



**Flora & Fauna Assessment
Lot 21 DP 714858
45 Hearn Lake Rd, Woolgoolga**

(ELA Project No. 139-001)

Report prepared for:
BBK Coastal Development Group

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1. Introduction

1.1 The Proposal

BBK Coastal Development Group (BBK) proposes a staged residential subdivision on Lot 21 DP 714858, at 45 Hearnese Lake Road, Woolgoolga. BBK has requested that Eco Logical Australia Pty Ltd (ELA) carry out flora and fauna investigations on the site, during spring, to determine the presence or likely presence of threatened species, populations or ecological communities and their habitat that are listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) or the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), and to assess potential impacts upon them of the proposal, in accordance with requirements under Section 5A of the *Environmental Planning & Assessment Act 1979* (EP&A Act).

Previous flora and fauna surveys had been undertaken on the subject site (James Warren & Associates 2003 (JWA); Bushfiresafe Australia 2006). The JWA survey assessed flora and vegetation of the subject site in June 2003, and undertook an assessment of threatened fauna habitat values based upon that fieldwork, but no systematic survey for fauna species was undertaken. The Bushfiresafe Australia (2006) survey carried out fieldwork in order to review the vegetation and flora data of the JWA report, and also undertook some systematic fauna survey methods (spotlighting, call playback, stag-watching, ultrasonic bat detection) on 24th February, 5th April and 1st June 2006. A review of these previous reports was undertaken by staff of Coffs Harbour City Council (CHCC), who concluded that the season in which flora and fauna survey had been undertaken was inappropriate for detecting the threatened flora and fauna likely to occupy or utilise the subject site. Therefore, further survey work was required to be carried out during spring, the season considered most appropriate for the detection of target species.

ELA is also required to consider the potential impacts in accordance with local environmental planning instruments, namely the CHCC Comprehensive Koala Plan of Management (CKPoM, Lunney *et al.* 1999) and the CHCC Tree Preservation Order (TPO, CHCC 2004). Where potential impacts upon any threatened species are identified, ameliorative measures are to be proposed.

The proposed residential subdivision includes a number of features and measures that are designed to retain and protect, or minimise potential impacts upon, the ecological values present within and adjacent to the subject site. These include:

- protection and buffering of the freshwater wetland and adjacent vegetated slope on the eastern side of the subject site;
- protection and buffering of the regenerating areas of wetland and littoral rainforest on the subject site;
- buffering of the adjacent SEPP 26 Littoral Rainforest community;
- adoption of a 50 metre horizontal buffer on the 3.5m above high water datum (AHD) vertical contour of Hearnese Lake in order to protect the values of the lake and fringing vegetation;

- installation of a stormwater management system designed to manage and minimise the ingress of potential stormwater-borne pollutants into both the freshwater wetland and Hearnese Lake;
- the maintenance of a native grassland character, dominated by Kangaroo Grass *Themeda australis*, across the subdivision. This grassland community will be maintained through mowing/slashing timed to maximise control of non-native grasses;
- the retention, where possible, of native trees on the subject site, and the use of local-provenance seed in replanting appropriate areas with Kangaroo Grass, Forest Red Gum, Broad-leaved Paperbark, Swamp Box and Swamp Oak.

Additional measures proposed to be undertaken to maintain or improve threatened species habitat on the subject site are discussed in Sections 4, 5, 6 and 7 of this report.

1.2 The Study Area and Subject Site

The study area (Figure 1), for the purpose of data collation, is a circle 10 kilometres in radius, centred upon the subject site (Figures 1 & 2) which comprises Lot 21 DP 714858, at the eastern end of Hearnese Lake Road, Woolgoolga. The subject site covers a total area of 5.45 ha.

Figure 1: Study Area and Subject Site.

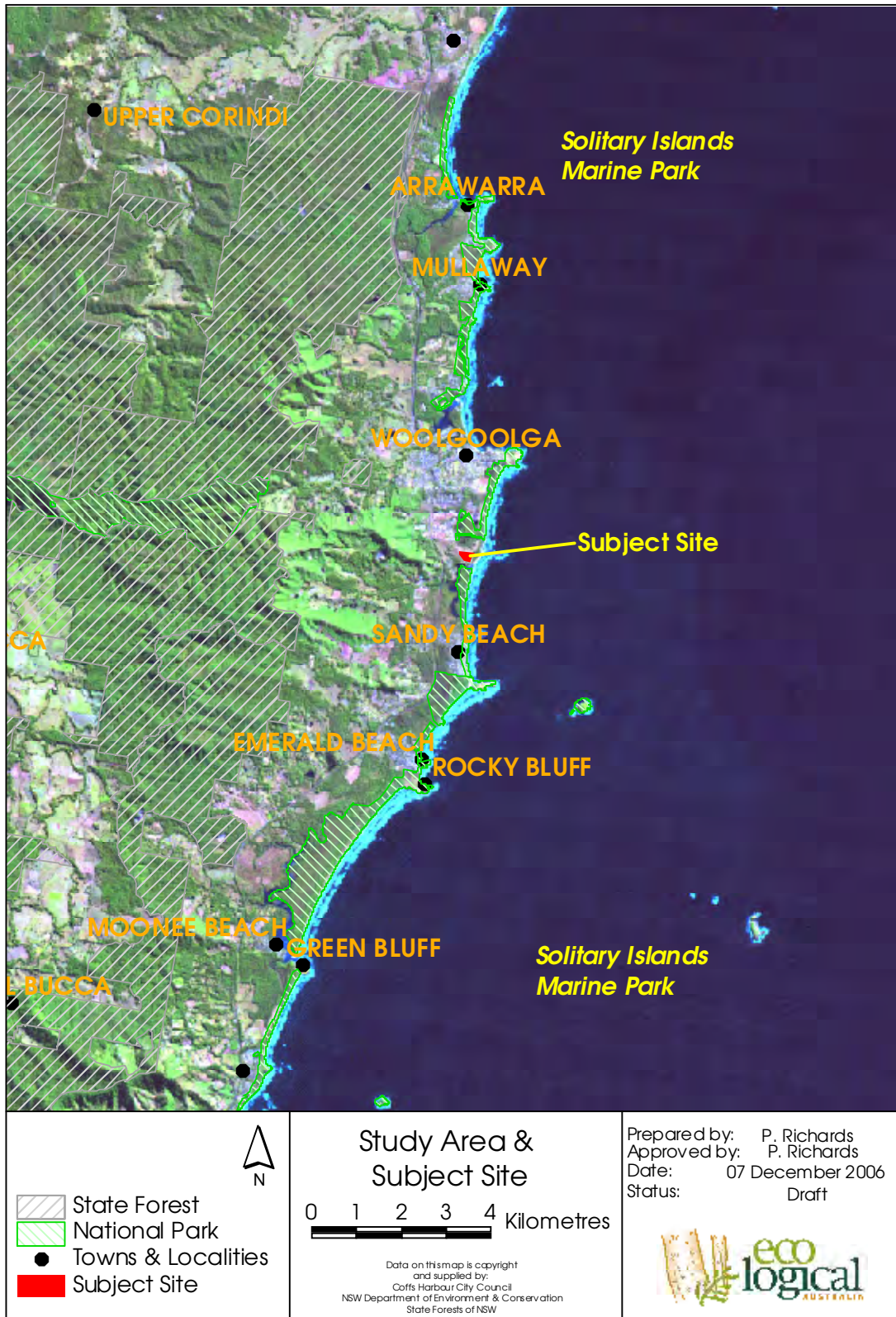
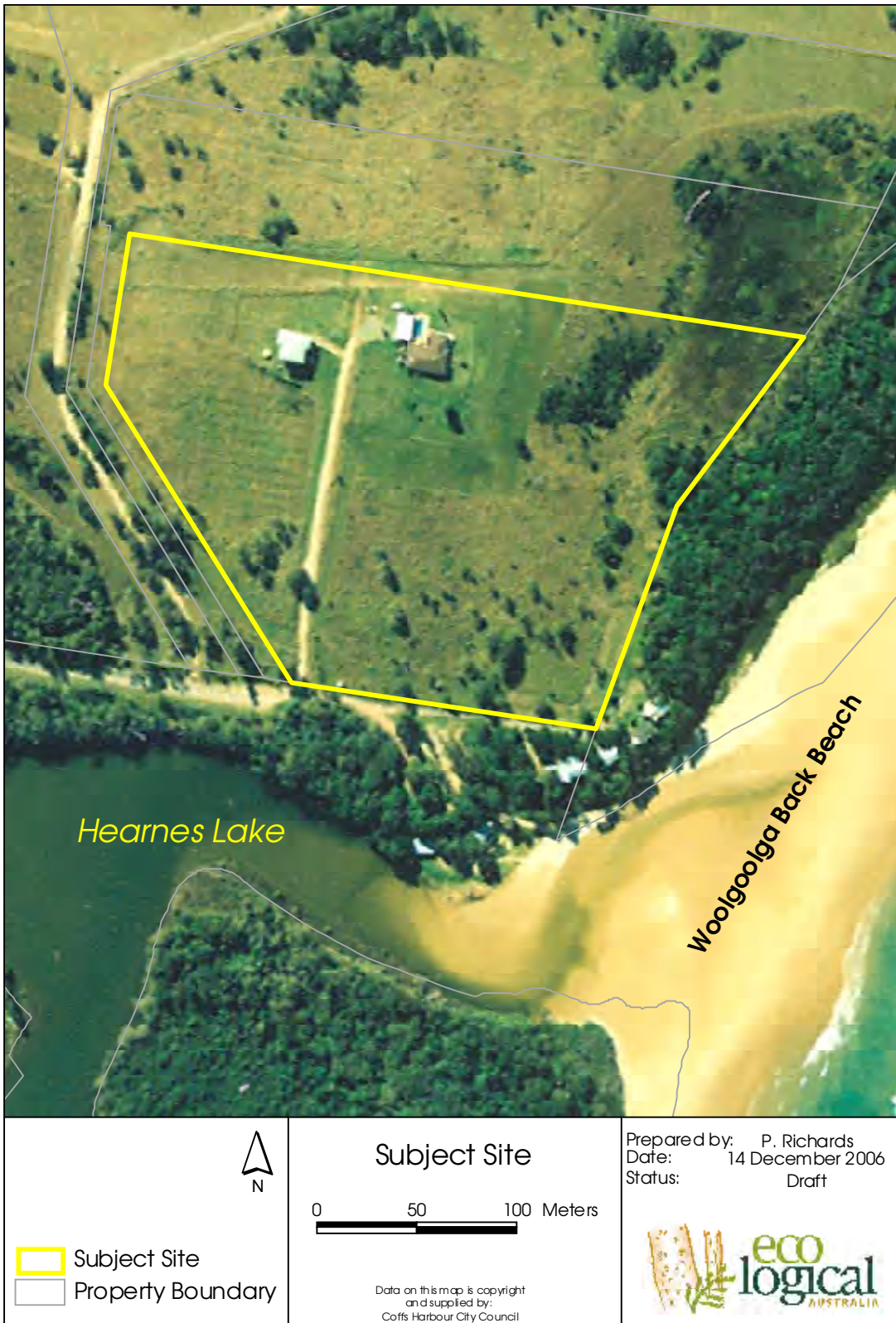


