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SURVEY FOR THE TASMANIAN MASKED OWL (*TYTO NOVAEHOLLANDIAE CASTANOPS*) ON THE PROPOSED PULP MILL SITE, BELL BAY

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CONTENTS

1. SUMMARY

A survey of the proposed pulp mill site was undertaken on 10-12th June 2006 to determine the presence/absence of masked owl individuals and/or habitat.

Habitat was assessed by ground surveys using binoculars and reference to vegetation mapping and other available information. The majority of the study area does not support habitat identified as potential roosting and/or breeding habitat for the masked owl due to the lack of key habitat features (such as large trees with well-developed large hollows suitable for breeding). Limited parts of the study area support potential habitat. These are mainly associated with riparian areas and steeper slopes facing the Tamar River.

Call-back survey was undertaken over 2 nights with no success with respect to the masked owl. Supplementary spotlight surveys over 2 nights also did not detect any masked owls.

A map is presented indicating the parts of the survey area considered to be support potential habitat for the masked owl. It is recommended that part of this area is incorporated into a reserve system for the species, on the assumption that at least part of the survey area of c. 430 ha forms part of a territory of a breeding pair of masked owls. Recommendations are made on what areas are considered most important to include in such a reserve system and include some of the lower slopes adjacent to the Tamar River and some of the slopes and riparian vegetation associated with the permanent stream immediately north of the current woodchip mill site. Additional suggestions are made for the management of individual potential nest trees elsewhere in the survey area.

2. PURPOSE, SCOPE AND LIMITATIONS OF THE SURVEY

2.1 *Purpose*

Gunns Limited (via Suzette Weeding) engaged Mark Wapstra (ECO*tas*) to undertake a zoological assessment of the proposed pulp mill site, specifically in relation to the presence or otherwise of habitat of the Tasmanian masked owl (*Tyto novaehollandiae castanops*).

2.2 *Scope*

This report addresses:

- the distribution of potential masked owl habitat at the proposed pulp mill site study area (see following);
- the results of call-back and habitat surveys for the masked owl at the proposed pulp mill site study area; and
- mitigation recommendations to minimise disturbance to potential masked owl habitat.

2.3 *Limitations*

The habitat assessment was not limited in any practical sense due to the presence of numerous tracks, well defined survey area boundaries, suitable survey conditions and easily negotiated terrain. Understorey and overstorey characteristics also meant that visibility (especially with the aid of binoculars) over often several hundred metres allowed broad habitat assessments to be made to facilitate targeting potentially higher quality habitat.

Call-back surveys were limited by practical and safety considerations. Specifically, call-back sites were selected as close as practical to potential habitat identified as part of the habitat assessments, taking into consideration nocturnal navigation and accessibility constraints.

It is also noted that the survey was conducted over a three-day period in mid-June. Nocturnal bird activity can vary at different temporal scales, and as with most fauna surveys, a negative result does not necessarily mean that a species is absent from a particular site. This is particular the case for species such as the masked owl, which has a large home range and is highly mobile.

However, the dates of the call-back survey were indicated as suitable for detecting masked owls (P. Bell pers. comm.).

3. THE STUDY AREA

The study area was defined by Gunns Limited (via Suzette Weeding) and is shown on Figure 1.

The area is c. 430 ha in extent, although the proposed "footprint" of areas to be intensively disturbed by direct infrastructure development is significantly less (c. 100ha). The study area is effectively divided into two sections by the East Tamar Highway. The western section is bound to the west by the Tamar River coastline (including a strip designated as coastal reserve), to the north by the Bell Bay Power Station facility and the East Tamar Highway, to the east by the East Tamar Highway and easements, and the south by the Gunns Limited woodchip facility. The eastern section is bound to the west by the East Tamar Highway and native forest, to the north by native forest on State forest, to the east by native forest on State forest and to the south by native forest on private property.

Altitude varies from 0 m a.s.l. to c. 200 m a.s.l. Topography is variable but generally comprises gentle slopes with broad ridges and several shallowly depressed drainage systems, and also a smaller number of drainage systems with steeper adjacent slopes (e.g. the rocky creekline immediately north of the Gunns Limited woodchip facility).

Most of the study area is disturbed to various extents. The majority of native forest is regrowth with few mature elements. Slopes above the coastline and adjacent to more deeply incised drainage systems tend to be less disturbed but there is evidence of tree removal throughout the entire study area. Numerous tracks dissect the study area, in the form of gravelled roads (e.g. under powerline easements), 4WD tracks (e.g. along old fencelines, old logging tracks, etc.) and broad firebreak or powerline easement maintenance tracks throughout. A major powerline and railway easement runs the length of the western section of the study area.

Vegetation of the study area is described by GHD (2006a).

4. METHODS

4.1 *Preliminary investigation*

Available sources of threatened fauna records were interrogated for point records of the masked owl. These sources include DPIW's threatened species database (GIS coverage of threatened fauna supplied by DPIWE current as at February 2006), the Forest Practices Authority's online version of the *Threatened Fauna Manual* and information on a potential masked owl sighting from the study area (GHD 2006b).

Other information sources were examined prior to the survey of 10-12th June 2006 to assess the most likely areas that may support potential roosting and/or nesting habitat, based on vegetation types and other site characteristics (e.g. topography, aspect, landform, disturbance history). These sources include the TASVEG vegetation coverage, a copy of the draft vegetation mapping for the proposed pulp mill site (GHD 2006a) and topographic/cadastral maps (Bell Bay 1: 25000 Tasmap).

4.2 *Zoological survey*

Several methods were employed to assess the presence or otherwise of the masked owl from the proposed pulp mill site. Zoological assessment was undertaken between 10-12th June 2006.

4.2.1 Habitat assessment

Reference to vegetation maps (digital layer of TASVEG and draft vegetation mapping provided in GHD (2006a) and topographic maps provided the basis for undertaking a more detailed habitat assessment.

