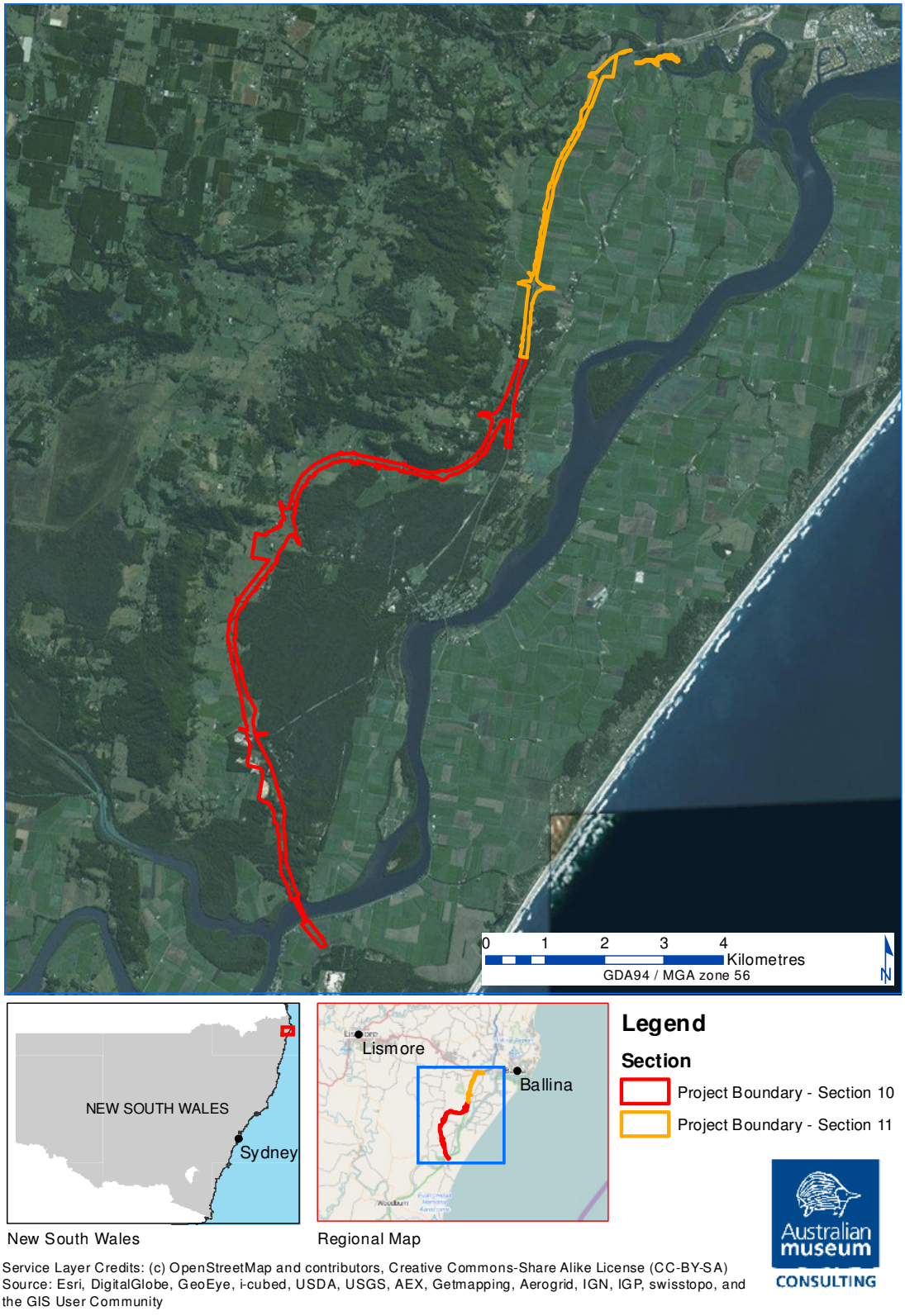

Figure 2.1 Location of the Study Area in a State-wide, Regional and Local context

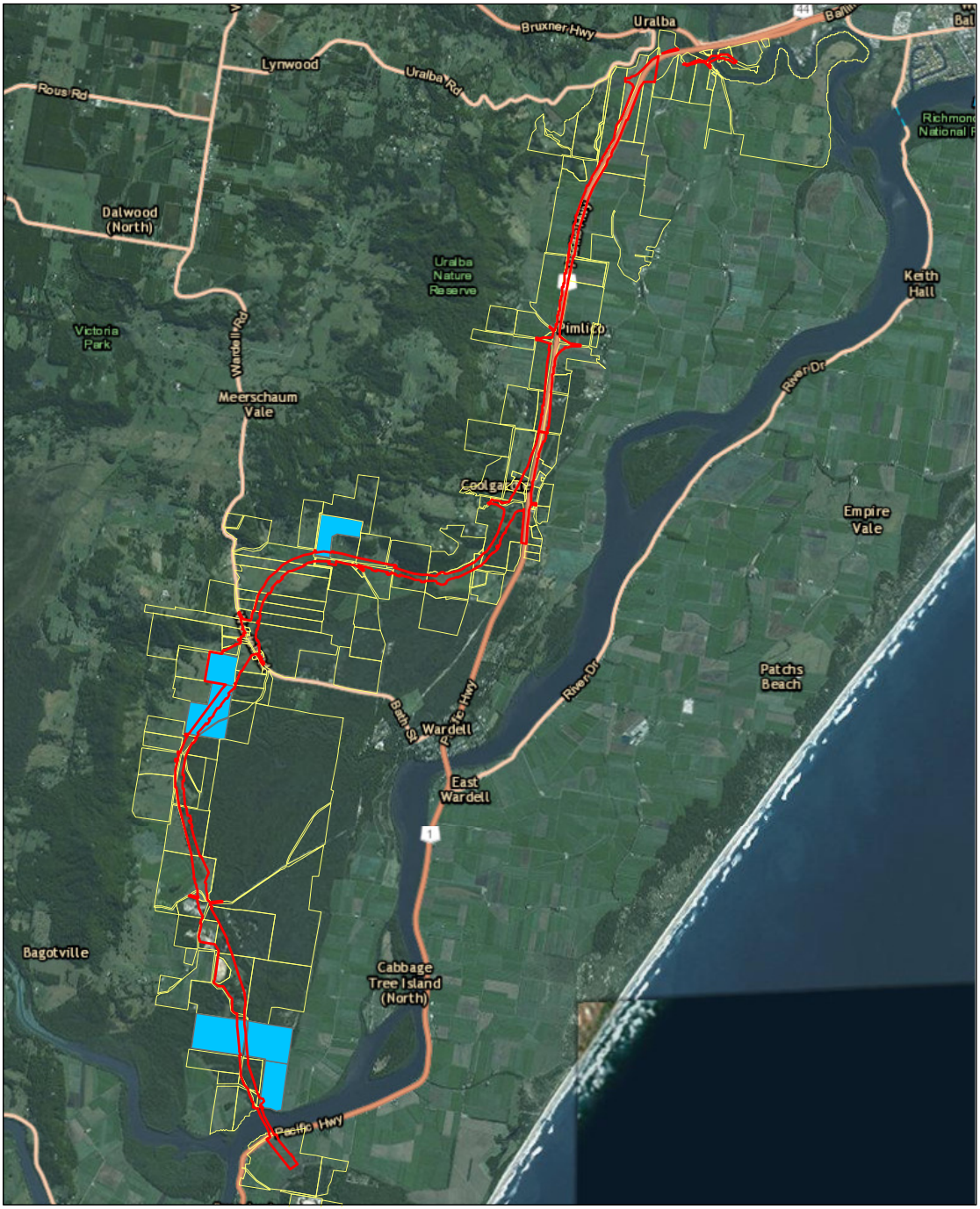

Figure 2.2 Properties not able to be surveyed due to access restrictions

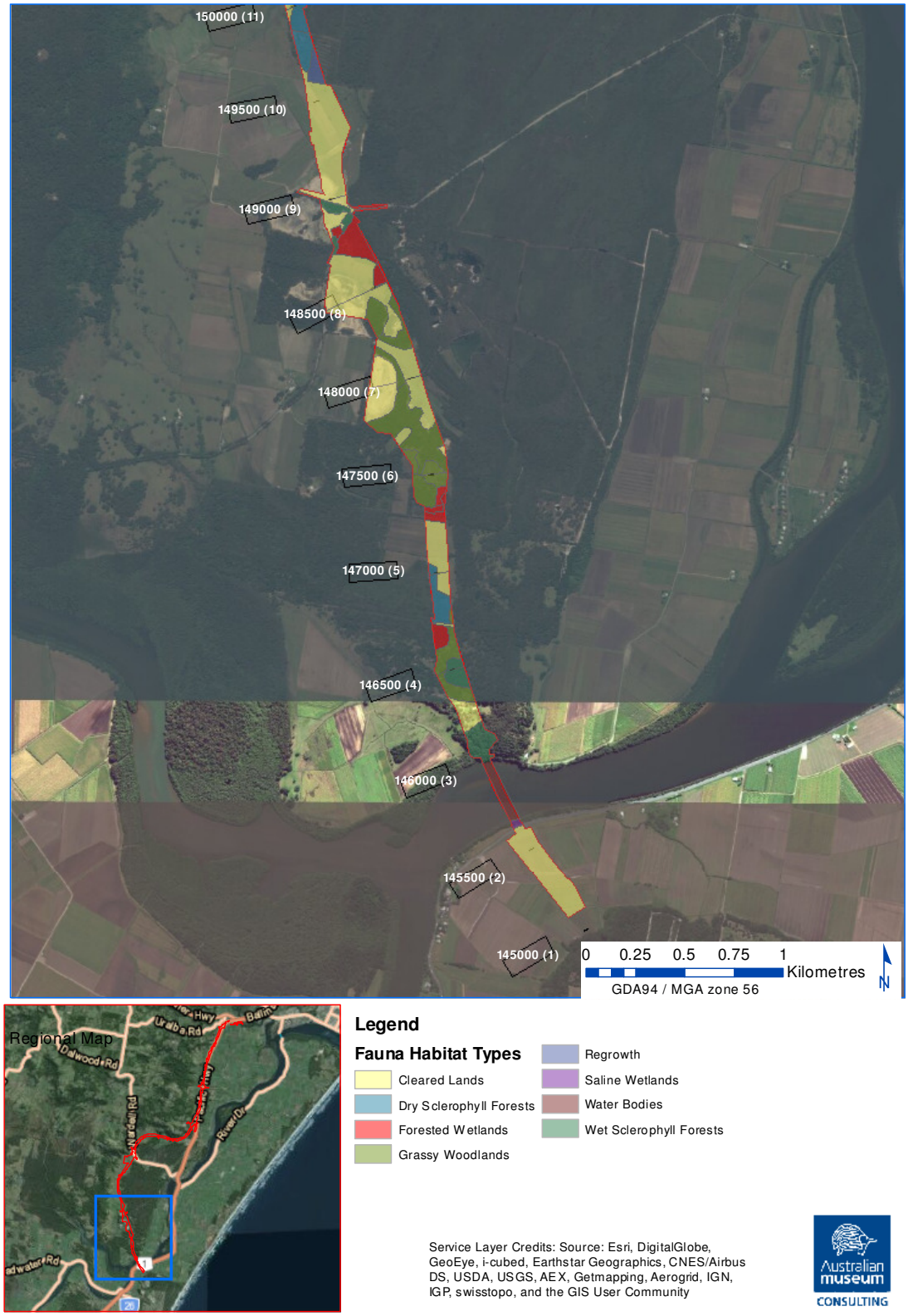

Figure 2.3 Fauna habitat types within the project area (Nest Box Zones 1 to 10)

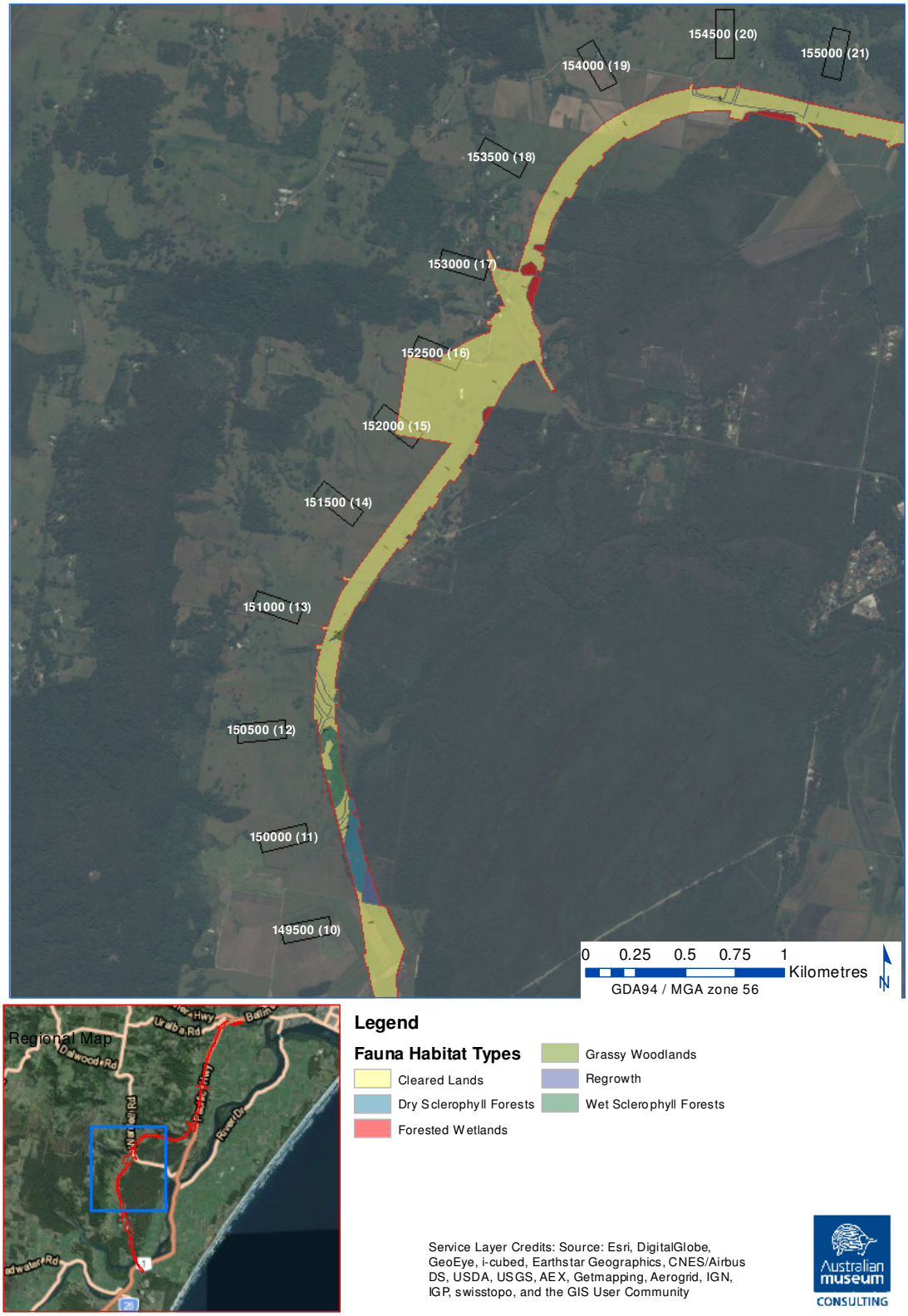

Figure 2.4 Fauna habitat types within the project area (Nest Box Zones 11 to 20)

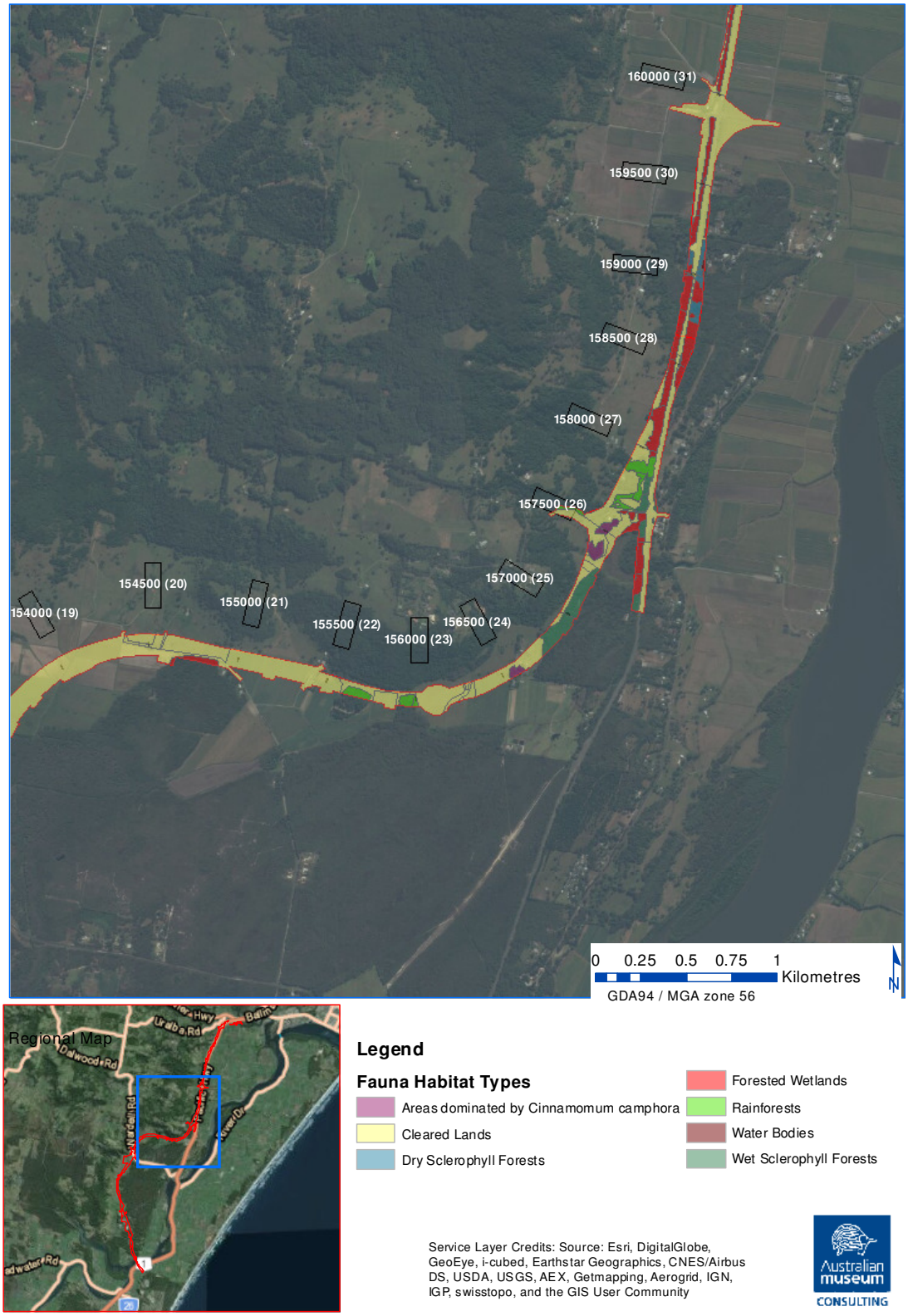

Figure 2.5 Fauna habitat types within the project area (Nest Box Zones 21 to 30)

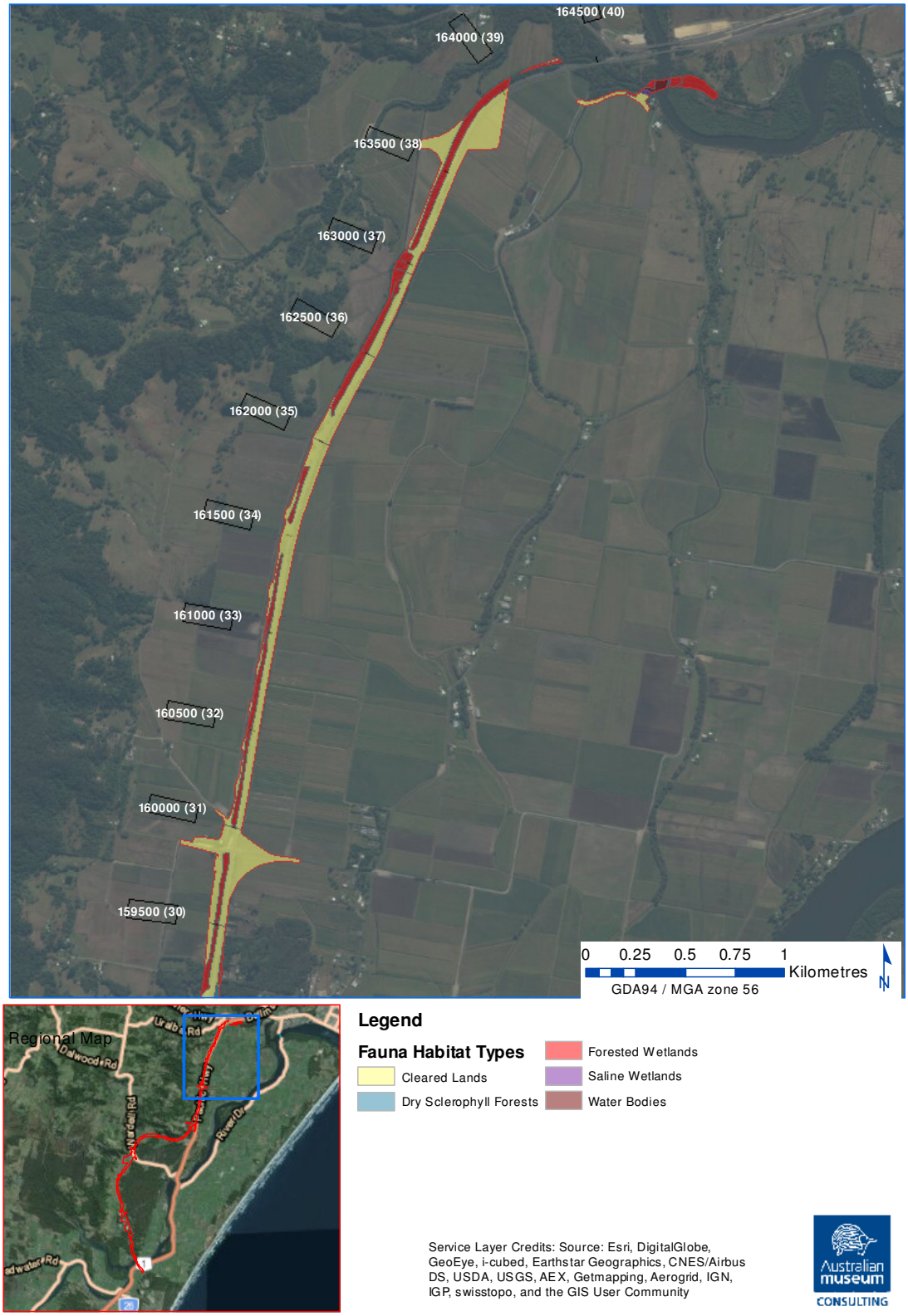

Figure 2.6 Fauna habitat types within the project area (Nest Box Zones 31 to 40)

3 Survey Methodology

3.1 Hollow-bearing Tree Inventory

The entire area within the project boundary and an additional area of 5 m to both sides of the project boundary (excluding any properties where access was not permitted, which are listed in Section 1.4) was traversed on foot by ecologist Chris Jackson between 8 July 2014 and 17 July 2014. Every tree within this area was inspected for potential tree hollows from the ground, using binoculars. All HBTs found were marked around the trunk with white spray paint and with a unique identifying number.