Figure 2: Subject Site (aerial photography dated June 2000).



2. Methods

2.1 Data audit of flora and fauna values

A preliminary list of threatened flora and fauna species, populations and ecological communities likely to occur in the study area was prepared by searching the Department of Environment & Conservation (DEC) Wildlife Atlas records for species listed under the TSC Act, and the Department of Environment & Heritage (DEH) database for threatened species and Matters of National Environmental Significance listed under the EPBC Act. Data searches were undertaken on 1st November 2006.

The data searches covered a circle of 10km radius, from a point located at 30.13° south and 153.19° east. These lists were then filtered to identify threatened species known from, or considered likely to occur on, or utilise, the subject site, based upon available specific habitat information in the scientific literature as well as information obtained during the site inspection. The following classes of likelihood of occurrence were applied:

Unlikely = Species or community is unlikely to occur, (vagrant individuals may occur infrequently).

Potential = Species or community could potentially occur.

Likely = Species or community is likely to occur.

Known = Species or community known to occur on site.

The resultant list of likely species was then further filtered to identify those species considered likely to be affected by the proposal.

Any State Environment Planning Policy (SEPP) features that may affect the subject site, as well as local environmental planning instruments, such as the CHCC CKPoM and TPO, were also considered.

2.2 Site Inspection

2.2.1 Flora and Vegetation Survey

Some preliminary floristic investigation was undertaken on 10th and 11th November during fauna survey. A full floristic inspection of the subject site was undertaken on 12th November 2006. This involved a detailed traverse of the property to identify vegetation types, delineate community boundaries and search for threatened flora species. Any remnant vegetation on the subject site was assessed and compared with the vegetation mapping undertaken by JWA (2003). Additional floristic survey was undertaken during a subsequent site visit on 14th December 2006.

A total of 6.5 hours of floristic survey and targeted threatened flora survey was undertaken on and adjacent to the subject site. A further nine person hours was required on 12th January 2007 to complete a detailed survey for Austral Toadflax *Thesium australe* (see 5.4 and Appendix 4 below). All flora survey was undertaken by Senior Ecologist Peter Richards and Botanist Phil Gilmour.

Additional detailed surveys for other local populations of Austral Toadflax were undertaken by M. Graham in early June 2007, and entailed a total of 23 hours search effort. This provided an understanding of the context and conservation security of populations in the local area. The survey area looked at similar coastal headland habitat between Arrawarra and Look-At-Me-Now headlands.

A comprehensive flora species list was compiled from data obtained during the site traverses. Although this had previously been undertaken in June 2003 by JWA (2003),

the spring survey undertaken during the current study was expected to produce a more complete species inventory for the subject site.

To enable discrimination of floristics between vegetation communities, the subject site was divided into four broad areas, based upon site inspection and analysis of aerial photography (Figure 3):

1. Grassland with scattered trees (c. 4.5 ha);
2. Slope with grassland and regenerating banksia woodland (c. 0.36 ha);
3. Intact and regenerating swamp sclerophyll and littoral rainforest (c. 0.13 ha);
4. Wetland and surrounding seasonal inundation area (c. 0.4 ha).

Figure 3: Flora study areas within the subject site.



Floristic survey effort and methodology was undertaken in accordance with DEC (2004) guidelines as outlined in Table 1 below.

Table 1: DEC (2004) suggested minimum effort for flora survey

Survey technique	Suggested minimum effort	Information recorded
Transect	1x100m traverse per stratification unit <2 hectares 2x100m traverses per 2-50 hectares of stratification unit 3x100m traverses per 51-250 hectares of stratification unit 5x100m traverses per 251-500 hectares of stratification unit 10x100m traverses per 501-1000 hectares of stratification unit, plus one additional 100m traverse for each extra 100 hectares thereof	Floristics, structure, vegetation boundaries
Random meander	30 minutes for each quadrat sampled within the same stratification unit as the quadrat	Targeted for threatened species