For the purpose of the habitat assessment, potential habitat for the masked owl was conservatively defined as any forest/woodland vegetation (i.e. only non-forest vegetation such as grassland, rockplate vegetation, scrub under easements, open roads, etc. was excluded). While this definition meant that a relatively large area required on-the-ground assessment, it did ensure that even areas of potentially marginal habitat suitability (e.g. young regrowth eucalypt forest) were assessed for suitability in a more detailed and systematic manner.

Habitat is broadly classified into two categories:

(1) nesting habitat (i.e. forest/woodland with trees with suitably large hollows for nesting); and (2) roosting habitat (i.e. vegetation suitable for daytime roosting behaviour including copses of medium-tall shrubs such as native cherry, dogwood, dense canopy swards of dodder, sheoak, bulloak, dense and complex riparian vegetation and any areas with eucalypts with large hollows suitable for a daytime roost site).

Habitat assessment was primarily undertaken by walking transects through the entire survey area, using roads/tracks as access points (Figure 1). Every effort was made to examine the range of vegetation types reported on the draft vegetation map (GHD 2006a). Binoculars were used to assess some areas of potential habitat from a distance (e.g. scanning the large expanse of regrowth eucalypt forest between the powerline easement and the East Tamar Highway from various vantage points), which was followed by more detailed assessment if deemed necessary.

Any sites considered potentially suitable for the masked owl were assessed in greater detail. For example, the majority of creeklines were thoroughly searched because the most recent and nearest sighting of a masked owl came from such a site. In addition, even though most of the regrowth eucalypt forest was deemed unsuitable due to the almost complete lack of mature trees, any such trees identified were examined in detail.

Potential nest trees were defined as any eucalypt with hollows (or potential hollows) with an entrance opening greater than 15 cm. This is perhaps a little conservative as the species probably uses hollows with a significantly larger entrance size. However, such a definition allowed a greater number of potential trees to be examined. All potentially suitable trees that were located were examined from the ground to assess: (1) evidence of owl activity in the tree, such as regurgitated pellets or prey remains at the base of the tree (the area searched beneath each tree varied depending on the density and size of the canopy, which defined the search area based on potential perch sites), and (2) potential suitability of hollows (using binoculars from the most suitable vantage point attainable – the reality is that many potential hollows are probably "blind", i.e. not containing a suitable cavity for nesting, but this cannot be seen from the ground). The location of several potential nest trees was recorded using hand-held GPS. Where such trees formed clusters, a more central grid reference was recorded. Where such trees were more widespread, notes were made on maps to later better delineate patches of potential nesting habitat.

4.2.2 Call-back survey

Twenty-one sites (Figure 2, Table 1 in Appendix A) were selected for call-back survey. Site selection was based on various factors including an initial assessment of the most likely roosting/nesting habitat (as conducted during the habitat assessment described in section 4.3.1) and accessibility (taking into consideration nocturnal navigation and safety issues). In addition, four sites (over 2 nights) were deliberately placed within 200 m of the masked owl sighting previously reported.

The call-back survey methodology closely followed Bell *et al*. (1997)

At each call-back site, the following protocol was followed. Upon arrival at a site (whether by vehicle or foot), a 5-minute "settling" period was observed, which allowed for call-back equipment to be prepared while listening for any nocturnal bird activity. Following this initial 5-

minute period, a 15-minute audio cassette with an intermittent masked owl call recording (including several screeches and occasional chittering calls) was played through a megaphone. Calls were broadcast from the bonnet or tailgate of the vehicle, or from a large rock or tree stump for sites accessed on foot. It was estimated that, for the masked owl, the broadcasts could be heard up to at least 500 m away (based on observations of Bell et al. (1997) and observations as part of the current survey). Following this 15-minute period, an additional 5-minute listening period was observed. Subsequent to this 25-minute call-back survey, a 5-10 minute spotlight survey was undertaken (see section 4.3.3 for more detail).

At some sites, a 5-minute period of the boobook owl (*Ninox novaeseelandiae*) call was played using the same cassette/megaphone equipment. While the primary purpose of this assessment was to determine the presence/absence of the masked owl, the call-back protocol also targeted the boobook owl at a subset of the masked owl call-back sites to confirm that the method was appropriate for detecting nocturnal birds at the sites on the nights in question.

At each call-back site, the following data was recorded (generally as per Bell *et al*. 1997): precipitation (nil, drizzle, rain, heavy rain); wind speed (calm, light, leaves rustle, moderate, moves branches, strong); nightlight (very dark, dark, quarter moon or heavy cloud, detail seen, moon and clear sky, bright, half moon and clear); moon phase (new, first quarter, third quarter, full); air temperature (estimate only based on numbness of hands and amount of ice on car roof); location (using hand-held GPS); and time the survey was conducted.

4.2.3 Spotlight survey

Three night time spotlight survey techniques were employed, as follows.

1. At each call-back survey site (see section 4.2.2 and Figure 2), following the conclusion of the call-back survey, a 5-10 minute spotlighting survey was undertaken. The time period varied according to the density of the understorey and overstorey (visibility factor) and the complexity of the vegetation/ground conditions (navigation/safety factor) but the intention was to spotlight an area of approximately 1 ha (although this would have varied somewhat in exact area and the configuration of the area due to the inability to judge distance well at night in native forest situations). At each spotlight area, a careful search of all vegetation layers (from ground through to upper canopy) was made in a systematic as practical manner.
2. A windscreen assessment of approximately 15 km of tracks driven with high beam lights and a deliberate speed of less than 5 km/h was achieved over 2 nights of accessing the call-back survey locations. While it is recognised that the method has limitations (such as flushing birds well prior to spotting, a potential bias towards less likely habitat, and sometimes poor visibility due to navigating poor quality tracks), it does have some merit because other nocturnal birds (and other birds) were observed using this method including a kookaburra and a tawny frogmouth.
3. "Random" additional spotlighting from the vehicle (either from the driver's window or standing outside car, depending on particular site conditions) between call-back sites. No systematic method was employed to select sites for additional spotlight surveys but it generally involved surveying limited areas of forest (sometimes single trees, or clumps of trees, especially stags amongst regrowth forest near tracks). The location of these additional spotlighting surveys were not recorded.

