# Flora and Fauna Assessment

## 48 Jervis Bay Road

## Falls Creek, NSW

Prepared for
**Theo Pasialis**

August 2019

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# Executive summary

Eco Logical Australia was engaged by Cowman Stoddart on behalf of Theo Pasialis to prepare a flora and fauna assessment to accompany a Development Application (DA) for the proposed community title subdivision at Lot 3 DP 846470 48 Jervis Bay Road, Falls Creek. The proposal involves a 15 lot community subdivision, including 14 rural residential allotments, within previously cleared parts of the subject land, and a residual 15.62 ha community property allotment, which predominantly contains intact native forest. The proposal has been modified to reduce impacts by reducing the size of the development footprint and retaining additional habitats within the community property allotment.

The proposed development footprint of 9.65 ha occurs within cleared grazing land containing scattered trees. Generally, vegetation in the study area is most similar to PCT 1079 Red Bloodwood – Blackbutt – Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion. Due to the high levels of historic disturbance in and around the subject site, no areas of intact native vegetation will be removed by the proposal, nor will any fauna habitats of importance.

No threatened ecological communities listed under the BC Act or EPBC Act were present in the study area.

No threatened flora species were recorded in the study area, and none were identified as likely to occur there.

Three threatened fauna species were recorded in the study area: Grey-headed Flying-fox, Glossy Black-cockatoo and Green and Golden Bell Frog (GGBF). A single adult GGBF was observed in each of the two dams on the property, but no evidence of breeding was recorded during surveys. The original proposal was modified to enable the retention of both dams, with 40 m buffers, which maintains much of the connectivity between the dams and adjoining areas of forest to the west and south. The retention of key GGBF habitat, together with short-term impact mitigation measures and ongoing protection of GGBF habitat, should enable any indirect impacts to this species to be adequately managed.

For other more mobile threatened species which could occur in the area, including the Grey-headed Flying-fox and Glossy Black-cockatoo, the disturbed subject site provides a relatively small area of generic foraging habitat, which was considered unimportant for these species.

One migratory species listed under the EPBC Act, the Black-faced Monarch, was recorded on the northern fringe of the study area, although all suitable forest habitat for this and other potentially occurring migratory species would be retained.

The proposal is assessed under the *Environmental Planning and Assessment Act 1979* rather than the newer *Biodiversity Conservation Act 2016* as it applies to a development application which was lodged with Council within the transitional period of the BC Act.

Following the application of the seven part test pursuant to s5A of the *Environmental Planning and Assessment Act 1979*, and in accordance with relevant assessment guidelines, it is concluded that the proposal is unlikely to have a significant effect any of the threatened species assessed, and does not require a Species Impact Statement.

Following consideration of the administrative guidelines for determining significance under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999*, it is concluded that the

proposal is unlikely to have a significant impact on any Matters of National Environmental Significance; and a referral to the Commonwealth Environment Minister is therefore not required.

The subject site was not considered to contain any potential Koala habitat as defined by SEPP 44.

Recommendations are made to mitigate potential indirect impacts of the proposal.

# 1 Introduction

Eco Logical Australia was engaged by Cowman Stoddart on behalf of Theo Pasialis to prepare a flora and fauna assessment to accompany a development application for the subdivision of Lot 3 DP 846470, 48 Jervis Bay Road, Falls Creek, NSW (the subject land) (**Figure 1**). The proposed subdivision is for 14 rural residential lots and one community title lot.

The objectives of this assessment were to

- Identify and describe the vegetation communities present in the study area and their conservation significance.
- Identify and describe the fauna habitats present.
- To identify the flora and fauna species of conservation significance which are present or likely to occur in the study area.
- Assess the impacts of the proposal on vegetation, fauna, habitats, and other environmental features as necessary.
- Make recommendations regarding any environmental management and impact mitigation/amelioration measures, which can be implemented to limit the effects of the proposal on vegetation, fauna, habitats, and other environmental features as necessary.
- Address the relevant statutory requirements to support development application approval by Shoalhaven City Council (SCC) under the Shoalhaven Local Environmental Plan (SLEP) 2014.

## 1.1 The proposal

The proposal involves a 15 lot community title subdivision, including 14 rural residential allotments within previously cleared parts of the subject land, and a residual 15.62 ha community property allotment which contains all areas of intact native forest along with semi-cleared areas around farm dams (**Figure 2**). A proposed perimeter road encompasses most of the residential lots, with access via the adjacent Jervis Bay Road. An emergency egress fire trail is proposed in the south east of the property. Wastewater will be treated and disposed of onsite.

The proposal has been modified from an earlier version to reduce impacts by reducing the development footprint and retaining additional habitats. The subdivision design has considered environmental features of the property and will avoid direct disturbance to areas of intact forest; will maintain a 40 m riparian buffer to the watercourse in the north of the property; and will include a 40 m buffer to both farm dams, where the GGBF was recorded (**Figure 3**). The most fundamental design consideration was to locate the proposed development footprint entirely within cleared parts of the property. Bushfire asset protection zones will be contained within the perimeter roadway / fire trail and adjacent lots, so no clearing of intact native forest will be required.

As part of the proposal, the SLEP zoning on Lot 3 will be amended from predominantly R5 (Large Lot Residential) to predominantly E2 (Environmental Conservation) with R5 zoning generally restricted to the proposed development footprint.

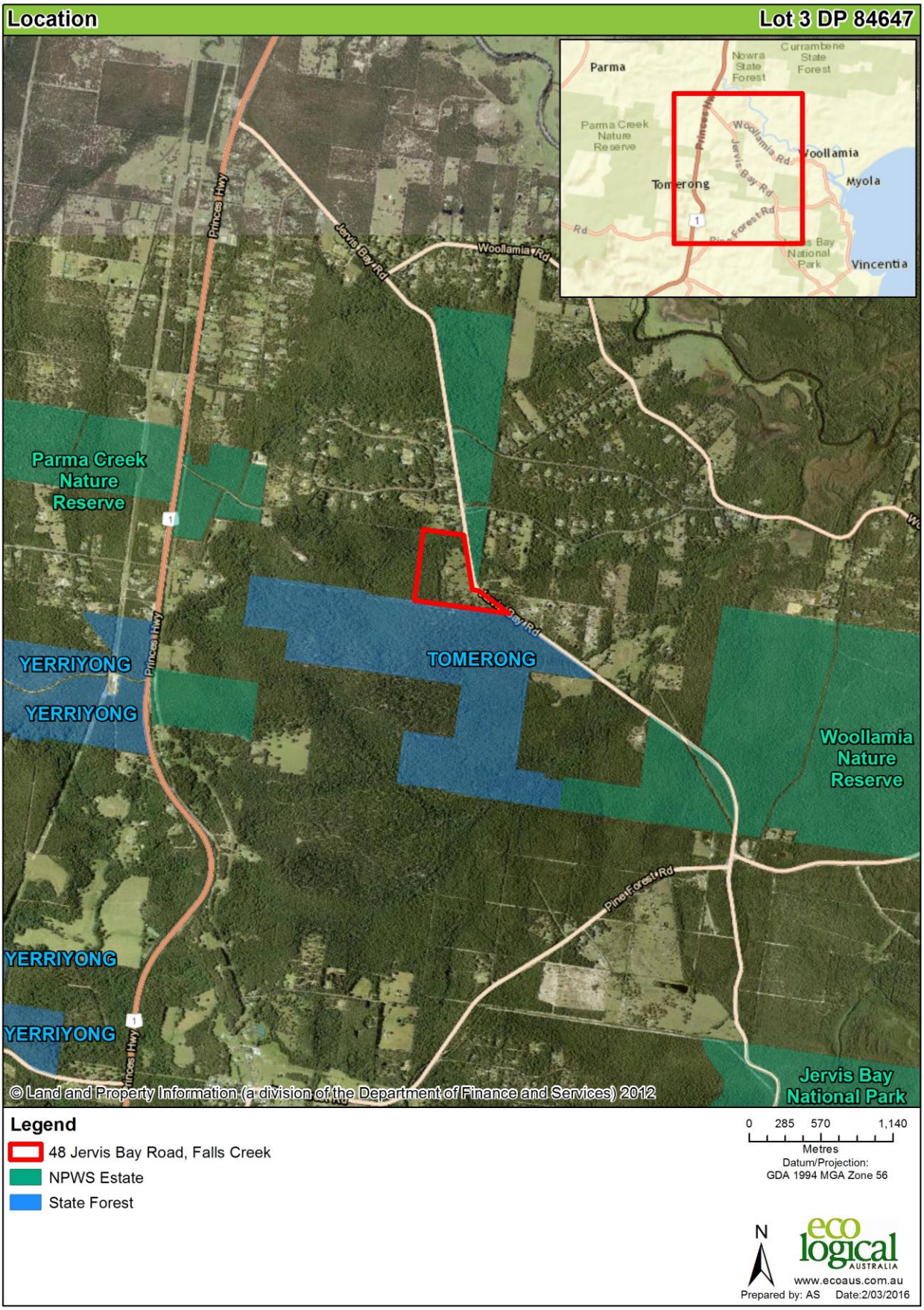


**Figure 1: Location of subject land**

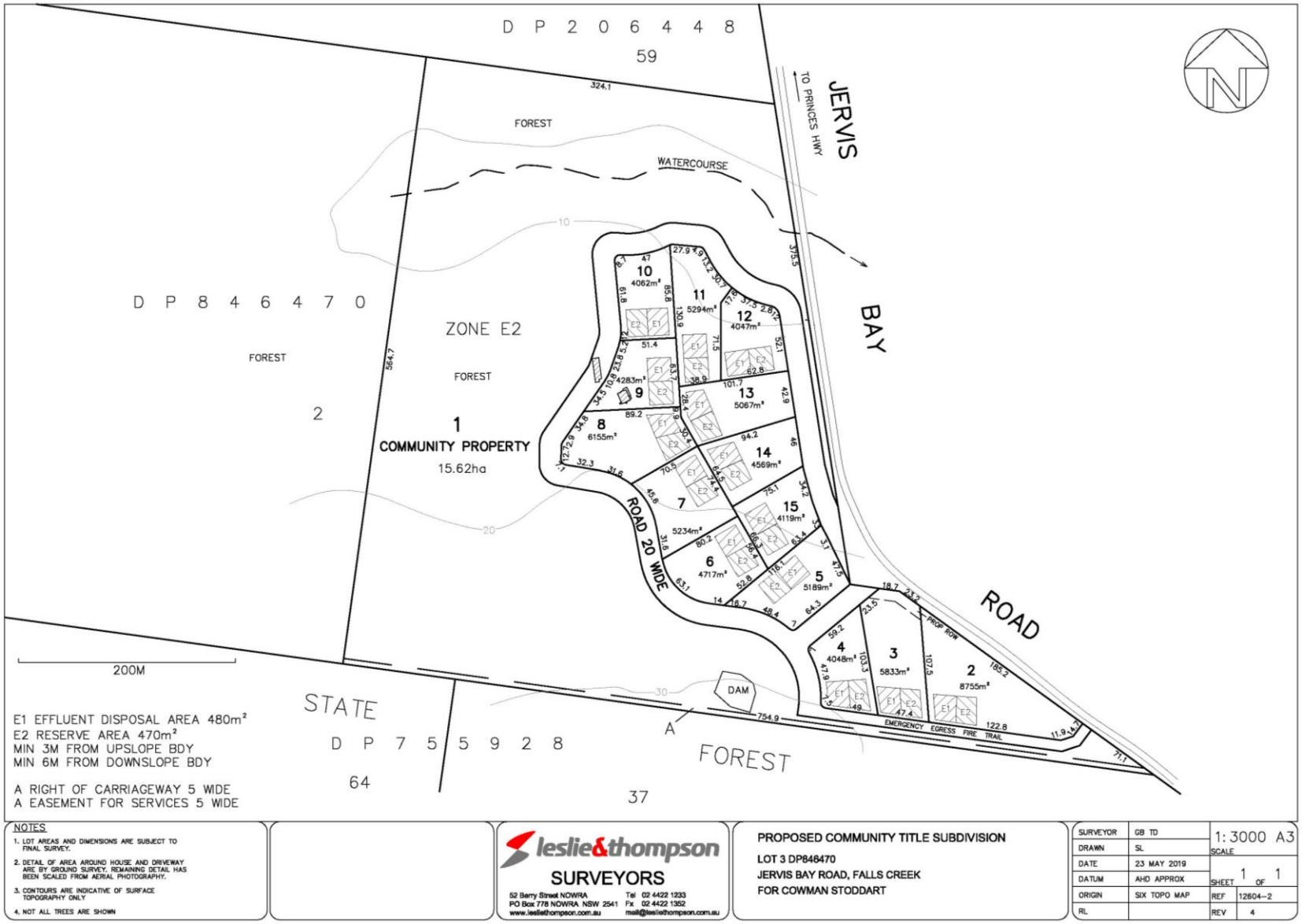


**Figure 2: Site plan**

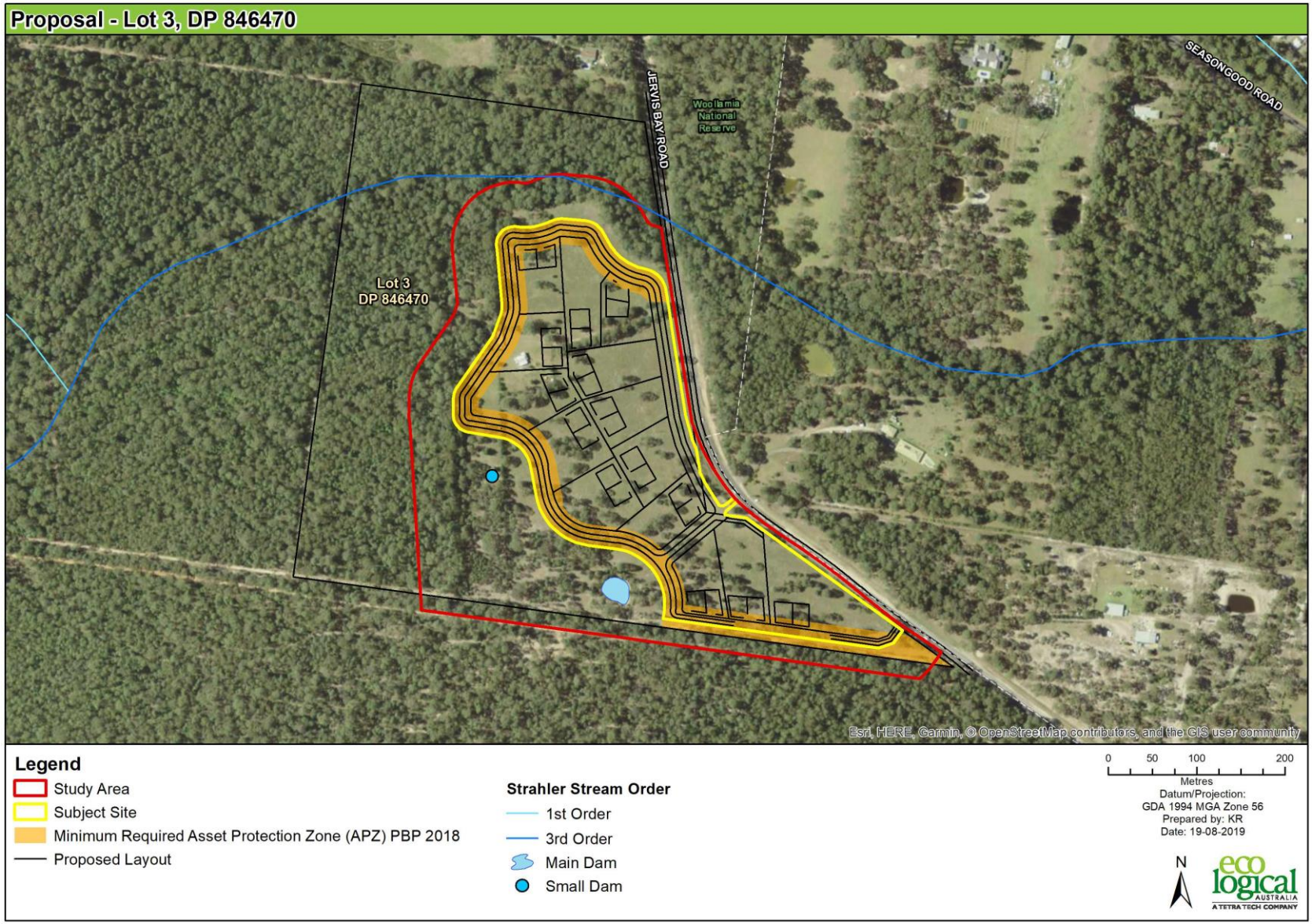


**Figure 3: The proposal**

## 1.2 Subject site, study area and locality

The subject site for the purposes of this report comprises the proposed development footprint (proposed lots 2-15, perimeter roads and fire trail), which is approximately 9.65 ha in size.

