Attachment 3: Proponent's Flora and Fauna Assessment

ANNEXURE 2

Flora and Fauna Assessment

prepared by

Eco Logical Australia

Lot 3 DP 846470
48 Jervis Bay Road, Falls Creek

Flora and Fauna Assessment

48 Jervis Bay Road

Falls Creek, NSW

Prepared for
Theo Pasialis

23 November 2017

DOCUMENT TRACKING

Item	Detail
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Project Number	8525
Project Manager	David Coombes T 02 4333 5555 1/51 Owen Street, Huskisson NSW 2540
Prepared by	David Coombes
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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 12 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 13 lot community subdivision, including 12 large (0.56 ha – 1.54 ha) rural residential allotments within previously cleared parts of the subject land, and a residual 13.51 ha community property allotment which contains intact native forest (**Figure 2**). A proposed perimeter road encompasses 11 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 onsite.

The subdivision design has considered environmental features of the property and will avoid direct disturbance to intact vegetation or higher value habitats. 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 additional clearing of intact native forest will be required.

A minimum 30 m vegetated riparian buffer to the creek will be maintained, and any currently cleared areas within the 30 m riparian buffer will be regenerated. The main dam in the south of the property will be retained for its frog habitat values (**Figure 3**).

1.2 Subject site, study area and locality

The subject site for the purposes of this report comprises the proposed development footprint (proposed lots 2-12 and perimeter roads and fire trail). The subject site is bounded by predominantly cleared land to the north; Jervis Bay Road to the east; an unsealed road (right of way) and Tomerong State Forest to the south; and predominantly intact forest to the west.

The study area is for the purposes of this report is an area up to 50m beyond the subject site that could be affected by indirect impacts of the development.