In order to assist the development of the NBMP, the study area was divided into nest box zones. Each nest box zone was an approximately 500 m length of the project corridor. For example, Section 10 of the W2B upgrade starts at chainage 145000, so the section from this chainage to chainage 145500 was designated as Nest Box Zone 1. In total, Sections 10 and 11 of the W2B upgrade were divided into 40 nest box zones.

The number painted on each tree indicated the nest box zone, an "H" and the tree number. For example, a tree marked 10H128 indicates that the HBT was in Nest Box Zone 10 and was the 128th HBT identified within the study area.

3.2 Tree Details and Tree Hollow Characteristics

Data regarding each HBT identified within the study area and data regarding the potential hollows in each HBT were recorded during the survey. The data recorded were:

- tree number;
- geographic co-ordinates of the location of the tree (using a hand-held GPS);
- type of tree (where known);
- whether the tree was alive or dead;
- approximate height of the tree;
- diameter at breast height (DBH);
- the total number of hollows or habitat features observed;
- the type of feature (main stem hollow [MSH], residual hollow [RH], crown hollow [CH], limb hollow [LH], or fissure [F]);
- approximate height of each feature;
- approximate size of each feature (i.e. width of entrance to the hollow) (Small [<50 mm], Medium [50-150 mm], Large [>150 mm]); and
- in some cases, additional notes (e.g. signs of fauna).

3.3 Hollow-bearing Tree Density

HBT density within the project corridor was determined by counting the number of HBTs in each nest box zone and dividing the total number of HBTs by the area of vegetation within the nest box zone. Areas mapped as cleared were omitted from calculations as were isolated paddock trees occurring in areas mapped as cleared. The HBT density in areas adjacent to the project corridor was estimated by performing surveys counting the number of HBTs within 50 x 100 m quadrats. Some areas of the project corridor were vegetated to both sides of the nest box zone, some were partially vegetated, some areas were cleared on both sides of the corridor and some areas were not accessible; thus, the number of quadrats surveyed alongside each nest box zone varied. Where quadrats were not used the HBT density was assessed where possible on the basis of HBT density in contiguous, similar habitat in the project boundary. The density of HBTs adjacent to each nest box zone was then estimated by calculating the average number of HBTs recorded in survey plots or in similar habitat.

4 Survey Results

4.1 Hollow-bearing Tree Inventory

A total of 155 HBTs were identified within the project corridor. A further 13 HBTs were recorded as being within 5 m of the project boundary. HBTs generally occurred as groups in the wooded parts of the study area, although some occurred as isolated trees within a cleared landscape. Some of the nest box zones contained no HBTs. The locations of the HBTs are shown at a broad scale on Figures 4.2 to 4.5 and the location of each numbered tree in Appendix A.

4.2 Tree Details and Tree Hollow Characteristics

A total of 314 potential tree hollows were identified within, or within 5 m of, the project boundary. Figure 4.1 shows the breakdown of the three hollow size categories and indicates that large hollows (>150 mm) were the most frequently observed size class and smaller hollows the least often observed. Limb hollows were the most commonly recorded type of hollow (172), followed by main stem hollows (103), and fissures (27). Ten crown hollows and two residual hollows were also recorded. Data regarding tree details and tree hollow characteristics are listed in Appendix B.

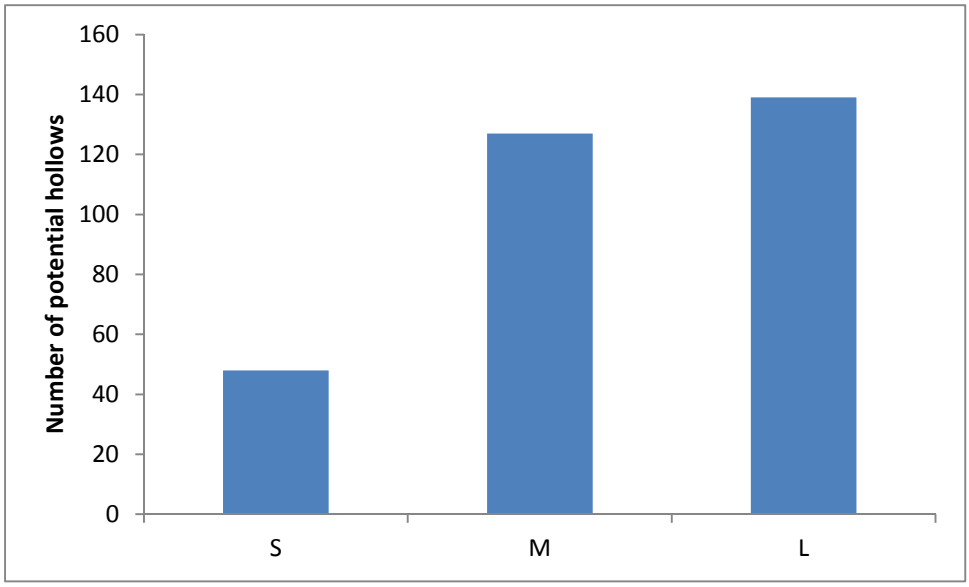

Figure 4.1 The number of potential hollows of various size classes recorded within the project corridor (S = < 50 mm, M = 50 mm – 150 mm, L = > 150 mm).

4.3 Hollow-bearing Tree Density

As discussed in Section 4.1, HBTs were concentrated in the more wooded parts of the study area and lengthy sections of the study area contained no HBTs. This was reflected in the results of the HBT density calculations, with some nest box zones containing HBT density of zero or very low. The highest HBT density (approximately 8 HBTs per hectare) was in Nest Box Zone 22. Estimates of HBT density in the adjacent landscape followed a similar pattern, with the area adjacent to some nest box zones containing a HBT density estimate of zero or very low.

The density of HBTs within the project boundary in each nest box zone is provided in Table 6.1 and estimates of HBT density adjacent to each nest box zone is provided in Table 6.2.

Figure 4.2 Location of hollow-bearing trees in Nest Box Zones 1 to 10

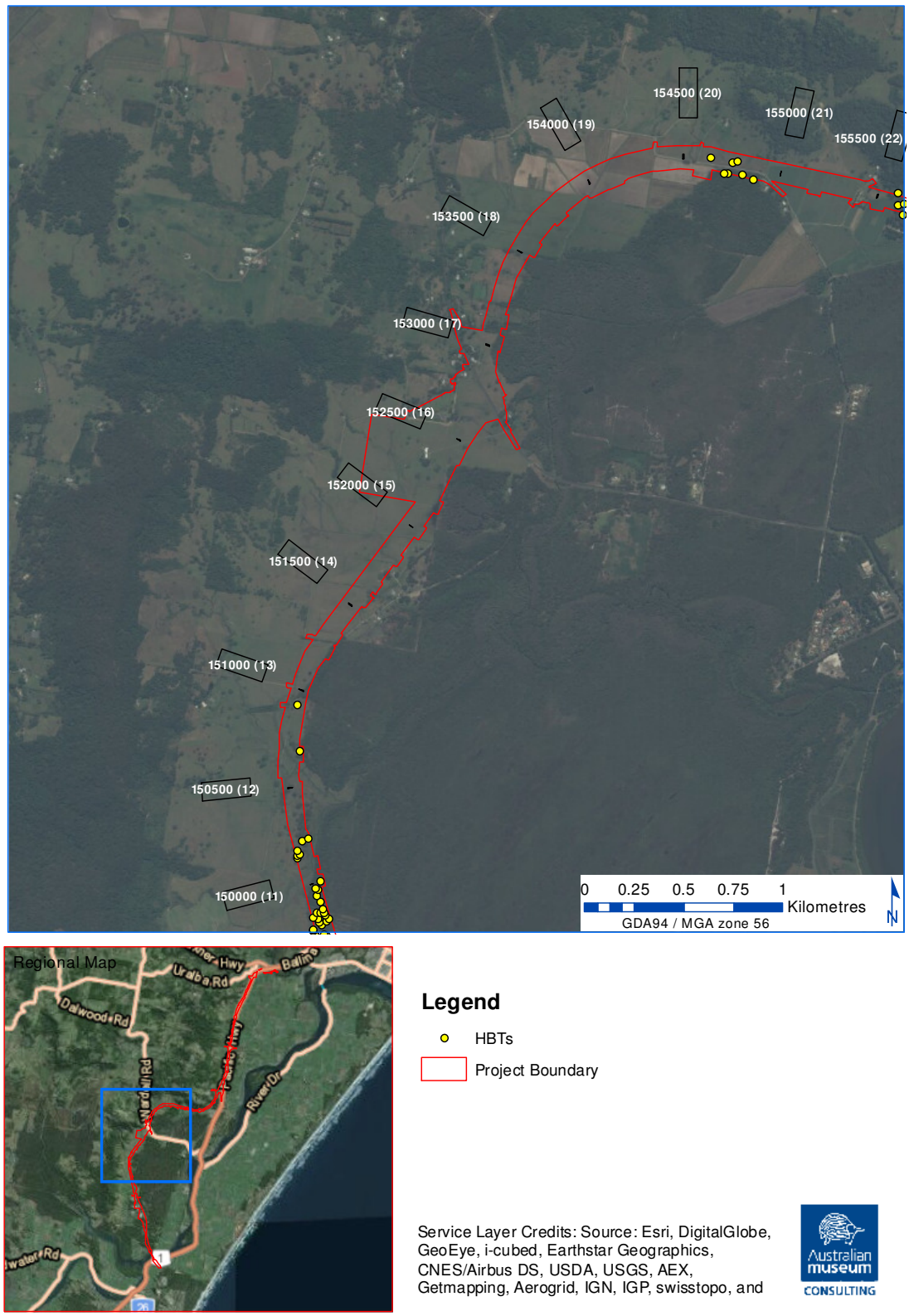

Figure 4.3 Location of hollow-bearing trees in Nest Box Zones 11 to 20

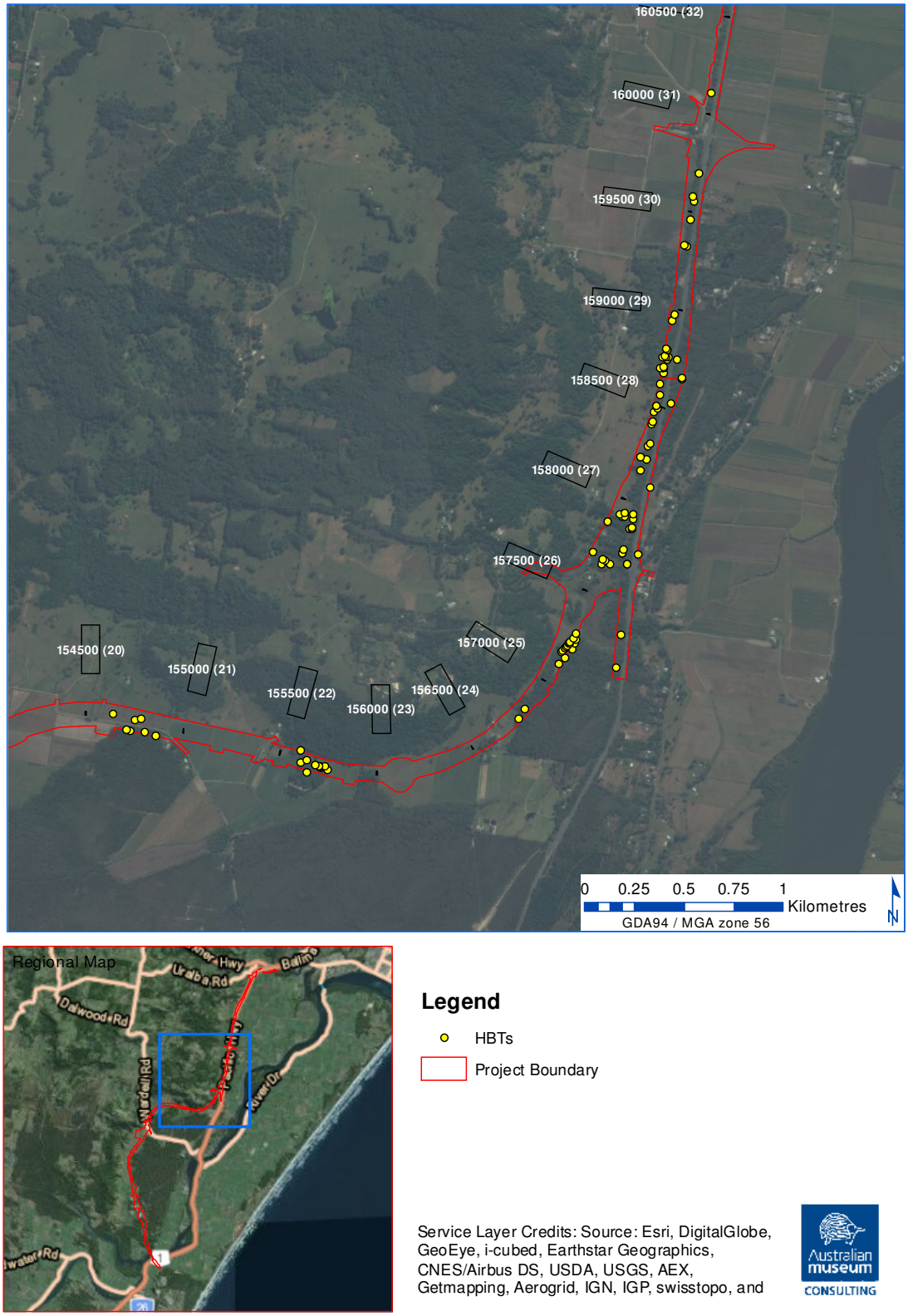

Figure 4.4 Location of hollow-bearing trees in Nest Box Zones 21 to 30

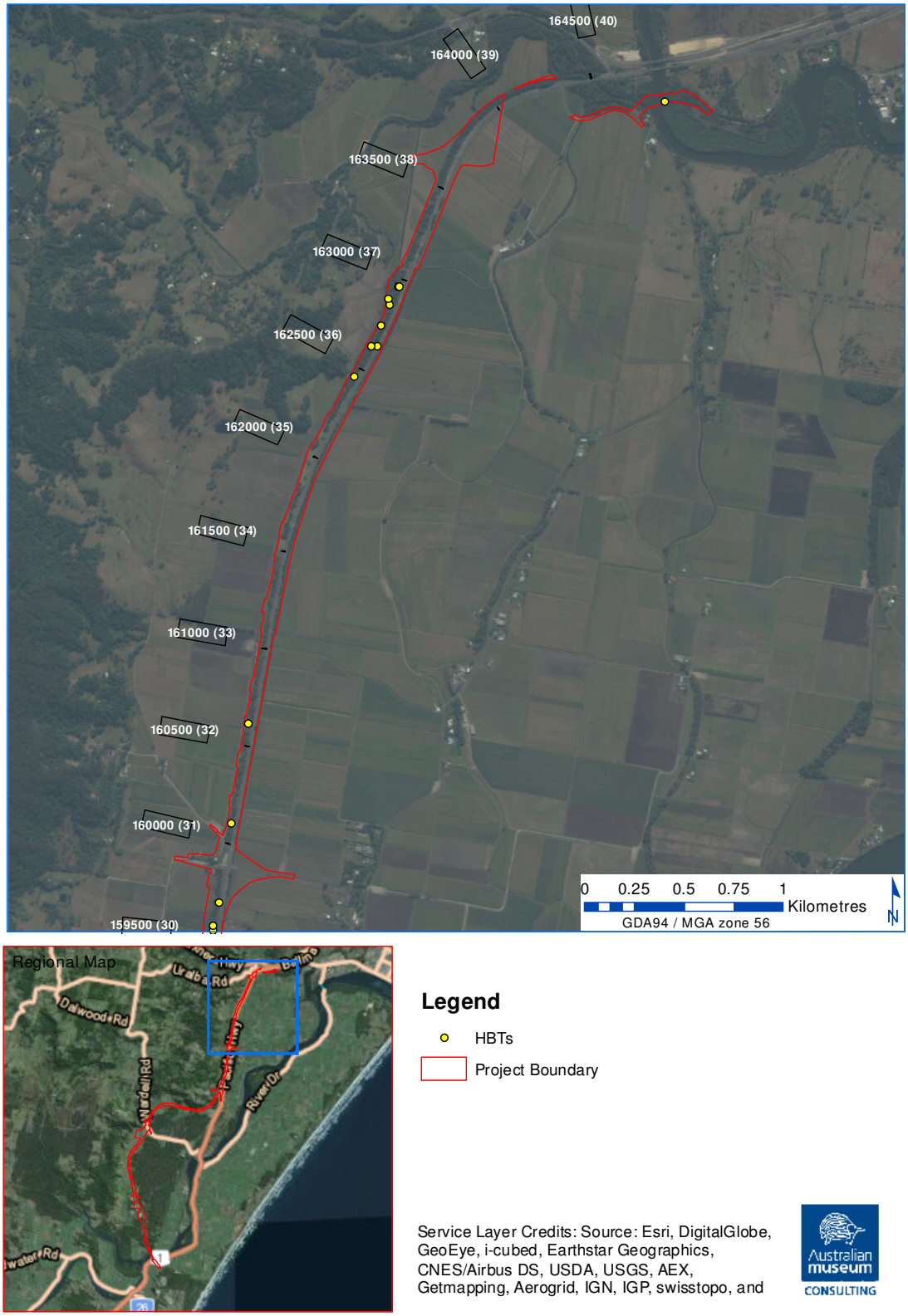

Figure 4.5 Location of hollow-bearing trees in Nest Box Zones 31-40

5 Nest Box Replacement Strategy

The EIS for the W2B upgrade identified 23 species of threatened fauna that are likely to rely on tree hollow resources in the area. The list includes seven birds, 14 mammals (including nine microbats) and two reptiles (Table 5.1).

Table 5.1 Threatened hollow-dependent species likely to occur in the project corridor

Common Name	Scientific Name	Status	
		TSC Act	EPBC Act
Glossy Black Cockatoo	*Calyptorhynctus lathami*	V	
Brown Treecreeper	*Climacteris picumnus picumnus*	V	
Double-eyed Fig Parrot	*Cyclopsitta diophthalma coxeni*	CE	
Little Lorikeet	*Glossopsitta pusilla*	V	
Powerful Owl	*Ninox strenua*	V	
Masked Owl	*Tyto novaehollandiae*	V	
Sooty owl	*Tyto tenebricosa*	V	
Eastern Pygmy-possum	*Cercartetus nanus*	V	
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E
Yellow-bellied Glider	*Petaurus australis*	V	
Squirrel Glider	*Petaurus norfolcensis*	V	
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	
Hoary Wattled Bat	*Chalinolobus nigrogriseus*	V	
Little Pied Bat	*Chalinolobus picatus*	V	
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	
Beccari's Freetail-bat	*Mormopterus beccarii*	V	
Eastern Freetail-bat	*Mormopterus norfolkensis*	V	
Southern Myotis	*Myotis macropus*	V	
Eastern Long-eared Bat	*Nyctophilus bifax*	V	
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	
Stephen's' Banded Snake	*Hoplocephalus stephensii*	V	

V = Vulnerable, E = Endangered, CE = Critically Endangered

It is estimated that as many as 70 animal species that occur in northern NSW forests are hollow-dependent (DEC 2004), including the threatened species listed above. Non-threatened species include mammals (such as Common Brushtail-possums *Trichosurus vulpeca*, Common Ringtail-possums *Pseudocheirus peregrinus*, Sugar Gliders *Petaurus breviceps*, Antechinus *Antechinus* spp., Feathertail Gliders *Acrobates pygmaeus* and several species of microbats), birds (such as Crimson Rosellas *Platycercus elegans*, Rainbow Lorikeets *Trichoglossus haematodus*, Sulphur-crested Cockatoos *Cacatua galerita*, Galahs *Eolophus roseicapilla*, Kookaburras *Dacelo novaeguineae,* Australian Owlet-nightjars *Aegotheles cristatus*, and Pardalotes *Pardalotus* spp.), numerous species of reptiles (e.g. Green Tree Snakes *Dendelaphis punculata,* Tree Skinks *Egernia striolata*, and numerous species of Gecko) and frogs (Tree Frogs *Litoria* spp.).