The study area for the purposes of this report includes the subject site and adjacent areas (

**Figure** 3). All of the subject site and most of the study area have been previously cleared.

The study area is bounded by areas of intact forest within Lot 3 to the north and west; Jervis Bay Road to the east; and Tomerong State Forest to the south.

The locality is defined as the area of land within a 10 km radius of the subject land.

## 1.3 Disturbances

Around half of the subject land has been cleared for rural purposes, and contains a dwelling, sheds, rural fencing and one main dam. Cleared areas are regularly grazed and slashed, but contain scattered trees and other vegetation. Exotic groundcover species occur in most cleared areas, along with native groundcovers. A range of exotic garden / landscape plant species occur around the dwelling, some extending into the surrounding paddocks. Beyond the cleared areas, the subject land contains largely intact native forest, much of which has been subject to historic logging, and parts are regenerating from previous clearing. An unsealed access road runs through an easement on the southern boundary of the subject land. Substantial disturbances on the eastern side of the property have been caused by the adjacent Jervis Bay Road and electricity easement.

## 1.4 Topography, geology and soils

The subject land occurs on a gentle slope with a northerly aspect between about 30m AHD in the south west, to about 10 AHD in the north. An unnamed ephemeral watercourse occurs in the north of the subject land, draining to the east, eventually joining Currambene Creek about 3 km downstream.

The subject land is underlain by Wandrawandian Siltstone, comprised of fine-grained quartz lithic silty sandstone and siltstone. The subject land has not been mapped as containing Quaternary soil landscapes, with the closest Quaternary sediments occurring about 1.3 km downstream (Troedson and Hashimoto 2008).

## 1.5 Planning and legislation

Commonwealth and State legislation and policies, as well as local policies apply to the assessment, planning and management of ecological issues within the study area. The primary assessment is undertaken under Part 4 of the *Environmental Planning and Assessment Act 1979* rather than the newer *Biodiversity Conservation Act 2016* (BC Act) as it applies to a development application which was lodged with Council within the transitional period of the BC Act.

The relevant Commonwealth and State Acts and policies assessed in this report are as follows (**Table 1**).

**Table 1: Planning and legislation summary**

| Name | Relevance to the project |
|---|---|
| **Commonwealth** | |
| *Environment Protection and Biodiversity Conservation Act 1999* | The site is not located within an area that has been the subject of a Strategic Assessment under the EPBC Act. The Commonwealth Minister for the Environment will need to be notified of all actions associated with the development that will impact upon Matters of National Environmental Significance (MNES). A preliminary MNES assessment has been provided. |
| **State** | |
| *Environmental Planning and Assessment Act 1979* | The proposal is to be considered as a Development Application (DA) to Shoalhaven City Council (SSC) and requires consideration under the EP&A Act 1979.<br>Assessments of significance for impacts to threatened species identified during this proposal have been prepared in accordance with s5A of the Act. |
| *Threatened Species Conservation Act 1995* | The land on which the development is proposed is not biodiversity certified under s126 of the TSC Act, and therefore impacts to threatened species and endangered ecological communities listed under the TSC Act are required in accordance with s5A of the EP&A Act. |
| *Biodiversity Conservation Act 2016* | The BC Act has recently come into effect, replacing the TSC Act, and introducing a new framework for assessing impacts on biodiversity. However, as the DA for the proposal was lodged with Council during the BC Act transitional period, it is assessed under the previous legislative framework as above. |
| *Fisheries Management Act 1994* | The development does not impact upon mangrove vegetation and marine vegetation, hence a permit under the FM Act is not required. No habitat for threatened species or Endangered Ecological Communities listed under this Act occurs in the study area. Formal assessment is thus not required. |
| *Water Management Act 2000* | The WM Act regulates activities carried out in relation to waterfront land. The subject site contains a third order stream and adjoining land is considered waterfront land under the WM Act. The proposal has incorporated the required buffer (vegetated riparian zone) to this waterway to comply with the WM Act. |
| *SEPP 44 Koala Habitat* | Shoalhaven is listed in Schedule 1 of SEPP 44, and the land to which the DA applies to is >1ha. Assessment under SEPP 44 is thus required. The identification of an area of land as SEPP 44 Potential Koala Habitat is determined by the presence Koala feed tree species listed within Schedule 2 of the policy. If Potential Koala Habitat is present, then it must be further assessed to determine whether it represents Core Koala Habitat. |
| **Local** | |
| *Shoalhaven Local Environmental Plan 2014* | The subject land is predominantly zoned R5 Large Lot Residential under the Shoalhaven Local Environment Plan 2014 (SLEP). A small area in the south western corner of the subject land is zoned RU2 Rural Landscape and mapped as 'Biodiversity - habitat corridor' under the SLEP, but this area is not affected by the proposal. The land is subject to Clause 7.20: Development in the Jervis Bay Region. The unnamed ephemeral creek which crosses the northern portion of the subject land, has been identified as a Category 2 Watercourse under the SLEP, requiring a minimum 30m vegetated buffer (which has been incorporated into the proposal design). |

# 2 Methods

## 2.1 Database and literature review

A review of relevant information was undertaken prior to the commencement of field studies, which involved:

a) Reviewing available literature including relevant flora and fauna studies, legislation, environmental planning instruments, topographic maps, aerial photographs and draft plans pertaining to the proposal.

b) Reviewing vegetation mapping of the subject land and surrounds.

c) Reviewing Shoalhaven Shire Council's LEP 2014 online maps (http://maps2.shoalhaven.nsw.gov.au/slep2014/), last accessed August 2019.

d) Searching the Atlas of NSW Wildlife (BioNet) for threatened flora and threatened fauna species recorded in the locality, accessed August 2019.

e) Searching the EPBC Act Protected Matters Search Tool in the locality of the subject site, accessed August 2019.

## 2.2 Flora Surveys

### Community identification and floristic audit

The Random Meander technique documented by Cropper (1993) was used to document the dominant flora species present and to define and verify vegetation communities present.

The vegetation was surveyed at all levels present: the canopy (trees), middle canopy (trees), understorey (shrubs), and groundcover plants (plants less than one metre in height). Dominant species and the projected foliage cover of each stratum were recorded at locations that typified the vegetation communities present in the study area. A general description of the vegetation was then prepared based on structural characteristics and dominant canopy species in accordance with Walker and Hopkins (1990) and Specht (1970). These techniques were used to classify and verify the vegetation communities in the study area.

Random meander surveys throughout the study area were employed on the 10 February 2016 and 9 November 2017 for a total of approximately 5 hours. Surveys focused within the subject site and fringing areas given that direct impacts would be limited to cleared areas. General observations were made of the wider area. Comprehensive flora surveys of intact vegetation on the property (beyond the subject site) were not undertaken.

### Targeted surveys

Specific searches for non-cryptic threatened species *Melaleuca biconvexa* (Biconvex Paperbark) and *Syzygium paniculatum* (Magenta Lilly Pilly) were undertaken on 18 April and 2 May 2016 throughout the subject site and fringing areas of intact vegetation, particularly to the north towards the creek.

Systematic surveys for the threatened orchid *Pterostylis ventricosa* were undertaken on 18 April and 2 May 2016, following confirmation of flowering at known populations elsewhere in the region. Surveys focused on forest edge habitats, i.e. cleared areas within about 50 m of intact vegetation along the

northern and western sides of the study area, which appeared to have a higher proportion of regenerating native species compared to elsewhere in the subject site, and more suitable microhabitat for *P. ventricosa.* These areas were surveyed via parallel transects about 5 m apart. Additional random meander searches were also undertaken within the subject site.

**Limitations**

The floristic audit undertaken recorded dominant and characteristic species to enable the vegetation communities to be verified and provides a representative but not definitive species list. More species would be recorded during a longer survey over various seasons. However, threatened flora species with the most potential to occur in the study area were targeted at appropriate times with appropriate survey methodologies.

The techniques used in this investigation are considered adequate to gather the data necessary to assess the impacts of the proposal on the flora species and vegetation communities found in the study area.

## 2.3 Fauna Surveys

**General Fauna and habitat surveys**

Specific searches were conducted for habitats or resources of relevance for those threatened fauna species known from the locality or species which might be anticipated to occur given the vegetation communities and habitats present. These resources included potential feed trees, foraging resources such as high nectar producing plants, glider incised trees, hollow-bearing trees, owl roost trees, understorey sheltering resources and water sources. Searches for hollow-bearing trees, *Petaurus australis* (Yellow-bellied Glider) incised trees and *Calyptorhynchus lathami* (Glossy Black-cockatoo) feed trees were undertaken within the study area. Resources were recorded and mapped via handheld GPS.

Fauna species were recorded through direct visual and aural means and indirectly through the presence of scats, tracks, burrows, diggings and incisions. Opportunistic recording of fauna species was undertaken throughout the survey period.

**Gang-gang Cockatoo nesting assessment**

Nesting assessments for *Callocephalon fimbriatum* (Gang-gang Cockatoo) were undertaken on 10 and 17 November 2017. Areas containing hollow-bearing trees in the west of the study are were monitored for the presence of the species in the late afternoon, prior to nocturnal stag-watching surveys. The entire study area was also opportunistically monitored for the presence of this species during other surveys.

**Dusk listening, nocturnal stag-watching and spotlighting surveys**

Stag-watching and spotlighting surveys for nocturnal fauna were undertaken on two occasions in the study area, during November 2017 (**Table 2**).

Stag-watching was undertaken for a period of 1 hour from sunset and focused on hollow-bearing trees to the east of the subject site. Nocturnal birds and mammals generally emerge from hollows at or just after dusk, and identification was aided by the use of spotlights and binoculars where necessary, as well as listening for characteristic vocalisations of some species. Characteristic dusk calls of gliders and large forest owls are often indicative of a denning, roosting or nesting site, and allow a broad area to be monitored for the presence of these species.

Following stag-watching, limited call playback surveys for threatened nocturnal birds and mammals (large forest owls and *Petaurus australis* Yellow-bellied Glider) were undertaken for 15 minutes, in an attempt to elicit a territorial response from any individuals within the vicinity.

Following call playback, spotlighting transects were undertaken throughout the subject site for between 30 minutes and 45 minutes per survey, using a 1,100-lumen hand-held flashlight to observe nocturnal fauna, particularly threatened species.

**AnaBat micrchiropteran surveys**

Titley ANABAT II bat detectors linked to Titley Z-Caim digital data recorders were used in conjunction with stag-watching surveys to enhance the detection of microchiropteran bats exiting specific tree hollows. As no bats were detected exiting hollows, the Anabat recorded data was not analysed. Threatened bat species with the potential to occur in the study area are assumed to be present for this assessment.

**Green and Golden Bell Frog surveys**

Surveys for the GGBF were undertaken at the main dam on four occasions between December 2016 and November 2017 (**Table 2**). Call playback, listening and spotlighting in and around the main dam were undertaken for about one hour per night. During 7 March and 10 November 2017, additional spotlight surveys included a smaller dam in the east and wider searches for frogs in cleared areas adjoining the dams. Surveys were undertaken under appropriate seasonal and rainfall conditions (**Table 3**).

**Limitations**

The results of fauna surveys can be optimised by conducting investigations over a long period to compensate for the effect of unfavourable weather, seasonal changes and climatic variation. In general, the longer the survey the more species will be detected. Results can also be improved by using a wide range of techniques, since some species are more likely to be detected by a particular method.

However, surveys are subject to constraints that determine the amount of time allocated, the methods used and the timing of the work. The fauna detected are a snapshot of species present at one particular time, but are by no means a definitive list of the species occurring within the area.

A number of targeted fauna surveys were undertaken during optimal conditions to increase the veracity of results for key threatened species. The techniques used in this investigation are considered adequate to gather the data necessary to assess the impacts of the proposal on the fauna species and habitats found in the study area.

**Table 2: Flora and fauna survey effort**

| Date | Method | Effort | Target species |
|---|---|---|---|
| 10 February 2016 | Random meander | 2 hrs | All flora species and habitat |
| 18 April 2016 | Transect searches | 2 hrs | *Pterostylis ventricosa* |
| | Targeted searches | 1hr | *Melaleuca biconvexa*, *Syzygium paniculatum* |
| | | 1hr | General fauna and habitat resources |
| 2 May 2016 | Transect searches | 2 hrs | *Pterostylis ventricosa* |
| | Targeted searches | 0.5 hrs | *Melaleuca biconvexa*, *Syzygium paniculatum* |
| | | 1hr | General fauna and habitat resources |
| 16 December 2016 | Call playback and spotlight | 1 hr | Green and Golden Bell Frog |
| 13 February 2017 | Call playback and spotlight | 1 hr | Green and Golden Bell Frog |
| 6 March 2017 | Call playback and spotlight | 1.25 hrs | Green and Golden Bell Frog |
| 7 March 2017 | Call playback and spotlight | 1.5 hrs | Green and Golden Bell Frog |
| 9 November 2017 | Random meander | 4 hrs | All flora species |
| | | 1hr | General fauna and habitat resources |
| 10 November 2017 | Nest assessment | 0.5 hrs | Gang-gang Cockatoo |
| | Stagwatch | 1hr | Hollow-dependant fauna |
| | Call playback | 0.25 hrs | Yellow-bellied Glider, owls |
| | Spotlight | 0.75 hrs | Mammals, birds, frogs |
| 17 November 2017 | Nest assessment | 0.5 hrs | Gang-gang Cockatoo |
| | Stagwatch | 1 hr | Hollow-dependant fauna |
| | Call playback | 0.25 hrs | Large Forest Owls, Yellow-bellied Glider |
| | Spotlight | 0.5 hrs | Mammals and birds |

### Survey conditions

All flora and fauna surveys were conducted under appropriate weather conditions. Nocturnal surveys (stagwatching and spotlighting) for mammals and birds were only undertaken during optimal conditions, with no rain and no (or very little) wind. Nocturnal surveys for GGBF were undertaken during mostly still conditions after heavy rainfall.