4.2.4 Assessment of location of "flushed" masked owl sighting

The location (Figure 3) of the sighting of a masked owl (GHD 2006b) was visited on three occasions over the 3-day assessment period on the off-chance that another (or the same) bird would be flushed from the site. The location was deliberately visited at three different times of

the day to maximise the opportunity of observing a bird (10th – late in the day, just before sunset; 11th – early in the day, mid-morning; 12th – around midday).

5. RESULTS

5.1 *Preliminary investigation*

Figure 3 shows all available records for the masked owl from within c. 10 km of the boundary of the survey area.

GHD (2006b) reported on a sighting of a masked owl from the study area from the lower to middle section on the unnamed stream flowing into Dirty Bay (493241mE 5444258mN).

DPIW's threatened species database (GIS coverage of threatened fauna supplied by DPIWE current as at February 2006) and Forest Practices Authority's online version of the *Threatened Fauna Manual* showed several records from within c. 10 km of the boundary of the survey area including one site (486012mE 5448283mN ± 1000 m, once considered a nest recording but now either deleted from databases or shown as a sighting record only) and several other records (presumably either sightings or roadkill data because the records are not listed as nest sites in FPA's dataset).

Examination of vegetation maps indicated that the majority of the survey area supports forest/woodland potentially suitable for nesting/roosting. On this basis, extensive areas of native vegetation was traversed on foot (Figure 1) to more closely examine the potential suitability of the habitat.

5.2 *Zoological survey*

5.2.1 Habitat assessment

Figure 1 shows that parts of the survey area that were examined by ground survey. The majority of the vegetation types identified from the survey area (GHD 2006a) were assessed. Appendix C contains a series of images of the survey area depicting different vegetation types with comments on their potential suitability as masked owl habitat.

The majority of the proposed pulp mill site does not support potential masked owl habitat in the form of suitable mature forest with nesting/roosting hollows in standing trees or other potential roosting habitat in the form of complex and dense understorey vegetation. This is due to the extensive disturbance history resulting in relatively young regrowth native forest with no substantial mature elements in the canopy. Such areas may form part of the territory of any individuals (if present), that is, form part of the foraging habitat, but is unlikely to be critical to the breeding of the species in the area.

Limited areas of the broader survey area support marginal masked owl habitat in the form of less disturbed native forest with more substantial mature elements. However, on closer inspection, while many such areas supported an abundance of stags, most stags did not have any hollows potentially suitable for the masked owl due to their size (most "hollows" were less than 10-15 cm in entrance dimensions) or form (most "hollows" appeared "blind" or were formed in near-vertical "pipes" in broken crowns). Appendix B illustrates trees considered typical of those considered as potential nest trees, on the basis of size of potential hollows. The distribution of the potential nest trees identified from within the study area is shown in Figure 4 (note that there are also likely to be additional potential nest trees although it is considered that the majority of these would fall within the broader potential habitat areas defined below).

Three patches of forest are identified as supporting higher quality potential masked owl habitat (breeding) due to the higher abundance of potential hollows. These are located as follows (see Figure 4 for greater detail):

- in the vegetation associated with the stream system between the Bell Bay Line and the cleared easement in the south of the study area (Habitat Patch 3, Figure 4);
- on the slopes above the rocky coastline along the western foreshore between the stream flowing directly below the current mill site and Dirty Bay about 800 m to the northwest (Habitat Patch 1, Figure 4);
- along the lower slopes (both sides) of the unnamed stream flowing from the easement to just north of the current mill site (Habitat Patch 5, Figure 4).

Five patches of forest are identified as supporting moderate to high quality potential masked owl habitat (roosting) in the form of dense and complex riparian scrubbery surrounded by relatively large patches of native forest, often associated with scattered mature trees, although not all with potentially suitable hollows (Figure 4). These are located as follows (see Figure 4 for greater detail):

- the unnamed stream flowing into Big Bay (Habitat Patch 4, Figure 4);
- the unnamed stream flowing into Dirty Bay (Habitat Patch 6, Figure 4);
- the unnamed stream flowing directly below the current mill site (Habitat Patch 5, Figure 4);
- the same stream flowing between the easement and the Bell Bay Line (Habitat Patch 3, Figure 4);
- and along short sections of two minor tributaries of Williams Creek (Habitat Patch 2, Figure 4).

Several potentially suitable trees (for nesting and/or roosting) were located throughout the survey area. These are shown on Figure 4 and illustrated in Appendix B. Note that no evidence of masked owl was located beneath any of these trees (or clusters of trees), although evidence of use by brushtail possums (i.e. droppings at the base of the tree, fur and runs on the bark of the bole of the tree) was noted at many such trees. Figure 4 shows the distribution of several of the recorded trees and indicates that the majority of such trees are located along gully systems or occur on slopes below the break of slope between the generally broad ridges and the slightly steeper slopes above the Tamar River.

5.2.2 Call-back survey

Twenty-one call-back sites were surveyed (Figure 2; Table 1 in Appendix A) over two nights. This includes two sites in close proximity to one another due to the potential sighting of a perching bird (see section 5.2.3 for more detail).

The weather conditions, which can influence the success of the call-back technique (Bell *et al.* 1997), were considered suitable on both nights (details of the weather conditions are provided in Table 1, Appendix A) with a near-full moon (1-2 days from full), clear to partially cloudy skies, cold to very cold conditions (c. 0-3°C) with calm to light wind conditions (with only occasional stronger breezes). There were no other significant confounding variables such as nearby disturbance (current or recent) such as vegetation clearing, burning or other such habitat disturbance.

No responses from masked owls were recorded.

Boobook owls (*Ninox novaeseelandiae*) were heard at four sites (approximate location of calls shown on Figure 5) over the two nights and one sighting was made (Figure 5) at 494886mE 5444271mN (±10 m, GPSed, GDA94) on the night of the 11th (full details in Table 1, Appendix A).