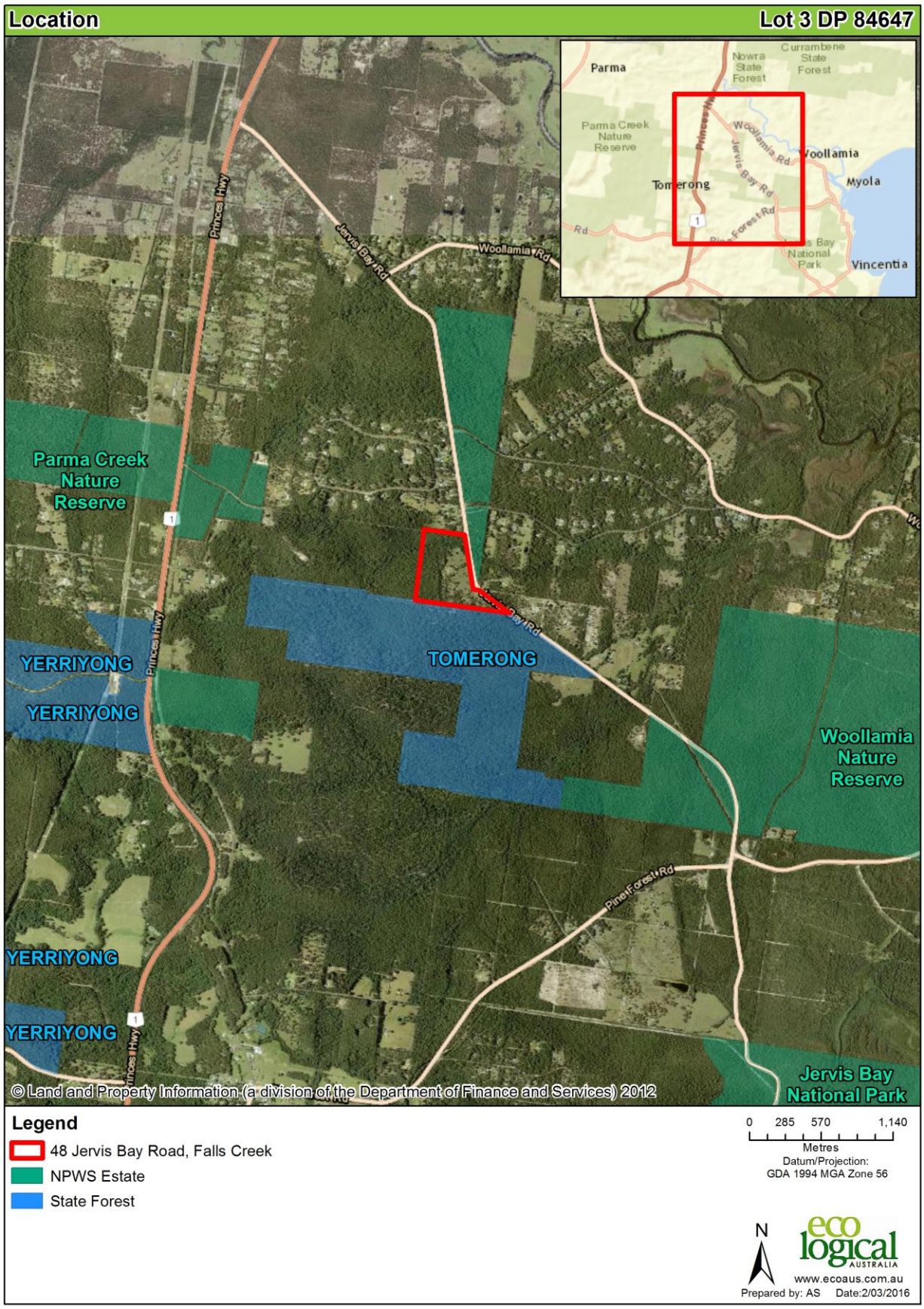

Figure 1: Location of subject land

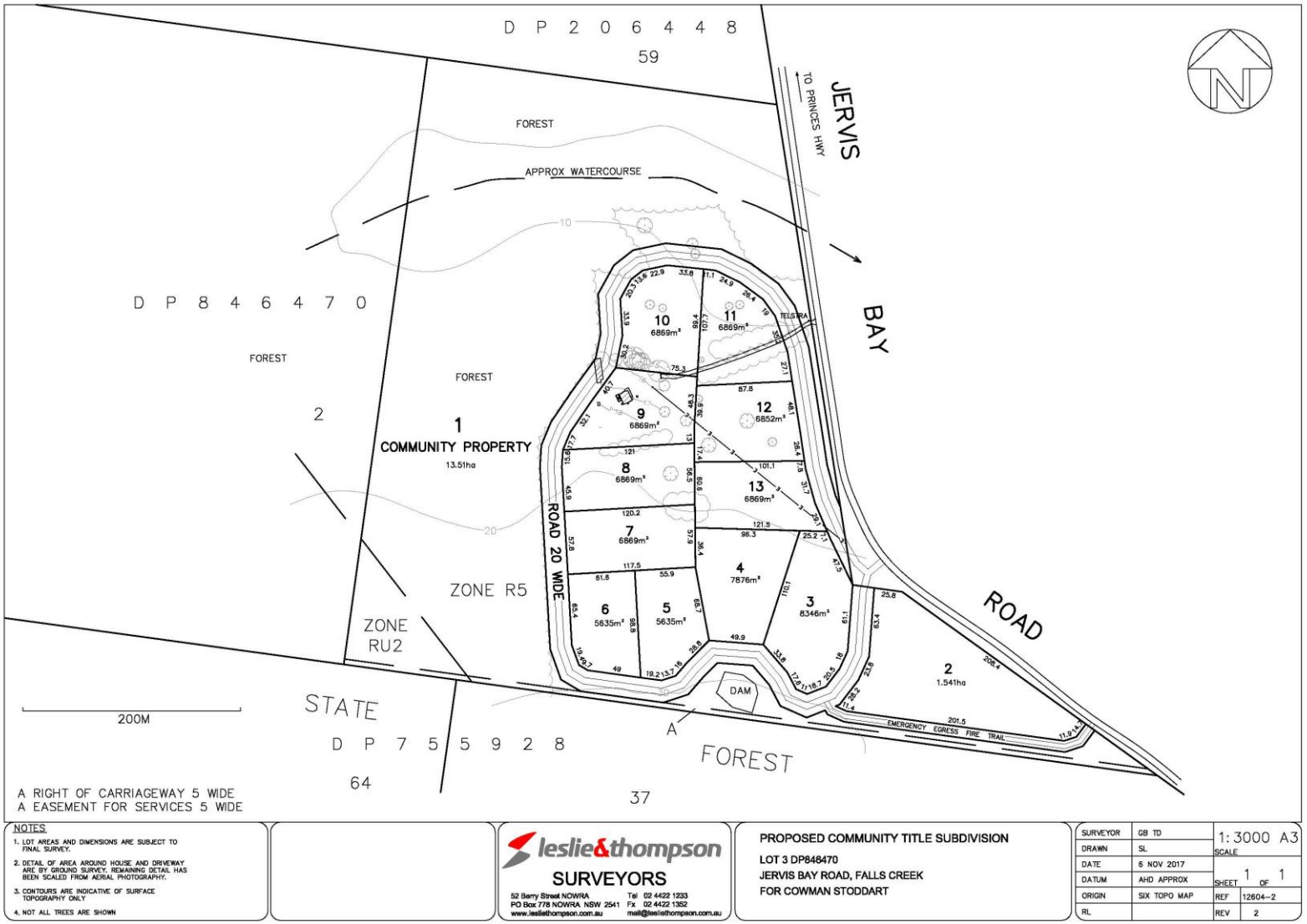

Figure 2: Site plan

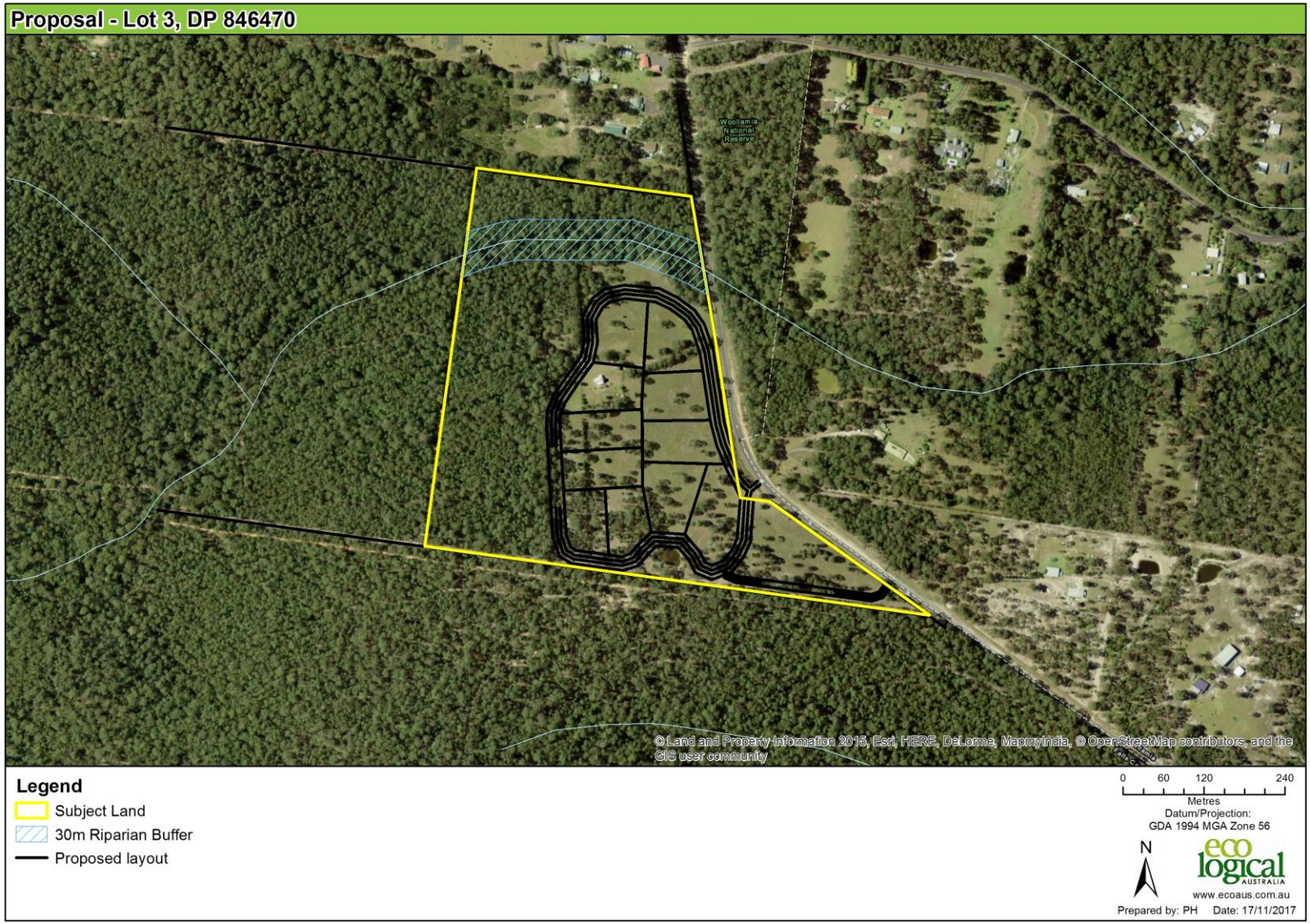

Figure 3: The proposal

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 groundcovers occur in most cleared areas, along with natives. A range of exotic landscaped 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 logged and parts are regenerating from previous clearing.