**Table 3: Fauna survey conditions**

| Date | Max temp (degrees C)* | Rainfall (mm) previous 5 days* | Rainfall during survey | Wind during survey |
|---|---|---|---|---|
| 16 December 2016 | 25.6 | 44 | Nil | Nil |
| 13 February 2017 | 25.7 | 62 | Nil | Nil |
| 6 March 2017 | 24.1 | 139 | Nil | Nil - light |
| 7 March 2017 | 22.1 | 138 | Nil | Light |
| 10 November 2017 | 24.4 | 45 | Light | Nil |
| 18 November 2017 | 23.8 | 21 | Nil | Light |

*Data from BOM Nowra RAN weather station

# 3 Results

## 3.1 Database and literature review

**Appendix A** provides a list of threatened and terrestrial migratory species that have been recorded from literature and database searches within a 10 km radius of the study area.

These species have been evaluated to determine their likelihood to occur within the study area.

## 3.2 Flora

***Vegetation communities***

Most of the study area within Lot 3 has been cleared in the past, with the only intact native vegetation occurring on the northern and western fringes. Intact vegetation in the north of the subject land is mapped as: *Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin* and intact vegetation in the south west of the subject land is mapped as *Spotted Gum - Grey Ironbark - Woollybutt grassy open forest on coastal flats, southern Sydney Basin and South East Corner* (OEH 2013) (**Figure 4**). *Red Bloodwood – Blackbutt – Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin* is also mapped to the south and south east of the site.

The forested vegetation in the study area appears most consistent with the Red Bloodwood – Blackbutt – Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin biometric community (or equivalent PCT 1079).

The northern (lower elevation) parts of the study area were dominated by the canopy species *Eucalyptus pilularis* (Blackbutt), *Eucalyptus globoidea* (White Stringybark), *Eucalyptus eugenioides* (Thin-leaved Stringybark), *Eucalyptus resinifera* (Red Mahogany), *Corymbia gummifera* (Red Bloodwood) *Syncarpia glomulifera* (Turpentine), and *Angophora floribunda* (Rough-barked Apple) towards the creek. A change in canopy species was evident with increasing elevation and the southern (higher elevation) parts of the study area were generally dominated by *Corymbia maculata* (Spotted Gum), *E. paniculata* (Grey Ironbark).and *E. eugenioides*.

The subject site contains the most modified areas on the property, and is predominantly a derived grassland with scattered trees. The grassland contains a mix of exotic grasses and forbs, along with native species such as *Pteridium esculentum*, (Bracken Fern), *Imperata cylindrica* (Blady Grass) and *Lomandra longifolia* (Mat Rush). A range of native regrowth species such as *Acacia longifolia* (Sydney Golden Wattle), *Kunzea ambigua* (White Kunzea), *Allocasuarina littoralis* (Black She-oak), *Leptospermum polygalifolium* (Tantoon), *Hakea sericea* (Bushy Needlebush) and *Melaleuca linariifolia* (Snow in Summer) were evident along fence lines, edges and other areas less subject to maintenance by slashing.

Introduced lawn grasses and a range of planted exotic garden species occur around the existing dwelling.

The main dam near the south of the subject land is dominated by *Eleocharis sphacelata* (Tall Spike Rush). A range of native groundcover, shrub and tree species have also established around the walls of both dams.

***Flora species***

A total of 66 flora species were recorded in the study area, and these are listed in **Appendix B**. No threatened flora species were recorded in the study area and the likelihood of threatened flora occurring in the subject site is considered to be very low.

No *Melaleuca biconvexa* was recorded within the study area during targeted surveys. This species is known to occur nearby, but if present on the subject land it would most likely to occur within riparian areas (or intact forest), which would not be affected by the proposal.

No threatened *Pterostylis ventricosa* orchids were recorded during targeted surveys. No *Cryptostylis* stems were observed in the subject site during other surveys when at least stems of *C. hunteriana* would have been visible. *Rhizanthella slateri* has been recorded near Seasongood road, but is considered unlikely to occur in the subject site due to the extent of habitat removal and modification.

## 3.3 Threatened ecological communities

The vegetation communities above do not correspond with any state or federally listed threatened ecological communities (TECs). Riparian vegetation to the north of the proposal is not dominated by canopy species characteristic of coastal floodplain TECs. Soils in the subject land are not mapped as alluvial soils, which are required for coastal floodplain TECs such as Swamp Sclerophyll Forest. The closest quaternary alluvial soil landscapes are mapped as occurring about 1.3km downstream from the subject land (Troedson and Hashimoto 2008).

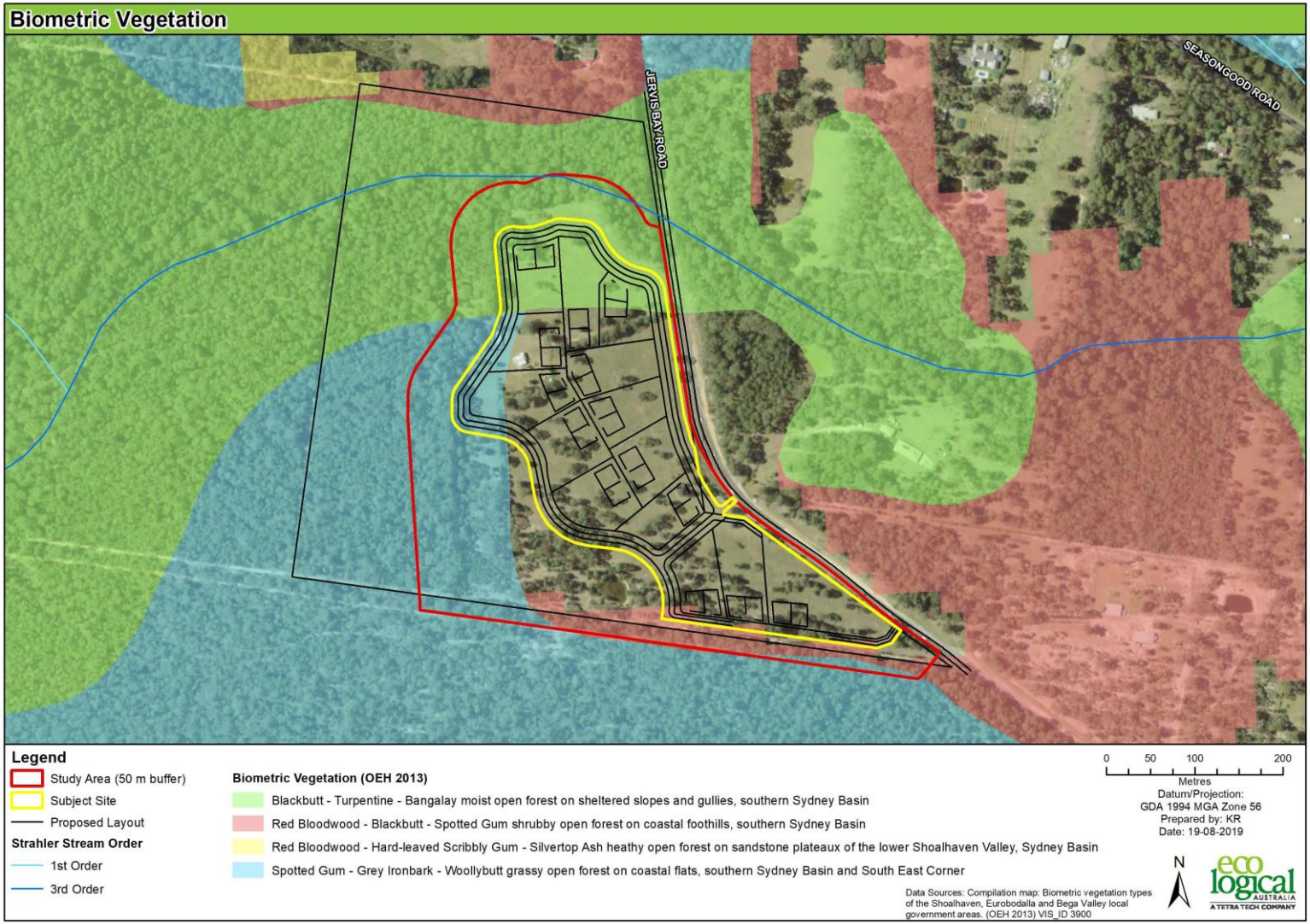


**Figure 4: Vegetation mapping**

## 3.4 Habitats and connectivity

Habitat values within the heavily disturbed subject site are distinctly lower than those in the proposed community title lot:

***Subject site***

- Grassy open foraging areas for macropods, birds, reptiles.
- Scattered remnant and regenerating eucalypt trees providing foraging resources including nectar, pollen, invertebrates, seed and foliage for birds and mammals.
- No obvious hollow-bearing trees were found in the subject site.
- Linear concentrations of subcanopy species along fence lines and driveway, such as *A. littoralis* and *Melaleuca* spp. which provide additional seed, nectar and invertebrate foraging resources and more protected shelter sites for birds and other species.
- Habitat connectivity through the subject site has been heavily limited due to the extent of clearing, and is present mainly as stepping stone connectivity between scattered trees for highly mobile species such as birds. The lack of large trees means connectivity is absent or negligible for arboreal mammals. No riparian connectivity is present through the subject site. Both dams in the subject site are relatively close to adjacent forest, but nearby areas lack aquatic or riparian habitats.

***Proposed Lot 1 (community title)***

- Intact forest, although previously disturbed by logging, containing a range of foraging resources.
- Scattered hollow-bearing trees and stags, few in number due to historic logging.
- Aquatic habitats provided by the main dam in the south. Moderately large (35 x 25m) dam (**photo 1**) dominated by emergent vegetation and some fringing terrestrial vegetation, providing good habitat for frogs. A second and much smaller (5 x 5m) dam provides much more limited aquatic habitats and during the survey period contained little emergent vegetation and was heavily disturbed by the resident horse.
- Riparian and ephemeral aquatic habitats along the creek, provide water sources, additional amphibian habitats, more sheltered habitats with specific microclimate for more cover dependent birds such as Black-faced Monarch, Wrens and potentially roosting sites for owls (although no high quality roosting habitat was observed for large forest owls).
- Proposed Lot 1 has good habitat connectivity with intact forest to the west and south, interrupted only by unsealed boundary roads and rural post and wire fencing. Partial connectivity is present to the north through rural residential properties. Connectivity to Woollamia Nature Reserve in the east is fragmented by Jervis Bay Road, but the relatively short gap across the road to the reserve means that the connection is still valuable for most species. **Figure 1** shows the broader landscape habitat connections in the vicinity of the subject land.
- The habitat connectivity through the northern portion of the subject land (proposed Lot 1) is considered particularly important as it provides a link between Woollamia Nature Reserve in the east and other habitat to the west, including Parma Creek Nature Reserve. This area of the subject land also provides important riparian habitat connectivity.

- The unnamed creek in the subject land has been identified under the SLEP as a Category 2 watercourse (terrestrial and aquatic habitat), requiring a minimum Core Riparian Zone of 20 m from the top of the bank plus a 10 m buffer, on either side of the creek. Apart from providing riparian habitat connectivity, the watercourse buffer will protect water quality in the creek, which flows through endangered ecological communities and state significant wetland habitats downstream.

## 3.5 Fauna

### *Threatened fauna*

The results of database searches for threatened and migratory terrestrial fauna species known or likely to occur in the locality are shown in **Appendix A**, together with an assessment of their potential to occur within the subject land.

Three species of threatened fauna were recorded in the study area: *Litoria aurea* (Green and Golden Bell Frog), *Pteropus poliocephalus* (Grey-headed Flying-fox), and *Calyptorhynchus lathami* (Glossy Black-cockatoo) (**Figure 5**).

The Glossy Black-cockatoo was recorded via evidence of feeding under a single *A. littoralis* tree in the south west of the subject site.

Numerous Grey-headed Flying-foxes were seen and heard flying over the area and foraging in flowering trees within proposed Lot 1.

The GGBF was recorded in the main dam (see **Photo 1**) and in a smaller dam (see **Photo 2**) on the property during March 2017. While only one adult GGBF was seen on each of two consecutive nights, during conditions favourable for frog movement, it is assumed the sightings represent two adult GGBF. The GGBF was only recorded by sight on two of five nocturnal surveys. No GGBF calls were heard despite conditions suitable for numerous other frog species to be calling strongly on each survey night. No evidence of GGBF breeding was recorded during the surveys, although surveys were not extensive enough to rule this out considering the suitable habitat in the main dam.

### *Non-threatened fauna*

A range of common fauna species (mostly birds) were recorded in the study area (**Table 4**). Birds included the Commonwealth migratory listed species *Monarcha melanopsis* (Black-faced Monarch), which was regularly heard calling from near the creek in the north of the subject land. Few common mammals were recorded, although *Macropus giganteus* (Eastern Grey Kangaroo) was abundant within the subject site and *Wallabia bicolor* (Swamp Wallaby) was observed beyond the subject site within dense vegetation. *Petaurus breviceps* (Sugar Glider) was the only arboreal mammal recorded in the subject site. A single reptile, *Lampropholis delicata* (Sun Skink) was recorded in the subject site.