5.2.3 Spotlight survey

Visibility on each of the nights was excellent with generally clear conditions (cloud cover mainly low with a near full-moon, only a very slight fog/mist on the 10th for the last 40 minutes or so).

No masked owls were observed during any of the spotlight surveys.

A suspected perching bird was observed on the night of the 11th during the spotlight survey after the call-back survey at 494727mE 5443391mN (sites 16 and 17 in Table 1, Appendix A). However, the site was approximately 100 m from the spotlighting location and near-impossible to access in the night (due to very dense vegetation and the presence of a meandering stream) and for safety reasons was not examined further. The reason the sighting is suspected to be a nocturnal bird rather than an arboreal mammal is due to the behaviour of the individual (appeared to turn its head from side to side and "stood" still for at least 5 minutes, both of which are somewhat unusual behaviours for a species such as brushtail or ringtail possum). However, it is possible that the sighting was of a mammal (e.g. brushtail possum – scat and bark damage traces observed the following day on and around trees) or a diurnal bird species (e.g. large bird such as a white-faced heron, yellow-tailed black cockatoo, laughing kookaburra, forest raven or grey currawong – all of which were observed the next day either directly or through evidence such as chewed bark indicating cockatoo feeding).

Due to the inability to safely and practically access the tree in the dark, two further survey options were used at this site. First, an additional call-back survey was undertaken from directly opposite the tree (with occasional spotlight checks of the individual, which appeared unperturbed by the call-back being played directly at the tree) with no resultant returned calling activity. Second, the tree itself and the surrounding 3-5 ha was assessed the following morning for around 1.5 hours with no evidence of masked owls recorded at the base of any of the trees in the vicinity of the sighting and no flushing of masked owls from the area (although several potential nest trees and dense roosting habitat is present – see section 5.2.1 for more detail).

5.2.4 Assessment of location of "flushed" masked owl sighting

The site was assessed on three occasions over three days at three different times of the day. No masked owls were observed at the site or within c. 100 m radius (the site was approached from the south, north and west). Three call-back sites were also located within c. 100 m of the site, and two more within c. 350 m of the site, over two nights with no resultant response calls.

The site (according to the GPSed location) supports one stag considered highly suitable for nesting by masked owls (based on a ground assessment using binoculars). The tree has several apparently deep hollows with relatively large entrances, although without tree-climbing, or other more destructive methods, there is no way of knowing the true dimensions of the hollows (see Appendix B).

There was no direct evidence of the use of this tree by masked owl in the form of regurgitated pellets or prey remains. There was a small amount of "whitewash" at the base of the tree but there is no means of knowing what species this might belong to but given its sparse spattering pattern it is suggested that it does not belong to a particular large bird.

Given the initial sighting of a flushed bird from this location, combined with the presence of a potential nest tree, it is tempting to conclude that the site may be important for breeding. However, it is my opinion that such a conclusion should be tempered by the additional evidence provided by previous surveys (which included call-back, GHD 2006b) and the present surveys, which do not indicate that the site is being used for roosting and/or breeding. Having said that, the site is within a section of stream identified as potential roosting and/or breeding habitat (see Figure 4) but whether this specific patch of forest is potentially more or less important is virtually impossible to test.

6. DISCUSSION

There is no definitive evidence that the proposed pulp mill site forms part of the territory of a pair (or pairs) of masked owls. However, given the size of the study area (c. 430 ha) compared to the potential size of the territory of a breeding pair of masked owls (c. 400-1200 ha, sources cited in Bell *et al*. 1997), it is possible to postulate that at least part of the study area will fall within a territory of the species.

The main direct threat to the species will come from clearing of potential nesting and roosting habitat and the main indirect threat will come from peripheral disturbance due to intensive construction, operation and maintenance activities.

The following recommendations for mitigation against direct and indirect threats are made by the consultant, refer only to the area covered by the survey and not to areas peripheral to the project (e.g. pipeline routes), and do not reflect direct advice of the Threatened Species Section (DPIW).

The most practical mitigation against these threats is to minimise the loss (and disturbance) of potential habitat through careful placement of infrastructure. A network of retained forest is likely to result in the maintenance of potential masked owl habitat. Such retention should aim to retain habitat across the whole study area, and use the areas identified in section 5.2.1 (see Figure 4) as a guideline for reserve design.

It is noted in Figure 4 that there is a considerable overlap between the areas identified as part of this study as potentially suitable habitat and the reserve patches proposed by Gunns Limited. It is not considered necessary to formally reserve all the patches identified as potentially suitable habitat as part of this study – they should be used as a guideline only because in drawing the boundaries of these polygons, identifiable features have been used (e.g. break of slope between the flatter "ridge" and the steeper slopes down to the Tamar River). The reality is that the "boundary" between "good" and "poor" habitat is not a straight line and a reserve system that incorporates a large proportion (say 50-60%) of the forest identified as potentially suitable is likely to capture much habitat. This is particularly the case if the reserve is targets the lower slopes closest to the water (say the first 30 m of elevation) and the steeper slopes and dense riparian vegetation associated with the stream below the current mill site (say the first 30-40 m of elevation along the northern side, and the first 20 m of elevation along the southern side) because these two areas have the highest densities of potential nesting trees and the greatest variation in vegetation types.

It is noted that a reserve system designed using the guidelines above would capture the majority of identified potential nest trees and also supports a range of vegetation types, providing for complexity in foraging and roosting habitat, and would allow for continual recruitment of hollow-bearing trees through natural succession.

Given the high mobility of the species, and its wide foraging range, the presence of some infrastructure within or adjacent to the network of retained forest is unlikely to be detrimental (at least relative to the existing network of cleared easements, highway and roads, naturally open vegetation and numerous tracks and firebreaks throughout the study area), although in the short-term (e.g. during the intensive construction phase), potential habitat close to new infrastructure may be unsuitable.