2.2.2 Fauna Survey

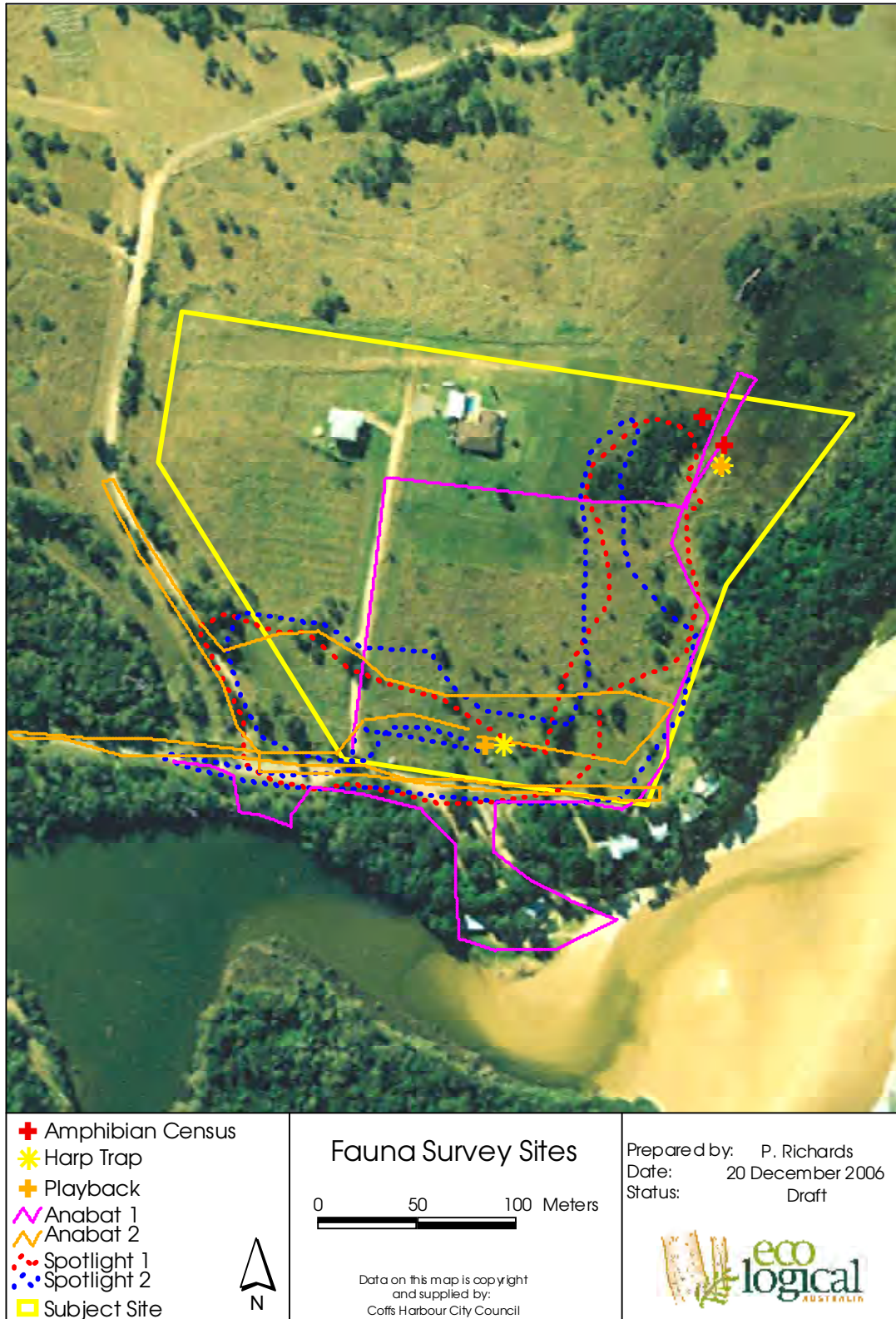
Targeted fauna survey was undertaken over several days and nights during November 2006, as detailed in Table 2 below. All surveys were undertaken by Senior Ecologist Peter Richards. Senior Ecologist Dr Julian Wall assisted where indicated as 2 people in Table 2 below.

Table 2: Fauna survey methods, date and effort

Survey Method	Date	Survey Effort	Total Survey Effort
Call Playback	1 Nov 2006	1 hour 45 min. - Powerful, Barking & Masked Owl, Koala, Squirrel Glider, Bush Stone-curlew – 1 person	3 hrs 40 mins
	10 Nov 2006	1 hour 55 min. – as above, plus Grass Owl - 2 people	
Spotlighting	3 Nov 2006	1 hour 40 mins, 1 light	2 hrs 50 mins; 2.03 km
	10 Nov 2006	1 hour 10 mins, 2 lights	
Harp Trapping	1 – 3 Nov 2006	2 traps per night = 4 trap nights	8 trap nights
	10 - 12 Nov 2006	2 traps per night = 4 trap nights	
Ultrasonic Call Detection	2 Nov 2006	Hand-held – 1 hour 30 min. walked meander	2 hrs 40 mins; 2.49 km
	10 Nov 2006	Hand-held - 1 hour 10 min. walked meander	
Nocturnal Amphibian Census	1 Nov 2006	1 hour 30 mins, 1 person	3 hrs
	10 Nov 2006	1 hour 30 mins, 1 person	

The locations of survey sites and transects undertaken for each survey method are provide below in Figure 4. Survey focussed upon areas of potential habitat for target species, which meant that the bulk of survey was concentrated in the southern and eastern sector of the subject site, where remnant vegetation and a wetland occurs.

Figure 4: Fauna survey sites and transects within, and adjacent to, the subject site.



It is considered that an adequate level of fauna survey was undertaken on the subject site, notwithstanding minimum survey effort suggested by DEC (2004) for methods such as ultrasonic bat detection and call playback for owls. For example, ultrasonic bat detection is, ideally, undertaken overnight at a fixed location. However, technical difficulties required that the handheld traverse method be applied in this case. In some respects, the hand-held traverse method is a better method than remote recording, as hand-operated detectors generally produce longer call sequences and therefore increase the chance of confident identifications (DEC 2004). In any case, very little bat activity was recorded in general, and the subject site is considered not to support suitable roosting or breeding habitat for microchiropteran or megachiropteran bats, and only a minor forage resource for most nectar and pollen feeders (refer to results in section 3.3 below).

Call playback was undertaken mainly because a previous survey undertaken on the subject site (Bushfiresafe Australia 2006) recorded a Powerful Owl call in response to call playback. This record is considered to be unlikely, as the subject site does not represent suitable habitat for this species, although it is possible that an individual could have been attracted to the site by call playback. Furthermore, the same survey recorded, utilising call playback, the Giant Barred Frog *Myxophyes iteratus* from the wetland on the subject site. This is clearly a spurious record given there is no suitable habitat on-site, casting doubt upon the accuracy of the previous survey in general. However, further call playback was carried out as a part of the current study to meet requirements for an adequate level of fauna survey to be undertaken on the subject site during the optimum survey season.

2.2.3 Koala Habitat

Although the subject site does not contain mapped Koala habitat, nearby vegetation is mapped as secondary Koala habitat according to the CHCC CKPoM (Lunney *et al.* 1999), and Koala food trees occur on the site. Therefore, an assessment of all suitable trees was undertaken in an effort to identify any signs of possible Koala usage of the site, such as the presence of Koala claw marks on trunks, Koala scats beneath tree crowns, or the actual presence of Koalas on site.

2.3 Collation of data

All data collected in the field and obtained from DEC and DEH were collated and analysed in order to make an evaluation of the threatened species values present on the subject site, and to inform an assessment of potential impacts upon them as a result of the proposed activity.

3. Results

3.1 Data audit of flora and fauna values

The data search for TSC Act and EPBC Act threatened species, populations and communities produced a total of 52 threatened fauna species and 16 threatened plant species known to occur, or considered likely to occur, in the study area (note that fish, sea birds, marine mammals and marine reptiles were excluded from this search). These species are listed in Appendix 1, with those considered likely or potentially to occur on, or utilise, the subject site (based on field-based habitat assessment), highlighted in bold.

3.2 Flora and Vegetation Survey

3.2.1 Flora Species

A total of 124 plant species was recorded during a traverse of the subject site. In comparison, JWA (2003) recorded 81 species. Of these, 32 (26%) were introduced species, the majority of which were recorded in Areas 1 and 2. A list of plant species recorded on the subject site, and the assessment area in which they were recorded, is provided as Appendix 2. Note that it is likely that not all plant species present on the subject site were recorded, although the likelihood is low considering that some level of flora survey has now been carried out on the subject site across all seasons.

3.2.2 Threatened Flora Habitat

The subject site is considered to contain potential habitat for seven threatened plant species as listed in bold in Appendix 1. A thorough search of the subject site located one threatened plant species, Austral Toadflax *Thesium australe* (see below).

3.2.3 Threatened Flora Species

One threatened plant species, Austral Toadflax *Thesium australe*, was recorded on the subject site. A subsequent detailed search for Austral Toadflax on the subject site revealed approximately 700 plants in eight discrete patches in the south-eastern sector of the site (see Section 5 of this report).

3.2.4 Vegetation

Six vegetation communities were identified on the subject site (Figure 5). These communities, their extent, and conservation status are discussed below. Vegetation assessment for this report generally concurred with that reported by JWA (2003).

Figure 5: Vegetation communities on the subject site.



3.2.4.1 Broad-leaved Paperbark Forest

Area: 0.11 ha.

Description: A small area of swamp forest dominated by Broad-leaved Paperbark *Melaleuca quinquenervia*. Occurs adjacent to a freshwater wetland in the swale of a consolidated beach hind-dune. Parts of the understorey of this community, and the adjoining wetland, are infested with the North American sedge *Cyperus proflifer*, a waterplant popular as an ornamental, which has only recently been recorded as naturalised in NSW in several localities (PlantNET 2007). This species has the potential to become a serious environmental weed that has the ability to suppress or replace indigenous wetland vegetation. Measures to control its spread should be undertaken as a matter of some urgency.

Conservation Status: Listed under NSW TSC Act as an Endangered Ecological Community (see 3.2.5 below). Habitat of the Wallum Froglet.

3.2.4.2 Coastal Banksia / Pink Bloodwood / Swamp Oak low woodland

Area: 0.35 ha.