**Table 4: Fauna species recorded**

| Category | Common Name | Scientific Name | Detection Method |
|---|---|---|---|
| Mammals | Common Wombat | *Vombatus ursinus* | Scats |
| | Eastern Grey Kangaroo | *Macropus giganteus* | Observed |
| | **Grey-headed Flying-Fox** | ***Pteropus poliocephalus*** | Observed |
| | Swamp Wallaby | *Wallabia bicolor* | Observed |
| | Sugar Glider | *Petaurus breviceps* | Call recognition |
| Birds | Australian Magpie | *Cracticus tibicen* | Observed |
| | Australian Owlet Nightjar | | Heard |
| | Australian Raven | *Corvus coronoides* | Call recognition |
| | Australian Wood Duck | *Chenonetta jubata* | Observed |
| | Black-faced Monarch | *Monarcha melanopsis* | Call recognition |
| | Brown Gerygone | *Gerygone mouki* | Call recognition |
| | Brown Thornbill | *Acanthiza pusilla* | Observed |
| | Cicadabird | *Coracina tenuirostris* | Call recognition |
| | Common Bronzewing Pigeon | *Phaps chalcoptera* | Observed |
| | Common Koel | *Eudynamys orientalis* | Call recognition |
| | Crested Shrike-tit | *Falcunculus frontatus* | Observed |
| | Crescent Honeyeater | | |
| | Crimson Rosella | *Platycercus elegans* | Observed |
| | Dollarbird | *Eurystomus orientalis* | Call recognition |
| | Eastern Spinebill | *Acanthorhynchus tenuirostris* | Observed |
| | Eastern Whipbird | | |
| | Eastern Yellow Robin | *Eopsaltria australis* | Observed |
| | Fan-tailed Cuckoo | *Cacomantis flabelliformis* | Call recognition |
| | Galah | *Eolophus roseicapilla* | Observed |
| | Golden Whistler | | |
| | **Glossy Black-cockatoo** | ***Calyptorhynchus lathami*** | Feeding sign |
| | Grey Butcherbird | | |
| | Grey Fantail | *Rhipidura fuliginosa* | Call recognition |
| | Grey Shrike-thrush | *Colluricincla harmonica* | Call recognition |
| | Laughing Kookaburra | *Dacelo novaeguineae* | Call recognition |
| | Musk Lorikeet | *Glossopsitta concinna* | Call recognition |

| Category | Common Name | Scientific Name | Detection Method |
|---|---|---|---|
| | Noisy Friarbird | *Philemon corniculatus* | Call recognition |
| | Olive-backed Oriole | | |
| | Pied Currawong | *Strepera graculina* | Observed |
| | Rainbow Lorikeet | *Trichoglossus haematodus* | Observed |
| | Red-browed Finch | *Neochmia temporalis* | Observed |
| | Red Wattlebird | *Anthochaera carunculata* | Observed |
| | Sacred Kingfisher | *Todiramphus sanctus* | Call recognition |
| | Scarlet Honeyeater | | |
| | Silvereye | *Zosterops lateralis* | Observed |
| | Southern Boobook | *Ninox novaeseelandiae* | Call recognition |
| | Spotted Pardalote | *Pardalotus punctatus* | Call recognition |
| | Striated Thornbill | *Acanthiza lineata* | Observed |
| | Sulphur Crested Cockatoo | *Cacatua galerita* | Call recognition |
| | Superb Fairy Wren | *Malurus cyaneus* | Observed |
| | White-naped Honeyeater | *Melithreptus lunatus* | Call recognition |
| | Variegated Fairy-wren | *Malurus lamberti* | Observed |
| | White-browed Scrubwren | *Sericornis frontalis* | Observed |
| | White-throated Treecreeper | *Cormobates leucophaea* | Observed |
| | Yellow-faced Honeyeater | *Lichenostomus chrysops* | Observed |
| Amphibians | Bibron's Toadlet | *Pseudophryne bibronii* | Heard |
| | Common Eastern Froglet | *Crinia signifera* | Observed / heard |
| | Eastern Dwarf Tree Frog | *Litoria fallax* | Observed / heard |
| | **Green & Golden Bell Frog** | ***Litoria aurea*** | Observed |
| | Haswell's Froglet | *Paracrinia haswelli* | Heard |
| | Jervis Bay Tree Frog | *Litoria jervisiensis* | Observed / heard |
| | Peron's Tree Frog | *Litoria peronii* | Observed / heard |
| | Striped Marsh Frog | *Limnodynastes peronii* | Observed / heard |
| | Tyler's Toadlet | *Uperoleia tyleri* | Heard |
| | Tyler's Tree Frog | *Litoria tyleri* | Observed / heard |
| | Whistling Tree Frog | *Litoria verreauxii* | Heard |
| Reptiles | Sun Skink | *Lampropholis delicata* | Observed |

**Photo 1: Main dam where single adult Green and Golden Bell Frog was observed**

**Photo 2: Small dam to NW of main dam where single adult Green and Golden Bell Frog was observed**

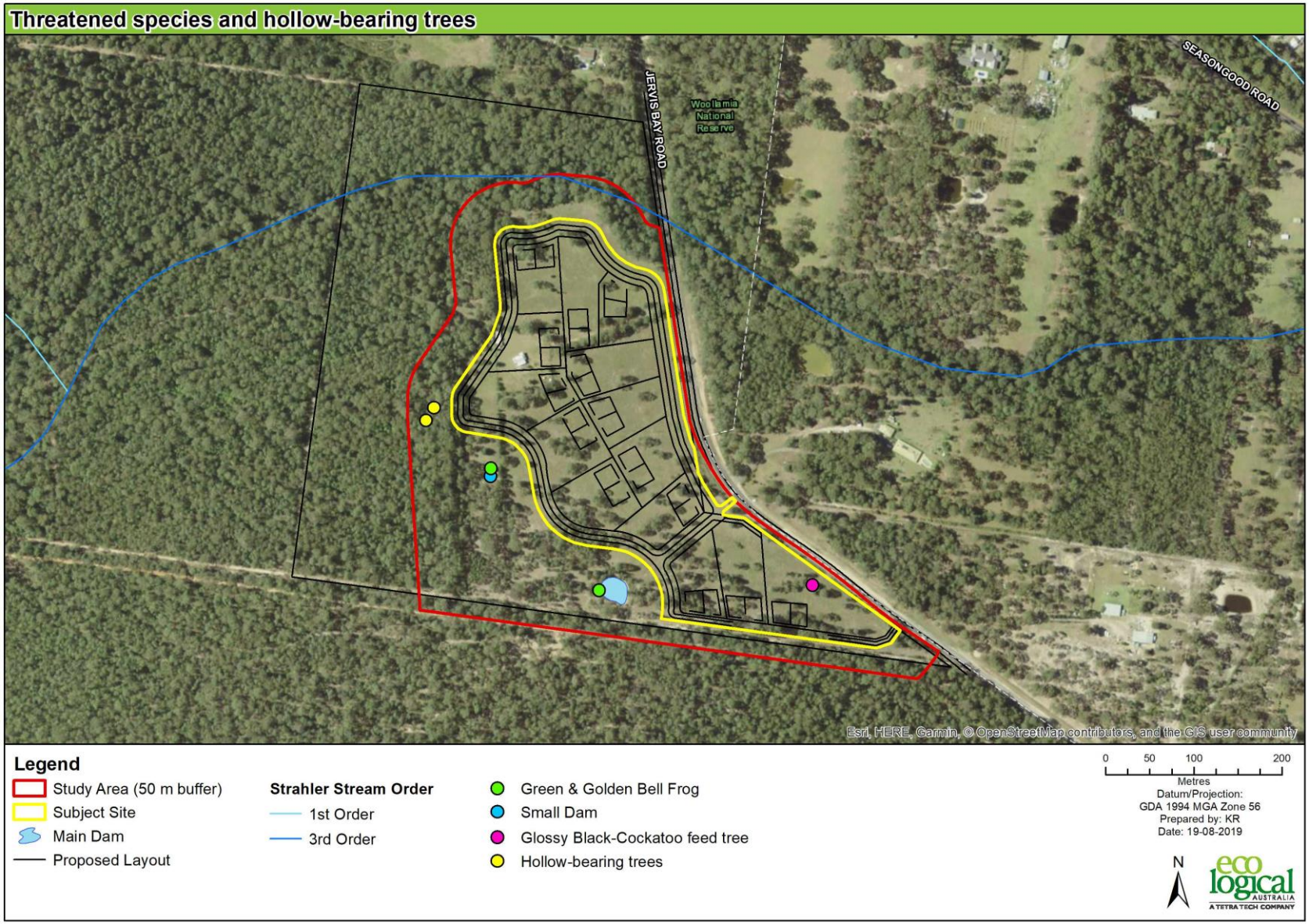


**Figure 5: Threatened species and habitat features**

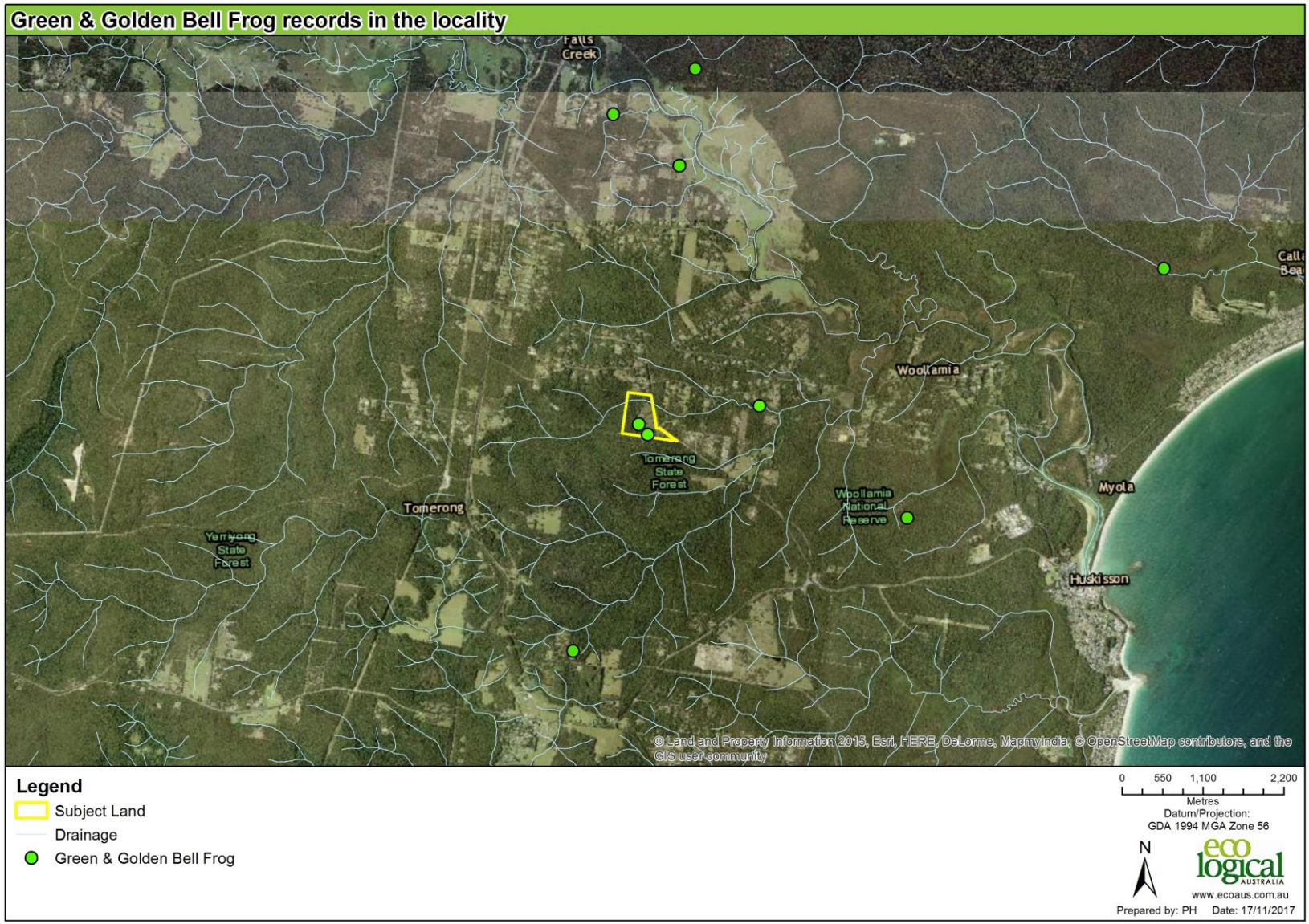


**Figure 6: Green and Golden Bell Frog locality records**

# 4 Impact assessment

## 4.1 Direct and indirect impacts

The following direct impacts on flora and fauna are anticipated from the proposal:

- Clearing of scattered regrowth trees and shrubs through the subject site of 9.65 ha.
- Removal of heavily disturbed (slashed and grazed) groundcover vegetation.
- Disturbance to the substrate for the development footprint.
- Compaction of the soil within areas to be accessed by heavy machinery/vehicles.
- Covering of some areas with hard surfaces.

The following indirect impacts on flora and fauna are anticipated from the proposal:

- Increased noise, light, and other disturbances from residential use which may alter behaviour of some fauna species.
- Microclimate changes to areas of vegetation to be retained arising from development in adjoining areas.
- Potential for increased erosion and altered hydrological and/or nutrient conditions to adversely affect downslope vegetation and habitats.
- Increased potential for weeds to spread from the subject site into adjoining areas of retained native vegetation.
- Reduced connectivity through the subject site.
- New roads increase the risk of vehicle strike for some species, including the GGBF.

## 4.2 Vegetation communities

The proposal will not remove any intact vegetation communities and will only directly affect scattered trees and regrowth vegetation within largely cleared and managed grazing land. The adjoining vegetation communities are relatively widespread in the region and are not expected to be adversely affected by the proposal given they will be retained within E2 zoned land.

## 4.4 Fauna habitat

The proposal will remove common and widespread habitats from the heavily disturbed and largely cleared subject site. These predominantly comprise generic foraging resources. The single Glossy Black-cockatoo feed tree is likely to be removed, although large areas of potential foraging resources will be retained in the subject land. No hollow-bearing trees or other potentially important shelter resources will be removed.

Canopy connectivity through the subject site will be further reduced, but does not form part of any important movement corridor for the highly mobile fauna species likely to occur there. Intact forest habitats within the remainder of the property do contribute to important habitat connectivity through the landscape, but will not be affected by the proposal.

Connectivity for the GGBF will be reduced through cleared, open areas of the subject site, as the frog is known to readily move throughout the landscape during wetter conditions. However, the primary movement and sheltering habitats for the species are the dams and riparian forest, which will be retained, and the proposal will not prevent GGBF movement through the area in any direction.

The impacts to fauna habitats are considered relatively minor and acceptable, with no important resources or connectivity being removed by the proposal.

## 4.5 Threatened and migratory species

As a result of field survey, habitat analysis and database searches (**Appendix A**), the following threatened and migratory species were found to occur in the study area or considered to have potential to occur in the study area (**Table 5**).

**Table 5: Threatened and migratory species with potential to occur in the study area**

| Scientific Name | Common Name | BC Act | EPBC Act | Occurrence |
|---|---|---|---|---|
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | V | — | Potential |
| *Calyptorhynchus lathami* | Glossy Black-cockatoo | V | — | Known |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | V | — | Potential |
| *Glossopsitta pusilla* | Little Lorikeet | V | — | Potential |
| *Litoria aurea* | Green and Golden Bell Frog | E | V | Known |
| *Lophoictinia isura* | Square-tailed Kite | V | — | Potential |
| *Miniopterus schreibersii oceanensis* | Eastern Bent-wing Bat | V | — | Potential |
| *Mormopterus norfolkensis* | East Coast Freetail Bat | V | — | Potential |
| *Myotis adversus* | Southern Myotis | V | — | Potential |
| *Ninox strenua* | Powerful Owl | V | — | Potential |
| *Petaurus australis* | Yellow-bellied Glider | V | — | Potential |
| *Petroica boodang* | Scarlet Robin | V | — | Potential |
| *Pteropus poliocephalus* | Grey-headed Flying-Fox | V | V | Known |
| *Scoteanax rueppellii* | Greater Broad-nosed Bat | V | — | Potential |
| *Tyto novaehollandiae* | Masked Owl | V | — | Potential |
| *Tyto tenebricosa* | Sooty Owl | V | — | Potential |
| *Monarcha melanopsis* | Black-faced Monarch | — | M | Known |
| *Myiagra cyanoleuca* | Satin Flycatcher | — | M | Potential |
| *Rhipidura rufifrons* | Rufous Fantail | — | M | Potential |

E = Endangered; V = Vulnerable; M = Migratory.