Tree hollows were recorded in 23 of the 40 nest box zones and no tree hollows were recorded in 17 nest box zones (Table 6.1). It should be noted, however, that three of the latter zones (13, 14 and 15) may contain tree hollows in isolated paddock trees and in forested areas on the edges of the road corridor, but were not able to be fully surveyed due to property access restrictions.

The distribution of HBTs by fauna habitat type is listed in Table 5.2. The highest density of HBTs was in Rainforests (6.5/ha), Dry Sclerophyll Forests (3.9/ha) and Wet Sclerophyll Forests (3.1/ha). No

HBTs were observed in Saline Wetlands, Tea Tree Plantation or areas dominated by Camphor Laurel. Cleared Lands contained an overall density of 0.1 HBTs/ha (paddock trees).

Table 5.2 Number of HBTs per hectare in each fauna habitat type

Fauna Habitat Type	HBTs/ha
Forested Wetlands	1.9
Grassy Woodlands	0.9
Dry Sclerophyll Forests	3.9
Wet Sclerophyll Forests	3.1
Rainforests	6.5
Saline Wetlands	0
Regrowth	0
Areas dominated by *Cinnamomum camphora*	0
Cleared Lands	0.1
Water Bodies	0

The hollows observed were matched with various fauna based on the size and location of hollows (Table 6.3). It should be noted that entrance size and position on the tree are not the only factors influencing the suitability of a particular hollow for a particular species or group. Also of importance are depth, shape and degree of insulation - characteristics which are often difficult to determine from the ground. This limitation was taken into consideration when determining the suitability of hollows for particular species, and thus a range of species that could potentially use hollows with a particular entrance diameter were included in the nest box plan. For example, hollows identified with an entrance diameter of less than 50 mm (i.e. small) could be suitable for small mammals (e.g. Antechinus, Feathertail Glider, microbats), small birds (e.g. Pardalote, Kingfisher), reptiles and frogs. Thus, when assigning specific nest box types to replace particular hollows, a range of box types have been chosen to compensate for a range of species that could potentially use those hollows.

Moreover, the entrance diameter of specific nest boxes provided in Table 7.1 is the optimum/average entrance size for the targeted species. However, individuals will use hollows with an entrance hole outside of the optimum range. For example, the entrance diameter of the Possum box in Table 7.1 is 110 mm, which falls in the range of a medium sized hollow (50 mm to 150 mm). However, Brush-tailed Possums will also use hollows with an entrance greater than 150 mm. Therefore, not all of the large hollows identified have been assigned a replacement nest box that has an entrance greater than 150 mm; some of the large hollows identified have been assigned a replacement nest box with a medium sized entrance hole (e.g. Possum box, small owl/boobook box or parrot box).

6 Number of Nest Boxes Required

A two-stage formula was used to calculate the number and type of nest boxes required. To calculate the theoretical maximum of nest boxes required, the following formula was applied:

A x B x 1.2 = proposed number of nest boxes required, where:

A = Density (HBT/ha) = $\frac{\text{Number of identified HBTs within the project corridor}}{\text{Area (ha) of vegetated land identified for removal}}$

B= Mean number of functional hollows per HBT = $\frac{\text{Total number of hollows identified}}{\text{Total number of HBTs in the area}}$

The area of vegetated land targeted for removal was calculated using only areas mapped as being forested. That is, any area mapped as cleared/modified was omitted from calculations even if those areas contained a few trees. Isolated paddock trees that occurred within areas mapped as cleared were also omitted from density calculations but were included in the calculation of the mean number of functional hollows for the next box zone.

An estimate of the density of HBTs adjacent to the project corridor is provided in Table 6.2. Most areas adjacent to nest box zones where HBTs occurred contained fewer than four HBTs per hectare and require nest boxes to replace lost hollows. Nest Box Zones 1, 2, 9, 13-19, 21, 23, 33, 34, and 37-39 do not require nest boxes because no HBTs were identified within the project corridor in those zones. It should be noted that zones 3, 4, 5, 13, 14 and 15 were not fully surveyed due to property access restrictions, and that these zones, while containing mostly cleared land, have potential hollows in isolated paddock trees, in forested areas and/or on the edges of the road corridor.

The nest box zones requiring nest boxes and the number of boxes required for each zone are listed in Table 6.2. Nest boxes are only required when areas adjacent to the project corridor have a stocking rate of HBTs of less than four per hectare. Nest Box Zones 4, 12, 20, 22, 24, 25, 26 and 27 do not require nest boxes because it is estimated that four or more HBTs per hectare occur in the area adjacent to the project corridor in those zones (N.B not all of Nest Box Zone 4 or adjacent forest was able to be surveyed). No adjacent HBT density calculation was made for Nest Box Zones 30-32, 35 and 36 because land is cleared on both sides of the corridor. However, it is recommended that the hollows recorded in roadside trees in those zones be replaced elsewhere (see Section 8).

The number of nest boxes for each species/group required for each nest box zone was derived based on the proportion of hollows of various size classes identified during surveys. For example, there were five small hollows, six medium hollows and nine large hollows identified in Nest Box Zone 6, and, based on the formula, Nest Box Zone 6 required three nest boxes. Therefore, one small nest box (e.g. small mammal, small bird), one medium sized nest box (e.g. parrot, glider), and one large nest box (e.g. large owl, cockatoo, possum) were allocated for that zone. In nest box zones designated to receive a large owl box, an extra possum box has been assigned to reduce competition for the owl box.

Table 6.1 Density of HBTs and the number of nest boxes required for each nest box zone

Nest Box Zone	Chainage	No. HBTs	No. of Functional Hollows	Area of Vegetation within Corridor (ha)	Density of HBTs within Corridor (per ha)	No. of Nest Boxes Required
1	145000	0	0	n/a	n/a	n/a
2	145500	0	0	n/a	n/a	n/a
3	146000	11	19	4.34	2.5	6
4	146500	3	6	4.5	0.7	2
5	147000	5	9	3.7	1.35	3
6	147500	6	17	7.6	0.8	3
7	148000	3	3	3.8	0.8	1
8	148500	1	3	4.6	0.2	1
9	149000	0	0	n/a	n/a	n/a
10	149500	19	38	3.4	5.6	14
11	150000	6	11	3.0	2.0	5
12	150500	1	1	0.2	4.1	10
13	151000	0	0	n/a	n/a	n/a
14	151500	0	0	n/a	n/a	n/a
15	152000	0	0	n/a	n/a	n/a
16	152500	0	0	n/a	n/a	n/a
16	153000	0	0	n/a	n/a	n/a
18	153500	0	0	n/a	n/a	n/a
19	154000	0	0	n/a	n/a	n/a
20	154500	3	5	0.6	5.4	4
21	155000	0	0	n/a	n/a	n/a
22	155500	9	15	1.1	8.1	17
23	156000	0	0	n/a	n/a	n/a
24	156500	2	8	2.1	0.9	5
25	157000	14	30	4.2	3.3	9
26	157500	21	31	4.6	4.5	9
27	158000	12	27	2.7	4.4	12
28	158500	17	30	4.5	3.8	9
29	159000	3	4	1.9	1.8	3
30	159500	3	3	0.8	3.8	5
31	160000	1	2	0.9	1.1	3
32	160500	1	1	1.0	1.0	2
33	161000	0	0	n/a	n/a	n/a
34	161500	0	0	n/a	n/a	n/a
35	162000	1	2	1.0	1.0	3
36	162500	7	8	1.7	4.2	6
37	163000	0	0	n/a	n/a	n/a
38	163500	0	0	n/a	n/a	n/a
39	164000	0	0	n/a	n/a	n/a
40	164500	1	4	1.6	0.6	4

Table 6.2 Average HBTs in adjacent land and the number of nest box required in each nest box zone

Nest Box Zone	Chainage	Average No. of HBTs per ha Adjacent	Nest Boxes required if <4 ha (yes/no)	No. of Nest Boxes Required
1	145000	n/a	No	0
2	145500	n/a	No	0
3	146000	2.5	Yes	6
4	146500	6	No	0
5	147000	1.4	Yes	3
6	147500	0.8	Yes	3
7	148000	0.8	Yes	1
8	148500	0.2	Yes	1
9	149000	n/a	No	0
10	149500	0	Yes	14
11	150000	3.3	Yes	5
12	150500	4	No	0
13	151000	n/a	No	0
14	151500	n/a	No	0
15	152000	n/a	No	0
16	152500	n/a	No	0
16	153000	n/a	No	0
18	153500	n/a	No	0
19	154000	n/a	No	0
20	154500	4	No	0
21	155000	n/a	No	0
22	155500	8	No	0
23	156000	n/a	No	0
24	156500	6	No	0
25	157000	6.6	No	0
26	157500	4.5	No	0
27	158000	4.7	No	0
28	158500	2	Yes	9
29	159000	1.6	Yes	3
30	159500	0	Yes*	5
31	160000	0	Yes*	3
32	160500	0	Yes*	2
33	161000	n/a	No	0
34	161500	n/a	No	0
35	162000	0	Yes*	3
36	162500	0	Yes*	6
37	163000	n/a	No	0
38	163500	n/a	No	0
39	164000	n/a	No	0
40	164500	0.6	Yes	4

* = No adjacent density calculation made due to the lack of adjacent forested areas, but it is recommended that hollows in these areas should be replaced by nest boxes elsewhere.

Table 6.3 The number of specific nest box types required for each nest box zone

Nest Box Zone	Chainage	No. Nest Boxes Req'd	Number of Specific Nest Box Types										
			Sm	Sg	Lg	Po	Mb	Sb	Pa	So	Lo	Co	Extra Po
1	145000	0											
2	145500	0											
3	146000	7	1			1	1	1	1		1		1
4	146500	0											
5	147000	3		1					1	1			
6	147500	3		1	1							1	
7	148000	1			1								
8	148500	1				1							
9	149000	0											
10	149500	15	1		2	1	3	1	2	1	1	2	1
11	150000	5				2	1		1			1	
12	150500	0											
13	151000	0											
14	151500	0											
15	152000	0											
16	152500	0											
16	153000	0											
18	153500	0											
19	154000	0											
20	154500	0											
21	155000	0											
22	155500	0											
23	156000	0											
24	156500	0											
25	157000	0											
26	157500	0											
27	158000	0											
28	158500	10	1	1	1	1	1	1	1		1	1	1
29	159000	3	1		1				1				
30	159500	5				1	1	1	1	1			
31	160000	3	1				1	1					
32	160500	2					1	1					
33	161000	0											
34	161500	0											
35	162000	3				1	1		1				
36	162500	6				1	2	1	2				
37	163000	0											
38	163500	0											
39	164000	0											
40	164500	4	1		1	1		1					

Sm= Small mammals, Sg= Small gliders, Lg= Large gliders, Po= Possums, Mb= Microchiropteran bats, Sb= Small birds, Pa= Parrots, So= Small owls, Lo= Large owls, Co= Cockatoos.

7 Nest Box Specifications

7.1 Nest Box Construction

Table 7.1 lists some hollow-dependent animal species that are likely to exist within the study area along with specifications of nest boxes that are suitable for those species. The list is not exhaustive but the range of nest box specifications suggested should provide for the majority of hollow-dependent species that occur in the area.

There are a number of commercial suppliers that produce a range of nest boxes that have been designed to suit specific species/groups of wildlife. The specifications provided in Table 7.1 are based on nest boxes provided by *Hollow Log Homes, Queensland, Australia.*

Important characteristics when constructing or commissioning nest boxes include:

- The front and base should be made from hardwood (> 25 mm thick)
- The box should include a hinged lid to allow easy inspection during monitoring/maintenance checks (the hinge should be stainless steel or aluminium)
- Only non-toxic paint should be used on the outside and the inside and the entrance hole should be left un-painted
- Grooves should be cut on the inside face to allow ease of access/exit
- Drainage holes should be included in the base
- Wood shavings or sawdust should be placed in the bottom of the box prior to installation
- Rear entrances and should be included in the design where appropriate (see Table 7.1).

Table 7.1 Specifications for nest boxes designed for specific groups/species of hollow-dependent fauna

Nest Box Type	Total Number required	Fauna Group/Species	Nest Box Dimensions				Home Range (ha)	Behaviour	Distance Between Boxes
			IM (mm)	DC (mm)	ED (mm)	HG (m)			
Sm	6	Brown Antechinus	145 x 180	370	20-25	4-8	0.5-5 ha	Nests in tree hollows, logs, stumps, fissures, cracks, often on ground but can be very arboreal.	100 m
		Feathertail Glider	145 x 180	370	20-25	4-8	0.1-2 ha	Will nest in virtually any enclosed space, including tree hollows, old bird nests or possum dreys. Uses more than one nest at a time. Wedge-shaped box with bottom entry can be used for this species. (Ward and Woodside 2008)	100 m
		Eastern Pygmy-possum	145 x 180	370	20-25	4-8	Typically < 0.75 ha	Favours tree hollows but will nest between the wood and bark of eucalyptus trees. (Ward and Turner 2008)	100 m
Sg	3	**Squirrel Glider**	270 x 180	410	50	5-12	1.4-2.8 ha	Social groups occupy multiple hollows within their home range. Uses hollows with a tight-fitting entrance hole. Rear entry box can be used to reduce occupation by exotic animals. (Van der Ree and Bennet 2003)	100 m
		Sugar Glider	270 x 180	410	50	5-12	2.4-4 ha	Found in wet and dry sclerophyll forests. Constructs a leaf nest in tree hollows. (Suckling 2008). Rear entry box can be used to reduce occupation by exotic animals	100 m
Lg	7	**Yellow-bellied Glider**	270 x 280	410	75	5-12	30-60 ha	Groups require a large exclusive area and use multiple hollows throughout the year. (Goldingay 2008)	100 m
		Brush-tailed Phascogale	270 x 280	410	75	4-12	5-40+ hectares	Nests in tree hollows in rough-barked trees, rotted stumps and bird nests. Individuals can use as many as 40 nest sites in a single year. (Soderquist and Rhind 2008)	100 m
Po	13	Possum	290 x 230	450	110	5-12	Variable. 0.2-4 individuals/ha	Nests in hollow limb in living or dead tree but will use almost any dark recess.	100 m
Mb	12	Various hollow-roosting microbats	230 x 100	340	25	5-12	-	Roost in tree hollows, fissures, branch or trunk; most commonly in Eucalyptus species, either living or dead.	100 m
Sb	8	Striated Pardalote	200 x 180	330	30 - 50	5-12	-	Builds bark and grass nest in a tree hollow.	100 m
		Brown Treecreeper	200 x 180	330	30 - 50	5-12	7-20 ha	Nests in tree hollows, often in rough-barked trees.	100 m

		Sacred Kingfisher	200 x 180	330	30 - 50	15-25	4 ha	Nests in high tree hollow.	200 m
Pa	12	**Little Lorikeet**	200-260 x 180	490	50 - 75	5-25	Multiple pairs nest in close proximity	Nests in hollow branch or knot hole from 5 m high to very high.	100 m
		Rainbow Lorikeet	200-260 x 180	490	50 - 75	5-25	Multiple pairs nest in close proximity	Nests in deep almost vertical hollow in major limb or trunk.	100 m
		Crimson Rosella	200-260 x 180	490	50 - 75	5-25	Multiple pairs nest in close proximity	Nests in hollow of live or dead tree from quite to very high.	100 m
So	2	Southern Boobook	230 x 260	400	110	3-15	18-200 ha	Uses tree hollows ranging from small stumps to high limbs.	
Lo	3	**Powerful Owl**	500 x 500	800	300	8-20	300-1500 ha	Typically nests in a hollow in very large tree, often on a hillside or head of a gully.	3-4 km
		Masked Owl	500 x 500	800	300	8-20	400 - 1000 ha	Nest in the trunk or main limb of a large tree in heavy forest, often near open country.	2-3 km
		Sooty Owl	500 x 500	800	300	8-20	200-800 ha	Nests in a large smooth-barked live tree, often very high.	2-3 km
Co	5	**Glossy Black-Cockatoo**	340 x 330	550	170	8-12	-	Inhabits forests and woodlands with abundant Casuarina trees. Uses a large hollow often high in a dead tree.	-

ID = inner dimensions, DC = depth, ED = entrance dimensions, HG = height from ground
BOLD text denotes threatened species

8 Distribution and Position of Nest Boxes

In total, 15 of the 40 nest box zones surveyed along sections 10 and 11 of the W2B upgrade require nest boxes. Including extra possum boxes in zones that will receive a large owl box, 71 nest boxes are required to compensate for the loss of hollows within the project corridor. The breakdown of specific nest box types is provided in Table 6.3.

To assist with planning of future installation of nest boxes, details of adjacent properties that contain potential habitat are provided in Table 8.1. It should be noted that Nest Box Zones 30-32, 35 and 36 have little or no forested areas on either side of the proposed road corridor. Therefore, no adjacent HBT density was calculated for those areas. However, HBTs were recorded in the road corridor in roadside trees in those zones. These hollows are potentially important in that they provide the only habitat for hollow-dependent fauna in or adjacent to those nest box zones. It is recommended therefore that those hollows be replaced. Alternative areas where nest boxes could be placed include: in roadside vegetation along roads to the east or west of the highway or in habitat adjacent to the corridor in other nest box zones; in landscaping of the highway verges (i.e. in the future, when planted trees are tall enough and strong enough, or attached to poles for some species); or in zones that do not require nest boxes due to the adjacent density of HBTs being four or greater per hectare, despite clearing resulting in the loss of hollows in those zones. Table 8.1 contains suggested areas where these HBTs could be offset.

Similarly, Nest Box Zones 10 and 11 require 14 and 5 nest boxes respectively, but there is a limited amount of forested area immediately adjacent to the road corridor in those zones. Alternative properties have also been suggested for these areas. Other nearby areas that could absorb some of the nest boxes required in zones with little available habitat include nearby National Parks or Nature Reserves such as Broadwater National Park or Tuckean Nature Reserve.

Table 8.1 Details of properties with potential habitat to receive replacement nest boxes

Nest box zone	Property details
3	Lot813/DP755691, Lot2/DP127944
5	Lot232/DP755691, Lot6/DP843369, Lot248/DP755691
6	Lot248/DP755691, Lot6/DP843369, Lot2/DP6276321
7	Lot2/DP627631, Lot6/DP843369, Lot5/DP843369, Lot244/DP755691
8	Lot244/DP755691, Lot2/DP585377, Lot5/DP843369, Lot1/DP787102
10	Lot2/DP787102, Lot268/DP727428, Lot104/DP113797, Lot268/DP272428*(9)
11	Lot268/DP727428, Lot104/DP113797, Lot108/DP113797*(12)
28	Lot3/DP814504, Lot9/DP1126162, Lot4/DP223267
29	Lot3/DP814504, Lot9/DP1126162, Lot4/DP223267, Lot9/DP594556
30	Roadside trees, landscaped verges, Lot10/DP1137966
31	Roadside trees, landscaped verges, Lot2/DP543525*(22)
32	Roadside trees, landscaped verges, Lot50/DP112507*(23,24)
35	Roadside trees, landscaped verges, Lot50/DP112507*(23,24)
36	Roadside trees, landscaped verges, Lot61/DP1088684*(25), Lot2/DP543525*(20)
40	Lot16/DP1013485, Lot3/DP1023283, Lot1/DP1023283

*Indicates that the property is not adjacent to the nest box zone where the HBTs were recorded. Number in parentheses indicates the nest box zone adjacent to that property.

When selecting the types of nest boxes to be installed in each nest box zone, consideration has been given to the location fauna crossing structures (Table 8.2) recommended by Sandpiper Ecological Surveys (2014) and in the W2B Submissions/Preferred Infrastructure Report – Connectivity Structure Inventory (RMS 2014). For example, glider boxes have been suggested for Nest Box Zone 6 where it

is recommended that a rope bridge be installed and owl boxes have been placed at least three nest box zones away from a glider crossing.

Table 8.2 Location of recommended (not actual) fauna crossing structures

Section	Nest Box Zone	Chainage	Name	Type	Crossing Type	Targeted Fauna
10	1	145106	Broadwater Viaduct 3	Bridge	Under Bridge	Macropods, birds
10	1	145287	Richmond River	Bridge	Under Bridge	Macropods, birds
10	3	146360		RCBC	Drainage	Koala, small to large mammals, Black Bittern, herpetofauna
10	4	146600		RCBC	Drainage	Koala, small to large mammals, Black Bittern, herpetofauna
10	6	147600		Land bridge	Overpass	Koala, small to large mammals, Black Bittern, herpetofauna
10	6	147600			Rope Bridge	Gliders
10	8	148595		RCBC	Drainage	Koala, small to large mammals, Black Bittern, herpetofauna
10	9	149227	Wardell Viaduct 4: Bingal Creek	Bridge	Under Bridge	
10	11	150030		RCBC	Drainage	Small-medium mammals, herpetofauna
10	12	150520		RCBC	Drainage	Small-medium mammals, herpetofauna
10	12	150600		RCBC	Drainage	Small-medium mammals, herpetofauna
10	14	151933	Wardell Viaduct 6	Bridge	Under Bridge	Macropods, herpetofauna
10	22	155950			Rope Bridge	Gliders
10	23	156135	North Wardell Fauna Bridge	Fauna crossing - bridge	Bridge	Koala, Long-nosed Potoroo
10	23	156340		RCBC	Drainage	Long-nosed Potoroo
10	24	156990		RCBC	Drainage	Long-nosed Potoroo
10	26	157655		RCBC	Drainage	
10	26	157705		RCBC	Drainage	
10	26	157878	North Wardell Viaduct 7: Ravelles Creek	Bridge	Under Bridge	Small-medium mammals, herpetofauna
11	28	158903		RCBC	Drainage	Small-medium mammals, herpetofauna
11	28	158903		RCBC	Drainage	Small-medium mammals, herpetofauna
11	30	159644		RCBC	Drainage	Small-medium mammals, herpetofauna

The exact location of nest box placement should be determined on site and take into account the following factors:

- The needs of specific species (e.g. shape, height above ground, volume of box, entry hole shape and size)
- Species home range and likely territory to be defended
- Ability to access a nest box via a clear flight path (e.g. in areas where the tree density is not too high)
- Aspect (overheating can increase mortality of young)
- Distance to feeding resources
- Camouflage from potential predators
- Access for monitoring (if nest boxes are installed on private property they should be placed close to property boundaries).