Within areas to be more intensively disturbed (such as vegetation clearing), any potential nest trees should be carefully examined prior to felling. While it is noted that the majority of such trees have been examined as part of the current survey, it is possible that occupation of trees happens some time in the future. If any evidence of masked owls is suspected, activities in the vicinity of the tree (e.g. 100 m) should cease until further specialist advice is obtained from officers of the Threatened Species Section (DPIW).

7. REFERENCES

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8. ACKNOWLEDGEMENTS

Thanks to Dr Phil Bell (Threatened Species Section, Department of Primary Industries and Water) for the use the call-back and spotlighting equipment and for advice on appropriate survey methods. Suzette Weeding (Gunns Limited) provided site maps, other background material, GIS shape files and a key.

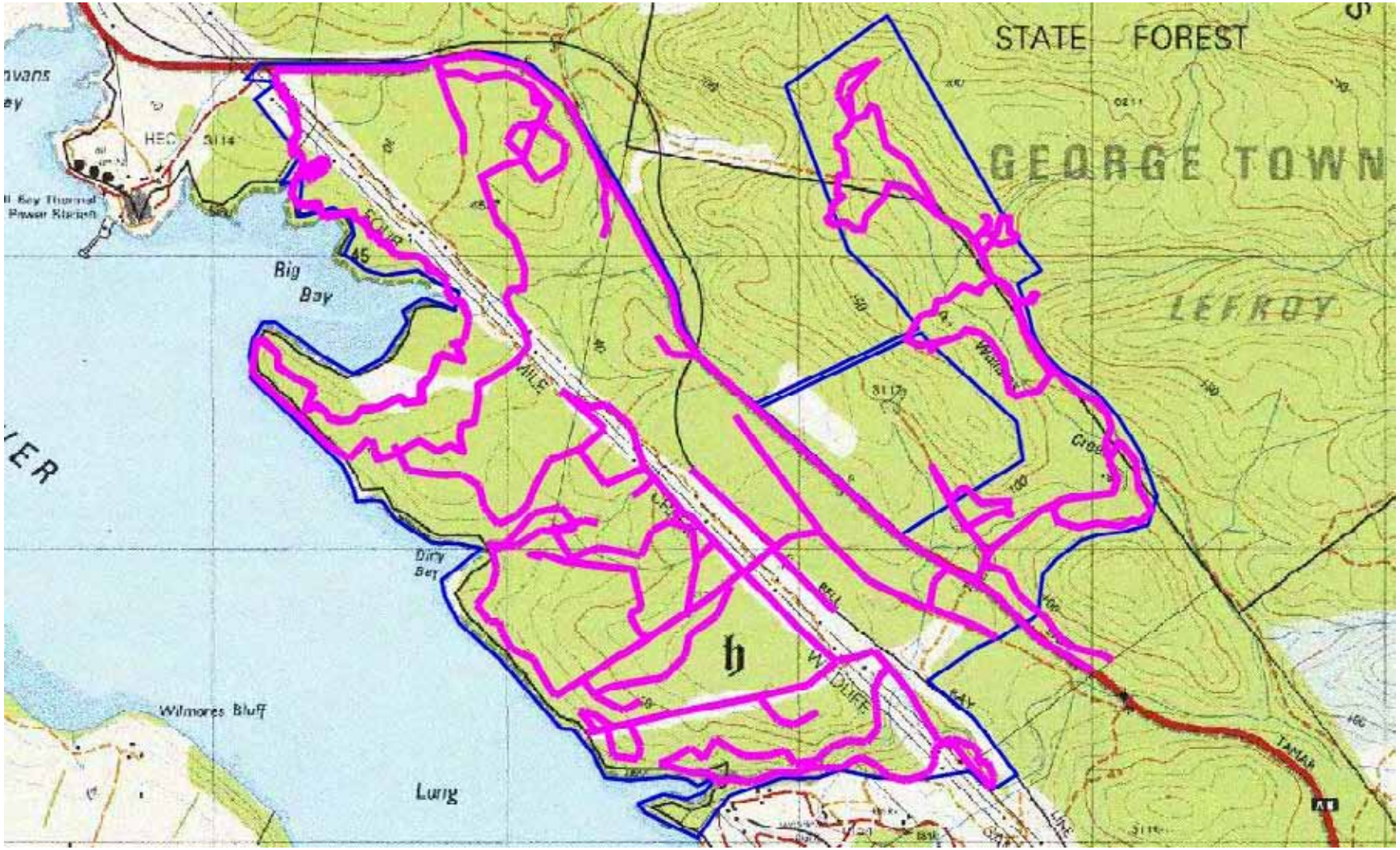

Figure 1. *Route taken for habitat assessment. Map shows survey area (solid blue line) and approximate survey route (solid pink line). Some sections of the survey route are GPSed, while others are estimated based on GIS overlays of tracks, topography and vegetation types.*