### Threatened flora

The subject site is unlikely to support any of the threatened flora species known from the locality (**Appendix A**). Targeted searches for *M. biconvexa, S. paniculatum* and *P. ventricosa* failed to locate these species. Any habitat suitable for *M. biconvexa, S. paniculatum* or *Rhodamnia rubescens* along the creek would be retained and buffered from the proposal. Other threatened flora species known from the locality are considered unlikely to occur in the study area due to lack of appropriate habitat. The proposal is therefore considered unlikely to affect threatened flora species and these species are not assessed further in this report.

**Threatened fauna**

Apart from the GGBF, which is discussed below, the threatened fauna with potential to occur (**Table 5**) are only likely to occur in the subject site infrequently, as part of a much larger range, to forage on small amounts of generic resources that are common and widely available in the locality. No breeding, sheltering or important foraging resources are present in the subject site for these species, nor is any important habitat connectivity. All intact forest habitats beyond the heavily disturbed development footprint would be retained and protected by E2 zoning. These species are assessed further in **Appendix C** (7 part test).

The initial proposal footprint has been modified to better retain and protect habitats and connectivity for the GGBF. All aquatic and riparian habitats would be buffered from the proposal by at least 40 m, and managed for conservation through E2 zoning. Connectivity between GGBF aquatic habitats and all intact forest on the subject land would be maintained. The proposal would not affect connectivity between these habitats and large areas of intact forest on adjacent lands to the west and south of Lot 3.

The proposal would restrict (but not remove) connectivity between the dams on Lot 3 and other aquatic habitat in the broader landscape to the east of Jervis Bay Road. The proposal would also increase threats to any GGBF traversing the subject site by introducing additional hostile environments such as roads, domestic animals and potentially barriers such as buildings and fencing. Most of these threats already exist in the broader landscape in which the GGBF would traverse in order to disperse or move between aquatic habitats (creeks and dams) or other refuge areas. Riparian areas are a key habitat component to GGBF movement through the landscape, although the species will traverse almost any environment in ideal conditions.

A range of mitigation measures should be implemented to enhance the protection and condition of GGBF aquatic habitat and connectivity between these habitats and other retained vegetation within the subject land. Frog exclusion fencing should also be implemented between the dams and the subject site during at least the initial construction phase of the subdivision.

The GGBF is assessed further in **Appendix C** (7 part test of significance).

The GGBF is also required to be assessed under the Commonwealth DEWHA (2009) guidelines for this species.

The following table assesses if the proposed action meets the DEWHA (2009) criteria for a potential significant impact, and hence requirement for referral:

| Criteria | Assessment |
|---|---|
| 1. The removal or degradation of aquatic or ephemeral habitat either where the green and golden bell frog has been recorded since 1995 or habitat that has been assessed as being suitable according to these guidelines. This can include impacts from Chytrid, Gambusia originating off-site. | The proposal will retain and buffer all aquatic or ephemeral habitat and will maintain connectivity between these habitats. With appropriate management, the quality of these habitats can be maintained. |
| 2. The removal or degradation of terrestrial habitat within 200 metres of habitat identified in threshold 1 | While the proposal is situated within previously cleared land and no aquatic habitat or riparian connectivity will be adversely affected, the proposal will occur 40 m from the dams and creek. In ideal conditions, the GGBF may use the proposed development area for |

| Criteria | Assessment |
|---|---|
| | dispersal or other movement, or potentially foraging. This meets the criteria for removal or degradation of terrestrial habitat with 200m of known GGBF aquatic habitat. |
| 3. Breaking the continuity of vegetation fringing ephemeral or permanent waterways or other vegetated corridors linking habitats meeting the criteria in threshold 1. | The proposal will include a 40 m buffer around all aquatic habitats and maintain connectivity between these areas. |

The outcome of the above assessment indicates that Criteria 2 (impacts to terrestrial habitat within 200 m of known aquatic habitat) is met by the proposal, which suggests that a significant impact on the GGBF is possible, and a Referral under the EPBC Act should be considered. However, as the MNES assessment of significance (**Appendix D**) indicates that a significant impact on the GGBF is unlikely in this case, a Referral under the EPBC Act is probably unwarranted.

**Migratory fauna**

The subject site contains no important habitats for migratory species listed on the EPBC Act. The highly modified habitats mean that migratory species are unlikely to occur there unless moving through the area. Intact forest areas beyond the subject site are suitable habitat for some migratory species, such as the Black-faced Monarch, which was recorded within forested part of the study area along the creek. All intact forest habitats including riparian areas would be retained by the proposal, therefore all suitable habitats for migratory birds would remain intact. No indirect impacts from the proposal are likely to adversely affect migratory species. Migratory species are assessed in **Appendix D**.

## 4.6 SEPP 44 Koala Habitat Assessment

Potential Koala Habitat is defined as areas where the tree species listed under Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. The study area does not contain any listed feed tree species. Therefore, the study area does not constitute Potential Koala Habitat pursuant to SEPP 44. No further aspects of SEPP 44 apply to the proposal.

## 4.7 Conclusion of Seven-Part Test

An assessment of significance under Section 5A of the EPA Act was undertaken on those species recorded on the site or with potential to occur on the site (**Appendix C**). The outcome of this assessment was that the proposed development is unlikely to have a significant impact on those threatened species assessed. A Species Impact Statement is not required.

## 4.8 Conclusion of EPBC Assessment

An assessment of significance under the EPBC Act was undertaken on those threatened and migratory species recorded or with potential to occur on the site (**Appendix D**). The outcome of this assessment was that the proposed development is unlikely to have a significant impact on any threatened or migratory species, or other Matters of National Environmental Significance. A Referral under the EPBC Act is not required.

# 5 Conclusions

This report describes the biological environment of Lot 3 DP 846470, 48 Jervis Bay Road, Falls Creek, and assesses the impacts of the proposed community title residential subdivision on the property.

The proposal has appropriately been limited to previously cleared areas of the property in order to retain intact vegetation, riparian areas and threatened species habitats. A number of recommendations are provided to further mitigate potential impacts of the proposal on surrounding habitats. These are expected to be implemented as consent conditions and hence form part of the proposal.

The site was assessed under SEPP 44 – Koala Habitat Protection, and deemed not to contain Potential Koala Habitat due to absence of fee tree species listed in Schedule 2. No further provisions of SEPP 44 apply.

Following the application of Section 5A of the EPA Act and in accordance with relevant assessment guidelines, it is concluded that the proposal is unlikely to have a significant effect on threatened species, endangered populations, ecological communities, or their habitats. A Species Impact Statement is not likely to be required for the proposal.

Following consideration of the administrative guidelines for determining significance under the Commonwealth EPBC Act, it is concluded that the proposal is unlikely to have a significant impact on matters of National Environmental Significance. The retention and buffering of all aquatic habitats and most connectivity for the Green and Golden Bell Frog, together with the mitigation measures outlined below, should ensure that the proposal will not have a significant impact on this species, and therefore a referral to the Commonwealth Minister should not be required.

# 6 Recommendations

To improve environmental outcomes, the following recommendations for impact mitigation and amelioration are suggested as modifications to the proposal and/or as conditions of consent.

1. A management plan should be prepared for the proposed Lot 1 Community Property to guide appropriate management activities and use of the area to maintain its natural values.

2. The above plan should include management actions for the Green and Golden Bell Frog on the property, to guide the clearing and construction process and longer term protection of Green and Golden Bell Frog habitat. The plan should address issues including frog exclusion fencing, access, enhancement of frog habitat and connectivity to adjoining forest, pre-clearing surveys, hygiene protocols, monitoring and reporting.

3. The extent of the development footprint is to be clearly and accurately defined prior to any vegetation removal.

4. Appropriate sediment and erosion control measures are to be implemented prior to any clearing or construction work and retained in place until exposed areas of soil are stabilised and/or revegetated.

5. Any currently cleared areas that fall within the 40 m riparian buffer to the creek shall be regenerated.

6. Known weeds or other plant species with potential to spread into adjoining bushland are not be used on the property for landscaping or other purposes.

7. External residential and street lighting is to minimise light spill into areas of retained vegetation or habitats.

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# Appendix A: Likelihood of occurrence

**Summary of initial assessment to determine the likelihood of occurrence of threatened species, populations and ecological communities in the proposal site.**

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. Fish, marine and wetland species have been omitted from the results due to lack of suitable habitat. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

“yes” = the species was or has been observed on the site

“likely” = a medium to high probability that a species uses the site

“potential” = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur

“unlikely” = a very low to low probability that a species uses the site

“no” = habitat on site and in the vicinity is unsuitable for the species

**Likelihood of occurrence**

| Flora Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Caladenia tessellata*<br><br>Thick Lip Spider Orchid | E | V | Caladenia tessellata occurs in grassy sclerophyll woodland, often growing in well-structured clay loams or sandy soils south from Swansea, usually in sheltered moist places and in areas of increased sunlight (DEC 2005). It flowers from September to November (DEC 2005). | Unlikely<br>Lack of local records |
| *Cryptostylis hunteriana*<br><br>Leafless Tongue Orchid | V | V | This terrestrial orchid is known from swamp-heath, open forest and woodland on sandy soils in coastal districts. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black She-oak (*Allocasuarina littoralis*); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*). The study area not preferred habitat and no *Cryptostylis* stems observed during surveys in November. | Unlikely<br>No preferred habitat |
| *Cynanchum elegans*<br><br>White-flowered Wax Plant | E | E | Cynanchum elegans is a climber or twiner with a variable form, and flowers between August and May, peaking in November. It occurs in dry rainforest gullies, scrub and scree slopes, and prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest (NPWS 1997). The species has also been found in littoral rainforest; Leptospermum laevigatum – Banksia integrifolia subsp. integrifolia coastal scrub; Eucalyptus tereticornis open forest/ woodland; Corymbia maculata open forest/woodland; and Melaleuca armillaris scrub to open scrub. | Unlikely<br>No preferred habitat or local records |
| *Eucalyptus langleyi*<br><br>Albatross Mallee | V | V | Occurs within poor sandy sites west and south west of Nowra and mallee shrubland on poorly drained shallow sand on sandstone. | No |

| Flora Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Genoplesium baueri*<br><br>Yellow Gnat-orchid | E | E | Known from coastal areas from Port Stephens south to the Shoalhaven district. Grows in shrubby woodland and dry open forest on shallow sandy soils and on moss gardens over sandstone. Preferred habitat is not present in the study area, particularly the heavily disturbed subject site. | Unlikely |
| *Melaleuca biconvexa*<br><br>Biconvex Paperbark | V | V | This species may occur in dense stands forming a narrow strip adjacent to watercourses, in association with other *Melaleuca* species or as an understorey species in wet forest. Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Known to occur within 1km of the subject land, but in a separate catchment. Not recorded in the subject site or adjacent riparian vegetation. If present in the subject land, would be confined to riparian or other forest habitats not affected by the proposal. | Unlikely in subject site |
| *Prasophyllum affine*<br><br>Jervis Bay Leek-orchid | E | E | Jervis Bay Leek Orchid is currently known from three areas south-east of Nowra on South Coast. These are Kinghorne Point, Wowly Gully near the town of Callala Bay, and near the township of Vincentia. The orchid grows on poorly drained clay soils that support low heathland and sedgeland communities. | No |
| *Pterostylis gibbosa*<br><br>Illawarra Greenhood | E | E | Known from a small number of populations in the upper Hunter Valley (Milbrodale), the Illawarra region (Albion Park and Yallah) and near Nowra (DEC 2005). Plants grow in specific woodland and open forest communities and in the Shoalhaven region appear to be restricted to the South Nowra – Worrigee area. | Unlikely |
| *Pterostylis vernalis* (sp. Flat Rock Creek)<br><br>Spring Tiny Greenhood | E | CE | The Spring Tiny Greenhood is endemic to NSW and is known from five populations in the Nowra district. It grows in heath and heathy forests. It is most commonly found in open sites in shallow sandy soil and moss gardens around the margins of sandstone sheets with associated dwarf heaths and sedges. The species is associated with soil of a specific moisture regime, where the flow of water through the profile is inhibited by the underlying rock strata. | No |

| Flora Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Pterostylis ventricosa* | CE | - | This Greenhood orchid is known primarily from populations centered on the St. Georges Basin region between Nowra and Ulladulla, where it grows in a range of widely occurring forest communities. Also recorded along edges of slashed roads and easements. Targeted surveys of slashed edge habitats did not record the species. | Unlikely in subject site |
| *Rhizanthella slateri*<br>Eastern Australian Underground Orchid | V | E | In NSW, this species is currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. The only local records (Woollamia and Vincentia) were located by accident, targeted surveys for the species in the Shoalhaven have not recorded any individuals. Unlikely to occur in the subject site due to the extent of habitat removal. | Unlikely in subject site |
| *Rhodamnia rubescens*<br>Scrub Turpentine | CE | - | Shub or small tree to 25 m high, occurring north from Batemans Bay. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest, usually on volcanic and sedimentary soils. Highly susceptible to infection by Myrtle Rust. Subject land may contain suitable habitat in association with the main gully. However, not recorded in study area and very unlikely to occur in subject site. | Unlikely in subject site |
| *Syzygium paniculatum*<br>Magenta Lillypilly | E | V | This species occupies a narrow coastal area between Bulahdelah and Conjola State Forests in NSW. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. Not recorded in study area. Recorded within 3 km of subject land, but habitat in study area is marginal and restricted to riparian areas beyond the subject site. | Unlikely |
| *Thesium australe*<br>Austral Toadflax | V | V | The Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It occurs in grassland or grassy woodland and is often found in damp sites in association with Kangaroo Grass (*Themeda australis*). | Unlikely |