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 study area has not been mapped as containing Quaternary sediments, 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* as it applies to a development application which will be lodged with Council before 25 November 2017.

The relevant Commonwealth and State Acts and policies assessed in this report are as follows (Error! Reference source not found.).

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 component for Development Application to Shoalhaven City Council (SSC) and requires consideration under the EP&A Act 1979. Assessments of significance for impacts to threatened species identified during this proposal have been prepared in accordance with s5A of the Act.

Name	Relevance to the project
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.
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.
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.
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 areas is not affected by the proposal. The subject 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, requiring a minimum 30m vegetated buffer that 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 November 2017.

d) Searching the Atlas of NSW Wildlife (BioNet) for threatened flora and threatened fauna species recorded in the locality, accessed November 2017.

e) Searching the EPBC Act Protected Matters Search Tool in the locality of the subject site, accessed November 2017.

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 elsewhere in the St. Georges Bay region. Surveys focused on forest edge habitats: cleared areas within about 50 m of intact vegetation along the northern and western sides of the subject site, 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.* Parallel transects about 5 m apart were searched for flowers or leaf rosettes of *P. ventricosa*.

Limitations

The floristic audit undertaken recorded dominant and characteristic species to enable the vegetation community to be described 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 east 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 1**).

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, to gauge if any of these species were currently inhabiting the subject land.

Following call playback, spotlighting transects were undertaken throughout the subject site for between 30 minutes, using a 1,100 lumen hand-held flashlight to observe nocturnal mammals and birds.

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.

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

Date	Method	Effort	Target species
	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) prev 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

Dominant canopy species within the lower elevation (northern and eastern) parts of the subject site were *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. Higher sections of the site (south and south west) were dominated by *Corymbia maculata* (Spotted Gum), *E. paniculata* (Grey Ironbark).and *E. eugenioides*. A distinct change in canopy species is evident with increasing elevation within the subject site

Intact vegetation in the northern half 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 southern half 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).

While vegetation in the subject site has been largely cleared, results of flora surveys in the subject site were generally consistent with the broader biometric vegetation community mapping above.

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. The likelihood of threatened flora occurring in the subject site is considered to be low.

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. Soil landscapes in the subject land do not contain alluvial soils required for coastal floodplain TECs such as Swamp Sclerophyll Forest, and the closest quaternary soils are mapped as occurring about 1.3km downstream of the subject land.

3.4 Habitats and connectivity

Habitats within the heavily disturbed subject site are generally distinct from habitats in the generally intact residual land (proposed community title Lot 1):

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.
- Aquatic habitats provided by the main farm 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.
- 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.
- 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 as a Category 2 watercourse (terrestrial and aquatic habitat), requiring a 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 4**).

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 listed migratory species *Monarcha melanopsis* (Black-faced Monarch), which was regularly heard calling from 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. *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 list

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

Category	Common Name	Scientific Name	Detection Method
	Musk Lorikeet	*Glossopsitta concinna*	Call recognition
	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 Green and Golden Bell Frog was observed