Description: A regenerating community on an east-facing slope adjacent to the western edge of the freshwater wetland. Dominant species are Coastal Banksia *Banksia integrifolia ssp. integrifolia*, Swamp Oak *Casuarina glauca*, Pink Bloodwood *Corymbia intermedia* and Forest Red Gum *Eucalyptus tereticornis*. The understorey contains a diversity of grassland and heath species. Weeds are generally few in number, and this community is considered to be in good condition.

Conservation Status: Not currently listed as an EEC. As a part of the north-east NSW forest assessments, NSW NPWS (1999a) listed the Banksia forest ecosystem as a broad community incorporating a number of coastal vegetation types dominated by species of banksia. The ecosystem was classified as a rare ecosystem that was considered to be severely depleted (c. 27% of pre-1750 extent remaining), highly inadequately reserved, and a priority for conservation on private lands. A recent refinement of the 1999 north-east NSW forest ecosystem classification (Eco Logical 2006) identified the 'coastal headland heaths of the North Coast' vegetation community, which better fits the banksia community on the subject site, as it recognises this community, which occurs on bedrock substrates, as distinct to the banksia-dominated types that grow on deep sands or sand sheets. This community was estimated to have about 70% of its pre-1750 extent remaining.

3.2.4.3 Freshwater Wetland

Area: 0.41 ha.

Description: A small, mostly ephemeral freshwater wetland, with a small central area which appears to be more or less permanently inundated. This wetland lies within the swale of a large consolidated hind-dune, at the contact zone of deep coastal sands and heavy clay-loams of the adjacent landward hillslope. Community dominants include the waterlilies *Nymphaea caerulea ssp. zanzibarensis* (a naturalised species) and *Nymphoides indica*, the sedges *Lepironia articulata*, *Eleocharis sphacelata*, and a significant infestation of the introduced *Cyperus proflifer* (see comments under 3.2.4.1 above), and the grasses *Leersia hexandra* and *Zoysia macrantha*.

Conservation Status: Listed under NSW TSC Act as an Endangered Ecological Community (see 3.2.5 below). Habitat of the Wallum Froglet. This occurrence of

freshwater wetland is not included in coastal wetland mapping under SEPP 14 Coastal Wetlands (Adam *et al.* 1985).

3.2.4.4 Littoral Rainforest regeneration

Area: 0.02 ha.

Description: A small regenerating patch of Littoral Rainforest, adjacent to the intact Littoral Rainforest adjoining the eastern boundary of the subject site. Indicative species include Cheese Tree *Glochidion ferdinandi*, Lilly Pilly *Syzygium smithii*, Brush Cherry *S. australe* and Sandpaper Fig *Ficus coronata*.

Conservation Status: Listed under NSW TSC Act as an Endangered Ecological Community (see 3.2.5 below).

3.2.4.5 Forest Red Gum / Broad-leaved Paperbark / Swamp Oak / Swamp Box remnant forest

Area: 0.14 ha.

Description: A remnant forest community of low stature, comprising several small clumps of trees and a number of individual trees scattered mainly across the southern and eastern sections of the subject site (see Figure 2). The dominant overstorey species is Forest Red Gum *Eucalyptus tereticornis*, with Broad-leaved Paperbark *Melaleuca quinquenervia*, Swamp Oak *Casuarina glauca* and Swamp Box *Lophostemon suaveolens* occupying the mid- to lower slopes of the site. The understorey has been modified through slashing and past grazing of livestock, and contains a number of weed species such as Broad-leaved Paspalum *Paspalum wettsteinii*, Carpet Grass *Axonopus compressus* and Dwarf Milkwort *Polygala japonica*, but it also supports a reasonable diversity of native species. There are approximately 30-40 mature overstorey trees of this community remaining on the subject site, along with a similar number of younger specimens. This community would once have occurred across most of the now-cleared parts of the subject site.

Conservation Status: Listed under NSW TSC Act as an Endangered Ecological Community (see 3.2.5 below). The overstorey and native groundcover species present in this community make it possible to assign parts of this remnant vegetation to either one of three EECs, depending upon whether Forest Red Gum, Broad-leaved Paperbark or Swamp Oak dominate. However, because Forest Red Gum currently dominates, and was probably the dominant overstorey species before the site was largely cleared, it is logical to assign this community to the Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC (SCFF EEC).

3.2.4.6 Slashed Kangaroo Grass / Broad-leaved Paspalum / Pigeon Grass Grassland

Area: 4.37 ha.

Description: Covering over 80% of the subject site, this is a derived grassland community, created mainly through the removal of the overstorey of community 3.2.4.5 above, followed by management of the land as a grazing enterprise. Depending upon soil moisture levels, this community is variously dominated by Kangaroo Grass *Themeda australis*, Broad-leaved Paspalum *Paspalum wettsteinii* and South African Pigeon Grass *Setaria sphacelata*. Other common species include Carpet Grass *Axonopus compressus* and Pennywort *Centella asiatica*.

Conservation Status: This community is not considered to be of conservation significance as it is a derived community. However, in areas where Kangaroo Grass

dominates and moisture levels are relatively constant, it constitutes habitat for the threatened plant Austral Toadflax *Thesium australe*.

3.2.5 Endangered Ecological Communities (EECs)

The following four Endangered Ecological Communities (EECs) were recorded on the subject site:

1. Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (SSF EEC). This EEC is represented on the subject site by community 3.2.4.1 Broad-leaved Paperbark Forest.
2. Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. This EEC is represented on the subject site by community 3.2.4.3 Freshwater Wetland.
3. Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions. This EEC is represented on the subject site by community 3.2.4.4 Littoral Rainforest Regeneration.
4. Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion (SCFF EEC). This EEC is represented on the subject site by community 3.2.4.5 Forest Red Gum / Broad-leaved Paperbark / Swamp Oak / Swamp Box Remnant Forest.

3.3 Fauna Survey

3.3.1 Fauna Habitat

The subject site contains potential habitat for 26 threatened fauna species, as listed in bold in Appendix 1. The remnant vegetation communities may provide foraging and shelter habitat for some of the threatened species that are considered likely to occur there, but the subject site supports very few, if any, hollow-bearing trees. The site's value as roosting and breeding habitat for hollow-dependent species is, therefore, negligible. However, the site may provide seasonal foraging for mobile hollow-dependent species in the local area.

3.3.2 Fauna Species Survey Results

Table 3 below presents the results of fauna surveys conducted on and adjacent to the subject site.

Table 3: Fauna survey results

Survey Method	Species detected	Number and Observation type
Call Playback	<i>Petaurus breviceps</i> Sugar Glider <i>Pseudocheirus peregrinus</i> Common Ring-tailed Possum	1, heard 3, observed
Spotlighting	<i>Nyctinomus australis</i> White-striped Mastiff Bat <i>Canis familiaris</i> Dog <i>Litoria fallax</i> Eastern Dwarf Tree Frog <i>Litoria nasuta</i> Rocket Frog	1, heard & observed 1, heard & observed 1, observed 1, observed
Harp Trapping	Nil result	-
Ultrasonic Call Detection	Nil – recorded calls not identifiable	-
Nocturnal Amphibian Census	<i>Crinia tinnula</i> Wallum Froglet <i>Litoria nasuta</i> Rocket Frog <i>Litoria tyleri</i> Laughing Tree Frog <i>Litoria fallax</i> Eastern Dwarf Tree Frog <i>Litoria peroni</i> Peron's Tree Frog <i>Pseudophryne coriacea</i> Red-backed Toadlet <i>Uperoleia laevigata</i> Smooth Toadlet <i>Lymnodynastes peronii</i> Striped Marsh Frog	6+, heard 100+, heard, observed 5, heard 50+, heard, observed 10+, heard 10+, heard 10+, heard 2, heard

Note that, in spite of a total of eight trap nights effort, no bats were captured in the harp traps. This is probably due to the lack of distinct 'flyways' on the subject site, and the observation of a generally low level of bat activity, even over the freshwater wetland. The little bat activity observed during the survey period occurred over the water body of Hearnese Lake. Traps were located on the subject site where the greatest chance of success was expected, but because of security concerns they could not be located outside the subject site. As mentioned previously, the subject site is considered to provide sub-optimal habitat for microchiropteran bats in general.

3.3.3 Threatened Fauna Species

One threatened fauna species, Wallum Froglet *Crinia tinnula*, was recorded on the subject site. Approximately six individuals were heard calling in and adjacent to the freshwater wetland in the eastern sector of the subject site.

3.3.4 Koala Habitat

Examination of the trunks and the ground beneath the crowns of Koala food trees on the subject site failed to locate Koala scratches or scats. No koalas were recorded during fauna survey. Lunney *et al.* (1999) reports that koala records are

concentrated in the south-east of Coffs Harbour Shire, with a significant drop-off in Koala numbers north from Korora on the coastal strip. It is therefore considered that the subject site constitutes very low quality Koala habitat, although it does support known Koala food trees.