| Flora Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Triplarina nowraensis*<br><br>Nowra Heath Myrtle | E | E | *Triplarina nowraensis* is mostly confined to the Nowra district where it grows in moist heath close to stream channels or swampy slopes (PlantNet 2011). Also known from one population near Sussex Inlet. Not recorded in subject site. Not recorded during surveys, no nearby records. Unlikely to occur in study area. | Unlikely |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| **Amphibians** | | | | |
| *Heleioporus australiacus*<br><br>Giant Burrowing Frog | V | V | Forages in woodlands, wet heath, dry and wet sclerophyll forest (Ehmann 1997). Associated with semi-permanent to ephemeral sand or rock based streams (Ehmann 1997), where the soil is soft and sandy so that burrows can be constructed (Environment Australia 2000). Generic forest habitat in subject land, but no preferred habitat or nearby records. Unlikely to occur in disturbed subject site. | Unlikely |
| *Litoria aurea*<br><br>Green and Golden Bell Frog | E | V | This species has been observed utilising a variety of natural and man-made waterbodies (Pyke & White 1996) such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water (DECC 2007). Fast flowing streams are not utilised for breeding purposes by this species (Mahony 1999). Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading (DECC 2007). Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable (Ehmann 1997; Robinson 1993). Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish (Gambusia holbrooki) (DECC 2007). | Yes<br>Recorded in dams |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Litoria littlejohni*<br>Littlejohn's Tree Frog | V | V | Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria (DECC 2007). It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. I t appears to be restricted to sandstone woodland and heath communities at mid to high altitude (NSW Scientific Committee 2000). It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks on high exposed ridges during summer (NSW Scientific Committee 2000). | No |
| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
| **Reptiles** | | | | |
| *Hoplocephalus bungaroides*<br>Broad-headed Snake | E | V | Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and/or heath on Triassic sandstone of the Sydney Basin (DECC 2007). They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (Webb & Shine 1998b). Some of the canopy tree species found to regularly co-occur at known sites include Corymbia eximia, C. gummifera, Eucalyptus sieberi, E. punctata and E. piperita (DECC 2007). | No |
| **Diurnal Birds** | | | | |
| *Anthochaera phrygia*<br>Regent Honeyeater | CE | CE | The Regent Honeyeater is associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised. The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes. As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar. Unlikely in study area due to sparseness of preferred foraging trees. | Unlikely |
| *Botaurus poiciloptilus*<br>Australasian Bittern | E | E | Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant & Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson & Day 1999). Very marginal habitat on site. | Unlikely |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Callocephalon fimbriatum*<br>Gang-gang Cockatoo | V | — | During summer, the species utilises dense, tall, wet forests of mountains and gullies and alpine woodlands. In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages. They sometimes inhabit woodland, farms and suburbs in autumn/winter. | Potential |
| *Calyptorhynchus lathami*<br>Glossy Black-Cockatoo | V | — | This Cockatoo is associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils. Intact drier forest types with less rugged landscapes are preferred. The species nests in large trees with large hollows. | Yes |
| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
| *Dasyornis brachypterus*<br>Eastern Bristlebird | E | E | This species habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years. | Unlikely |
| *Glossopsitta pusilla*<br>Little Lorikeet | V | — | In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes. | Potential |
| *Grantiella picta*<br>Painted Honeyeater | V | V | A nomadic species that typically inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests with abundant mistletoe (DECC 2007). It is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, preferring Amyema sp mistletoe (DECC 2007). Lack of records in local area. | Unlikely |
| *Hieraaetus morphnoides*<br>Little Eagle | V | | Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland. Uses tall trees for nesting, with a large stick nest being built. Lays eggs in spring, and young fledge in early summer. Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion. No suitable nesting habitat, marginal foraging habitat, no regular records, unlikely to occur. | Unlikely |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Lathamus discolor*<br><br>Swift Parrot | - | V | The species breeds in Tasmania between September and January and migrates to mainland in autumn, where it forages on profuse flowering Eucalypts. Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*). Unlikely in study area due to sparseness of preferred foraging trees. | Unlikely |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Lophoictinia isura*<br><br>Square-tailed Kite | V | — | In coastal areas, this species is associated with tropical and temperate forests and woodlands on fertile soils with an abundance of passerine birds. It can be recorded inland along timbered watercourses In NSW it is commonly associated with ridge or gully forests dominated by Woollybutt (*Eucalyptus longifolia*), Spotted Gum (*E. maculata*), or Peppermint Gum (*E. elata, E. smithii*). | Potential |
| *Neophema chrysogaster*<br><br>Orange-bellied Parrot | CE | CE | This species breeds only in coastal south-west Tasmania and spends the winter in coastal Victoria and South Australia. It nests in hollows in eucalypt trees which grow adjacent to its feeding plains. In early October the birds arrive in the south west and depart after the breeding season usually in March and April. | No |
| *Petroica boodang*<br><br>Scarlet Robin | V | - | The Scarlet Robin is found in south-eastern and south-western Australia, as well as on Norfolk Island. In Australia, it is found south of latitude 25°S, from south-eastern Queensland along the coast of New South Wales (and inland to western slopes of Great Dividing Range) to Victoria and Tasmania, and west to Eyre Peninsula, South Australia; it is also found in south-west Western Australia. The Scarlet Robin lives in open forests and woodlands in Australia, while it prefers rainforest habitats on Norfolk Island. During winter, it will visit more open habitats such as grasslands and will be seen in farmland and urban parks and gardens at this time (BIB, 2006). Potential non-breeding visitor to area. | Potential |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Rostratula australis*<br><br>Australian Painted Snipe | E | E | Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December (DECC 2007). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (DECC 2007). Feeds on worms, molluscs, insects and some plant-matter (ibid.). | Unlikely |
| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
| **Nocturnal Birds** | | | | |
| *Ninox connivens*<br><br>Barking Owl | V | — | Associated with a variety of habitats such as savanna woodland, open eucalypt forests, wetland and riverine forest. The habitat is typically dominated by Eucalypts (often Redgum species), however often dominated by Melaleuca species in the tropics (DECC 2007). It usually roosts in dense foliage in large trees such as River She-oak (*Allocasuarina cunninghamiana*), other Casuarina and Allocasuarina, eucalypts, Angophora, Acacia and rainforest species from streamside gallery forests (NPWS 2003). It usually nests near watercourses or wetlands (NPWS 2003) in large tree hollows with entrances averaging 2-29 metres above ground, depending on the forest or woodland structure and the canopy height (Debus 1997). Lack of regular occurrence in locality. | Unlikely |
| *Ninox strenua*<br><br>Powerful Owl | V | — | Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes. Large trees with hollows at least 0.5m deep are required for shelter and breeding. Marginal foraging habitat in subject site. | Potential |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Tyto novaehollandiae*<br>Masked Owl | V | — | The Masked Owl is associated with forest with sparse, open, understorey, typically dry sclerophyll forest and woodland and especially the ecotone between wet and dry forest, and non forest habitat. It is known to utilise forest margins and isolated stands of trees within agricultural land and heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained. Marginal foraging habitat in subject site. | Potential |
| *Tyto tenebricosa*<br>Sooty Owl | V | — | Sooty Owls are associated with tall wet old growth forest on fertile soil with a dense understorey and emergent tall Eucalyptus species (Environment Australia 2000, Debus 1994). Pairs roost in the daytime amongst dense vegetation, in tree hollows and sometimes in caves. The Sooty Owl is typically associated with an abundant and diverse supply of prey items and a selection of large tree hollows (Debus 1994, Garnett 1993, Hyem 1979). Marginal foraging habitat in subject site. | Potential |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| **Mammals (excluding bats)** | | | | |
| *Cercartetus nanus*<br>Eastern Pygmy-possum | V | — | The Eastern Pygmy-possum is found in wet and dry eucalypt forest, subalpine woodland, coastal banksia woodland and wet heath. Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit. The presence of Banksia sp. and Leptospermum sp. are an important habitat feature. Small tree hollows are favoured as day nesting sites, but nests have also been found under bark, in old birds' nests and in the branch forks of tea-trees. Unlikely to occur in subject site due to substantial removal and modification of habitat, particularly understorey foraging habitat. | Unlikely in subject site |
| *Dasyurus maculatus*<br>Spotted-tailed Quoll | V | E | The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in. Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; and burrows. May occur in adjacent forested areas but no resources in subject site. | Unlikely in subject site |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Isoodon obesulus*<br>Southern Brown Bandicoot | E | E | This species is associated with heath, coastal scrub, heathy forests, shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire. Very unlikely due to lack of recent records and heavily modified subject site. | Unlikely |
| *Petauroides volans*<br>Greater Glider | — | V | The greater glider is restricted to eucalypt forests and woodlands of eastern Australia. Its diet is mostly eucalypt leaves and occasional flowers and is found in highest abundance in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows. The distribution may be patchy even in suitable habitat. Forests with a diversity of eucalypt species, due to seasonal variation, is its preferred tree species. Unlikely to occur in subject site due to extent of canopy removal and lack of old growth elements. | Unlikely in subject site |
| *Petaurus australis*<br>Yellow-bellied Glider | V | — | This species is restricted to tall mature forests, preferring productive tall open sclerophyll forests with a mosaic of tree species including some that flower in winter. Large hollows within mature trees are required for shelter, nesting and breeding. Unlikely to occur in subject site due to extent of historic clearing and canopy removal and lack of connectivity. | Unlikely in subject site |
| *Petrogale penicillata*<br>Brush-tailed Rock-wallaby | E | V | This species inhabits rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices. | No |
| *Phascolarctos cinereus*<br>Koala | V | V | The Koala is associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% with acceptable Eucalypt food trees. Unlikely to occur due to lack of preferred habitat and lack of recent local records. | Unlikely |
| *Potorous tridactylus*<br>*Potorous tridactylus*<br>Long-nosed Potoroo | V | V | This species is associated with dry coastal heath and dry and wet sclerophyll forests with dense cover for shelter and adjacent more open areas for foraging. No suitable habitat in subject site due to removal of understorey. | Unlikely in subject site |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Pseudomys novaehollandiae*<br><br>New Holland Mouse | | V | A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (DSEWPC 2010). No suitable habitat in subject site due to historic clearing. | Unlikely |
| *Sminthopsis leucopus*<br><br>White-footed Dunnart | V | | The White-footed Dunnart occurs in Tasmania and along the Victorian and southern NSW coast. The Shoalhaven area is the species' northern-most limit. The species is found in a range of different habitats across its distribution, including coastal dune vegetation, coastal forest, tussock grassland and sedgeland, heathland, woodland and forest. In NSW, the species appears to prefer habitats with an open understory structure. The White-footed Dunnart is an opportunistic carnivore that feeds on a variety of ground-dwelling invertebrates and, occasionally, small lizards. They shelter in bark nests in hollows understanding or fallen timber, burrows in the ground, piles of logging debris, large grass clumps such as provided by Grass Trees Xanthorrhoea sp. and Macrozamias and rock crevices. Unlikely to occur in subject site due to substantial removal and modification of habitat. Unlikely to occur in subject site due to historic clearing, grazing and lack of resources. | Unlikely in subject site |
| **Mammals (Bats)** | | | | |
| *Chalinolobus dwyeri*<br><br>Large-eared Pied Bat | V | V | The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces. Unlikely to occur in area due to lack of local roosting resources. | Unlikely |
| *Falsistrellus tasmaniensis*<br><br>Eastern False Pipistrelle | V | | Prefers moist habitats with trees taller than 20m. Roosts in tree hollows but has also been found roosting in buildings or under loose bark. | Potential |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Miniopterus schreibersii oceanensis*<br><br>Eastern Bentwing-Bat | V | | Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. It forages above and below the tree canopy on small insects. Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter. | Potential |
| *Mormopterus norfolkensis*<br><br>Eastern Freetail-bat | V | | Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges. Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting elsewhere. | Potential |
| *Pteropus poliocephalus*<br><br>Grey-headed Flying-Fox | V | V | The Grey-headed Flying-fox inhabits a wide range of habitats including rainforest, mangroves, and paperbark forests. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy. | Yes |
| *Scoteanax rueppellii*<br><br>Greater Broad-nosed bat | V | - | Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range, tending to be more frequently located in more productive forests. Within denser vegetation types use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey. | Potential |
| **Migratory Terrestrial Species** | | | | |
| *Cuculus optatus*<br><br>*Oriental Cuckoo* | | M | Occurs in a range of vegetated habitats including monsoon rainforest, wet sclerophyll forest and open woodland, often along edges of forests or ecotones. Generally forages for invertebrates on tree trunks, branches and foliage. Rarely occurs south of Sydney. Negligible habitat in subject site. | Unlikely |
| *Hirundapus caudacutus*<br><br>White-throated Needletail | | M | Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993). Negligible resources present, unlikely to utilise or occur in the study area apart from overflying the site. | Unlikely |

| Fauna Species | TSC Act | EPBC Act | Habitat Associations | Likelihood of Occurrence |
|---|---|---|---|---|
| *Merops ornatus*<br>Rainbow Bee-eater | | M | Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May (Pizzey and Doyle 1988). Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (ibid). Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (*ibid*). | Unlikely |
| *Monarcha melanopsis*<br>Black-faced Monarch | | M | Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984). Recorded along creek in north of study area. | Yes |
| *Monarcha trivirgatus*<br>Spectacled Monarch | | M | Wet forests, mangroves (Simpson and Day 1999). Much less common in Shoalhaven than Black-faced Monarch. | Unlikely |
| *Myiagra cyanoleuca*<br>Satin Flycatcher | | M | Wetter, denser forest, often at high elevations (Simpson & Day 2004). Potential non-breeding visitor to the site. | Potential |
| *Rhipidura rufifrons*<br>Rufous Fantail | | M | The Rufous Fantail is a summer breeding migrant to southeastern Australia (Morcombe, 2004). The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation (Morcombe, 2004). Open country may be used by the Rufous Fantail during migration (Morcombe, 2004). Potential occurrence in forest beyond subject site. | Potential |

EPBC Act listed migratory bird species comprise Migratory Marine Birds, Migratory Terrestrial Species, Migratory Wetland Species and Marine Species. Due to the absence of marine or wetland habitats only Migratory Terrestrial Species are included in the table.