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

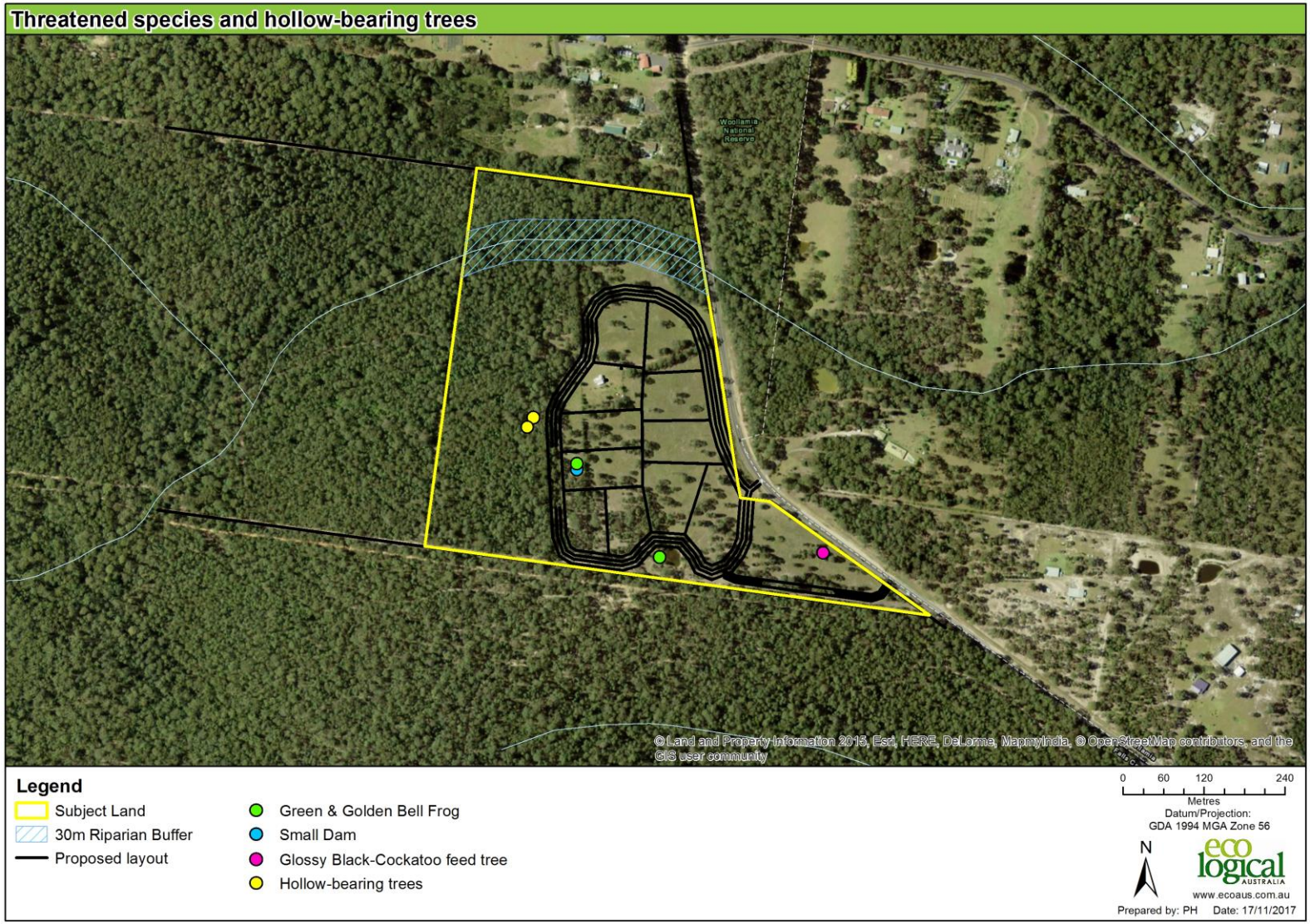

Figure 4: Threatened species and habitat features

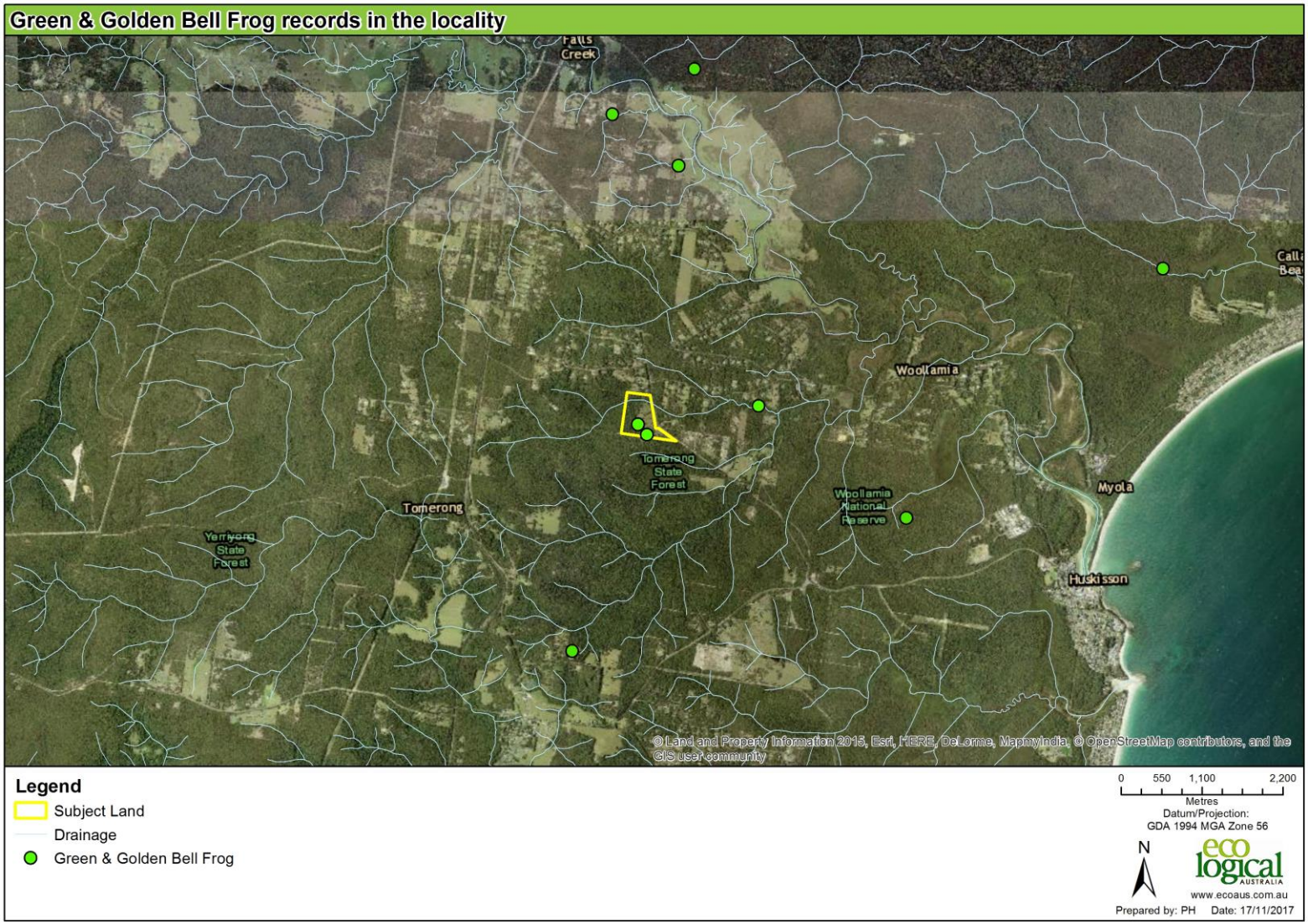

Figure 5: Green and Golden Bell Frog locality records

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 remnant trees and patches or regrowth vegetation through the subject site of 11.5 ha.
- Removal of negligible amounts of heavily disturbed 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 fauna.
- 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 increased 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 largely cleared grazing land. The adjoining vegetation communities are relatively widespread in the region.

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 can potentially be retained within a large lot. No hollow-bearing trees or other potentially important shelter resources will be removed.

Canopy connectivity through the subject site will be further reduced, but riparian and intact forest connectivity through the property will not be affected by the proposal. Connectivity will be reduced in part around the dams used by the GGBF, although mitigation measures will be developed to minimise this impact to the frogs.

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 Species

As a result of field survey, habitat analysis and database searches (**Appendix A**), the following species were found to occur in the study area or considered to have potential to occur in the study area (**Table 4**).

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

Scientific Name	Common Name	TSC Act	EPBC Act	Occurrence
Litoria aurea	Green and Golden Bell Frog	E	V	Known
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
Lophoictinia isura	Square-tailed Kite	V	—	Potential
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	—	Potential
Mormopterus norfolkensis	East Coast Freetail Bat	V	—	Potential
Ninox strenua	Powerful Owl	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
Hirundapus caudacutus	White-throated Needletail	—	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 – other threatened flora are considered unlikely to occur in the heavily modified subject site. Any possible *M. biconvexa* habitat along the creek would be retained and buffered. 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, threatened fauna in **Table 4** are only likely to occur in the subject site infrequently to forage on limited and generic resources. No breeding, sheltering or important foraging resources are present in the subject site. These species are assessed further in **Appendix C** (7 part test).

The GGBF is the only threatened fauna species likely to shelter in the subject site, and potentially breed there. The GGBF is assessed further in **Appendix C** (7 part test).