Nest boxes should be mounted in healthy living trees without existing hollows. Aspect of the nest box should aim to provide shelter from the sun and rain (Freegard and Richter 2009), with the exception that bat boxes may be positioned to receive late afternoon sun providing warmth prior to nocturnal exit (Goldingay and Stevens 2009). Anecdotal evidence also suggests parrots prefer nest boxes with an east facing aspect (N. Williams pers. comm.). Bat boxes should be installed on a tree clear of branches above or below the box (de Souza-Daw, 2003) and where possible nest boxes should be installed on opposite sides of a single tree to provide two approach / exit options.

For efficient and safe installation, it is preferred that nest boxes be installed on the main trunk of the tree. They should be installed at a variety of heights on each tree based on:

- The height range of the hollows that were removed
- The ecology of the species for which the nest box is targeting
- The requirements of safe work methods and practical considerations.

The information in Table 7.1 should be used to inform decisions on heights for installation and distances between nest boxes. Recommended distances between nest boxes should be used as a guide only because in some cases it may be appropriate to select trees closer than the recommended distance, regardless of species' home ranges, as previous studies suggest that not all nest boxes installed are likely to be considered suitable by the target fauna.

9 Nest Box Installation

Seventy per cent of nest boxes will be installed prior to vegetation within the project corridor being cleared. The remaining 30% of nest boxes will be installed post-clearing once a final tally of functional hollows has been compiled during supervision of clearing.

Nest boxes should be installed under the supervision of a qualified ecologist to ensure nest boxes are installed appropriately and in suitable positions for particular species (see Section 8). Nest boxes should be installed using the 'Habisure' system (Franks and Franks 2006), or similar. Galvanised tie wire should be pushed through hose pipe to minimise damage to the tree. 'Zig-zag' bends should be incorporated into the wire near the tie-off point with the nest box, to allow for expansion during tree growth (Figure 9.1). If a branch is unavailable to place the garden hose over, a nail can be used for added support. All nest boxes should be given a unique identifying number that includes the nest box zone and have their GPS location recorded at the time of installation.

Access to heights in each tree would be achieved using a ladder or with rope climbing techniques. The chosen technique would depend on the height that the nest box is required and safety aspects of the chosen tree.

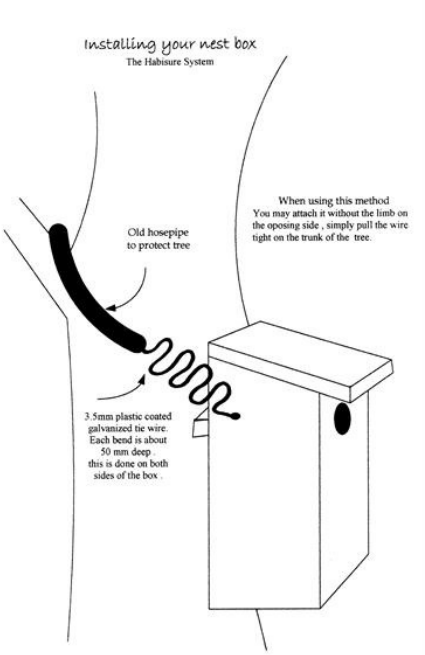

Figure 9.1 The 'Habisure System' of attachment of nest boxes

Image from Hollow Log Homes http://hollowloghomes.com/NESTBOXES.html.

10 Nest Box Monitoring and Maintenance

The schedule of monitoring and maintenance of nest boxes is provided in Table 10.2. In summary, nest boxes should be monitored and maintained in years three, four, six and eight years after installation. Monitoring should be performed by a suitably qualified ecologist to observe signs of fauna usage. Ideally, animal usage should be confirmed by climbing the tree (with a ladder or rope access) but if WH&S requirements prohibit this then monitoring of some boxes (if less than 8 m high) may also be able to be performed from the ground with a 'burrow scope'. Monitoring from the ground may not be possible for nest boxes installed high in the tree or those with rear entrance holes.

The following data should be recorded during each monitoring event:

- date;
- type of nest box and its specifications (at commencement of study);
- nest box number and location;
- signs of animal presence (e.g. scats, fur, feathers, nesting material, etc.);
- species of animals present (or possibly present if inferred from secondary evidence);
- breeding data (where possible);
- number of individuals;
- sex and age of individuals (if possible);
- condition of each nest box; and
- any maintenance required.

During each monitoring event, the entrance to the nest box should be blocked prior to inspection to reduce the chance of nocturnal inhabitants escaping and risking predation (Freegard and Richter 2009). Handling of animals occupying a nest box should be avoided unless identification is uncertain. The surveyor should minimise disturbance in the vicinity of the nest box, as recent inhabitants may be inclined to escape on approach. If any animal exits the nest box on approach, the surveyor should quietly move away to enable the animal to re-enter the box.

Surveillance of bat boxes can be undertaken via watching for exiting bats at dusk (de Souza-Daw, 2003), or through use of a 'burrow' scope during the day. If exiting bats have been recorded identification may be possible through use of Anabat detection units. Bat boxes should not be opened once occupied by bats (de Souza-Daw, 2003) as disturbing hibernating bats can lead to exhaustion of food reserves and death of the animal (Strahan, 2004).

In situations where fauna signs within a nest box are inconclusive for determination of the species, remote monitoring cameras may be placed on the tree facing the nest box to assist in identification, where practicable. For example, this may be useful to identify a species of glider that has built a leaf nest if the glider is not present in the box at the time of inspection.

A number of performance objectives and contingencies are suggested (Table 10.1).

Table 10.1 Performance and contingency measures

Performance measure	Contingency
Occupancy by a wide range of native fauna	If any nest box has not been occupied after four years, consideration should be given to moving the nest box to an alternative location.
Uptake of nest boxes by targeted threatened species	If uptake is poor, re-evaluate nest box types and placement.
Low occurrence of non-native fauna or pest species	If a large number of boxes or occupied by non-natives or pests the selection of nest boxes and their placement should be re-evaluated.
Durability of nest boxes.	If nest boxes are deteriorating rapidly, consider alternative design and construction materials.

If feral birds (e.g. Common Mynas) are identified inhabiting the nest box any eggs and nesting material should be removed, and consideration be given to including a myna 'baffle' on the nest box (Homan 2000), or replacing the box with a rear-entry design (Dobson 2002; Beyer 2003; Goldingay *et al.* 2006, 2007). Decisions would need to consider suitability for the target species. A natural insecticide should be sprayed to kill any lice (Franks and Franks 2006).

Feral bees should be managed at dusk or night when they are less active with a non-residue insecticide used to kill the hive (Franks and Franks 2006). The nest box will likely need to be cleaned out, which can be done 24-48 hours later (Franks and Franks 2006). Coopex ® powder can be used to manage ant infestations.

Other maintenance may be required to address nest boxes in disrepair. Maintenance may be only minor, such as replacement of lid hinges, but depending on the state of disrepair replacement of the nest box may be required.

If an occupied nest box requires maintenance it should be carried out, if possible, without disturbing the animal. If disturbance to the occupant is likely, consideration should be given to returning at night (when nocturnal animals are foraging), or waiting until a breeding event is finished (e.g. nesting birds).

Table 10.2 Schedule of timing and frequency of installation and maintenance of nest boxes

Management Action	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Responsibility	Documentation Requirements
Pre-Construction										
Prepare nest box management plan	✓								RMS	Construction environmental management plan (CEMP) and G36 Quality Specification
Construction										
Commission construction of nest boxes	✓								Contractor	CEMP and G36 Quality Specification
Nest box installation: pre-clearing 70% Post-clearing 30%	✓								Contractor	CEMP and G36 Quality Specification
Review of final nest box requirements following post clearing survey		✓							Contractor	CEMP and G36 Quality Specification
Monitoring										
Summer and Winter			✓	✓		✓		✓	RMS	Yearly report aligned with sample periods Final Nest Box Report in Yr 8
Maintenance										
Maintenance of boxes			✓	✓		✓		✓	Post construction RMS	Maintenance records

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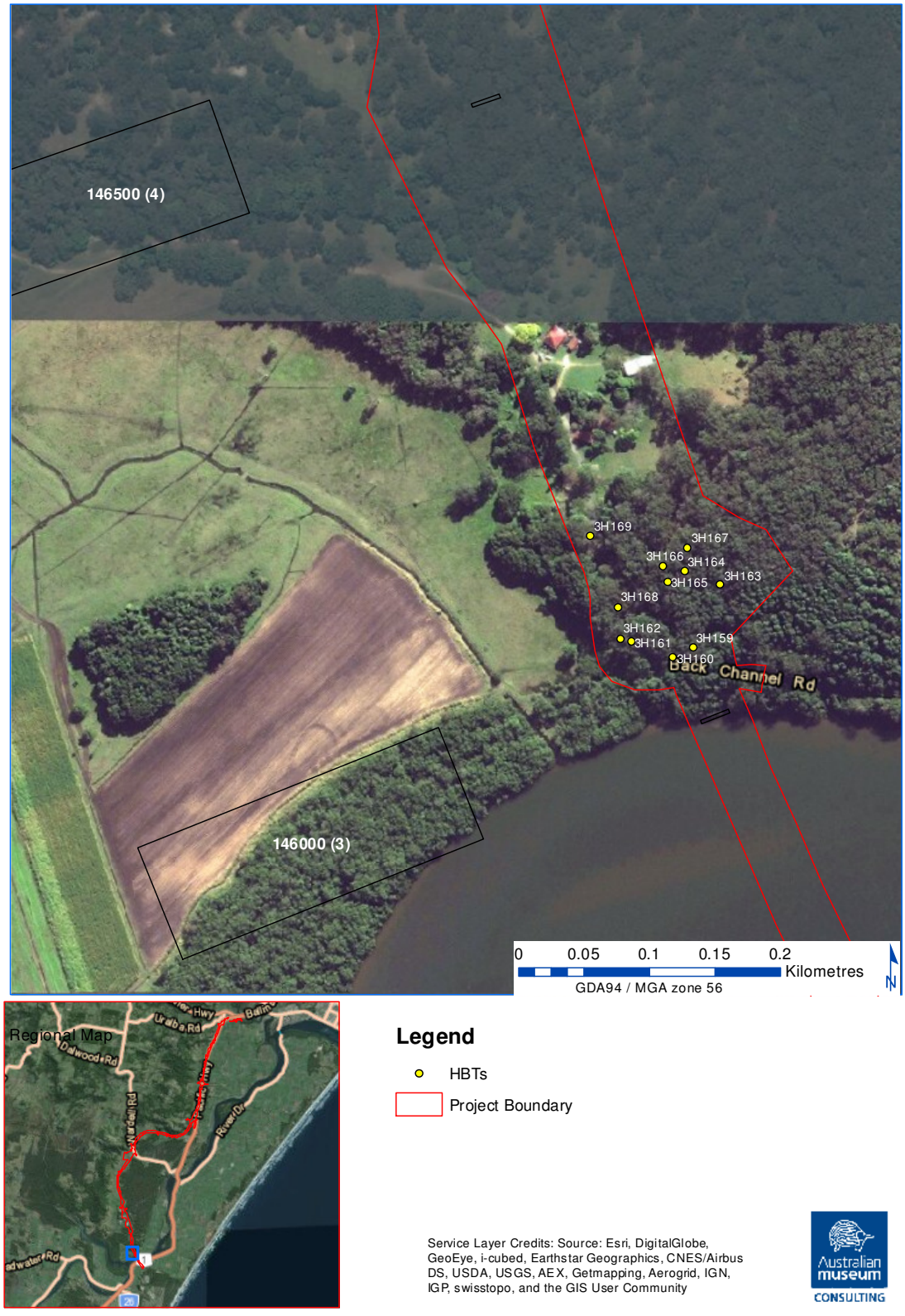
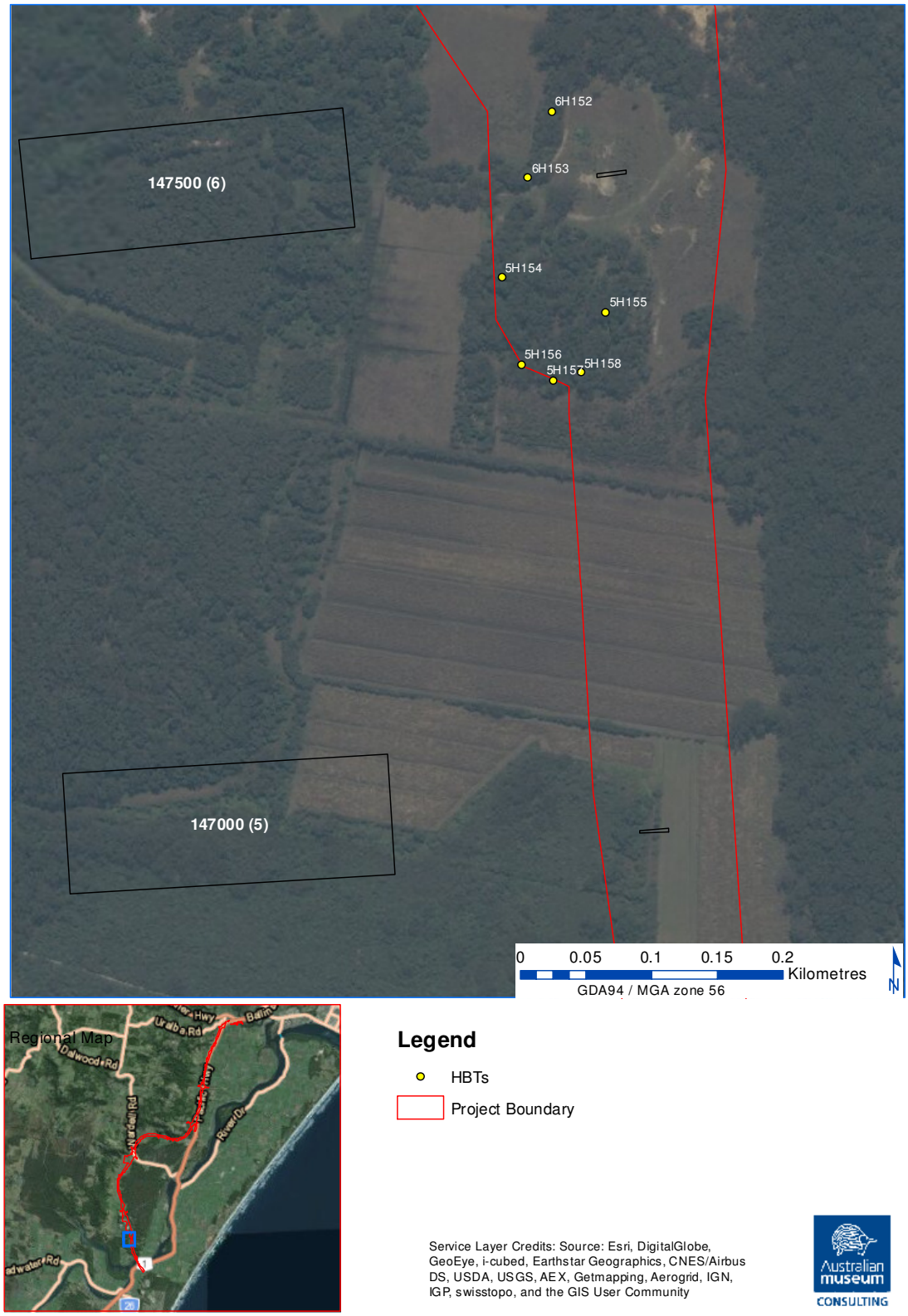
Appendix A: Location of HBTs



Location of hollow-bearing trees in Nest Box Zone 3.

Location of hollow-bearing trees in Nest Box Zone 4



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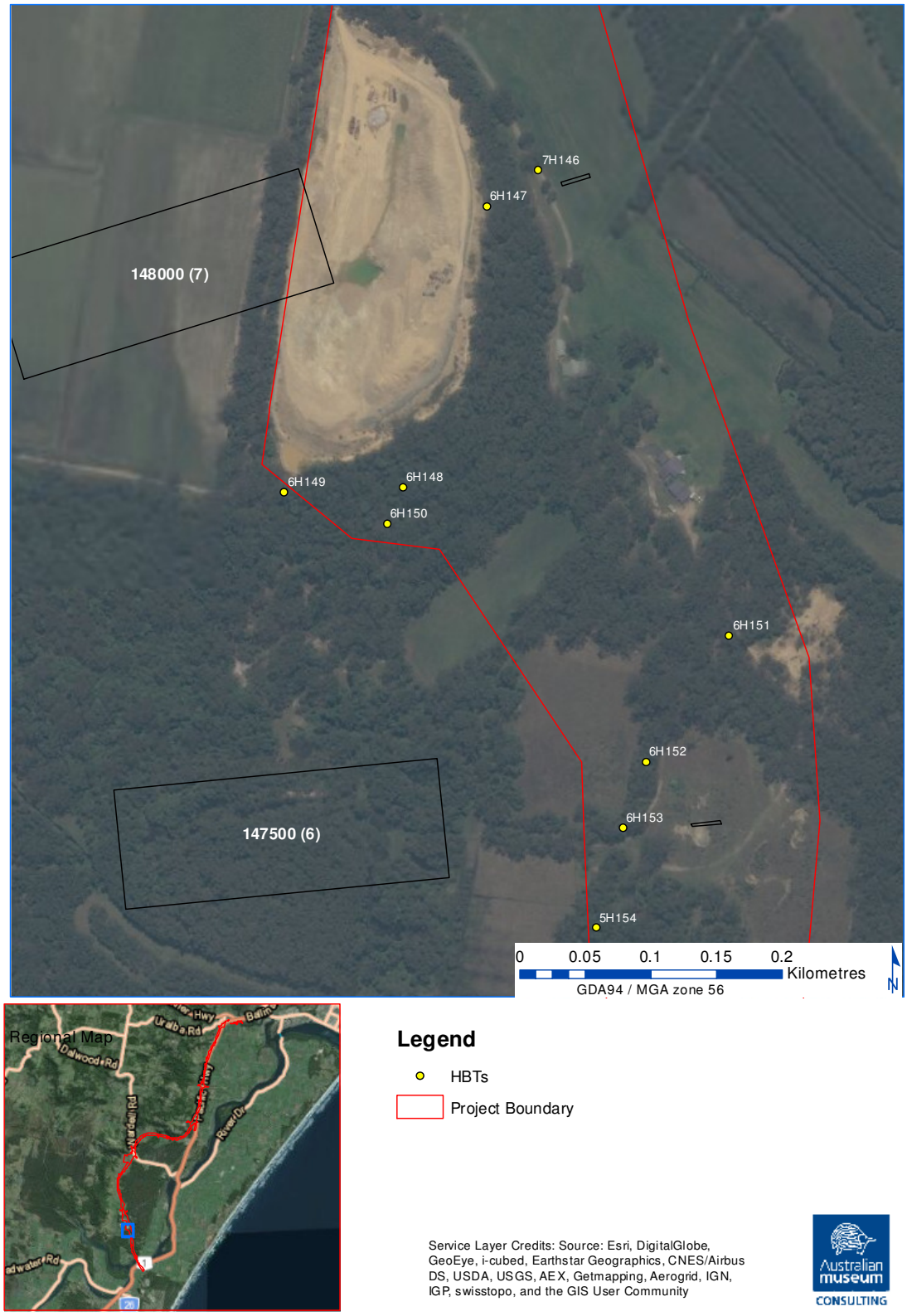

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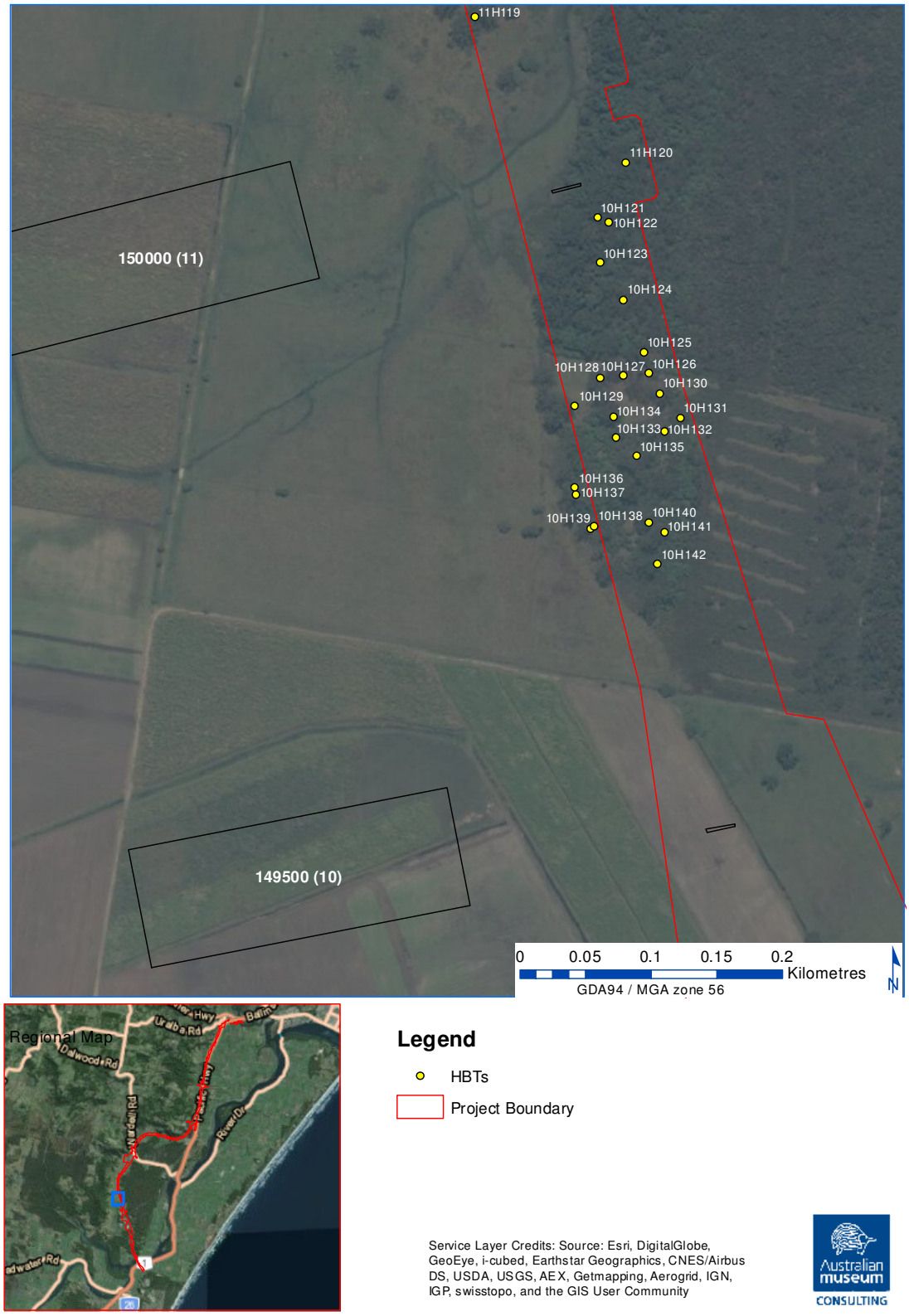
Location of hollow-bearing trees in Nest Box Zone 7

Location of hollow-bearing trees in Nest Box Zone 8.