# Appendix B: Flora species list

| Species Name | Common Name |
|---|---|
| *Acacia implexa* | Hickory |
| *Acacia irrorata* | Green Wattle |
| *Acacia longifolia* | Sydney Golden Wattle |
| *Acacia mearnsii* | Black Wattle |
| *Acacia parramattensis* | Parramatta Green Wattle |
| *Acacia ulicifolia* | Prickly Moses |
| *Acacia terminalis* | Sunshine Wattle |
| *Adiantum aethiopicum* | Common Maidenhair Fern |
| *Allocasuarina littoralis* | Black She-oak |
| *Angophora floribunda* | Rough-barked Apple |
| *Agapanthus sp.** | Agapanthus |
| *Banksia ericifolia* | Heath-leaved Banksia |
| *Banksia serrata* | Saw banksia |
| *Banksia spinulosa* | Hairpin Banksia |
| *Bidens pilosa** | Cobblers Pegs |
| *Billardiera scandens* | Apple Berry |
| *Bursaria spinosa* | Blackthorn |
| *Calochlaena dubia* | Rainbow Fern |
| *Callicoma serratifolia* | Black Wattle |
| *Centaurium erythraea** | Common Century |
| *Cissus hypoglauca* | Water Vine |
| *Corymbia gummifera* | Red Bloodwood |
| *Corymbia maculata* | Spotted Gum |
| *Daviesia ulicifolia* | Gorse Bitter Pea |
| *Dianella caerulea* | Flax Lilly |
| *Eleocharis sphacelata* | Tall Spike-rush |
| *Eucalyptus botryoides* | Bangalay |
| *Eucalyptus eugenioides* | Thin-leaved Stringybark |
| *Eucalyptus globoidea* | White Stringybark |
| *Eucalyptus paniculata* | Grey Ironbark |

| Species Name | Common Name |
|---|---|
| *Eucalyptus pilularis* | Blackbutt |
| *Eucalyptus resinifera* | Red Mahogany |
| *Exocarpos cupressiformis* | Native Cherry |
| *Gahnia clarkei* | Saw Sedge |
| *Goodenia heterophylla* | Variable-leaved Goodenia |
| *Hakea sericea* | Bushy Needlebush |
| *Hakea salicifolia* | Willow-leaved Hakea |
| *Hardenbergia violacea* | Twining Pea |
| *Hibbertia dentata* | Twining Guinea Flower |
| *Imperata cylindrica* | Blady Grass |
| *Kunzea ambigua* | White Kunzea |
| *Lambertia formosa* | Mountain Devil |
| *Leontodon taraxacoides** | Hairy Hawkbit |
| *Lepidosperma laterale* | Variable Sword-sedge |
| *Leptospermum polygalifolium* | Tantoon |
| *Leptospermum trinervium* | Flaky-barked Tea-tree |
| *Leucopogon juniperinus* | Prickly Bearded Heath |
| *Leucopogon lanceolatus* | Lance-leaved Beard-heath |
| *Lindsaea linearis* | Screw Fern |
| *Lomandra longifolia* | Spiny-headed Matt-rush |
| *Lomandra multiflora* | Many-flowered Mat-rush |
| *Lomandra obliqua* | |
| *Melaleuca linariifolia* | Snow in Summer |
| *Melaleuca styphelioides* | Prickly-leaved Tea Tree |
| *Patersonia sp* | Purple Flag |
| *Persoonia linearis* | Narrow-leaved Geebung |
| *Pimelea linifolia* | Rice Flower |
| *Pittosporum undulatum* | Sweet Pittosporum |
| *Plantain lanceolata** | Plantain |
| *Pteridium esculentum* | Bracken Fern |
| *Sannantha pluriflora* | Tall Baeckea |

| Species Name | Common Name |
|---|---|
| *Scaevola ramosissima* | Snake Flower |
| *Stylidium graminifolium* | Trigger Plant |
| *Syncarpia glomulifera* | Turpentine |
| *Taraxacum officinale** | Dandelion |
| *Zieria smithii* | Sandfly Zieria |

* Denotes introduced species

# Appendix C: Seven part tests

### EP&A Act Assessment of Significance (7-Part Test)

The Assessment of Significance (7-part test) is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the FM Act.

The assessment sets out 7 factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement (SIS). All factors must be considered and an overall conclusion made based on all factors in combination. An SIS is required if, through application of the 7-part test, an action is considered likely to have a significant impact on a threatened species, population or ecological community.

The assessment is undertaken for the species recorded or predicted to occur in the subject site in **Appendix A** as follows:

**Amphibians**

***Litoria aurea* Green and Golden Bell Frog**

***Part a)***

*In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*

A singe adult GGBF was observed in the main dam and a single adult GGBF was observed on the edge of a smaller dam in the study area (**Figure 5**). No calls (over five survey nights) or other evidence of breeding was recorded, although comprehensive surveys to determine the status of the species in the study area have not been undertaken. Habitat in the study area comprises the main dam which is dominated by emergent vegetation, and a much smaller dam with very little emergent vegetation and extensively disturbed by the resident horse. Other aquatic habitat is limited to the watercourse to the north of the study area, which does not appear to contain likely breeding habitat but could be used by the species for shelter and movement.

Within the locality, GGBF are known from several scattered locations, mostly from dams (**Figure 6**). The primary resources for GGBF in the vicinity of the study area and surrounds appear to be rural dams (which may include suitable breeding habitat) and drainage lines, which provide refuge sites and movement corridors. The species may also move through the landscape via other vegetated or cleared land, and use a range of shelter sites from dense groundcover and logs to residential gardens, structures and other materials. The vast majority of the subject site does not contain likely shelter sites or over-wintering habitat given that it is regularly slashed and largely devoid of dense vegetation, structure such as logs and rocks, or water sources. Sheltering habitat is essentially limited to the dams and areas of denser forest beyond to the subject site, particularly the riparian areas to the north.

The proposal incorporates a 40 m buffer around the main dam, the smaller dam, and the creek, so no aquatic or riparian habitat will be removed or directly impacted. The two dams will retain all current connectivity to the south (Tomerong State Forest) and to the west (large areas of intact forest), which will also maintain connectivity through to the creek to the north west.

The GGBF will also be able to move through open areas within the proposed large lot subdivision, which may eventually contain suitable aquatic habitat and refuges sites, although will also be subject to potential barriers and hazards, such as an increase in vehicles, roads, and domestic pets. The proposal will reduce potential movement and foraging habitat within the subject site and will increase the risk of frogs being killed by vehicles if frogs move through the subject site.

A range of mitigation measures could readily be employed to provide more secure shelter sites at the dams; to discourage or prevent frogs from moving into the subject site (exclusion fencing); and to encourage frogs to disperse in other directions, by providing frog appropriate habitat better linked to adjacent forest. A range of mitigation measures are expected to be refined and implemented as part of the proposal.

Thus the life cycle of the GGBF will not necessarily be affected by the proposal as all potential breeding and primary refuge habitat will be retained, and much of the existing connectivity. However there is potential for increased GGBF mortality if individuals move through the subject site, primarily from vehicles on proposed nearby roads.

Characteristics of the species, in particular irruptive breeding events during ideal conditions and the ability to travel long distances, suggest that the local population would not be confined to the study area, with movement between the study area and surrounding areas of suitable habitat most likely via farm dams or drainage lines. The study area is relatively well connected to the closest recent records of the species near Seasongood Road via the watercourse in the north of the subject land. The study area is also less than 4 km away from GGBF records in Tomerong to the south, Falls Creek to the north, and potentially Woollamia Nature Reserve to the East (this record location is only indicative). There are no major movement barriers between the study area and these surrounding records, and the surrounding landscape of low density rural properties (with numerous dams), large natural areas (including Woollamia Nature Reserve and Tomerong State Forest), and numerous drainage lines, is conducive to long distance GGBF movement during appropriate conditions. Thus the 'viable local population' is unlikely to be confined to the study area or subject land, and very likely to include proximate areas, such as those near Seasongood Road.

Considering the GGBF using the study area would be part of a larger population beyond the subject land; that the dams and all riparian habitat connectivity along the watercourse will be retained and buffered; and that measures to mitigate the effects of new roads and other hazards will be implemented as part of the development, it is unlikely that the proposal will have an adverse effect on the life cycle of the GGBF such that a viable local population of the species would be placed at the risk of extinction.

***Part b)***

*In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.*

No endangered populations are found in the study area.

***Part c)***

*In the case of an endangered ecological community, whether the action proposed:*

*(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*

*(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

No EECs are considered to occur in the study area. The maintenance and enhancement of the vegetated buffer to the watercourse in the north of the subject land together with standard development controls should ensure the proposal has no adverse impact to any coastal floodplain EECs that are known to occur further downstream.

The proposal will not adversely affect any ecological community such that its local occurrence is likely to be placed at risk of extinction.

***Part d)***

*In relation to the habitat of a threatened species, population or ecological community:*

*(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*

*(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*

*(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

i. Extent of Habitat Affected

No intact areas of native vegetation will be removed, as the proposal is located on cleared grazing land with scattered vegetation. Around 9.65 ha of this highly modified habitat will be removed or further modified by the proposal. All GGBF aquatic habitat would be retained and buffered by 40 m. Some generic potential GGBF foraging habitat and connectivity through the subject site would be removed or modified by the introduction of roads and other low density residential development. The unmitigated construction of roads in close proximity to the dams increases the risk of frog deaths by vehicle strike, although the 40 m buffer and a range mitigation measures would be implemented as part of the proposal to reduce this risk.

ii. Effects on Habitat Connectivity

As the proposal is located only within heavily disturbed areas on the property, the core areas of habitat connectivity (riparian connectivity to the north and connectivity through intact forest elsewhere) will not be affected. The proposal will reduce the extent of connectivity to the north and east of the two dams, currently provided through largely cleared grazing land. However as mentioned above, riparian habitat connectivity through the study area, providing refuge sites and aquatic resources for larger scale frog movements, will not be affected.

iii. Importance of Habitat to be Affected

The key habitats of importance to the GGBF on the property will be retained and buffered by 40 m, and linked through undeveloped areas of the property which will be managed for conservation and rezoned to E2. The reduction in connectivity through the subject site affects land predominantly cleared for grazing, with only generic habitat value for the GGBF.

The increase in hazards to the GGBF, such as increased vehicle movements in the subject site, would only affect individuals moving through the subject site. The subject site is already largely cleared, subject to property maintenance activities such as slashing of vegetation, and lies adjacent to the heavily used Jervis Bay Road, so some hazards to the GGBF are already present.

However, the protection of all important habitat for the GGBF, along with all areas of intact vegetation (more than half of the subject land), suggest that the areas affected by the proposal are not important to the long term survival of the GGBF in the locality.

***Part e)***

*Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

No areas in the subject land are listed as critical habitat.

***Part f)***

*Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

The draft *Recovery Plan for the Green and Golden Bell Frog* (DEC 2005) identifies the following as primary threatening processes to this species:

- Habitat loss, modification and disturbance.
- Fragmentation and isolation of habitat.
- Predation by introduced fish (predominantly Plague Minnow)
- Disease i.e. Chytridiomycosis.
- Pollution and water quality issues e.g. use of herbicides, urban runoff, erosion and sedimentation, etc.

The proposal is largely consistent with the objectives and actions of the plan as all habitats of potential importance will be retained, buffered, connected and protected. There will be some loss or restriction of generic foraging and / or movement habitat through the subject site, and additional disturbances in and around the subject site, but this will not directly affect any important habitat for the GGBF. Measures to mitigate these indirect impacts will occur as part of the proposal.

No relevant threat abatement plans have been prepared.

***Part g)***

*Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposal will involve the key threatening process Clearing of native vegetation, however all areas affected have been heavily cleared in the past, and no vegetation comprising GGBF habitat will be cleared. This key threatening process will have a negligible impact to the GGBF.

**Birds**

***Ninox strenua* Powerful Owl; *Tyto novaehollandiae* Masked Owl; Tyto tenebricosa Sooty Owl; *Calyptorhynchus lathami* Glossy Black-Cockatoo; *Callocephalon fimbriatum* Gang-gang Cockatoo; *Glossopsitta pusilla* Little lorikeet, *Lophoictinia isura* Square-tailed Kite, *Petroica boodang* Scarlet Robin**

***Part a)***

*In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*

Powerful Owl, Masked Owl and Sooty Owl

The subject site contains no nesting or roosting habitat for these species, and provides very marginal foraging habitat. The intact forest in the subject land provides better foraging habitat, which could be used by these species on occasions. No hollow-bearing trees in the study area are likely to suitable as nest trees, so breeding is very unlikely to be affected. Some trees along the creek provide potentially suitable Powerful Owl roost trees, but no evidence of roosting by these species was found during the surveys. Riparian roosting habitat would be protected within a 40 m buffer to the creek.

The loss of a small amount of very marginal foraging habitat from the subject site would not adversely affect these species, which forage over large home ranges. The forest on the northern and western fringes of the study area may be used for occasional foraging by these owls, but would not form a core part of a home range due to the small size and degraded nature of these habitats. The proposal would not affect the ability of these owls to continue to forage within the subject land.

The proposal would not place a viable local population of these species at risk of extinction.

Glossy Black-cockatoo and Gang-gang Cockatoo

The Glossy Black-cockatoo was recorded in the subject site via chewed cones underneath a single *A. littoralis tree*, which is likely to be removed. Other cone-bearing *A. littoralis* are present in the subject site, mainly along fence lines and edges of forest, although none showed evidence of Glossy Black-cockatoo feeding during the survey period, suggesting the subject site is not a particularly important foraging resource. *A. littoralis* is also prevalent throughout the subject land and surrounding vegetated areas. The removal of one known feed tree, and a small amount of potential feed trees, will not substantially affect the species, which moves through a large home range.

The Gang-gang Cockatoo could also forage occasionally in the study area and subject site, given the presence of generic seed resources of eucalypts and wattles etc. However the removal of a relatively small amount of these generic resources from the subject site will not adversely affect this wide ranging species.

Both species nest in tree hollows, and no hollow-bearing trees occur in the subject site. Only two sizable hollow-bearing trees were recorded from the study area, and these will be retained within surrounding forest. Additional HBTs are known to occur beyond the study area. Nesting is unlikely to occur in the study area and unlikely to be disrupted by the proposal.

The proposal would not place a viable local population of these species at risk of extinction.

Square-tailed Kite,

The study area may provide foraging habitat for the Square-tailed Kite, but no breeding habitat is likely and no evidence of raptor nests was observed. The removal of a very small area of disturbed and generic foraging habitat, considering the immense foraging range of the species and large extent of suitable foraging habitat in the locality, would be a negligible impact to this species. The retained forest throughout the subject land would remain accessible to the Square-tailed Kite for foraging.

The proposal would not place a viable local population of this species at risk of extinction.

Little Lorikeet

The Little Lorikeet is likely to forage on flowering eucalypts throughout the study area on occasions, during nomadic movements through the area or as part of a large home range. It is possible that suitable nesting hollows occur in the more mature forest on the subject land, but no nesting habitat is likely within the heavily disturbed subject site. The potential for breeding elsewhere on the property would not be affected by the proposal. The removal of generic and highly disturbed foraging habitat from the subject site is a negligible impact for this species.

The proposal would not place a viable local population of this species at risk of extinction.

Scarlet Robin

The Scarlet Robin may occur throughout the study area on occasions as a non-breeding visitor to the site. The removal of generic, marginal and occasionally used foraging habitat from the subject site is not likely to adversely affect this species. Access to retained forest habitat in the subject land would not be affected by the proposal.

The proposal would not place a viable local population of this species at risk of extinction.

***Part b)***

*In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.*

No endangered populations are found in the study area.

***Part c)***

*In the case of an endangered ecological community, whether the action proposed:*

*(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*

*(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable.

***Part d)***

*In relation to the habitat of a threatened species, population or ecological community:*

> *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
>
> *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
>
> *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

i. Extent of Habitat Affected

The proposal will remove scattered regrowth trees and other vegetation from 9.65 ha of previously cleared land. Approximately 15 ha of predominantly intact forest would be retained within the subject land.