3.4 EPBC Matters of National Environmental Significance

Matters of National Environmental Significance, and other matters listed under the EPBC Act that may be affected by the proposal, are listed in Appendix 3. One EPBC-listed vulnerable species was recorded on the subject site, Austral Toadflax *Thesium australe*. As Austral Toadflax is also listed under the NSW TSC Act, it is here considered further under that Act for the purposes of Part 5A of the EPA Act. It is considered that some other listed species may periodically utilise the site. Those species are highlighted in bold in Appendix 3.

4. Assessment of impacts upon threatened species

4.1 Species not considered further

A number of species listed under the TSC Act and/or EPBC Act, although having the potential to occupy or utilise the subject site, are not considered further here, as it is considered that they will not be affected by the proposed activity. Further details are provided in Table 4 below.

Table 4: Species excluded from further consideration

Species	Reason for exclusion from further consideration
Australasian Bittern <i>Botaurus poeciloptilus</i>	May periodically utilise freshwater wetland on site. All potential habitat for this species on the subject site is proposed to be protected and will not be affected by proposal.
Barred Cuckoo-shrike <i>Coracina lineata</i>	All potential habitat (littoral rainforest) for this species on the subject site is proposed to be enhanced and protected and will not be affected by proposal.
Black Bittern <i>Ixobrychus flavicollis</i>	May periodically utilise freshwater wetland on site. All potential habitat for this species on the subject site will not be affected by proposal.
Black Flying-fox <i>Pteropus alecto</i>	May occasionally utilise the forage resource offered by the canopy species at the subject site, but loss of these trees is considered unlikely to adversely impact upon this species due to its ability to forage over a very large area.
Black-necked Stork <i>Ephippiorhynchus asiaticus</i>	May periodically utilise freshwater wetland on site. All potential habitat for this species on the subject site is proposed to be protected and will not be affected by proposal.
Common Blossom-bat <i>Syconycteris australis</i>	Most foraging and roosting habitat for this species (banksia scrub, littoral rainforest and swamp sclerophyll forest) on the subject site is proposed to be protected and enhanced. Assisted regeneration of these communities considered to benefit this species.
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	May roost in nearby culverts, stormwater drains, or more distant caves or mine shafts. Would possibly forage in the vicinity of the subject site, but removal of trees at this site not considered to impact this species.
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i>	Not commonly encountered in near-coastal habitats. Roosts in tree hollows. No hollows apparent on the subject site. May forage above and around the canopy, but removal of trees at this site is considered unlikely to adversely affect this species.
Eastern Freetail-bat <i>Mormopterus norfolkensis</i>	Roosts in tree hollows. No hollows apparent on the subject site. May forage above and around the canopy, but removal of trees at this site is considered unlikely to adversely affect this species.
Golden-tipped Bat <i>Kerivoula papuensis</i>	All potential habitat (littoral rainforest) for this species on the subject site is proposed to be enhanced and protected and will not be affected by proposal.
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	Only one record within study area. Roosts in tree hollows. No hollows apparent on site, but may forage around and over tree canopy of site. Removal of trees, however, not considered to significantly affect this species.
Green and Golden Bell Frog <i>Litoria aurea</i>	No local records of this species, but may potentially occupy such sites. All potential habitat for this species on the subject site to be protected and will not be affected by proposal.
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	May occasionally utilise the forage resource offered by the canopy species at the subject site, but loss of these trees is considered unlikely to adversely impact upon this species due to its ability to forage over a very large area.
Hoary Bat <i>Chalinolobus nigrogriseus</i>	Very rare in the area, but may be present. Roosts in tree hollows. No hollows apparent on site, proposed removal of vegetation on subject site considered not to adversely affect this species.
Koala <i>Phascolarctos cinereus</i>	No mapped Koala Habitat will be affected by proposal, although Koala food trees will be affected, but the site is not considered to support Koala. Amelioration for other species and communities on-site includes retaining and planting local tree species, including Forest Red Gum, Broad-leaved Paperbark and Swamp Oak, as well as restoration of vegetation communities supporting these Koala food species.
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	Very rare in the area, but may be present. Roosts in tree hollows. No hollows apparent on site, proposed removal of vegetation on subject site considered not to adversely affect this species.

Species	Reason for exclusion from further consideration
Large-footed Myotis <i>Myotis adersus</i>	May roost in nearby culverts, stormwater drains, bridges. Would possibly forage in the vicinity of the subject site, mostly over open water. Removal of trees at this site not considered to impact this species.
Little Bentwing-bat <i>Miniopterus australis</i>	May roost in nearby culverts, stormwater drains, or more distant caves or mine shafts. Would possibly forage in the vicinity of the subject site, but removal of trees at this site not considered to impact this species.
Olongburra Frog <i>Litoria olongburrensis</i>	No local records of this species, but may potentially occupy such sites. All potential habitat for this species on the subject site to be protected and will not be affected by proposal.
Osprey <i>Pandion haliaetus</i>	Forages in Hearnese Lake and adjacent coastal waters. May occasionally roost on or adjacent to subject site, but removal of trees at this site not considered to impact this species, as Osprey generally utilises much larger trees, with good visibility over local area, for nesting and feeding.
Rose-crowned Fruit-Dove <i>Ptilinopus regina</i>	All potential habitat for this species on the subject site to be protected and will not be affected by proposal.
Square-tailed Kite <i>Lophoictinia isura</i>	Regularly observed 'cruising' over parts of the study area. Occupies a very large home-range and forages over a wide area. Not likely to be affected by removal of this area of vegetation
Superb Fruit-Dove <i>Ptilinopus superbus</i>	All potential habitat for this species on the subject site to be protected and will not be affected by proposal.
Swift Parrot <i>Lathamus discolor</i>	Seasonal visitor to this area. May occasionally utilise nectar from canopy trees on the subject site, but records for the species in this area are scarce, and removal of trees from this site is not considered to be significant to this species. Assisted regeneration of vegetation will incorporate local-source Forest Red Gum, a favoured food species of Swift Parrot.
Wallum Froglet <i>Crinia tinnula</i>	Entire extent of Wallum Froglet habitat (Freshwater Wetland and Paperbark Forest) on subject site, with additional vegetated buffer, is proposed for protection and enhancement through weed control, and will therefore benefit from the proposal.
Wompoo Fruit-Dove <i>Ptilinopus magnificus</i>	All potential habitat for this species on the subject site to be protected and will not be affected by proposal.
Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.	Entire Freshwater Wetland on subject site, with additional vegetated buffer, is proposed for protection through appropriate zoning, and enhancement through weed control, and will therefore benefit from the proposal.
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions.	All regenerating Littoral Rainforest on subject site, with additional vegetated buffer, is proposed for assisted regeneration, and protection through appropriate zoning, and will therefore benefit from the proposal.
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Entire extent of Broad-leaved Paperbark Forest on subject site is proposed for protection through appropriate zoning, and enhancement through weed control and assisted regeneration, and will therefore benefit from the proposal.

4.2 Affected Species

It is considered that the threatened species likely to be affected by this proposal are:

- Austral Toadflax *Thesium australe*
- remnant EEC 'Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion'

Therefore the application of the "7-part test" is required for this species and community, in accordance with S5A of the EP&A Act. This is provided in Appendix 4.

4.3 EPBC Matters of National Environmental Significance

Species highlighted in bold type under the EPBC Act 'Matters of National Environmental Significance' and 'Other Matters' in Appendix 3 are likely to occasionally utilise the subject site. However, it is considered that none of these species, or Commonwealth lands supporting these species, are likely to be affected by the proposal.

5. Ecological Objectives and Ameliorative Measures

5.1 Freshwater wetland and environs

Minimise impacts upon the ecological values of the freshwater wetland and environs within a proposed 7A reserve for environmental protection.

The stormwater management system proposed for the site provides current best practice in maintaining groundwater conditions and the pattern of freshwater flow within and into the proposed 7A protected area (WBM Oceanics, 2006). A substantial vegetated slope adjoining the wetland is included in the proposed 7A reserve, as are areas of regenerating swamp forest and littoral rainforest. The slope comprises patches of regenerating Banksia/Red Gum/ Bloodwood, Swamp Oak, and Kangaroo Grass sward.

5.2 Wallum Froglet

Protect existing Wallum Froglet habitat and create habitat expansion opportunities.