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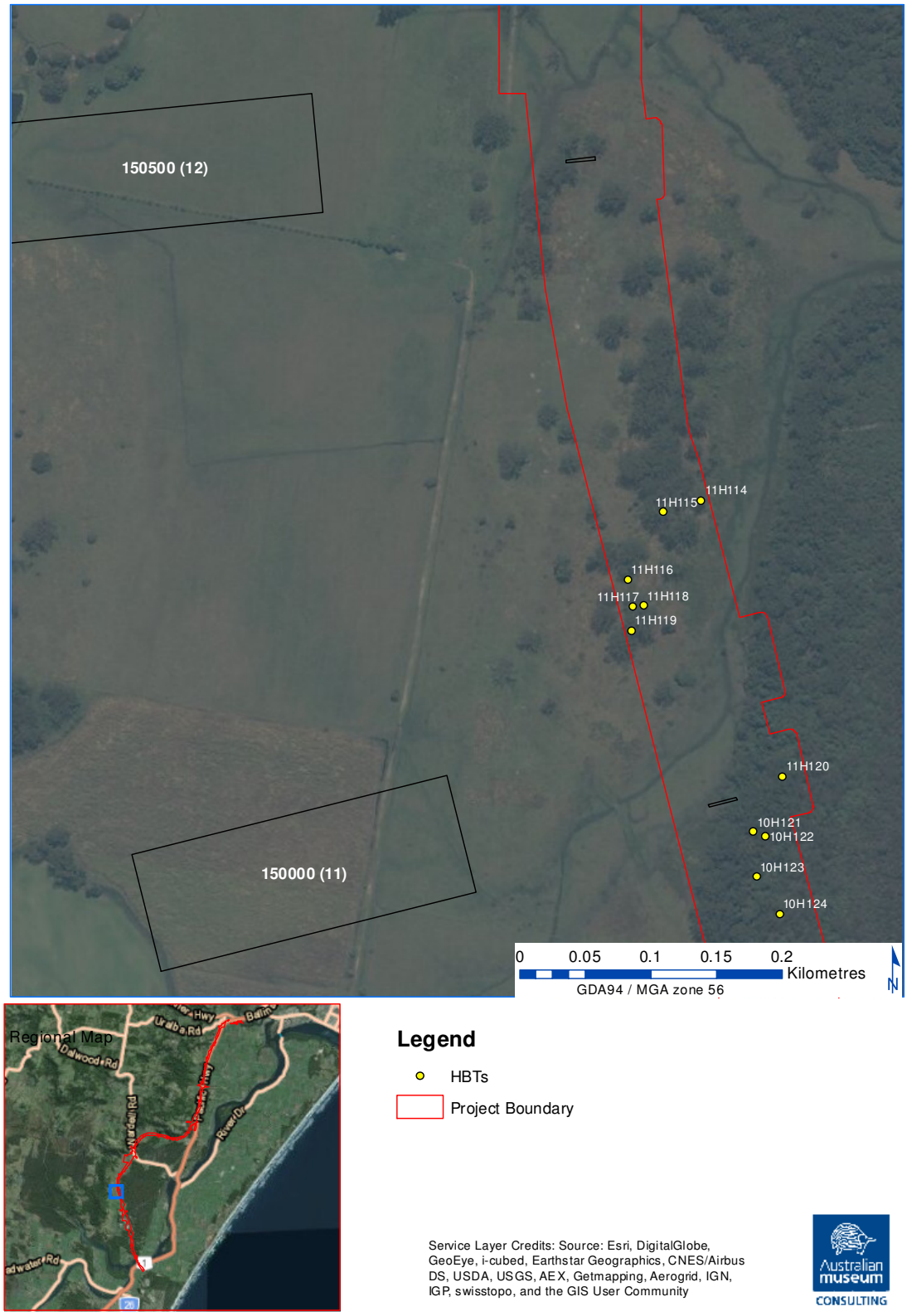

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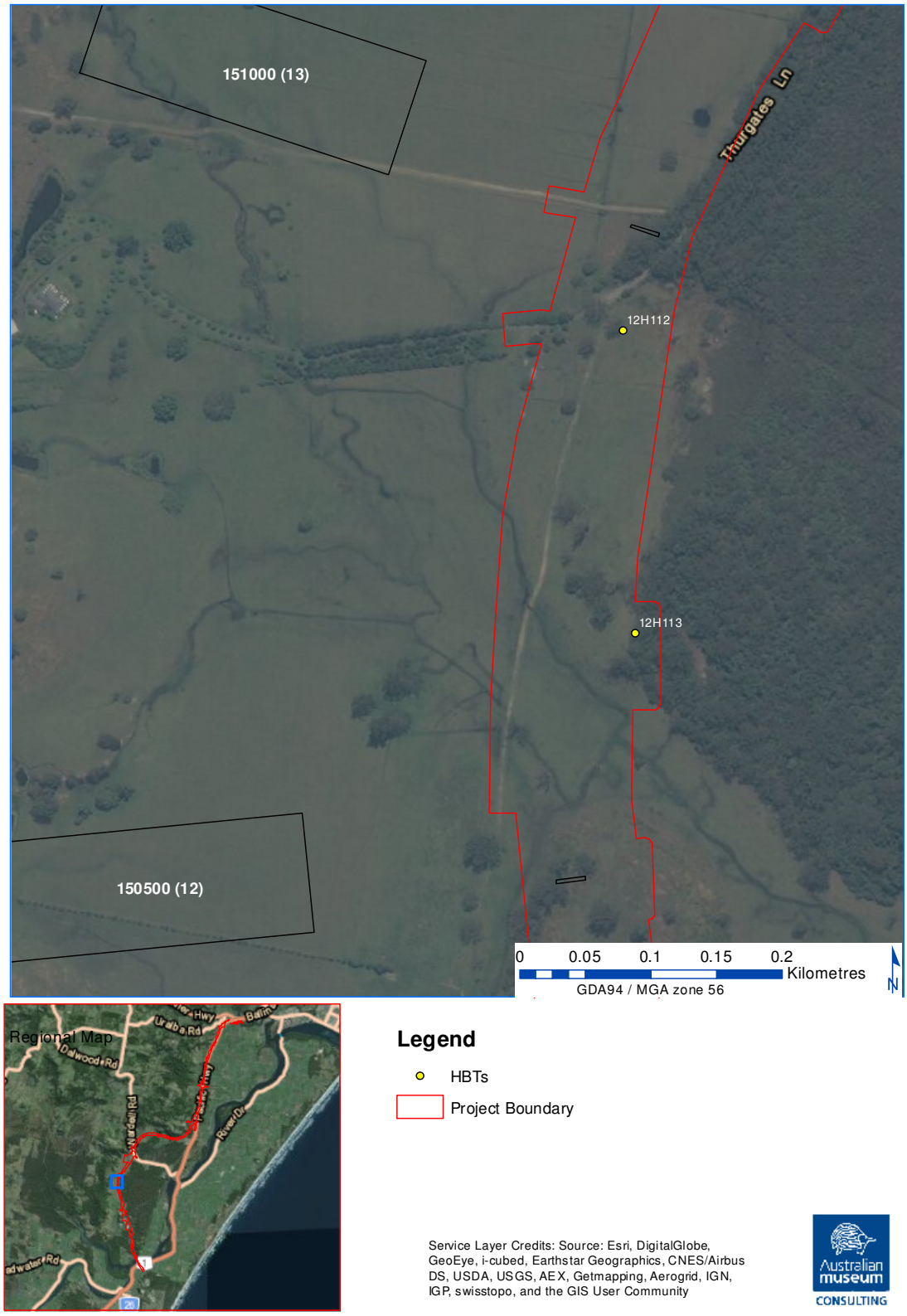

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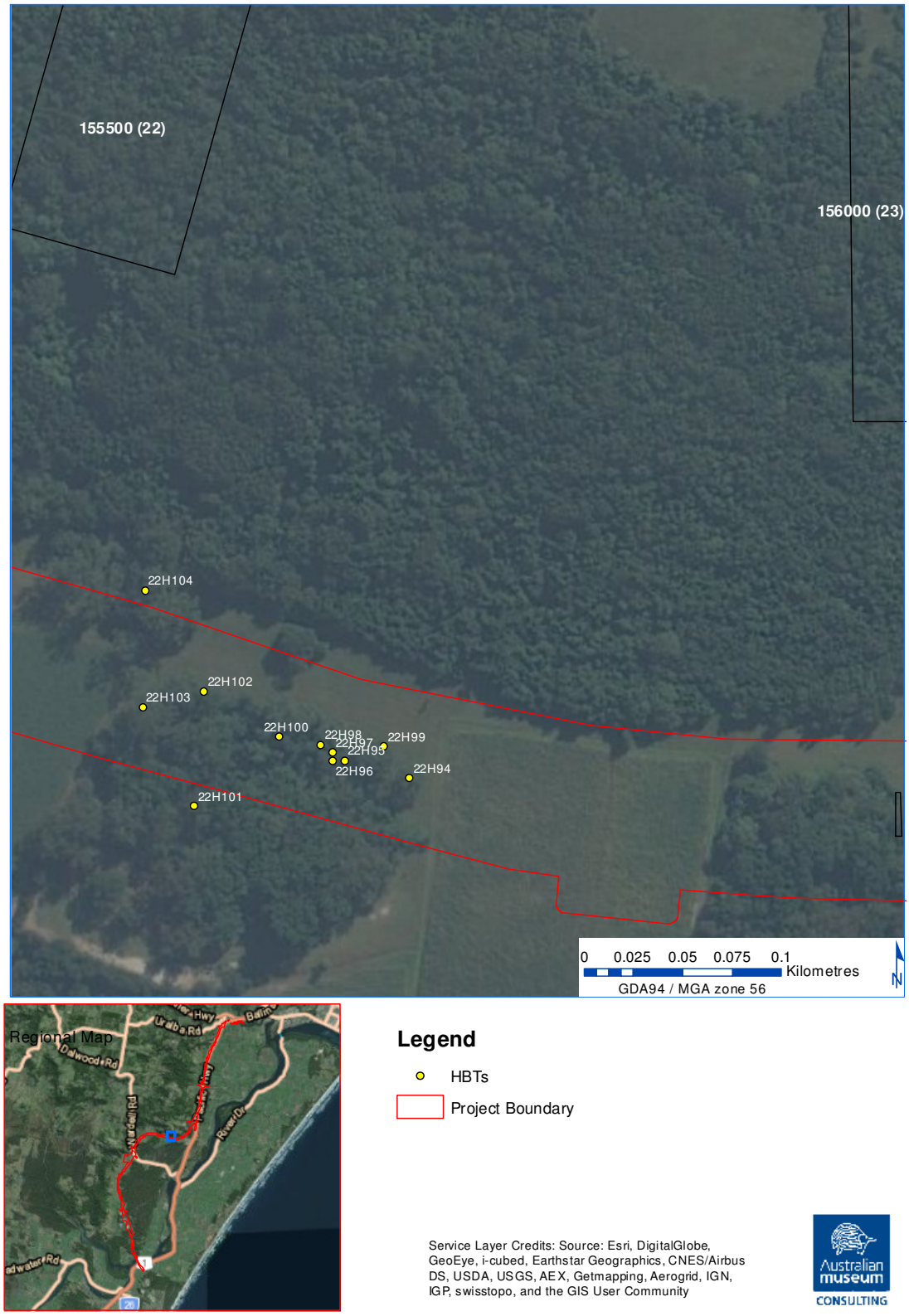
Location of hollow-bearing trees in Nest Box Zone 20.



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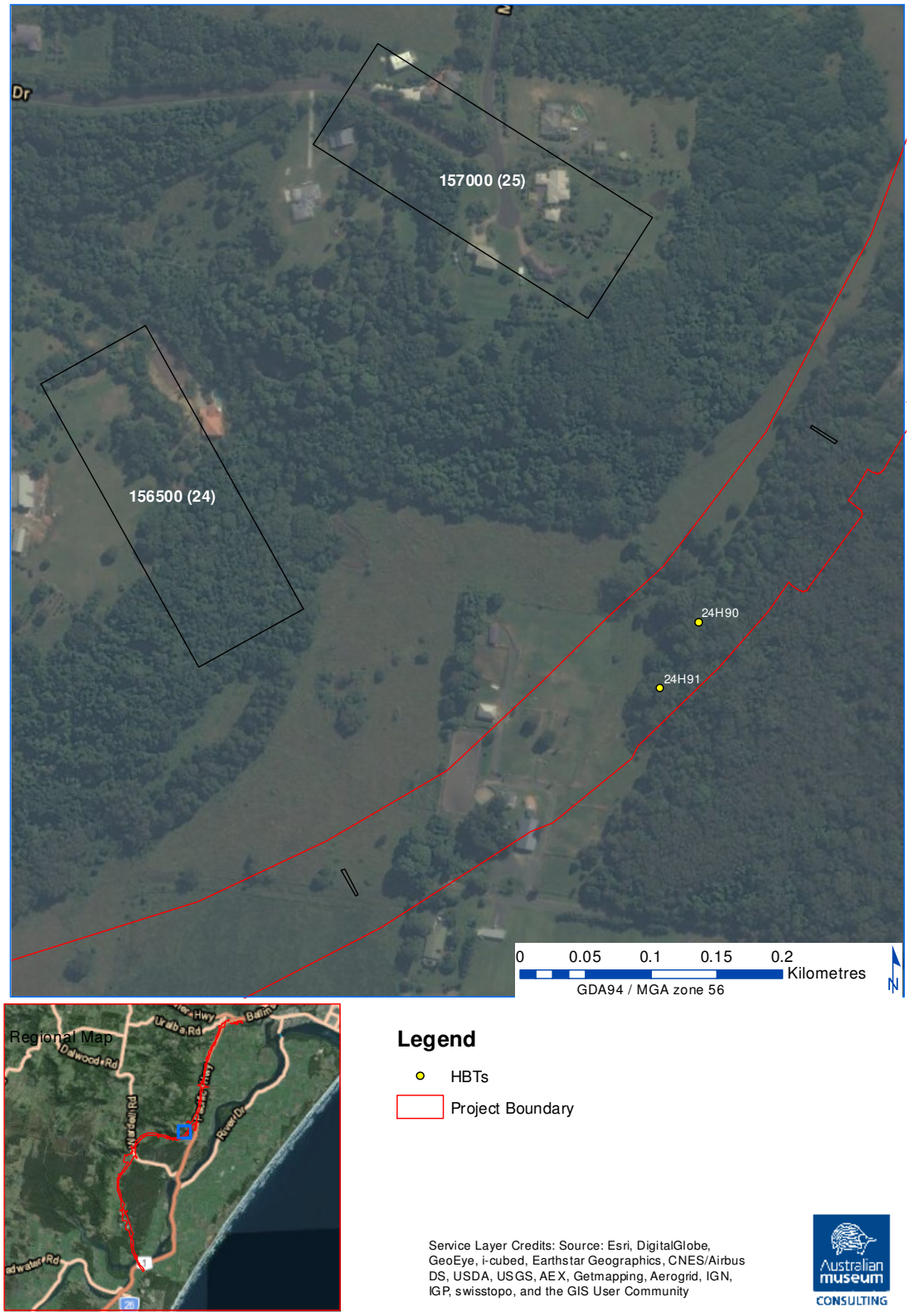

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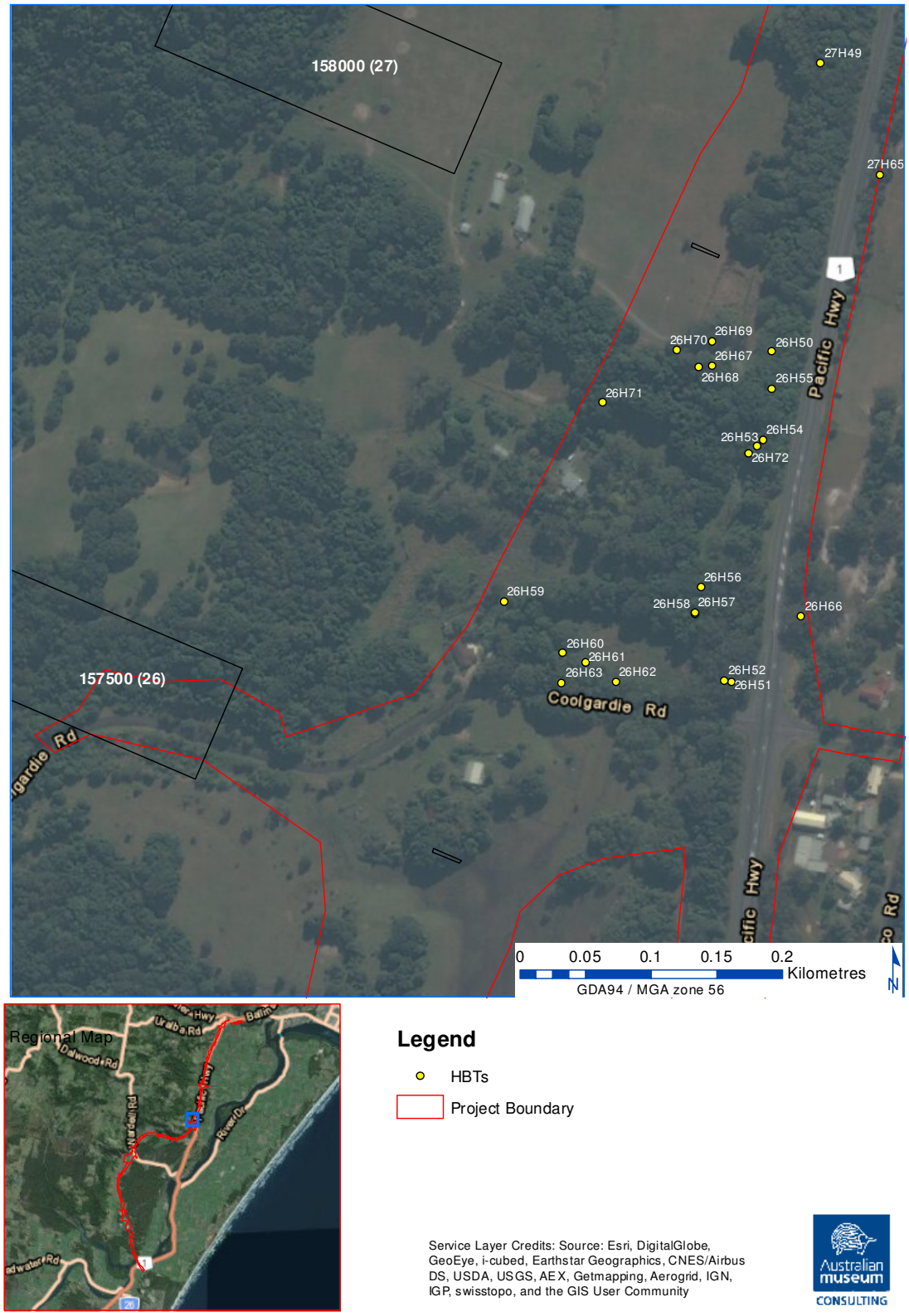
Location of hollow-bearing trees in Nest Box Zone 25.