The proposed has the potential to indirectly affect adjacent areas of forest by way of altered drainage, sedimentation, increased nutrients and weed incursion, and increased noise, lighting and predation by domestic animals. However the proposed perimeter roads define the extent of individual lots to control potential encroachment, and most of the area within 50 m of the subject site has been previously cleared or disturbed.

ii. Effects on Habitat Connectivity

The proposal is located within previously cleared areas, adjacent to Jervis Bay Road, and provides low levels of habitat connectivity. Stepping-stone canopy connectivity through the subject site for highly mobile species, will be reduced or removed, although canopy connectivity will be retained elsewhere within the property. Riparian habitat connectivity through the study area will not be affected. The proposal will have only minor effects on connectivity.

iii. Importance of Habitat to be Affected

The proposal will remove a highly modified, relatively small and marginal area of generic foraging habitat for these species. All intact forest habitats in the subject land would be retained. Higher quality habitat is widely available in surrounding areas. The proposal will have no likely impact to breeding or other important resources and negligible impact to habitat connectivity for these species.

The proposal will not affect any habitat that is important for the long term survival of these species in the locality.

***Part e)***

*Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

No areas listed as critical habitat occur in the study area, therefore the action proposed will not adversely affect critical habitat.

***Part f)***

*Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

A recovery plan has been produced for Large Forest Owls (DEC 2006). The objectives and actions of these plans have been reviewed and the proposal is consistent with these plans as the proposal has been designed around predominantly cleared land and will not remove or affect important habitat for these species.

No relevant threat abatement plans have been prepared.

***Part g)***

*Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Clearing of native vegetation

The proposal will remove regrowth native vegetation, and constitutes the Key Threatening Process: '*Clearing of native vegetation'*.

However the contribution to this key threatening process is considered to be minor as all of the area affected has been cleared and used for grazing, and all of the vegetation affected is regrowth.

Invasion of native plant communities by exotic perennial grasses

The proposal may potentially increase the impact of the key threatening process: '*Invasion of native plant communities by exotic perennial grasses'.*

While exotic grasses are already present in most of the previously cleared areas, the proposal has the potential to result in the further establishment and/or spread of exotic perennial grasses into adjoining areas of vegetation. However, this process can be readily controlled by not planting exotic perennial grasses beyond the footprint of the proposal and monitoring the edges of the residual lot to allow identification and control of all invasive weed species.

**Mammals**

*Petaurus australis* Yellow-bellied Glider

*Pteropus poliocephalus* Grey-headed Flying-fox

*Falsistrellus tasmaniensis* Eastern False Pipistrelle
*Mormopterus norfolkensis* East Coast Freetail Bat
*Miniopterus schreibersii oceanensis* Eastern Bentwing Bat
*Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
*Scoteanax rueppellii* Greater Broad-nosed Bat;
*Myotis macropus* Southern Myotis

***Part a)***

*In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*

Yellow-bellied Glider

The Yellow-bellied Glider is known to occur in the surrounding landscape, but has not been recorded from the study area. Suitable habitat occurs on the vegetated fringes of the study area, but habitat the subject site is very restricted and marginal. It is not likely to occur regularly, if at all, in the subject site given the extent of clearing, low density of trees, lack of tree hollows and lack of connectivity through the subject site. Occurrence would be most likely limited to occasional foraging on the fringes that connect to intact forest. The subject site does not provide any denning resources or important foraging habitat or connectivity.

The proposal would not have an adverse effect on the life cycle of the Yellow-bellied Glider such that a viable local population of the species would be placed at risk of extinction.

Grey-headed Flying-fox

The Grey-headed Flying-fox is likely to forage in the study area during seasonal eucalypt flowering periods, as part of a huge foraging area. There are no roosting habitat in the area so sheltering and breeding will not be affected. The amount of potential foraging habitat to be removed is relatively small, as essentially all trees in the subject site are regrowth after clearing (or have been planted along the driveway). Extensive areas of foraging resources will be retained in the subject land.

The proposal would not have an adverse effect on the life cycle of this species such that a viable local population would be placed at risk of extinction.

Microchiropteran bats (Eastern Bentwing Bat, Eastern False Pipistrelle, East Coast Freetail Bat, Greater Broad-nosed Bat, Southern Myotis, Yellow-bellied Sheathtail-bat)

The study area provides suitable foraging habitats and would provide some general invertebrate foraging resources for threatened microchiropteran bat species around vegetated areas. Potentially also lower quality foraging habitat in the dams and creek for the Southern Myotis. There are potential tree hollow roosts in the more heavily forested parts of the study area, but none in the subject site. The generic foraging potential in the subject site is heavily disturbed from previous clearing, and relates to a relatively small and unimportant resource for these species.

The proposal will not impact roosting or breeding resources for these species or important areas of foraging resources. Connectivity will not be affected by the proposal.

The proposal will not have an adverse effect on the life cycle of these bat species such that a viable local population of any species would be placed at risk of extinction.

***Part b)***

*In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.*

No endangered populations are found in the study area.

***Part c)***

*In the case of an endangered ecological community, whether the action proposed:*

*(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*

*(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable.

***Part d)***

*In relation to the habitat of a threatened species, population or ecological community:*

*(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*

*(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*

*(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

i. Extent of Habitat Affected

The proposal will remove scattered regrowth trees and other vegetation from 9.65 ha of previously cleared land. Approximately 15 ha of predominantly intact forest would be retained within the subject land.

The proposed has the potential to indirectly affect adjacent areas of forest by way of altered drainage, sedimentation, increased nutrients and weed incursion, and increased noise, lighting and predation by domestic animals. However the proposed perimeter roads define the extent of individual lots to control potential encroachment, and most of the area within 50 m of the subject site has been previously cleared or disturbed.

ii. Effects on Habitat Connectivity

The proposal is located within previously cleared areas, adjacent to Jervis Bay Road, and provides low levels of habitat connectivity. Stepping-stone canopy connectivity through the subject site for highly mobile species, will be reduced or removed, although canopy connectivity will be retained elsewhere within the property. Riparian habitat connectivity through the study area will not be affected. The proposal will have only minor effects on connectivity.

iii. Importance of Habitat to be Affected

The proposal will remove a highly modified, relatively small and marginal area of generic foraging habitat for these species. All intact forest habitats in the subject land would be retained. Higher quality habitat is widely available in surrounding areas. The proposal will have no likely impact to breeding, sheltering or other important resources and negligible impact to habitat connectivity for these species.

The proposal will not affect any habitat that is important for the long term survival of these species in the locality.

***Part e)***

*Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

No areas listed as critical habitat occur in the study area, therefore the action proposed will not adversely affect critical habitat.

***Part f)***

*Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

A recovery plan has been produced for the Yellow-bellied Glider (NPWS 2003) and draft recovery plan for the Grey-headed Flying-fox (DECCW 2009). The objectives and actions of these plans have been reviewed and the proposal is generally consistent with these plans as all intact habitat on the property will be retained and only small amounts of generic foraging habitat would be affected. No important resources for these species will be removed.

No relevant threat abatement plans have been prepared.

***Part g)***

*Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

Clearing of native vegetation

The proposal will remove regrowth native vegetation, and constitutes the Key Threatening Process: '*Clearing of native vegetation'*.

However the contribution to this key threatening process is considered to be minor as all of the area affected has been cleared and used for grazing, and all of the vegetation affected is regrowth.

Invasion of native plant communities by exotic perennial grasses

The proposal may potentially increase the impact of the key threatening process: '*Invasion of native plant communities by exotic perennial grasses'.*

While exotic grasses are already present in most of the previously cleared areas, the proposal has the potential to result in the further establishment and/or spread of exotic perennial grasses into adjoining areas of vegetation. However, this process can be readily controlled by not planting exotic perennial grasses beyond the footprint of the proposal and monitoring the edges of the residual lot to allow identification and control of all invasive weed species.

# Appendix D: EPBC Act - MNES assessment of significance

### EPBC Act - Significant Impact Criteria on Matters of National Environmental Significance

The EPBC Act Administrative Guidelines on Significance set out 'Significant Impact Criteria' that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities
- Listed migratory species
- Wetlands of International Importance
- The Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Nuclear actions
- Great Barrier Reef.

Specific 'Significant Impact Criteria' are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act.

The study area contains suitable habitat for the Vulnerable Green and Golden Bell Frog and Grey-headed Flying-Fox, and three migratory birds: Black-faced Monarch; Rufous Fantail; and Satin Flycatcher.

The relevant Significant Impact Criteria have been applied to these threatened and migratory species to determine the significance of impact of the project as follows:

| Matters To Be Addressed | Impact (Commonwealth Legislation) |
|---|---|
| (a) any environmental impact on a World Heritage Property; | No. The proposal does not impact on a World Heritage Property. |
| (b) any environmental impact on Wetlands of International Importance; | No. The proposal will not affect any part of a Ramsar wetland. |
| (c) any impact on Commonwealth Listed Critically Endangered or Endangered Species; | No. The study area does not contain potential or known habitat for these species. |

| Matters To Be Addressed | Impact (Commonwealth Legislation) |
|---|---|
| (d) any impact on Commonwealth Listed vulnerable Species; | Yes. The study area contains provides suitable habitat for the Grey-headed Flying-fox, and GGBF.<br>The significant impact criteria are assessed below:<br>An important population of Grey-headed Flying-fox is considered those roosting seasonally in the nearest major camp i.e. a maternity colony. An important population of the GGBF is considered to be any population. A population is defined as individuals within 10 km of each other, where suitable connectivity is present (DEWHA 2009). There are several records of the species within 5 km (**Figure 6**), which would form part of the same population as the frogs in the study area.<br><br>*a. lead to a long-term decrease in the size of an important population of a species,*<br>The proposal will not adverse effect the population size of the Grey-headed Flying-fox as no breeding or roosting habitat for this species will be affected; and only a relatively small area of highly disturbed foraging habitat will be removed. The proposal does not have the capability of leading to a long term decrease of an important population.<br><br>The proposal is not likely to lead to a long term decrease in the size of the GGBF population given that all primary habitat and connectivity for the GGBF will be retained and buffered from the development. Potential breeding habitat would be retained, as would the ability for the frogs to disperse through the broader landscape. The proposal will introduce additional hazards for any GGBF moving through the development area, but more sheltered movement corridors, along riparian areas and through intact forest, would remain available to individuals moving through the area. The implementation of mitigation measures would also reduce potential adverse indirect impacts within the development area.<br><br>*b. reduce the area of occupancy of an important population*<br>The proposal will affect only a small amount of seasonal foraging habitat in the context of that available locally for the Grey-headed Flying-fox, and as such it will not significantly reduce the area of occupancy of an important population for this species.<br><br>The proposal will retain all aquatic, riparian and intact forest habitats for the GGBF, with development centered on previously cleared land, containing no important habitats for the GGBF. While the GGBF could currently utilise the modified habitats within the development footprint for foraging or movement under ideal conditions, it contains no potential breeding or long-term refuge habitat. While the proposal will introduce additional hazards for the GGBF, it will not prevent the GGBF from moving through the development area once it is established. So with all important GGBF habitats being retained, and with no substantial barriers to movement, any reduction in the area of occupancy associated with the proposal is considered relatively minor.<br><br>*c. fragment an existing important population into two or more populations*<br>The proposal will not fragment an existing important population of the Grey-headed |

| Matters To Be Addressed | Impact (Commonwealth Legislation) |
|---|---|
| | Flying-fox as it will affect only a relatively small amount of seasonal foraging habitat; and the species is capable of flying interstate depending on seasonal flowering.<br><br>The proposal will not fragment the GGBF population into two or more populations as connectivity within the population will be maintained. While the proposal will reduce some connectivity through the subject site, it will not prevent the species moving through the subject site. Elsewhere on Lot 3, all riparian and intact forest habitat will be retained to ensure connectivity within the property and with adjoining properties.<br><br>*d. adversely affect habitat critical to the survival of a species*<br>No habitat within the study area is considered to be critical to the survival of an important population of Grey-headed Flying-fox, for reasons detailed above.<br><br>As all important habitat for the GGBF will be retained, along with most of the habitat connectivity, and as the development is located on previously cleared grazing land, the proposal is not considered to adversely affect habitat critical to the survival of this species.<br><br>*e. disrupt the breeding cycle of an important population*<br>The proposal will not affect the breeding cycle for Grey-headed Flying-fox as no breeding habitat occurs within the study area or adjacent areas, and no important foraging habitat will be affected.<br><br>While the breeding status of the GGBF in the study area is not known, all potential breeding habitat for the GGBF will be retained, along with all riparian connectivity. The proposal will introduce additional hazards to potential dispersal areas through currently cleared land, but will not prevent frogs dispersing through the subdivision area. The proposal will not substantially disrupt the breeding cycle of an important population.<br><br>*f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*<br>The proposal would not impact the Grey-headed Flying-fox to the extent that the species is likely to decline, as it will affect only a marginal amount of seasonal foraging habitat. Extensive foraging resources would remain available within the study area and the locality within its local range.<br><br>With all primary habitat and connectivity for the GGBF retained, and mitigation measures implemented, the proposal will not result in changes to habitat such that the species is likely to decline.<br><br>*g. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat* |

| Matters To Be Addressed | Impact (Commonwealth Legislation) |
|---|---|
| | The proposal is not likely to result in invasive species becoming established.<br><br>*h. introduce disease that may cause the species to decline*<br>The proposal is not likely to introduce any diseases that will affect these species.<br><br>*j. interferes substantially with the recovery of the species.*<br>The proposal will only affect a minor amount of occasional foraging habitat so the recovery of the Grey-headed Flying-fox will not be substantially impacted.<br><br>With all primary habitat and connectivity for the GGBF retained, and mitigation measures implemented, the proposal will not interfere substantially with the recovery of the species. |
| (e) any environmental impact on Commonwealth Listed Migratory Species; | Yes. The study area provides habitat for migratory species including the Black-faced Monarch, Rufous Fantail, Satin Flycatcher.<br>There is marginal to no suitable habitat for these species in the subject site, which they would only use on rare occasions at best, however adjacent riparian areas provide suitable habitat (potentially breeding habitat) for the Black-faced Monarch and Rufous Fantail. The Satin Flycatcher may forage in more mature forest habitats on occasions, but would not breed locally.<br>The significant impact criteria in terms of migratory species are discussed below:<br>*a. substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*<br>No important habitat for these species will be adversely affected by the proposal – all suitable and better quality habitats would be retained.<br><br>*b. result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or*<br>The proposal is unlikely to introduce any invasive species that are likely to become established and harmful to migratory species.<br><br>*c. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.*<br>The proposal does not directly impact any breeding habitat. Potential breeding habitat along the creek would be retained within a 40 m vegetated buffer, and indirect impacts are not likely to substantially affect this habitat. |
| (f) does any part of the Proposal involve a Nuclear Action; | No. The project does not include a Nuclear Action. |

| Matters To Be Addressed | Impact (Commonwealth Legislation) |
|---|---|
| (g) any environmental impact on a Commonwealth Marine Area; | No. There are no Commonwealth Marine Areas within the study area. |
| (h) any impact on Commonwealth lands | No. The project does not directly or indirectly affect Commonwealth land. |

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