Protection of the water quality of the wetland area, coupled with assisted regeneration of native wetland vegetation, will result in an improvement to Wallum Froglet foraging, shelter and breeding habitat. Active control of the introduced sedge *Cyperus prolifer*, which currently infests the freshwater wetland edges, will also assist in expanding and enhancing the quality of Wallum Froglet habitat. A created wetland proposed as part of the overall stormwater management system will potentially expand Wallum Froglet habitat on the subject site.

5.3 High Conservation Value Vegetation

Maintain or improve quality and extent of Endangered Ecological Communities.

(Refer also to 7-part test for SCFF EEC in Appendix 4)

To improve the area, quality and integrity of the SCFF EEC it is proposed to undertake assisted regeneration of previously cleared or heavily disturbed examples of these communities within the proposed 7A reserve and within protected areas bounded by a 50 metre buffer on Hearnese Lake, as well as protection, where practicable, of extant trees within the footprint of the proposed development, and use of local-provenance tree and shrub species in any on-site plantings. Proposed regeneration and planted areas are provided in Figure 6 below. Proposed actions include:

1. Collection of local seed for use in an assisted regeneration program and buffer and amenity plantings.
2. Active control of the wetland weed *Cyperus prolifer* to enhance the regeneration of native sedges and the SSF EEC on wetland margins.
3. Assisted regeneration of SCFF EEC within proposed 7A area and no-build areas within 50 metre lake buffer zone, and in constructed wetland site within lake buffer.
4. Establishment of a vegetated buffer to protect the intact adjacent littoral rainforest from edge effects. Previous correspondence from CHCC regarding this issue supports this initiative: "The preference is for five metres of wattle plantings, interspersed with the hardiest mesic species. These include: *Cupaniopsis anacardioides*, *Syzygium australe*, *Syzygium luehmannii*, *Syzygium oleosum*, *Acmena smithii*, *Endiandra discolor*, *Endiandra sieberi*, *Mischocarpus pyriformis*, *Cryptocarya triplinervis*, *Glochidion ferdinandi*, *Acronychia imperforata*, *Notelaea longifolia*, *Cassine australis*, *Alectryon coriaceus*, *Arytera divaricata*, *Rhodomyrtus psidioides* and *Celtis paniculata*. CHCC ecologist confirms a minimum five metres wide edge protection planting to the southern section of the littoral rainforest would

be acceptable, although a wider buffer would be preferable, where this was possible” (extract from letter, CHCC to BBK dated 22 May 2006).

Establishment of the minimum five metre buffer is proposed at this site, in order to maximise the available area of Kangaroo Grass grassland habitat for enhancement of Austral Toadflax population (see section 5.5 below).

5. Retention of SCFF EEC trees within development footprint, where practicable, e.g. on road verges, in no-build parts of residential blocks, etc.
6. Explore opportunities for neighbouring landowners to engage in sympathetic restoration and protective management of the freshwater wetland and environs.

These proposals are considered to more than adequately provide for the protection, restoration and maintenance of high conservation value vegetation on the subject site. Furthermore, the restoration and protection of vegetation within a proposed 7A reserve has the added benefit of securing a key local vegetated corridor which links Hearnes Lake, via the subject site, with other vegetated areas, including parts of Coffs Coast Regional Park, to the north of the subject site. A total area of 0.55 ha is proposed for assisted regeneration and compensatory plantings.

Figure 6: Proposed ameliorative planting and regeneration sites



5.4 Austral Toadflax

5.4.1 Review of Biology and Status of Austral Toadflax

In order to consider the adequacy of proposed ameliorative measures on the local population of Austral Toadflax, it has been necessary to:

- undertake a literature review of, and discuss with relevant experts, current knowledge regarding Austral Toadflax biology, ecology, populations and conservation status;
- undertake a detailed study of the local population to determine plant numbers and location on the subject site;
- undertake a detailed study of other local populations in order to determine the relative significance of the population on the subject site.

5.4.2 Literature Review and Current Knowledge

5.4.2.1 Biology and Response to Disturbance

Austral Toadflax is a short-lived perennial herb on the NSW North Coast (Griffiths 1992), but in cooler parts of its range plants may exhibit annual dieback of their above-ground parts, and resprout from a woody rootstock (Jeanes 1999) or may behave as an annual (Griffith 1992; J. Briggs, DEC Botanist per. comm.). It is semi-parasitic, deriving water and mineral salts from the roots of other plants (Scarlett 1980, cited in Griffith 1992), whilst retaining the ability to nourish itself through photosynthesis. Its key host plant is Kangaroo Grass *Themeda australis*, with which it is very often associated (Griffith 1992; NSW NPWS 1999b, 2000, 2003). It has recently, however, been observed parasitising the introduced species Coolatai Grass *Hyparrhenia hirta* (G. Steenbeeke, CMA Botanist pers. comm. Dec 2006).

Austral Toadflax produces numerous globular nut-like fruits which are shed from the adult plant to produce a soil-borne seed bank. Seed is known to remain viable for at least 3 years (N. Scarlett, cited in Griffiths 1992), but probably survives for longer (Griffith 1992). On the NSW North Coast, plants have been observed flowering and/or fruiting year round (pers. obs), but peak flowering occurs in spring to summer (Wiecek 1992).

Austral Toadflax populations show significant fluctuations in the number of plants present at any time (Griffith 1992). It has been proposed (Archer 1987; Griffith 1992; P. Sheringham, DEC Botanist *pers. comm*) that this dynamic behaviour could be due to disturbance events (e.g. fire, soil disturbance, salt-scalding or slashing) acting as triggers that induce a 'pulse' of germination of Austral Toadflax seed. Such disturbance events can reduce the height and density of tussocks of Kangaroo Grass, thereby increasing the local available inter-tussock habitat for Austral Toadflax, which may respond, by germination of seed, with an increase in numbers of plants which in turn shed seed into the local environs.

In time it is presumed that, in the absence of further disturbance events, Kangaroo Grass density increases, leading to a decline in plant numbers of Austral Toadflax and leaving only a seed bank in or on the soil, which may again be induced to germinate by a subsequent disturbance event. It is unclear, however, if fire or heat acts directly on Austral Toadflax seed to break dormancy or induce germination (Archer 1987; Leigh & Briggs 1989).

Griffith (1992) postulated that, with a general decline in fire frequency over parts of its habitat, Austral Toadflax populations may be threatened by the encroachment of shrubland and an increase in the density of Kangaroo Grass tussocks on grassy headland sites in northern NSW (Austral Toadflax habitat on the subject site is analogous to these naturally-occurring grassy headlands, albeit subject to regular slashing). He further postulated that a management regime utilising methods designed to reduce the density of Kangaroo Grass and prevent the incursion of native and exotic shrubs, namely slashing or burning, would be beneficial to Austral Toadflax.

Cohn (1999) investigated Griffith's hypotheses, and found little data to support them, instead concluding that slashing, burning or cutting plants neither benefited nor disadvantaged the species. However, Cohn did observe a trend toward higher densities of plants after cutting at one site and a short-term increase in density after slashing at another. Nonetheless, Cohn made the observation that management intervention was required to halt shrub recruitment or to reduce bushfire hazard. Similarly, she opined that less exposed sites may require active management to reduce the domination of Kangaroo Grass and allow recruitment and persistence of species such as Austral Toadflax.

5.4.2.2 Translocation

It is considered that translocation of Austral Toadflax plants is probably possible so long as the main host plant is also taken (J. Briggs, DEC Botanist, pers. comm. Jan 2007), and a consolidated soil ball is also taken with the plants to protect the host-parasite connection (G. Leonard, CHCC Ecologist pers. comm. Nov 2006).

However, DEC views translocation as a 'last resort' option, and considers that suitable habitat should be secured as a priority. Further advice from DEC considers that, in the case of Austral Toadflax, a better option would be to collect seed for later sowing onto a suitably prepared site, rather than translocating plants of this relatively short-lived species (J. Briggs, DEC Botanist, pers. comm. Jan 2007).

5.4.2.3 Distribution and Abundance

At the time that a species recovery plan was first drafted for Austral Toadflax (Griffith 1992), the species was recorded from eastern Tasmania to south-east Queensland, and was considered to be naturally uncommon to rare across its range. Griffith (1992) detailed 30 known localities for Austral Toadflax in NSW. 14 of these localities were post-1980 records, nine of which were located in the North Coast bioregion. Griffiths estimated that known and potential habitat for the species occurred in seven coastal reserves, and stated, with some qualification, that (as at 1992) the total population of Austral Toadflax in NSW "greatly exceeds 1,000 individuals". At that time, there was very little information about populations on the New England Tablelands and Nandewar bioregions, with only seven or eight localities known, and little, if any, population information.