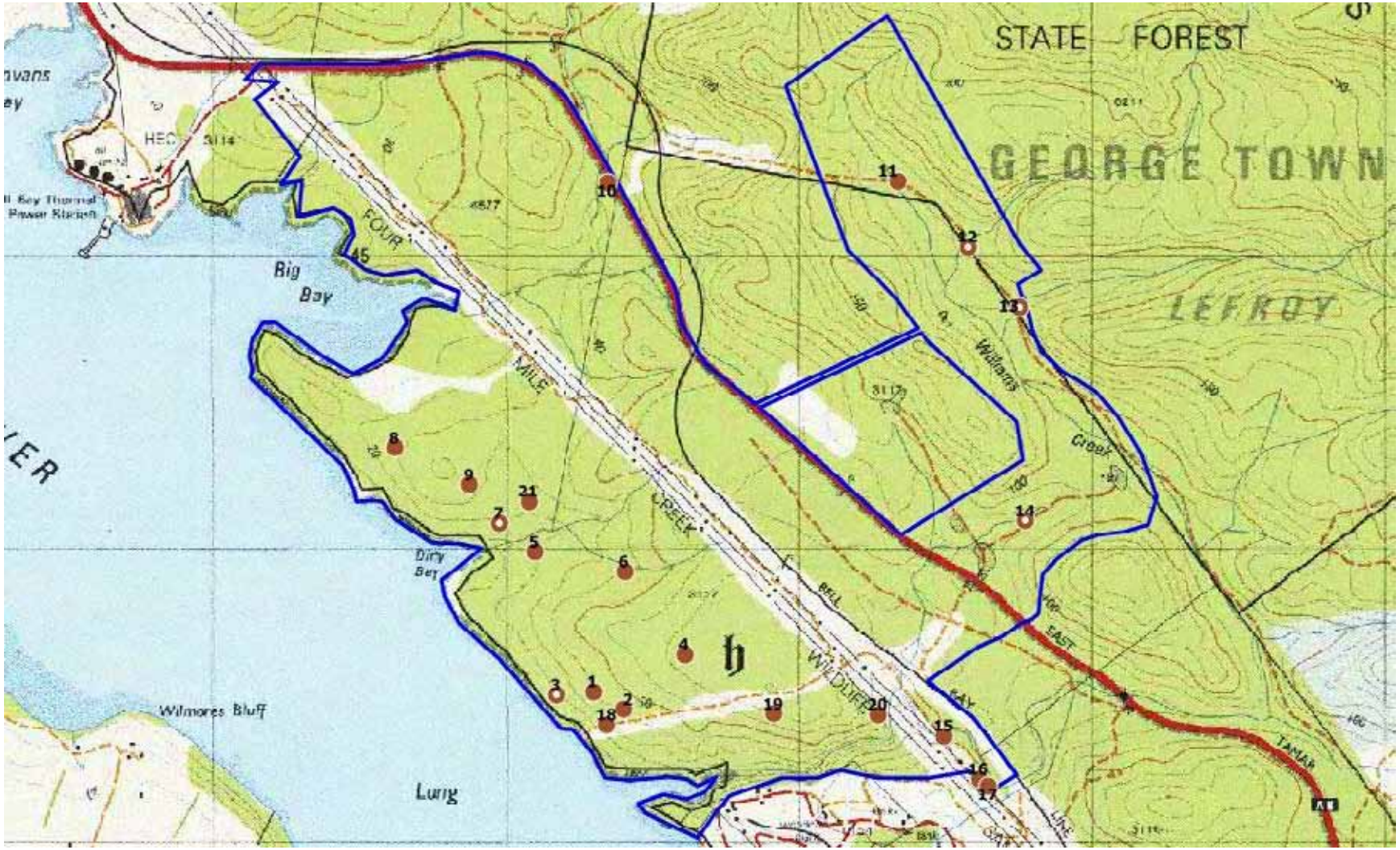

Figure 2. *Call-back survey sites. Map shows survey area (solid blue line) and call-back sites (solid circles = masked owl only; white-centred circles = masked owl and boobook owl). See Appendix 1 for details on call-back sites.*

Figure 3. *Records of masked owl from within c. 10 km of boundary of survey area. Map shows survey area (solid blue line) and database records (solid-red point = nest record now deleted from databases as not considered a nest site; green-dotted points = other records (presumably sightings or roadkill); blue-crossed point = sighting reported by GHD (2006a,b) from within the survey area).*