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.	While the proposal will retain both dams where the Green and Golden Bell Frog has been recorded, this habitat has the potential to become degraded by a range of immediately adjacent land uses associated with the proposal.
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, the areas around the dams could be used for Green and Golden Bell Frog dispersal or other movement. The proposed road adjacent to the dams and proposed nearby dwellings meet the criteria for removal or degradation of terrestrial habitat with 200m of 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.	Riparian vegetation and other vegetated corridors would be retained by the proposal. However the proposed perimeter road and other development with the subject site brakes the continuity of modified vegetation between the two dams, and between the dams and the creek.

The outcome of the above assessment, particularly Criteria 2, is that a significant impact is possible, and a Referral is required under the EPBC Act.

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 observed 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 and communities 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 or migratory species with potential to occur on the site (**Appendix C**). With the exception of the Green and Golden Bell Frog, the proposed development is unlikely to have a significant impact on threatened or migratory species. Proposed development adjacent to Green and Golden Bell Frog habitat triggers the requirement for a Referral under the EPBC Act.

5 Conclusions

This report describes the biological environment of Lot 3 DP 846470 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 and sensitive 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 complete 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 apart from the Green and Golden Bell Frog, the proposal is unlikely to have a significant impact on matters of National Environmental Significance. The proposed removal or modification of habitat adjacent to dams used by the Green and Golden Bell Frog triggers the requirement to refer the proposal to the Commonwealth Minister. Therefore a referral is recommended as part of the EPBC Act approval process.

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 for the Green and Golden Bell Frog on the property should be prepared to guide the clearing and construction process and longer term protection of Green and Golden Bell Frog habitat. The plan should address issues including temporary and permanent fencing of the main dam, access, road design adjacent to the main dam, enhancement of frog habitat and connectivity to adjoining forest, pre-clearing surveys, hygiene protocols, monitoring and reporting.

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

3. 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.

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. External residential and street lighting is to avoid light spill into areas of retained vegetation.

6. Any currently cleared areas that fall within the 30 m riparian buffer shall be revegetated.

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 (Source: Office of Environment and Heritage and Department of Sustainability Environment Water Population and Communities)

Flora Species	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Caladenia tessellata 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 Lack of local records
Cryptostylis hunteriana 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*). Study area not preferred habitat and no Cryptostylis stems observed during surveys in November.	Unlikely No preferred habitat
Cynanchum elegans 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 (DECC 2007). 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 (DECC 2007).	Unlikely No preferred habitat or local records
Eucalyptus langleyi 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
Genoplesium baueri Yellow Gnat-orchid	E	E	Known from coastal areas from northern Sydney south to the Shoalhaven district. Grows in shrubby woodland and open forest on shallow sandy soils. Preferred habitat is not present in the heavily modified subject site.	Unlikely in subject site

Flora Species	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Melaleuca biconvexa 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 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 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) 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
Pterostylis ventricosa	CE	-	This Greenhood orchid is known from only a small number of 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

Flora Species	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Rhizanthella slateri 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
Syzygium paniculatum 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 subject site. Recorded within 3 km of subject land, but natural habitat on subject land is marginal and would be restricted to riparian areas beyond the subject site.	Unlikely
Thesium australe 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
Triplarina nowraensis 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 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).	Unlikely
Litoria aurea 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 Recorded in dams
Litoria littlejohni 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

Reptiles				
Hoplocephalus bungaroides 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 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
Botaurus poiciloptilus Australasian Bittern	E	E	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant & Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson & Day 1999).	Unlikely
Callocephalon fimbriatum 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 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

Dasyornis brachypterus 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 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 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).	Unlikely
Hieraaetus morphnoides 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.	Unlikely
Lathamus discolor 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
Lophoictinia isura 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 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 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
Rostratula australis 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
Nocturnal Birds				
Ninox connivens 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 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
Tyto novaehollandiae 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 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

Mammals (excluding bats)				
Cercartetus nanus 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.	Unlikely in subject site
Dasyurus maculatus 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.	Unlikely in subject site
Isoodon obesulus 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.	Unlikely
Petauroides volans 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.	Unlikely in subject site
Petaurus australis 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 canopy removal.	Unlikely in subject site

Petrogale penicillata 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 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 Lack of preferred habitat and local records
Potorous tridactylus *Potorous tridactylus tridactylus* 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.	Unlikely in subject site
Pseudomys novaehollandiae 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)	Unlikely