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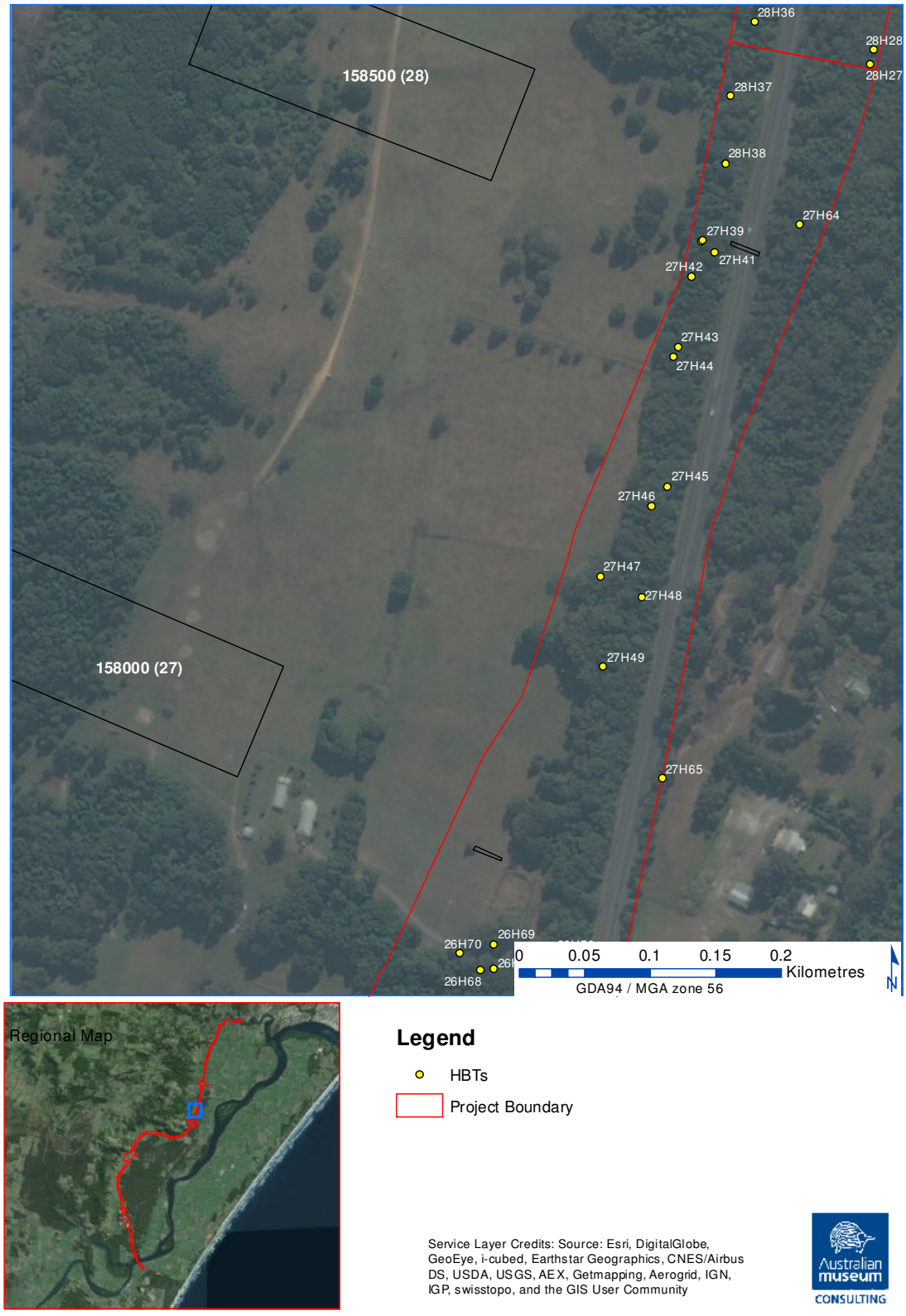

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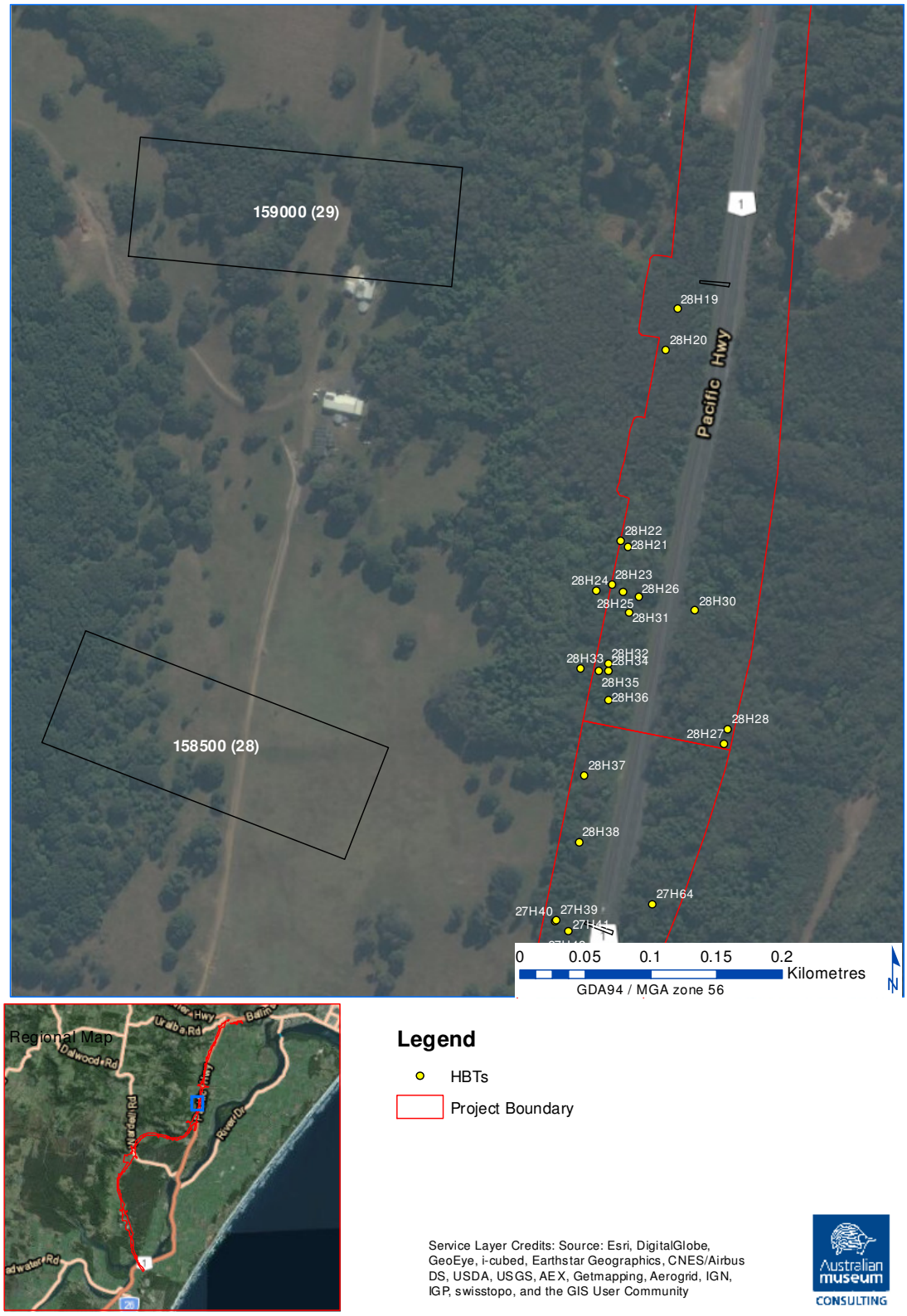

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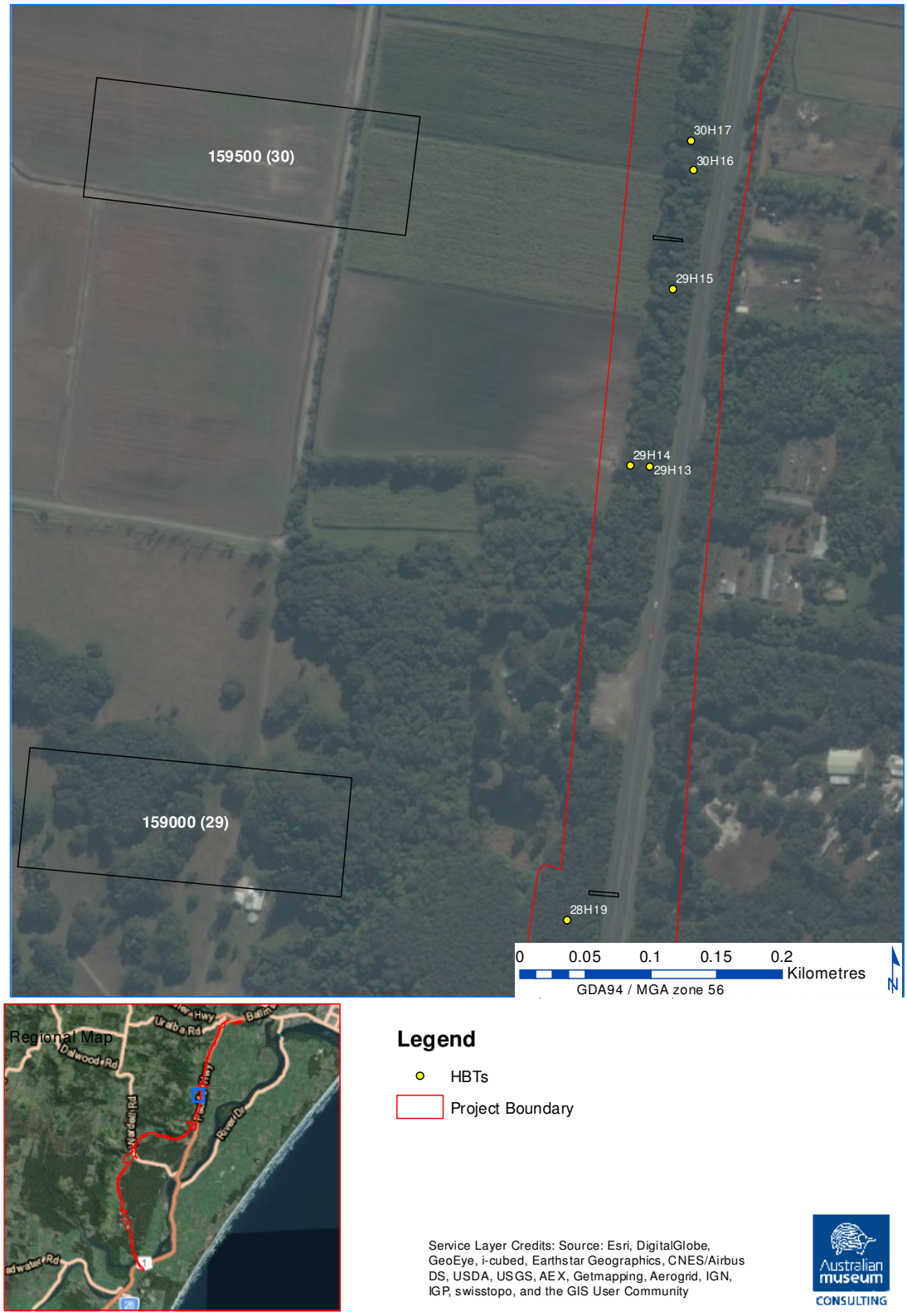
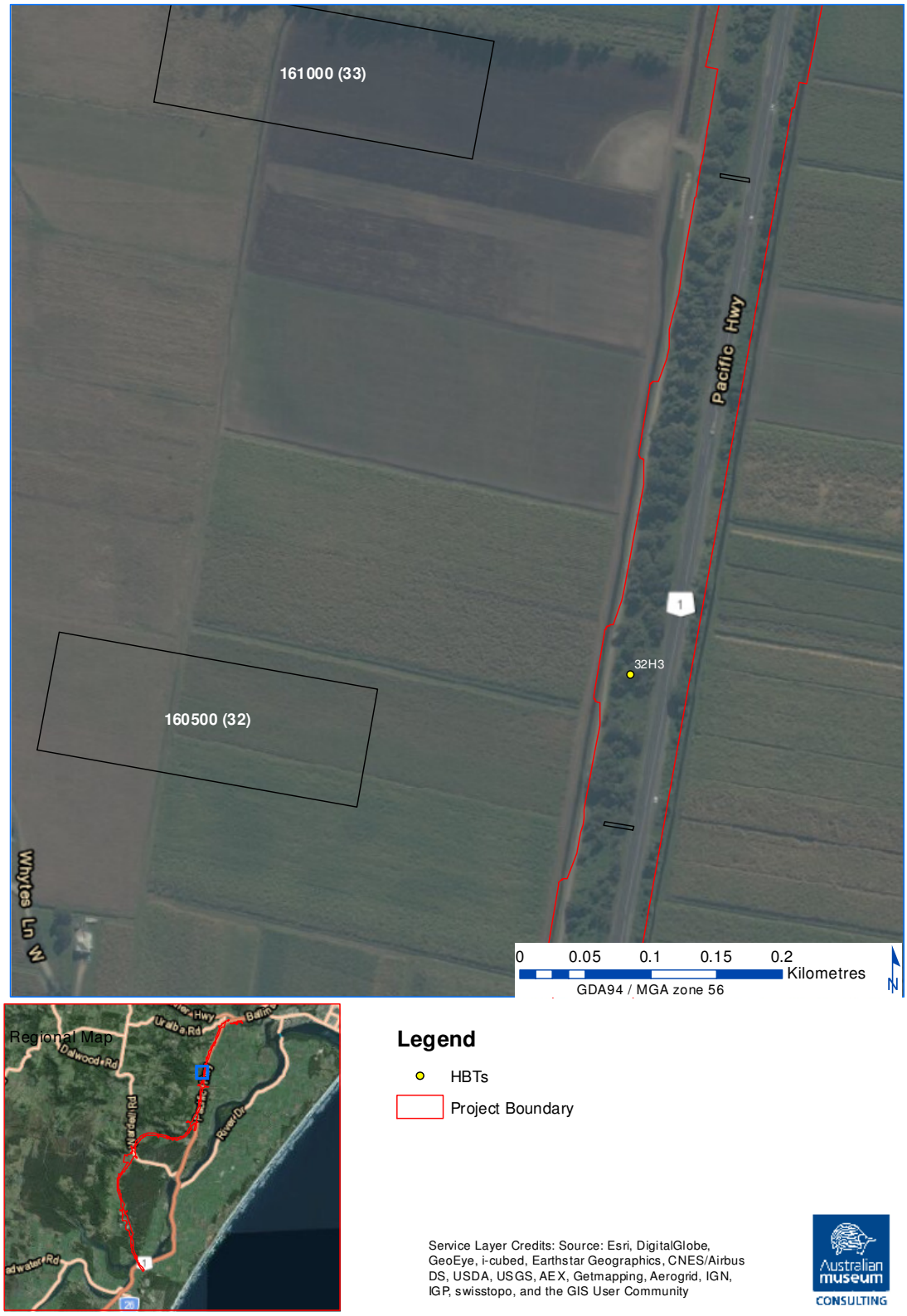


Location of hollow-bearing trees in Nest Box Zone 29.

Location of hollow-bearing trees in Nest Box Zone 30.

Location of Hollow-bearing trees in Nest Box Zone 31.



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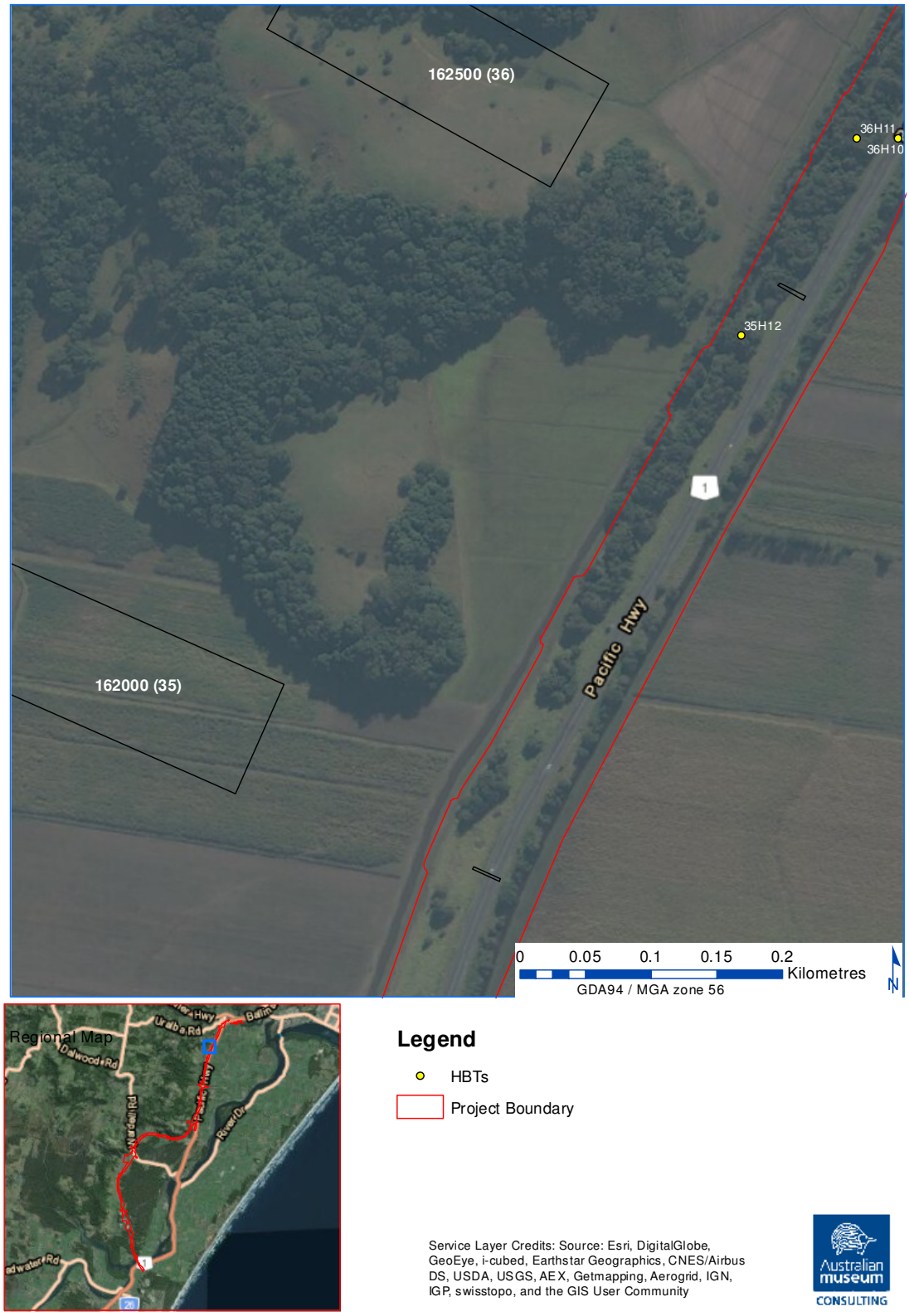

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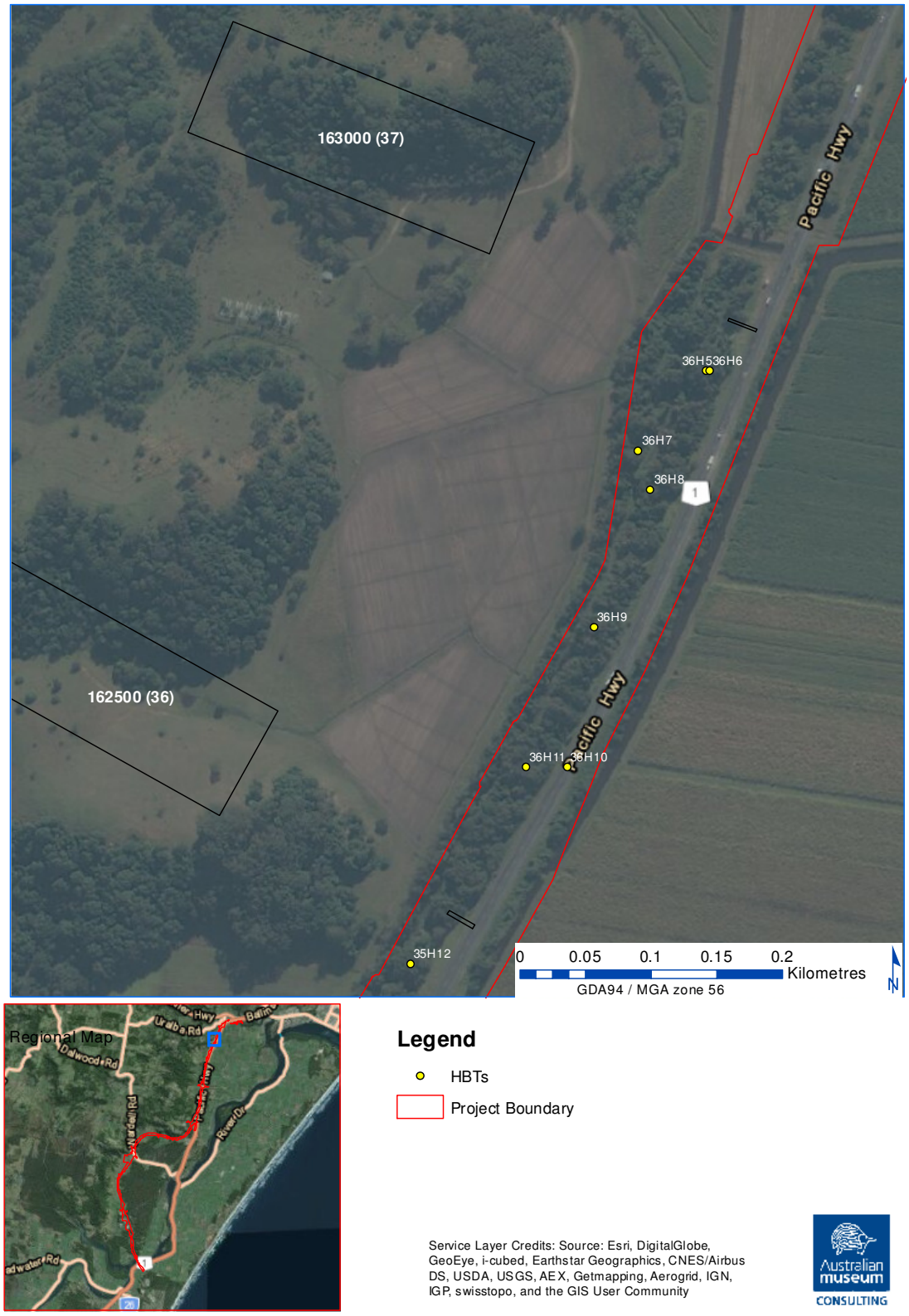