In spite of his description of its general rarity and fairly poor reservation status in NSW, Griffith recommended that the species' conservation status be downgraded from 'endangered' to 'vulnerable' (in the sense of Briggs & Leigh 1988), noting that populations recorded in areas where no management for the species had been undertaken had persisted for decades, in which case the species could not be considered in danger of imminent extinction. He commented that further

downgrading of the species status from ‘vulnerable’ to ‘rare’ may be justifiable “following improved reservation and additional studies of its distribution, biology and management requirements, but cannot be supported on present knowledge.”

Since that time, a significant number of new localities of Austral Toadflax have been recorded, particularly in the North Coast, New England Tablelands and Nandewar bioregions of northern NSW. There are now about 120 known localities for this species from those three bioregions alone (DEC Wildlife Atlas records, DEC ‘YAVSD’ flora database November 2006).

The reservation status of Austral Toadflax in these bioregions has also significantly improved since 1992, with about a third of known records being reserved in at least 14 national parks, nature reserves or regional parks managed by the NSW NPWS (Table 5). By contrast, the species appears to remain uncommon or rare in the south of the state, with few new records (J. Briggs, DEC botanist, pers. comm. 19 Jan 2007).

Table 5: List of north-eastern NSW NPWS reserves containing Austral Toadflax

RESERVE NAME	BIOREGION	RESERVE TYPE
Arakoola Nature Reserve	Nandewar	NATURE RESERVE
Coffs Coast Regional Park	North Coast	REGIONAL PARK
Crowdy Bay National Park	North Coast	NATIONAL PARK
Guy Fawkes River National Park	North Coast	NATIONAL PARK
Hat Head National Park	North Coast	NATIONAL PARK
Kattang Nature Reserve	North Coast	NATURE RESERVE
Kings Plains National Park	New England Tableland	NATIONAL PARK
Kwiambal National Park	Nandewar	NATIONAL PARK
Linton Nature Reserve	Nandewar	NATURE RESERVE
Little Llangothlin Nature Reserve	New England Tableland	NATURE RESERVE
Moonee Beach Nature Reserve	North Coast	NATURE RESERVE
Oxley Wild Rivers National Park	New England Tableland/North Coast	NATIONAL PARK
Werrikimbe National Park	North Coast	NATIONAL PARK
Yuraygir National Park	North Coast	NATIONAL PARK

Dr. Lachlan Copeland, botanist at the University of New England (pers. comm. Jan 2007) knows of ‘in excess of 50 populations’ of Austral Toadflax, and estimates the total population of those occurrences as in the ‘tens of thousands’. In Dr. Copeland’s opinion, Austral Toadflax should not be considered a threatened species.

In the NSW North Coast bioregion, most known occurrences of Austral Toadflax are now contained within coastal conservation reserves. Population information for most localities is vague, but the population on the subject site is considered to be relatively large for coastal occurrences of Austral Toadflax, where the estimates of plant numbers currently range from less than 10 to several hundred (Griffiths 1992; Dr. L. Copeland; Mr. P. Sheringham, DEC botanist, pers. comm.).

5.4.3 Austral Toadflax on the Subject Site

On 12th January 2007, a detailed survey of the Austral Toadflax population on the subject site was undertaken by ELA botanists P. Richards and P. Gilmour. The entire property was traversed by both botanists walking three to five metres apart, scanning the groundcover for Austral Toadflax. When a plant was located a detailed search ensued, and the size and extent of each colony recorded. Each colony was marked with a stake and its position recorded using hand-held GPS. A stem was

counted as a single plant if it was separated from adjacent stems by more than 10 cm.

The search revealed eight discrete colonies of Austral Toadflax on the site, with a total site population of about 700 plants (Figure 7). An additional 40 plants were recorded in the northernmost colony during a later inspection by M. Graham (see 5.4.4 below). Flowering and fruiting plants were observed in all patches, as were seedlings and juvenile plants. The current area of occupancy is about 1000 m², with potential habitat estimated at about 0.8 hectares in the south-eastern sector of the site (Figure 7).

It is considered that Austral Toadflax would have been absent, or present in much lower numbers, at the subject site when the original forest vegetation was present. The population of Austral Toadflax on the subject site is most likely a direct result of the current regime of grassland management practiced on the site, which favours the establishment, persistence and recruitment of this species.

Similarly, it is predicted that plant numbers would decline in the absence of regular slashing of the subject site. No plants of Austral Toadflax were recorded under the crowns of remnant clumps of trees on the site, nor in areas where dense patches of the introduced Broad-leaved Paspalum and South African Pigeon Grass had established. Far fewer plants were located in areas where the Kangaroo Grass has not been subject to regular slashing.

Figure 7: Location of Austral Toadflax on subject site. Yellow numbers represent count of Austral Toadflax in each patch. Note: Patch labelled as '65+' includes 40 additional plants located by M. Graham in later survey.



5.4.4 Survey of other local populations of Austral Toadflax

5.4.4.1 Methods

A detailed survey of nearby sites that were known, or considered likely, to support populations of Austral Toadflax was undertaken by consultant ecologist Mark Graham over a three day period in early June 2007. An initial half-hour search at the subject site was undertaken to determine that Austral Toadflax plants were still present at this known locality, and that survey for the species at that time of year was feasible.

A total of 23 hours search effort was then undertaken at eight separate coastal headland sites from Arrawarra Headland north of the subject site to Look-At-Me-Now headland, which occurs about 5 km south of the subject site (see Figure 1). The search method was similar to that described in section 5.4.3 above, although larger sites were first divided into a grid pattern to facilitate plant searches. The same criterion was used in counting individual plants. Not all available habitat was searched at each site, as access was difficult on steeper parts of some headlands.

5.4.4.2 Results

A total of 1165 Austral Toadflax plants were recorded during this survey, including an additional 40 plants not previously counted in the northernmost colony on the subject site (see 5.4.3 and Figure 7 above). Austral Toadflax was located at all but one of the eight other sites searched.

Three sites where Austral Toadflax was recorded during this study represent new locality records for this species. The results of these searches are provided below in Table 6.

Table 6: Results of searches of other local Austral Toadflax sites

Location	Arrawarra	Ocean View	Mullaway	Woolgoolga	Hearnese Lake	Bare Bluff	Diggers Point	Dammerels	Look-At-Me-Now	TOTAL
No of Plants	60	42	29	119	40	4	0	46	825	1165
New Locality for Austral Toadflax?	Yes	Yes	Yes	No	No	No	No	No	No	
Hours of survey	2	2.75	1	3.75	0.5	3	0.75	2.5	6.75	22.5

5.4.4.3 Discussion

The Look-At-Me-Now Headland locality currently supports the largest known coastal population of Austral Toadflax, with at least 825 plants recorded during this study. It is of interest to note that Griffith (1992) recorded 'probably several hundred' plants at the same site. Furthermore, he recorded 36 plants at Bare Bluff whereas this study recorded only four plants. This is not altogether surprising in light of the fluctuations in population size over time exhibited by this species across its range.

All of the populations of Austral Toadflax recorded during this study are protected in secure reserves under the management of the NSW NPWS. Half of the sites are within

the Coffs Coast Regional Park while the remaining sites occur within the Moonee Beach Nature Reserve.

Notwithstanding their occurrence within conservation reserves, it is doubtful that these localities are managed specifically for the protection and enhancement of Austral Toadflax and its preferred habitat. As postulated by Griffith (1992), it is apparent that this species has the ability to persist in the wild in the absence of specific management. Since the preferred coastal habitat of Austral Toadflax, Kangaroo Grass grassland on coastal headlands, has recently been listed as an EEC under the TSC Act, it is likely that any future active management to maintain or improve the condition and extent of this EEC will also prove to be of benefit to populations of Austral Toadflax.

5.4.5 Discussion of status of Austral Toadflax

It is apparent from the results of this review of the current knowledge of Austral Toadflax that the present view of the conservation status of this species is based upon information that is now out of date. The number of known localities for this species has increased by over 400% since publication of the species' recovery plan (Griffiths 1992), from 30 populations for the entire state of NSW to 120 for the north-eastern corner of NSW alone. Similarly, the proportion of known Austral Toadflax localities that are in secure conservation reserves has greatly increased, with over 90% of northern NSW coastal localities now protected in reserves.

Current knowledge about known population sizes of Austral Toadflax is yet to be incorporated into public data systems. For example, the DEC Threatened Species website (DEC 2005) describes Austral Toadflax as occurring in 'very small populations scattered across eastern NSW..', and NPWS Wildlife Atlas records indicate that the largest population in north-eastern NSW is a colony of 223 plants in Kattang NR (DEC 2007). The information obtained in the course of this study, through discussion with local experts and detailed local surveys, has greatly improved the current level of knowledge of the populations and numbers of Austral Toadflax. It is now apparent that this species is known from a large number of very large populations across its northern NSW distributional range.