Sminthopsis leucopus 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 adjoining vegetated areas of the subject land due to dense understory regrowth.	Unlikely
Mammals (Bats)				
Chalinolobus dwyeri 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 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
Miniopterus schreibersii oceanensis 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 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 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 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 *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.	Unlikely
Hirundapus caudacutus 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).	Potential
Merops ornatus 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 Black-faced Monarch		M	Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984).	Yes

Monarcha trivirgatus Spectacled Monarch		M	Wet forests, mangroves (Simpson and Day 1999).	Unlikely
Myiagra cyanoleuca Satin Flycatcher		M	Wetter, denser forest, often at high elevations (Simpson & Day 2004).	Potential
Rhipidura rufifrons 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

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
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

Species Name	Common Name
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
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 predicted to occur in the study area in Appendix A as follows:

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

Green and Golden Bell Frog

A singe adult GGBF was observed in the main dam and a single adult on the edge of a smaller dam in the study area (**Figure 4**). 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, 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 5**). 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 and artificial structures. 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, logs and rocks. Sheltering habitat is essentially limited to the dams and areas of denser forest adjacent to the subject site, particularly the riparian areas to the north.

The proposal will avoid and retain the main dam and can retain the smaller dam within proposed Lot 7, so no known aquatic habitat (potential breeding habitat) will not be removed. The main dam will be retained outside of the development area, retaining connectivity to forested public land to the south (Tomerong State Forest), while the smaller dam can be retained within the subject site, but close to retained native vegetation on the western edge, accessible via the proposed external road. 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 and roads. The proposal will reduce potential movement and foraging habitat close to each dam and increase the risk of frogs being killed on nearby roads.

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 from the main dam to the proposed adjacent road; and to encourage frogs to disperse away from (rather than towards) the subject site 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 will not necessarily be affected by the proposal as all potential breeding habitat will be retained. However there is potential for increased GGBF mortality beyond the aquatic dam habitat, primarily from vehicles on adjacent 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 two closest (less than 1 km and 1.5 km respectively) and 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 (record location 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 that measures to mitigate the effects of new roads 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.

Other species

No potential breeding habitat is present in the subject site for the other species assessed. For these species, the subject site contains generic and mostly marginal foraging habitat that could be used on occasions. The proposal would not effect on the life cycle of these species such that a viable local population is likely to 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 listed in *Schedule 1 - Part 2* of the *Threatened Species Conservation Act 1995*, 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 EECs further downstream.

The proposal is unlikely to 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 mature and regrowth trees. Up to 11.5 ha of this highly modified habitat will be removed or further modified by the proposal.

The proposed perimeter road and subdivision in general has the potential to indirectly affect adjacent intact forest habitats by way of altered drainage, sedimentation, increased nutrients and weed incursion.

While the two GGBF dams and all riparian connectivity would be retained, some 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 close to the dams increases the risk of frog deaths by vehicle strike, although a range of design and mitigation measures would be implemented as part of the proposal to reduce this risk.

ii. Effects on Habitat Connectivity

As the proposal located only within heavily disturbed area on the property, the core areas of habitat connectivity (riparian connectivity to the north and connectivity through intact forest elsewhere) will not be affected. Through the subject site, stepping-stone canopy connectivity for highly mobile species, will be reduced or removed.

The proposal will reduce the extent of connectivity around the two dams for the GGBF, currently provided through largely cleared grazing land. However as mentioned above, riparian habitat connectivity through the study area will not be affected, which provides refuge sites and aquatic resources for larger scale frog movements.

iii. Importance of Habitat to be Affected

The key habitats of importance to the GGBF on the property will be retained, although adjacent areas will be modified by the proposal. The modifications would reduce the integrity of GGBF habitat at the site, but are a small component of habitat available to the population in the locality, and would not threatened the term survival of the species in the locality.

For other species, the proposal will remove a small and unimportant amount of foraging resources from within cleared grazing land, which would not be important to the 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 under the TSC Act 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.

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. While refuge habitat and potential breeding habitat (main dam) will be retained, along with all riparian and intact forest habitat connectivity elsewhere on the property, some loss and modification of surrounding cleared habitat likely to be used by the species for foraging and / or movement will occur. Measures to mitigate these impacts will occur as part of the proposal.

A recovery plan has been produced for Large Forest Owls (DEC 2006) and 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 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

While the proposal will remove small amounts of native vegetation, it is limited to within heavily modified and mostly cleared grazing land. As such, the proposal will not contribute significantly to this key threatening process.

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