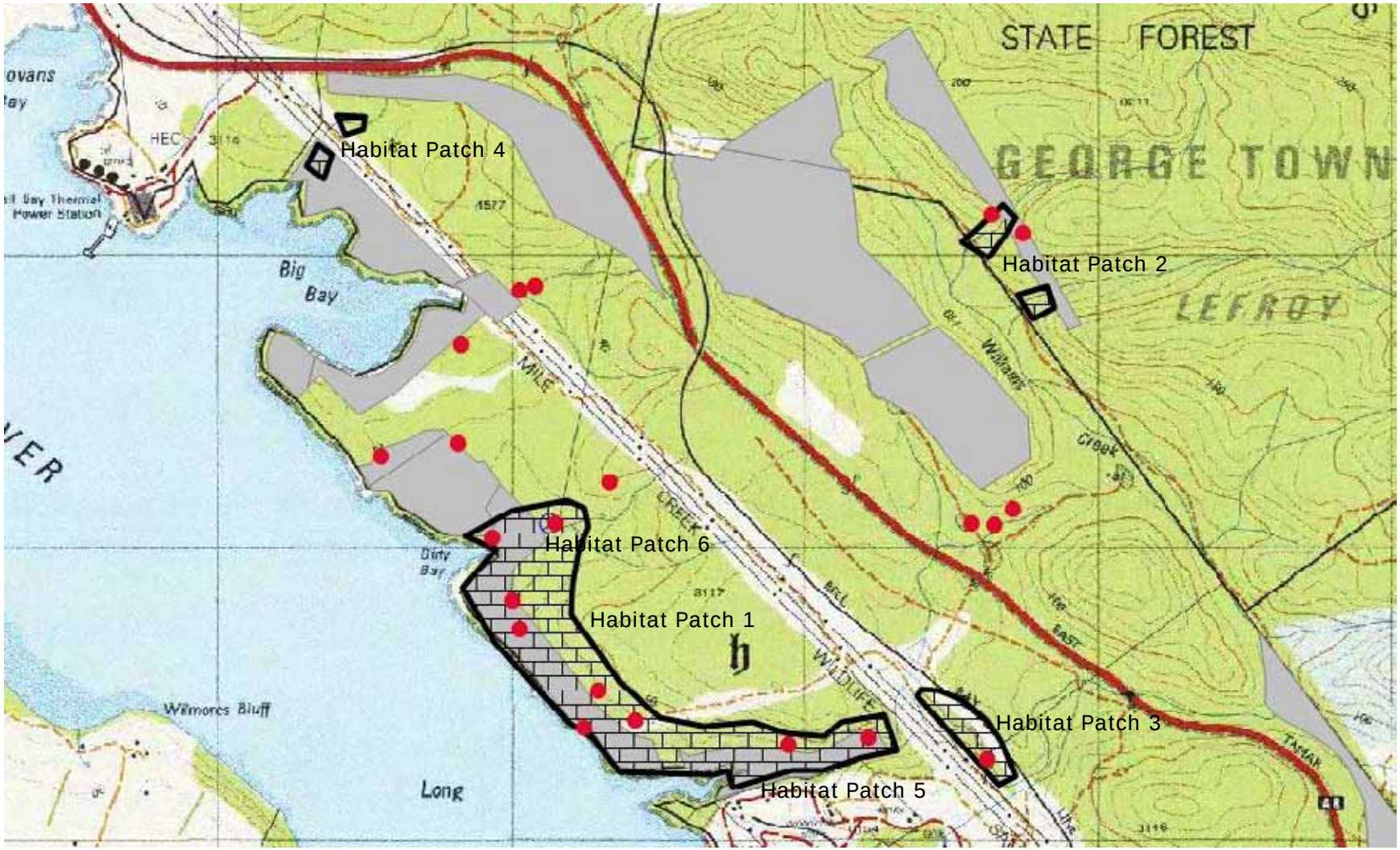

Figure 4. *Key patches of potential masked owl habitat. Map shows survey area (solid blue line), database records (blue-crossed point = sighting reported by GHD (2006a,b) from within the survey area); potential nest/roost trees (solid red points – note some "points" represent small clusters of trees and others single trees); potential roost/nest habitat (black-bricked polygons – see report text for more detail); reserves proposed by Gunns Limited (solid-grey polygons – see section 5.2.1 for discussion of Habitat Patch site numbers).*

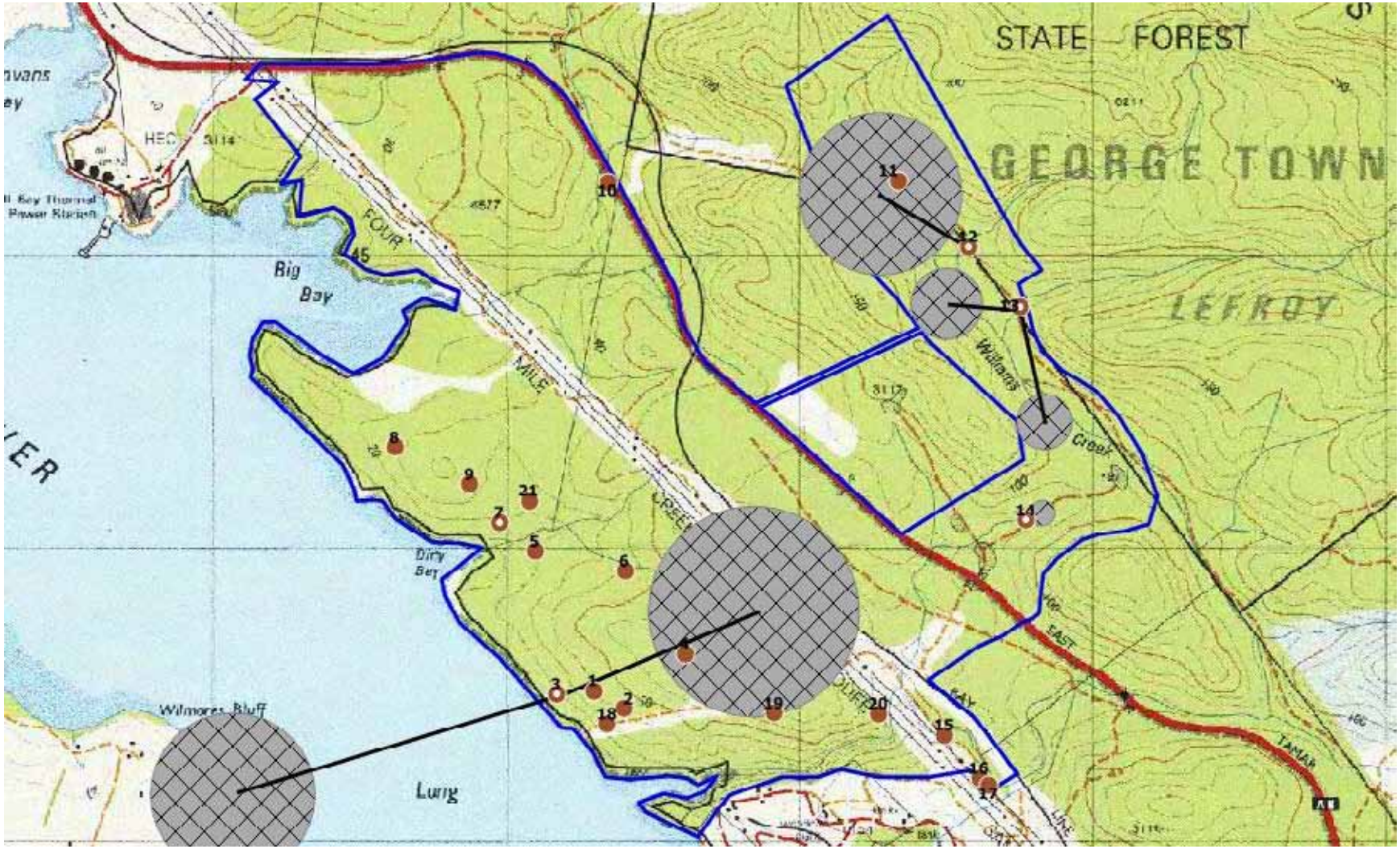

Figure 5. *Boobook owl response calls. Map shows survey area (solid blue line), call-back sites (solid circles = masked owl only; white-centred circles = masked owl and boobook owl) and general location of response calls (size of hatched circle indicates relative certainty of location with the smaller the circle the greater the precision; smallest circle = actual sighting of bird after response calls heard; solid black lines from response circle to call-back site indicates from which call-back site the response call was heard).*