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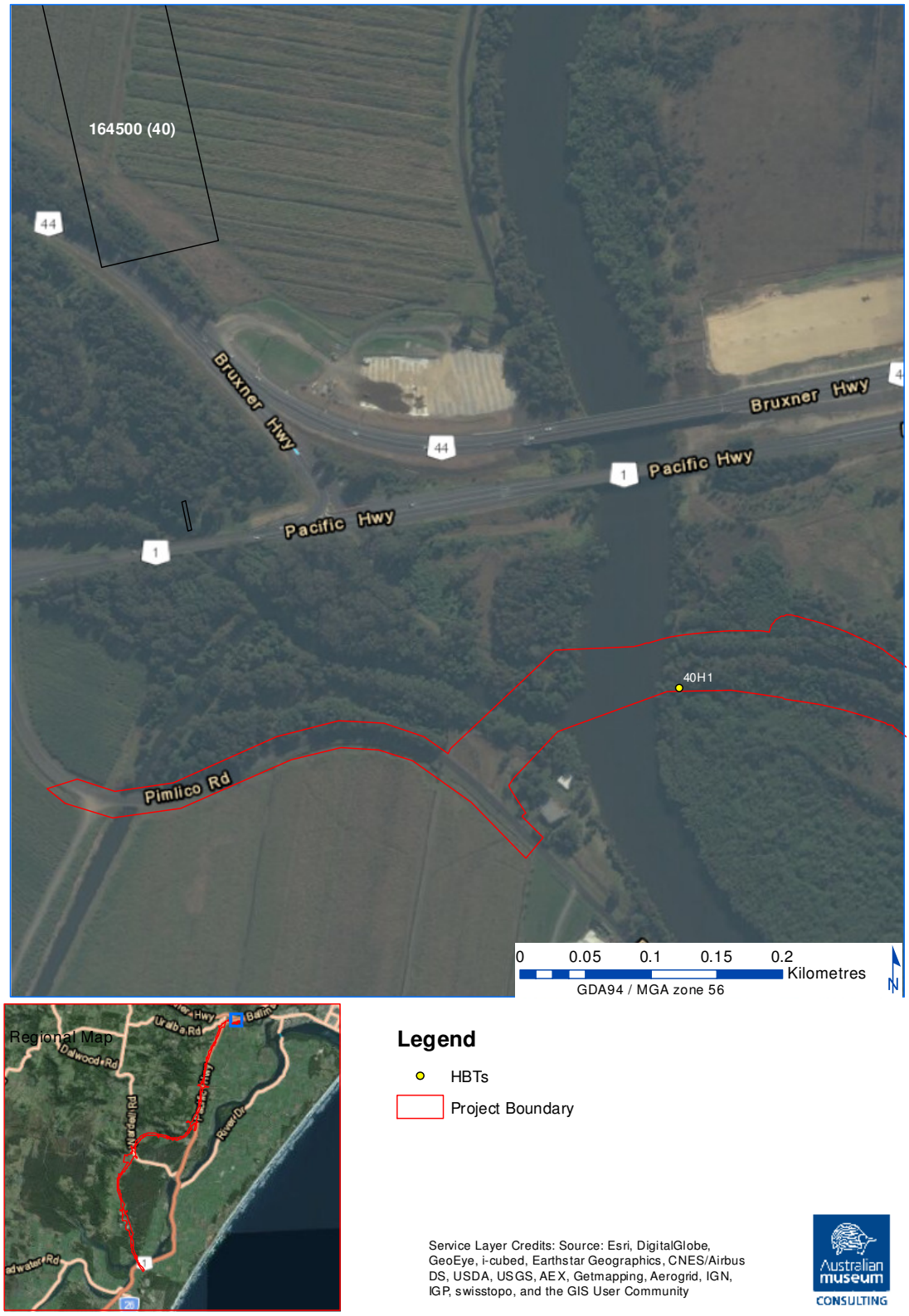

Location of hollow-bearing trees in Nest Box Zone 40.

Appendix B: Hollow-bearing Tree Data

Notes:
* A = Alive; D = Dead
** S = Small, M = Medium, L = Large
***LH = Limb Hollow, MSH = Main Stem Hollow, F = Fissure, RH = Residual Hollow
^ = HBT recorded as being outside of road corridor

Date	Surveyor	Nest Box Zone	Easting	Northing	Tree #	Tree Species	Health* (D or A)	Height (m)	DBH (m)	Total hollows	Feature	Feature Height (m)	Size*(S, M, L)
16/07/2014	CJ	3	542749	6792377	3H159	Blackbutt	A	30	3.23	2	LH	15	M
16/07/2014	CJ	3	542749	6792377	3H159	Blackbutt	A	30	3.23	2	LH	13	S
16/07/2014	CJ	3	542734	6792370	3H160	Blackbutt	A	30	4.81	1	LH	10	S
16/07/2014	CJ	3	542702	6792382	3H161	Blackbutt	A	25	3.8	3	LH	10	M
16/07/2014	CJ	3	542702	6792382	3H161	Blackbutt	A	25	3.8	3	LH	15	M
16/07/2014	CJ	3	542702	6792382	3H161	Blackbutt	A	25	3.8	3	LH	16	M
16/07/2014	CJ	3	542694	6792384	3H162	Blackbutt	A	25	3.72	2	LH	20	L
16/07/2014	CJ	3	542694	6792384	3H162	Blackbutt	A	25	3.72	2	LH	15	M
16/07/2014	CJ	3	542770	6792425	3H163	Blackbutt	A	20	1.81	1	MSH	7	M
16/07/2014	CJ	3	542743	6792435	3H164	Blackbutt	A	25	2.02	2	LH	14	M
16/07/2014	CJ	3	542743	6792435	3H164	Blackbutt	A	25	2.02	2	LH	10	S
16/07/2014	CJ	3	542730	6792427	3H165	Blackbutt	A	25	2.11	1	LH	15	M
16/07/2014	CJ	3	542726	6792439	3H166	Blackbutt	A	25	2.4	2	LH	10	M
16/07/2014	CJ	3	542726	6792439	3H166	Blackbutt	A	25	2.4	2	LH	15	M
17/07/2017	CJ	3	542745	6792453	3H167	Blackbutt	A	25	3.11	1	MSH	2	L
17/07/2017	CJ	3	542692	6792408	3H168	Blackbutt	A	35	4.05	3	LH	13	M
17/07/2017	CJ	3	542692	6792408	3H168	Blackbutt	A	35	4.05	3	LH	15	M
17/07/2017	CJ	3	542692	6792408	3H168	Blackbutt	A	35	4.05	3	LH	20	M
17/07/2017	CJ	3	542671	6792462	3H169	Blackbutt	A	30	4.25	1	MSH	115	L
18/07/2014	CJ	4	542544	6792961	4H171	Stag	D	15	1.74	2	MSH	12	L
18/07/2014	CJ	4	542544	6792961	4H171	Stag	D	15	1.74	2	LH	14	L
18/07/2014	CJ	4	542547	6793003	4H172	Stag	D	15	2.91	2	F	0	L
18/07/2014	CJ	4	542547	6793003	4H172	Stag	D	15	2.91	2	MSH	8	S
18/07/2014	CJ	4	542516	6793015	4H173	Redgum	A	25	3.17	2	LH	7	M
18/07/2014	CJ	4	542516	6793015	4H173	Redgum	A	25	3.17	2	LH	8	M
16/07/2014	CJ	5	542398	6793705	5H154	Stag	D	13	2.51	2	RH	10	L
16/07/2014	CJ	5	542398	6793705	5H154	Stag	D	13	2.51	2	LH	13	L
16/07/2014	CJ	5	542477	6793679	5H155	Stringybark	A	25	4.17	2	LH	15	M
16/07/2014	CJ	5	542477	6793679	5H155	Stringybark	A	25	4.17	2	LH	20	M
16/07/2014	CJ	5	542413	6793639	5H156	Stringybark	A	20	1.91	1	LH	7	S

Date	Surveyor	Nest Box Zone	Easting	Northing	Tree #	Tree Species	Health* (D or A)	Height (m)	DBH (m)	Total hollows	Feature	Feature Height (m)	Size*(S, M, L)
16/07/2014	CJ	5	542437	6793627	5H157	Stringybark	A	20	2.28	3	LH	7	M
16/07/2014	CJ	5	542437	6793627	5H157	Stringybark	A	20	2.28	3	LH	10	M
16/07/2014	CJ	5	542437	6793627	5H157	Stringybark	A	20	2.28	3	LH	8	S
16/07/2014	CJ	5	542458	6793633	5H158	Stringybark	A	15	2.19	1	CH	13	L
16/07/2014	CJ	6	542315	6794253	6H147	Blackbutt	A	35	5.83	4	LH	14	L
16/07/2014	CJ	6	542315	6794253	6H147	Blackbutt	A	35	5.83	4	MSH	18	L
16/07/2014	CJ	6	542315	6794253	6H147	Blackbutt	A	35	5.83	4	LH	25	L
16/07/2014	CJ	6	542315	6794253	6H147	Blackbutt	A	35	5.83	4	LH	16	M
16/07/2014	CJ	6	542251	6794040	6H148	Corymbia sp	A	25	2.28	3	MSH	13	L
16/07/2014	CJ	6	542251	6794040	6H148	Corymbia sp	A	25	2.28	3	MSH	12	M
16/07/2014	CJ	6	542251	6794040	6H148	Corymbia sp	A	25	2.28	3	MSH	12	S
16/07/2014	CJ	6	542161	6794036	6H149^	Corymbia sp	A	25	3.01	3	LH	15	M
16/07/2014	CJ	6	542161	6794036	6H149^	Corymbia sp	A	25	3.01	3	LH	20	M
16/07/2014	CJ	6	542161	6794036	6H149^	Corymbia sp	A	25	3.01	3	LH	20	M
16/07/2014	CJ	6	542239	6794012	6H150	Stag	D	20	2.4	1	MSH	15	S
16/07/2014	CJ	6	542499	6793927	6H151	Mahogany sp	A	20	3.1	3	MSH	15	L
16/07/2014	CJ	6	542499	6793927	6H151	Mahogany sp	A	20	3.1	3	LH	10	L
16/07/2014	CJ	6	542499	6793927	6H151	Mahogany sp	A	20	3.1	3	LH	17	S
16/07/2014	CJ	6	542436	6793831	6H152	Redgum	A	15	2.7	2	MSH	10	S
16/07/2014	CJ	6	542436	6793831	6H152	Redgum	A	15	2.7	2	MSH	10	S
16/07/2014	CJ	6	542418	6793781	6H153	Stringybark	A	20	3.48	4	MSH	5	L
16/07/2014	CJ	6	542418	6793781	6H153	Stringybark	A	20	3.48	4	LH	6	L
16/07/2014	CJ	6	542418	6793781	6H153	Stringybark	A	20	3.48	4	LH	10	L
16/07/2014	CJ	6	542418	6793781	6H153	Stringybark	A	20	3.48	4	MSH	15	M
16/07/2014	CJ	7	542346	6794548	7H144	Stag	D	3	1.89	1	RH	3	L
16/07/2014	CJ	7	542360	6794478	7H145	Stag	D	15	1.92	1	LH	9	S
16/07/2014	CJ	7	542354	6794281	7H146	Redgum	A	30	4.84	1	MSH	12	L
15/07/2014	CJ	8	541985	6794919	8H143	Stringybark	A	15	1.78	3	LH	7	M
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15/07/2014	CJ	8	541985	6794919	8H143	Stringybark	A	15	1.78	3	LH	9	S
15/07/2014	CJ	10	541805	6796142	10H121	Blackbutt	A	20	1.98	1	CH	18	L
15/07/2014	CJ	10	541814	6796139	10H122	Stag	D	5	0.71	1	CH	5	M
15/07/2014	CJ	10	541807	6796108	10H123	Stag	D	8	1.18	3	CH	8	L
15/07/2014	CJ	10	541807	6796108	10H123	Stag	D	8	1.18	3	LH	5	M
15/07/2014	CJ	10	541807	6796108	10H123	Stag	D	8	1.18	3	LH	7	S
15/07/2014	CJ	10	541825	6796080	10H124	Scribbly Gum	A	15	2.49	1	LH	10	L

Date	Surveyor	Nest Box Zone	Easting	Northing	Tree #	Tree Species	Health* (D or A)	Height (m)	DBH (m)	Total hollows	Feature	Feature Height (m)	Size*(S, M, L)
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15/07/2014	CJ	10	541840	6796040	10H125	Blackbutt	D	15	2.66	4	LH	7	M
15/07/2014	CJ	10	541840	6796040	10H125	Blackbutt	D	15	2.66	4	LH	10	M
15/07/2014	CJ	10	541840	6796040	10H125	Blackbutt	D	15	2.66	4	LH	10	M
15/07/2014	CJ	10	541844	6796024	10H126	Scribbly Gum	A	20	2.71	1	LH	10	L
15/07/2014	CJ	10	541825	6796022	10H127	Scribbly Gum	A	20	2.61	1	LH	9	M
15/07/2014	CJ	10	541807	6796021	10H128	Scribbly Gum	A	15	3.17	3	MSH	3	L
15/07/2014	CJ	10	541807	6796021	10H128	Scribbly Gum	A	15	3.17	3	LH	13	L
15/07/2014	CJ	10	541807	6796021	10H128	Scribbly Gum	A	15	3.17	3	LH	13	M
15/07/2014	CJ	10	541788	6795999	10H129	Scribbly Gum	A	20	3.59	1	MSH	18	L
15/07/2014	CJ	10	541852	6796009	10H130	Scribbly Gum	A	20	2.21	2	LH	7	M
15/07/2014	CJ	10	541852	6796009	10H130	Scribbly Gum	A	20	2.21	2	LH	8	S
15/07/2014	CJ	10	541868	6795990	10H131	Scribbly Gum	A	15	1.79	1	LH	8	M
15/07/2014	CJ	10	541856	6795980	10H132	Scribbly Gum	A	15	2.26	2	MSH	8	L
15/07/2014	CJ	10	541856	6795980	10H132	Scribbly Gum	A	15	2.26	2	LH	4	L
15/07/2014	CJ	10	541819	6795975	10H133	Stag	D	15	2.32	3	F	0	L
15/07/2014	CJ	10	541819	6795975	10H133	Stag	D	15	2.32	3	LH	7	M
15/07/2014	CJ	10	541819	6795975	10H133	Stag	D	15	2.32	3	LH	7	M
15/07/2014	CJ	10	541817	6795991	10H134	Scribbly Gum	A	25	2.71	2	LH	10	M
15/07/2014	CJ	10	541817	6795991	10H134	Scribbly Gum	A	25	2.71	2	LH	11	M
15/07/2014	CJ	10	541835	6795961	10H135	Scribbly Gum	A	20	2.42	3	LH	13	M
15/07/2014	CJ	10	541835	6795961	10H135	Scribbly Gum	A	20	2.42	3	LH	14	S
15/07/2014	CJ	10	541835	6795961	10H135	Scribbly Gum	A	20	2.42	3	LH	15	S
15/07/2014	CJ	10	541788	6795937	10H136^	Corymbia sp	A	15	2.97	1	MSH	6	L
15/07/2014	CJ	10	541789	6795932	10H137^	Scribbly	A	30	3.21	4	LH	12	M

Date	Surveyor	Nest Box Zone	Easting	Northing	Tree #	Tree Species	Health* (D or A)	Height (m)	DBH (m)	Total hollows	Feature	Feature Height (m)	Size*(S, M, L)
						Gum							
15/07/2014	CJ	10	541789	6795932	10H137^	Scribbly Gum	A	30	3.21	4	LH	13	M
15/07/2014	CJ	10	541789	6795932	10H137^	Scribbly Gum	A	30	3.21	4	LH	17	M
15/07/2014	CJ	10	541789	6795932	10H137^	Scribbly Gum	A	30	3.21	4	LH	10	S
15/07/2014	CJ	10	541803	6795908	10H138^	Scribbly Gum	A	12	2.77	3	LH	14	M
15/07/2014	CJ	10	541803	6795908	10H138^	Scribbly Gum	A	18	2.77	3	LH	4	M
15/07/2014	CJ	10	541803	6795908	10H138^	Scribbly Gum	A	12	2.77	3	MSH	5	S
15/07/2014	CJ	10	541800	6795906	10H139^	Scribbly Gum	A	20	1.93	2	LH	15	S
15/07/2014	CJ	10	541800	6795906	10H139^	Scribbly Gum	A	20	1.93	2	LH	15	S
15/07/2014	CJ	10	541844	6795911	10H140	Scribbly Gum	A	20	2.89	2	MSH	12	L
15/07/2014	CJ	10	541844	6795911	10H140	Scribbly Gum	A	20	2.89	2	LH	15	S
15/07/2014	CJ	10	541856	6795903	10H141	Scribbly Gum	A	20	2.79	1	LH	10	L
15/07/2014	CJ	10	541851	6795879	10H142	Scribbly Gum	A	25	4.42	5	F	0	L
15/07/2014	CJ	10	541851	6795879	10H142	Scribbly Gum	A	25	4.42	5	LH	10	L
15/07/2014	CJ	10	541851	6795879	10H142	Scribbly Gum	A	25	4.42	5	LH	17	L
15/07/2014	CJ	10	541851	6795879	10H142	Scribbly Gum	A	25	4.42	5	LH	15	L
15/07/2014	CJ	10	541851	6795879	10H142	Scribbly Gum	A	25	4.42	5	LH	18	L
15/07/2014	CJ	10	541827	6796184	10H120	Scribbly Gum	A	20	3.21	1	LH	5	L
15/07/2014	CJ	11	541765	6796394	11H114	Blackbutt	A	20	2.54	1	MSH	15	L
15/07/2014	CJ	11	541736	6796385	11H115	Blackbutt	A	20	4.58	1	MSH	15	L
15/07/2014	CJ	11	541709	6796334	11H116	Stag	D	15	2.09	1	MSH	15	L
15/07/2014	CJ	11	541713	6796313	11H117	Stag	D	20	2.23	2	MSH	20	L
15/07/2014	CJ	11	541713	6796313	11H117	Stag	D	20	2.23	2	MSH	15	L
15/07/2014	CJ	11	541721	6796314	11H118	Mahogany	A	20	2.69	1	MSH	15	L

Date	Surveyor	Nest Box Zone	Easting	Northing	Tree #	Tree Species	Health* (D or A)	Height (m)	DBH (m)	Total hollows	Feature	Feature Height (m)	Size*(S, M, L)
						sp							
15/07/2014	CJ	11	541712	6796295	11H119	Stag	D	20	5.2	3	F	0.5	L
15/07/2014	CJ	11	541712	6796295	11H119	Stag	D	20	5.2	3	LH	15	L
15/07/2014	CJ	11	541712	6796295	11H119	Stag	D	20	5.2	3	CH	20	L
15/07/2014	CJ	12	541713	6797070	12H112	Blackbutt	A	25	5.17	3	MSH	10	L
15/07/2014	CJ	12	541713	6797070	12H112	Blackbutt	A	25	5.17	3	LH	20	L
15/07/2014	CJ	12	541713	6797070	12H112	Blackbutt	A	25	5.17	3	LH	22	L
15/07/2014	CJ	12	541722	6796840	12H113	Stag	D	15	3.63	1	MSH	15	L
14/07/2014	CJ	20	544012	6799722	20H105	Swamp Box	A	20	2.92	2	MSH	12	L
14/07/2014	CJ	20	544012	6799722	20H105	Swamp Box	A	20	2.92	2	F	0.5	L
14/07/2014	CJ	20	543955	6799742	20H106	Swamp Box	A	20	1.91	1	MSH	6	M
14/07/2014	CJ	20	543880	6799750	20H107	Stag	D	15	3.3	2	MSH	12	L
14/07/2014	CJ	20	543880	6799750	20H107	Stag	D	15	3.3	2	F		L
14/07/2014	CJ	20	543862	6799753	20H108^	Swamp Box	A	15	2.78	1	MSH	13	L
14/07/2014	CJ	20	543795	6799832	20H109	Flooded Gum	A	20	3.09	2	MSH	7	L
14/07/2014	CJ	20	543795	6799832	20H109	Flooded Gum	A	20	3.09	2	LH	9	L
14/07/2014	CJ	20	543908	6799804	20H110	Flooded Gum	A	25	3.87	2	LH	4	L
14/07/2014	CJ	20	543908	6799804	20H110	Flooded Gum	A	25	3.87	2	LH	7	L
14/07/2014	CJ	20	543933	6799809	20H111	Flooded Gum	A	25	4.28	2	LH	10	L
14/07/2014	CJ	20	543933	6799809	20H111	Flooded Gum	A	25	4.28	2	LH	15	L
14/07/2014	CJ	22	544810	6799576	22H100	Blackbutt	A	35	3.37	3	LH	7	M
14/07/2014	CJ	22	544810	6799576	22H100	Blackbutt	A	35	3.37	3	LH	9	M
14/07/2014	CJ	22	544810	6799576	22H100	Blackbutt	A	35	3.37	3	LH	15	M
14/07/2014	CJ	22	544767	6799541	22H101^	Blackbutt	A	40	4.97	5	LH	2	L
14/07/2014	CJ	22	544767	6799541	22H101^	Blackbutt	A	40	4.97	5	LH	7	L
14/07/2014	CJ	22	544767	6799541	22H101^	Blackbutt	A	40	4.97	5	LH	12	L
14/07/2014	CJ	22	544767	6799541	22H101^	Blackbutt	A	40	4.97	5	LH	20	L
14/07/2014	CJ	22	544767	6799541	22H101^	Blackbutt	A	40	4.97	5	F	0	L
14/07/2014	CJ	22	544772	6799599	22H102	Blackbutt	A	30	4.52	2	LH	10	M
14/07/2014	CJ	22	544772	6799599	22H102	Blackbutt	A	30	4.52	2	LH	15	M
14/07/2014	CJ	22	544741	6799591	22H103	FRG	A	35	5.39	2	LH	10	L
14/07/2014	CJ	22	544741	6799591	22H103	FRG	A	35	5.39	2	LH	15	M
14/07/2014	CJ	22	544742	6799650	22H104^	Stag	D	25	2.92	3	LH	8	M
14/07/2014	CJ	22	544742	6799650	22H104^	Stag	D	25	2.92	3	LH	19	M
14/07/2014	CJ	22	544742	6799650	22H104^	Stag	D	25	2.92	3	LH	2	S