APPENDIX A. Detailed information on call-back survey

Table 1. Details for each call-back site

Site[1]	Date	Easting[3]	Northing[3]	Time Started	Species Call Played	Weather Conditions[2]	Response[3]
1	10/06/2006	493410	5443689	1900	Masked Owl	P: Nil W: Calm L: Very bright, clear M: Full-2 days T: 2°C	Nil
2	10/06/2006	493513	5443627	1920	Masked Owl	As site 1	Nil
3	10/06/2006	493284	5443677	1945	Masked Owl Boobook Owl	P: Nil W: Calm to Light L: Very bright, 5-10% cloud M: Full-2 days T: 3-4°C	Boobook owl responded from other side of Tamar River for about 5 minutes; another bird called from c. 300 m upslope to the east.
4	10/06/2006	493722	5443816	2025	Masked Owl	P: Nil W: Calm to Light L: Bright, 80% cloud M: Full-2 days T: 3-4°C	Nil
5	10/06/2006	493211	5444165	2100	Masked Owl	P: Nil W: Calm to Light L: Bright, 60% cloud M: Full-2 days T: 1°C	Nil
6	10/06/2006	493517	5444098	2130	Masked Owl	P: Nil W: Calm to Light L: Bright, 40% cloud M: Full-2 days T: 2°C	Nil
7	10/06/2006	493090	5444264	2205	Masked Owl Boobook Owl	P: Nil W: Light L: Bright, 5% cloud M: Full-2 days T: 4°C	Nil
8	10/06/2006	492733	5444520	2235	Masked Owl	P: Nil W: Light L: Bright, 5% cloud M: Full-2 days T: 2°C	Nil
9	10/06/2006	492989	5444395	2300	Masked Owl	As site 8.	Nil

Site[1]	Date	Easting[3]	Northing[3]	Time Started	Species Call Played	Weather Conditions[2]	Response[3]
10	10/06/2006	493460	5445426	2340	Masked Owl	As site 8.	Nil
11	11/06/2006	494453	5445431	1815	Masked Owl	P: Nil W: Calm to Light L: Bright, 0% cloud M: Full-1 day T: 1°C	Nil
12	11/06/2006	494690	5445207	1855	Masked Owl Boobook Owl	As site 11.	Boobook owl responded c. 2 minutes after end of 5-minute call period from somewhere near site 11.
13	11/06/2006	494866	5445002	1925	Masked Owl Boobook Owl	As site 11.	Boobook owls (2) responded from somewhere in the patch of *E. ovata* forest to the west.
14	11/06/2006	494886	5444271	2000	Masked Owl Boobook Owl	As site 11.	Boobook owl responded and came to within 50 m of call-site, sat in *E. amygdalina* in spotlight for c. 5 minutes and then flew off c. 150 m to north and kept calling.
15	11/06/2006	494608	5443538	2040	Masked Owl	P: Nil W: Calm to Light L: Bright, 5% cloud M: Full-1 day T: 0°C (ice forming)	Nil
16	11/06/2006	494727	5443391	2105	Masked Owl	As site 15.	Nil
17	11/06/2006	494759	5443368	2130	Masked Owl	As site 15.	Nil
18	11/06/2006	493458	5443576	2150	Masked Owl	P: Nil W: Calm to Light L: Bright, 15% cloud M: Full-1 day T: 1-2°C	Nil
19	11/06/2006	494027	5443613	2220	Masked Owl	P: Nil W: Calm to Light L: Bright, 50% cloud M: Full-1 day T: 2-3°C	Nil
20	11/06/2006	494383	5443611	2305	Masked Owl	P: Nil W: Calm to Light L: Bright, 80% cloud M: Full-1 day T: 1°C	Nil
21	11/06/2006	493190	5444338	2335	Masked Owl	As site 20.	Nil

[1] Site numbers refer to those shown on Figure 2.
[2] P: precipitation (nil; drizzle; rain; heavy rain); W: wind speed (calm; light, leaves rustle; moderate, moves branches; strong); L: nightlight (very dark; dark, quarter moon or heavy cloud; detail seen, moon and clear sky; bright, half moon and clear); M: moon phase (new; first quarter; third quarter; full); T: air temperature (estimate only).
[3] See Figure 5 for location of call-back sites and response call locations.

APPENDIX B. Images of potential roost/nest trees from survey area

Typical potential habitat trees from the survey area (potential hollows suitable for masked owl arrowed). 1. 493447mE 5444401mN – one potentially suitable hollow; 2. 492932mE 5444531mN – potential habitat tree (1 of 4 at site) with several potential hollows; 3. 493410mE 5443689mN – typical stag on west-facing slopes below the break of slope; 4. potential habitat tree at the location of the masked owl sighting at 493263mE 5444258mN. Apart from a small amount of "whitewash" at the base of this tree, there was no evidence that any of the potential hollows were or had been in use (photo taken near dusk).

APPENDIX C. Images of vegetation types with comments on habitat suitability

Vegetation types showing degree of habitat suitability. All images in this sequence are of the large expanse of regrowth eucalypt forest adjacent to the powerline easement. Note the absence or very sparse stags, most of which are too small to support potential masked owl hollows.

Riparian vegetation. From left to right. 1. dense and complex riparian scrub along semi-permanent stream flowing into Big Bay (most northerly stream); 2. Looking north across the deeply incised gully of the unnamed stream flowing immediately north of the Gunns Limited chipmill site; 3. Dense riparian vegetation along the permanent stream associated with the gully in image 2.

APPENDIX C. Continued…

Vegetation types showing degree of habitat suitability. From left to right. 1. Typical grassy to shrubby forest/woodland dominated by *Eucalyptus amygdalina* – most stag trees did not have potentially suitable hollows; 2. Image of patch of grassy *E. viminalis* forest east of the East Tamar Highway; 3. Looking across Big Bay towards the low ridge supporting dense stands of *Acacia mearnsii* and *Allocasuarina* forest.

Vegetation types showing degree of habitat suitability. From left to right. 1. *Allocasuarina littoralis* woodland on the top of the hill northeast of Big Bay and above the East Tamar Highway; 2 & 3. *Eucalyptus ovata* forest on broad flat associated with Williams Creek. Note the generally dense understorey of low to medium height shrubs.