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14/07/2014	CJ	22	544876	6799555	22H94	Flooded Gum	A	35	4.34	2	F	0	L
14/07/2014	CJ	22	544876	6799555	22H94	Flooded Gum	A	35	4.34	2	LH	25	L
14/07/2014	CJ	22	544843	6799564	22H95	Unknown Rainforest sp	A	20	1.32	1	MSH	2.5	L
14/07/2014	CJ	22	544837	6799564	22H96	Unknown Rainforest sp	A	15	1.15	1	MSH	7	L
14/07/2014	CJ	22	544837	6799568	22H97	Unknown Rainforest sp	A	10	1.22	1	MSH	4	L
14/07/2014	CJ	22	544831	6799572	22H98	Unknown Rainforest sp	A	15	1.49	1	MSH	8	L
14/07/2014	CJ	22	544863	6799571	22H99	Brush Box	A	25	3.24	2	F	0.5	L
14/07/2014	CJ	22	544863	6799571	22H99	Brush Box	A	25	3.24	2	LH	7	L
13/07/2014	CJ	24	545866	6799861	24H90	Tallowwood	A	35	2.99	4	LH	2	M
13/07/2014	CJ	24	545866	6799861	24H90	Tallowwood	A	35	2.99	4	LH	5	M
13/07/2014	CJ	24	545866	6799861	24H90	Tallowwood	A	35	2.99	4	LH	10	M
13/07/2014	CJ	24	545866	6799861	24H90	Tallowwood	A	35	2.99	4	LH	3	S
13/07/2014	CJ	24	545837	6799811	24H91	Blackbutt	A	35	3.09	4	MSH	20	L
13/07/2014	CJ	24	545837	6799811	24H91	Blackbutt	A	35	3.09	4	LH	3	M
13/07/2014	CJ	24	545837	6799811	24H91	Blackbutt	A	35	3.09	4	LH	4	M
13/07/2014	CJ	24	545837	6799811	24H91	Blackbutt	A	35	3.09	4	LH	8	M
11/07/2014	CJ	25	546352	6800232	25H73	Ash?	A	15	1.29	1	MSH	1	L
11/07/2014	CJ	25	546330	6800066	25H74	Blackbutt	A	25	2.45	2	LH	5	M
11/07/2014	CJ	25	546330	6800066	25H74	Blackbutt	A	25	2.45	2	LH	5.5	S
13/07/2014	CJ	25	546126	6800241	25H75	Corymbia sp	A	35	4.17	1	LH	25	M
13/07/2014	CJ	25	546127	6800207	25H76^	Corymbia sp	A	15	1.88	2	MSH	5	L
13/07/2014	CJ	25	546127	6800207	25H76^	Corymbia sp	A	15	1.88	2	MSH	4	M
13/07/2014	CJ	25	546112	6800212	25H77	Blackbutt	A	40	4.69	2	LH	10	M
13/07/2014	CJ	25	546117	6800190	25H78^	Ash?	A	15	0.81	1	MSH	5	M
13/07/2014	CJ	25	546095	6800197	25H79	Stag	D	10	4.27	2	MSH	0	L
13/07/2014	CJ	25	546095	6800197	25H79	Stag	D	10	4.27	2	LH	8	M
13/07/2014	CJ	25	546092	6800190	25H80	Unknown Rainforest sp	A	15	1.27	2	F	2	L
13/07/2014	CJ	25	546092	6800190	25H80	Unknown Rainforest	A	15	1.27	2	MSH	2	L

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						sp							
13/07/2014	CJ	25	546086	6800187	25H81	Brush Box	A	25	3.11	1	F	0	L
13/07/2014	CJ	25	546085	6800178	25H82	Corymbia sp	A	30	2.53	2	LH	17	L
13/07/2014	CJ	25	546085	6800178	25H82	Corymbia sp	A	30	2.53	2	LH	25	M
13/07/2014	CJ	25	546079	6800174	25H83	Blackbutt	A	20	2.52	3	MSH	10	L
13/07/2014	CJ	25	546079	6800174	25H83	Blackbutt	A	20	2.52	3	LH	10	M
13/07/2014	CJ	25	546079	6800174	25H83	Blackbutt	A	20	2.52	3	LH	15	M
13/07/2014	CJ	25	546108	6800162	25H84^	Stag	D	15		1	LH	6	M
13/07/2014	CJ	25	546067	6800166	25H85	Blackbutt	A	30	3.72	3	LH	15	M
13/07/2014	CJ	25	546067	6800166	25H85	Blackbutt	A	30	3.72	3	LH	17	M
13/07/2014	CJ	25	546067	6800166	25H85	Blackbutt	A	30	3.72	3	LH	20	M
13/07/2014	CJ	25	546060	6800153	25H86	Blackbutt	A	20	1.76	4	LH	6	L
13/07/2014	CJ	25	546060	6800153	25H86	Blackbutt	A	20	1.76	4	LH	8	L
13/07/2014	CJ	25	546060	6800153	25H86	Blackbutt	A	20	1.76	4	LH	4	M
13/07/2014	CJ	25	546060	6800153	25H86	Blackbutt	A	20	1.76	4	LH	6	M
13/07/2014	CJ	25	546052	6800150	25H87	Blackbutt	A	30	2.07	2	LH	8	M
13/07/2014	CJ	25	546052	6800150	25H87	Blackbutt	A	30	2.07	2	LH	9	M
13/07/2014	CJ	25	546067	6800117	25H88	Blackbutt	A	35	4.18	4	LH	2	M
13/07/2014	CJ	25	546067	6800117	25H88	Blackbutt	A	35	4.18	4	LH	3	M
13/07/2014	CJ	25	546067	6800117	25H88	Blackbutt	A	35	4.18	4	MSH	15	M
13/07/2014	CJ	25	546067	6800117	25H88	Blackbutt	A	35	4.18	4	LH	5	M
13/07/2014	CJ	25	546041	6800084	25H89	Unknown Rainforest sp	A	15	1.92	2	F	0	L
13/07/2014	CJ	25	546041	6800084	25H89	Unknown Rainforest sp	A	15	1.92	2	MSH	6	L
10/07/2014	CJ	26	546416	6800841	26H50	Unknown Rainforest sp	A	20	1.31	1	LH	3.5	M
11/07/2014	CJ	26	546385	6800590	26H51	Stag	D	15	1.17	1	MSH	2	L
11/07/2014	CJ	26	546380	6800591	26H52	Blackbutt	A	25	3.07	5	F	0.5	L
11/07/2014	CJ	26	546380	6800591	26H52	Blackbutt	A	25	3.07	5	LH	2.6	M
11/07/2014	CJ	26	546380	6800591	26H52	Blackbutt	A	25	3.07	5	LH	3	M
11/07/2014	CJ	26	546380	6800591	26H52	Blackbutt	A	25	3.07	5	LH	9	M
11/07/2014	CJ	26	546380	6800591	26H52	Blackbutt	A	25	3.07	5	LH	11	S
11/07/2014	CJ	26	546405	6800769	26H53	Brush Box	A	20	1.78	1	MSH	6.5	L
11/07/2014	CJ	26	546409	6800774	26H54	Camphor	A	15	1.66	1	F	0	L
11/07/2014	CJ	26	546416	6800813	26H55	Ficus sp	A	25	10.4	2	LH	6.5	M
11/07/2014	CJ	26	546416	6800813	26H55	Ficus sp	A	25	10.4	2	LH	2	S
11/07/2014	CJ	26	546362	6800662	26H56	Red Ash?	A	25	1.47	1	LH	8	M

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11/07/2014	CJ	26	546357	6800643	26H57	Stag	D	8	0.72	2	MSH	2	M
11/07/2014	CJ	26	546357	6800643	26H57	Stag	D	8	0.72	2	MSH	7	M
11/07/2014	CJ	26	546357	6800642	26H58	Corymbia?	A	30	1.91	1	LH	15	M
11/07/2014	CJ	26	546212	6800651	26H59	Unknown Rainforest sp	A	20	1.82	1	LH	16	M
11/07/2014	CJ	26	546257	6800612	26H60	Unknown Rainforest sp	D	13	0.92	1	MSH	6	M
11/07/2014	CJ	26	546274	6800605	26H61	Red Ash?	A	15	1.77	1	F	1	L
11/07/2014	CJ	26	546297	6800590	26H62	Red Ash?	A	20	1.55	3	F	0	L
11/07/2014	CJ	26	546297	6800590	26H62	Red Ash?	A	20	1.55	3	LH	5	M
11/07/2014	CJ	26	546297	6800590	26H62	Red Ash?	A	20	1.55	3	LH	5	M
11/07/2014	CJ	26	546256	6800589	26H63	Red Ash?	A	20	2.02	2	MSH	5	L
11/07/2014	CJ	26	546256	6800589	26H63	Red Ash?	A	20	2.02	2	MSH	10	L
11/07/2014	CJ	26	546438	6800640	26H66	Blackbutt	A	25	3.98	2	LH	6	L
11/07/2014	CJ	26	546438	6800640	26H66	Blackbutt	A	25	3.98	2	LH	7	L
11/07/2014	CJ	26	546370	6800830	26H67	Stag	D	12	2.89	1	MSH	7	L
11/07/2014	CJ	26	546360	6800829	26H68	Corymbia sp	A	25	3.08	1	LH	13	S
11/07/2014	CJ	26	546370	6800849	26H69	Red Mahogany	A	30	4.28	1	MSH	6	S
11/07/2014	CJ	26	546344	6800842	26H70	Brush Box	A	20	1.63	1	MSH	5	S
11/07/2014	CJ	26	546287	6800802	26H71	Stinging Tree?	A	15	0.6	1	MSH	2.5	M
11/07/2014	CJ	26	546398	6800764	26H72	Unknown Rainforest sp	A	15	0.93	1	MSH	2	M
10/07/2014	CJ	27	546529	6801384	27H39	Stag	D	6	1.07	2	MSH	1.5	S
10/07/2014	CJ	27	546529	6801384	27H39	Stag	D	6	1.07	2	MSH	3	S
10/07/2014	CJ	27	546528	6801383	27H40	Stag	D	10	1.13	2	LH	4.5	M
10/07/2014	CJ	27	546528	6801383	27H40	Stag	D	10	1.13	2	LH	9	S
10/07/2014	CJ	27	546538	6801375	27H41	Stag	D	15	1.53	2	CH	15	L
10/07/2014	CJ	27	546538	6801375	27H41	Stag	D	15	1.53	2	LH	7	S
10/07/2014	CJ	27	546520	6801357	27H42	Paperbark	A	20	1.42	1	F	1	L
10/07/2014	CJ	27	546510	6801303	27H43	Stag	D	7	1.51	1	MSH	4.5	L
10/07/2014	CJ	27	546506	6801296	27H44	Unknown	A	25	2.21	8	F	2	L
10/07/2014	CJ	27	546506	6801296	27H44	Unknown	A	25	2.21	8	F	3	L
10/07/2014	CJ	27	546506	6801296	27H44	Unknown	A	25	2.21	8	MSH	15	L
10/07/2014	CJ	27	546506	6801296	27H44	Unknown	A	25	2.21	8	LH	6	M
10/07/2014	CJ	27	546506	6801296	27H44	Unknown	A	25	2.21	8	LH	7	M
10/07/2014	CJ	27	546506	6801296	27H44	Unknown	A	25	2.21	8	LH	11	M

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10/07/2014	CJ	27	546506	6801296	27H44	Unknown	A	25	2.21	8	LH	11	M
10/07/2014	CJ	27	546506	6801296	27H44	Unknown	A	25	2.21	8	MSH	17	M
10/07/2014	CJ	27	546502	6801197	27H45	Unknown Rainforest sp	A	17	1.34	2	MSH	11	L
10/07/2014	CJ	27	546502	6801197	27H45	Unknown Rainforest sp	A	17	1.34	2	F	6	L
10/07/2014	CJ	27	546490	6801182	27H46	Ash?	A	15	0.74	2	MSH	6	M
10/07/2014	CJ	27	546490	6801182	27H46	Ash?	A	15	0.74	2	MSH	7	M
10/07/2014	CJ	27	546451	6801129	27H47	Tallowwood	A	45	3.59	1	LH	13	L
10/07/2014	CJ	27	546482	6801113	27H48	Tallowwood	A	35	2.26	2	MSH	12	L
10/07/2014	CJ	27	546482	6801113	27H48	Tallowwood	A	35	2.26	2	F	17	L
10/07/2014	CJ	27	546453	6801060	27H49	Paperbark	A	20	2.54	2	MSH	2.5	L
10/07/2014	CJ	27	546453	6801060	27H49	Paperbark	A	20	2.54	2	MSH	4	L
10/07/2014	CJ	27	546602	6801396	27H64	Red Mahogany	A	35	3.32	2	F	0	L
10/07/2014	CJ	27	546602	6801396	27H64	Red Mahogany	A	35	3.32	2	LH	12	S
10/07/2014	CJ	27	546498	6800975	27H65	Unknown Rainforest sp	A	20	1.79	1	MSH	17	M
9/07/2014	CJ	28	546621	6801848	28H19	Paperbark	A	20	1.18	1	MSH	3.5	M
9/07/2014	CJ	28	546612	6801817	28H20	Paperbark	A	25	1.27	3	MSH	0.5	L
9/07/2014	CJ	28	546612	6801817	28H20	Paperbark	A	25	1.27	3	MSH	3	L
9/07/2014	CJ	28	546612	6801817	28H20	Paperbark	A	25	1.27	3	MSH	2	S
9/07/2014	CJ	28	546583	6801667	28H21	Paperbark	A	30	1.71	1	MSH	8	L
9/07/2014	CJ	28	546578	6801672	28H22	Paperbark	A	25	1.28	2	MSH	20	L
9/07/2014	CJ	28	546578	6801672	28H22	Paperbark	A	25	1.28	2	LH	22	S
9/07/2014	CJ	28	546571	6801639	28H23	Pink Euodea	A	30	1.73	2	CH	10	L
9/07/2014	CJ	28	546571	6801639	28H23	Pink Euodea	A	30	1.73	2	LH	10	M
9/07/2014	CJ	28	546559	6801634	28H24^	Pink Euodea	A	35	2.83	2	LH	15	L
9/07/2014	CJ	28	546559	6801634	28H24^	Pink Euodea	A	35	2.83	2	MSH	20	L
9/07/2014	CJ	28	546579	6801633	28H25	Pink Euodea	A	35	3.34	2	MSH	10	L
9/07/2014	CJ	28	546579	6801633	28H25	Pink Euodea	A	35	3.34	2	LH	15	L
9/07/2014	CJ	28	546591	6801629	28H26	Pink Euodea	A	20	0.94	1	MSH	1	M
9/07/2014	CJ	28	546656	6801518	28H27	Swamp Box	A	35	1.84	2	LH	6	L
9/07/2014	CJ	28	546656	6801518	28H27	Swamp Box	A	35	1.84	2	F	1.5	L
9/07/2014	CJ	28	546659	6801529	28H28	Swamp Box	A	30	2.44	2	MSH	10	L
9/07/2014	CJ	28	546659	6801529	28H28	Swamp Box	A	30	2.44	2	LH	15	S
9/07/2014	CJ	28	546634	6801619	28H30	Squiggly	A	25	3.84			8	S

Date	Surveyor	Nest Box Zone	Easting	Northing	Tree #	Tree Species	Health* (D or A)	Height (m)	DBH (m)	Total hollows	Feature	Feature Height (m)	Size*(S, M, L)
10/07/2014	CJ	28	546584	6801617	28H31	Stag	D	20	1.54	3	F	0	L
10/07/2014	CJ	28	546584	6801617	28H31	Stag	D	20	1.54	3	CH	20	L
9/07/2014	CJ	28	546584	6801617	28H31	Stag	D	20	1.54	3	LH	15	S
10/07/2014	CJ	28	546568	6801579	28H32	Pink Euodea	A	35	2.65	1	MSH	8	L
10/07/2014	CJ	28	546547	6801575	28H33^	Pink Euodea	A	35	1.71	2	LH	17	M
10/07/2014	CJ	28	546547	6801575	28H33^	Pink Euodea	A	35	1.71	2	LH	20	M
10/07/2014	CJ	28	546568	6801573	28H34	Pink Euodea	D	15	1.94	2	MSH	15	M
10/07/2014	CJ	28	546568	6801573	28H34	Pink Euodea	D	15	1.94	2	MSH	15	M
10/07/2014	CJ	28	546561	6801573	28H35	Pink Euodea	A	25	1.47	2	MSH	5	L
10/07/2014	CJ	28	546561	6801573	28H35	Pink Euodea	A	25	1.47	2	MSH	15	M
10/07/2014	CJ	28	546568	6801551	28H36	Pink Euodea	A	25	1.06	3	LH	7	L
10/07/2014	CJ	28	546568	6801551	28H36	Pink Euodea	A	25	1.06	3	MSH	13	L
9/07/2014	CJ	28	546568	6801551	28H36	Pink Euodea	A	25	1.06	3	LH	9	S
10/07/2014	CJ	28	546550	6801494	28H37	Unknown Rainforest sp	A	10	0.74	1	MSH	3	M
10/07/2014	CJ	28	546546	6801443	28H38	Stag	D	2.5	1.88	1	CH	2.5	L
9/07/2014	CJ	29	546684	6802192	29H13	Scribbly Gum	A	25	2.84	2	LH	7	M
9/07/2014	CJ	29	546684	6802192	29H13	Scribbly Gum	A	25	2.84	2	LH	4	M
9/07/2014	CJ	29	546669	6802193	29H14	Scribbly Gum	A	20	2.29	1	LH	7	M
9/07/2014	CJ	29	546701	6802327	29H15	Ash?	A	3	0.59	1	MSH	1.5	S
9/07/2014	CJ	30	546717	6802417	30H16	Ash?	A	5	0.7	1	MSH	2	M
9/07/2014	CJ	30	546715	6802440	30H17	Turpentine	A	30	1.52	1	MSH	12	M
9/07/2014	CJ	30	546745	6802558	30H18	Turpentine	A	15	2.21	1	MSH	8	M
8/07/2014	CJ	31	546806	6802959	31H2	Unknown Rainforest sp	A	15	1.41	2	MSH	3	S
8/07/2014	CJ	31	546806	6802959	32H2	Unknown Rainforest sp	A	15	1.41	2	MSH	7	S
8/07/2014	CJ	32	546894	6803462	32H3	Unknown Rainforest sp	A	15	1.29	1	MSH	5	S
8/07/2014	CJ	32	546897	6803483	32H4	Unknown Rainforest sp	A	20	1.73		Termitaria	10	
8/07/2014	CJ	35	547425	6805211	35H12	Paperbark	A	25	2.54	2	MSH	13	L
8/07/2014	CJ	35	547425	6805211	35H12	Paperbark	A	25	2.54	2	MSH	0	L

Date	Surveyor	Nest Box Zone	Easting	Northing	Tree #	Tree Species	Health* (D or A)	Height (m)	DBH (m)	Total hollows	Feature	Feature Height (m)	Size*(S, M, L)
8/07/2014	CJ	36	547544	6805361	36H10	Swamp Oak	A	30	2.07	1	F	2	L
8/07/2014	CJ	36	547513	6805361	36H11	Paperbark	A	15	0.97	1	MSH	1	M
8/07/2014	CJ	36	547649	6805662	36H5	Unknown Rainforest sp	A	30	1.72	2	LH	12	M
8/07/2014	CJ	36	547649	6805662	36H5	Unknown Rainforest sp	A	30	1.72	2	LH	25	S
8/07/2014	CJ	36	547652	6805662	36H6	Swamp Oak	A	25	1.51	1	LH	20	S
8/07/2014	CJ	36	547598	6805601	36H7	Swamp Oak	A	30	1.37	2	MSH	20	M
8/07/2014	CJ	36	547607	6805571	36H8	Ficus sp	A	20	1.94	1	F	4	L
8/07/2014	CJ	36	547564	6805467	36H9	Stag	D	6	1.07	2	CH	6	M
8/07/2014	CJ	40	546992	6806594	40H1	Mangrove (grey)	A	10	2.24	4	MSH	3	M
8/07/2014	CJ	40	546992	6806594	40H1	Mangrove (grey)	A	10	2.24	4	LH	2.5	M
8/07/2014	CJ	40	548991	6806594	40H1	Mangrove (grey)	A	10	2.24	4	LH	6	S
8/07/2014	CJ	40	546992	6806594	40H1	Mangrove (grey)	A	10	2.24	4	MSH	4	S