Based on the results of this study, the estimated current total population of Austral Toadflax in north-eastern NSW is conservatively estimated to exceed 20 000 plants occurring in at least 120 known localities, over a third of which are protected in conservation reserves. In the local area surrounding and including the subject site, the currently known total population of Austral Toadflax likely exceeds 2 000 plants in eight separate populations. Seven of these local populations are protected in conservation reserves, including the largest known coastal population of Austral Toadflax at Look-At-Me-Now Headland in Moonee Beach Nature Reserve.

In light of this new information regarding the state-wide and local distribution and relative abundance of Austral Toadflax, it is considered that ameliorative measures discussed below for ensuring the persistence of the local population are more than adequate in achieving their objective. This is especially the case considering the likelihood that the population on the subject site is 'artificial', in that human modification of the original habitat has created conditions suitable for colonisation of the site by Austral Toadflax.

5.5 Austral Toadflax - Ecological Objectives and Ameliorative Measures

Seek to protect the local sub-population of Austral Toadflax in order to ensure its persistence in the long term.

(refer also to 7-part test for Austral Toadflax, in Appendix 4)

Proposed actions to maintain the future viability of the local occurrence of Austral Toadflax are provided below. These actions are also illustrated in Figure 8.

1. Secure occupied habitat of Austral Toadflax through protection of three patches of plants, containing at least 250 plants, and Austral Toadflax habitat, totalling 0.13 ha, within the proposed 7A reserve on the eastern side of the subject site. This action protects over a third of the Austral Toadflax plants recorded on the site, and an area of habitat which exceeds the current Austral Toadflax area of occupancy on the subject site.
2. Expansion of the proposed 7A reserve to include an area of slashed Kangaroo Grass grassland vegetation community in the southern extremity of the proposed reserve. This area is to be maintained as high quality grassland habitat into which Austral Toadflax may recruit. This expanded portion of the proposed 7A reserve was delineated on-site with agreement from CHCC's ecologist, and was subsequently found to be already partially occupied by a colony of Austral Toadflax.
3. Undertake active management within those parts of the proposed 7A reserve identified as Austral Toadflax habitat (Figure 8), to promote an increase in the area of high quality habitat for Austral Toadflax, in the proximity of where this species has already been located in the reserve. This would entail active management to reduce the height and density of the Kangaroo Grass in those selected parts of the reserve, thus promoting the creation of habitat for, and a predicted potential increase in local recruitment of, Austral Toadflax.
4. Proposed seeding, with locally-sourced Austral Toadflax seed, of all areas within the proposed 7A reserve that are to be managed as Austral Toadflax habitat (point 3 above). Seed would be harvested from those plants that would be subject to impact on the subject site under the current proposal. Harvesting of seeds would occur prior to the commencement of any construction activities on the subject site. This proposal is in accordance with advice from DEC as outlined in section 6.1.1.3 above. All activities related to seed harvesting and sowing would be undertaken in consultation with DEC, and in accordance with information and guidelines provided in Vallee *et al.* (2004).
5. Maintain the present Kangaroo Grass grassland community within suitable areas in the proposed subdivision. Maintain this Kangaroo Grass grassland environment through a program of slashing timed to minimise competition from weed species, such as Broad-leaved Paspalum, Pigeon Grass and Parramatta Grass, and to enhance the amount of potential Austral Toadflax habitat. This action is not intended to form a fundamental plank of the overall conservation strategy for the site, but seeks to utilize available areas of native grasses, such as road verges, as Austral Toadflax habitat through the maintenance of the native grassland character of these areas throughout the subdivision.
6. Explore opportunities for neighbouring properties to adopt a sympathetic grassland maintenance regime to improve the quality of habitat for Austral Toadflax.

The above proposed actions account for the retention or protection of part or all of 7 of the 8 patches of Austral Toadflax on-site. In addition, 1 300m² of Austral Toadflax habitat will be formally protected and actively managed in a 7A reserve, and a further 1 300m² of Austral Toadflax habitat will be managed to maintain the existing Kangaroo Grass grassland. Actions 3, 4 and 6 could be incorporated in to a site Vegetation Management Plan (VMP) which would guide the current and future protection and management of vegetation on the subject site.

Protection of the majority of the current population of plants, coupled with active management to increase, maintain and enhance habitat, is predicted to not only sustain the current population but result in an increased, secure local population of Austral Toadflax into the future.

5.6 Address requirements under the CHCC CKPoM

Whilst it is considered that only low quality Koala habitat occurs on the subject site, and it is likely that Koalas do not utilise the site, known Koala food trees do occur on the subject site. In accordance with the CHCC CKPoM, therefore, Koala food trees will be retained, where practicable, on the subject site, and any plantings or assisted regeneration of appropriate remnant vegetation communities will incorporate local-provenance Koala food tree species including Forest Red Gum, Swamp Oak, and Broad-leaved Paperbark.

5.7 Consider the CHCC Tree Preservation Order

The CHCC TPO (CHCC 2004) applies to the site as it is zoned 2E Residential Tourist Zone and is over 2000m² in area. Because the subject site is covered by the CHCC TPO, development consent is required before any native trees are removed. Proposed ameliorative measures, discussed below, include the protection of undisturbed native vegetation on the site, assisted regeneration of disturbed vegetation using local-provenance seed stock, a control program to remove weeds, and compensatory offset plantings of appropriate native vegetation.

Figure 8: Proposed Management of Austral Toadflax in relation to proposal layout.



6. Summary and Conclusion

This report describes an investigation of the flora and fauna values within and adjacent to the land parcel located at 45 Hearnese Lake Road, Woolgoolga. A number of threatened species and communities were identified on the subject site. An assessment of the potential impact upon these species and communities of a proposed residential subdivision concluded that a number of ameliorative measures were required in order to meet ecological objectives for the site. These include:

- Secure environmental protection zoning on part of the site to protect known occurrences of, and potential habitat for, threatened flora and fauna and EECs
- Consolidation and enhancement of native vegetation within the above environmental protection zone to ensure the persistence of a local, coastal vegetated corridor which links areas to the north and south of the site
- Active, sympathetic management within environmental protection areas and suitable parts of the development footprint to assist in the regeneration of EECs and other native vegetation, and to maintain quality habitat for threatened flora
- Possible use of local threatened plant seed for use in a population enhancement program within suitably managed parts of an environmental protection zone
- The maintenance of the Kangaroo Grass grassland habitat on designated parts of the development footprint
- Provision of environmental buffers to protect areas of conservation value from 'edge effects'
- Stormwater management designed to maintain groundwater conditions and local patterns of freshwater flow, and to ensure that the quality of runoff water into high conservation value areas within and adjacent to the site remains high
- Exploring opportunities for neighbouring properties to adopt similar sympathetic management of areas to enhance EEC regeneration and also to provide extended habitat for threatened flora.

It is considered that these measures will ensure the protection, persistence and ongoing viability of those threatened species and communities known to occur within and adjacent to the subject site.

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Appendices

7.1 APPENDIX 1 - TSC / EPBC Act Threatened Species data search results

Note: Those species in **bold** considered likely to occur on, or utilise the subject site.

Fauna Species

* y = Present; u = Unlikely; p = Potential to occur; l = Likely to occur

CLASS	FAMILY	SCIENTIFIC NAME	COMMON NAME	TSC Act	EPBC Act	Likelihood of occurrence*
Amphibia	Hylidae	<i>Litoria aurea</i>	Green & Golden Bell Frog	E	V	p
Amphibia	Hylidae	<i>Litoria olongburensis</i>	Olongburra Frog	V	V	p
Amphibia	Myobatrachidae	<i>Crinia tinnula</i>	Wallum Froglet	V	-	y
Amphibia	Myobatrachidae	<i>Mixophyes iteratus</i>	Giant Barred Frog	E	E	u
Aves	Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	p
Aves	Accipitridae	<i>Pandion haliaetus</i>	Osprey	V	-	p
Aves	Ardeidae	<i>Botaurus poiciloptilus</i>	Australasian Bittern	V	-	p
Aves	Ardeidae	<i>Ixobrychus flavicollis</i>	Black Bittern	V	-	p
Aves	Burhinidae	<i>Esacus neglectus</i>	Beach Stone-curlew	E	-	u
Aves	Cacatuidae	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	-	u
Aves	Campephagidae	<i>Coracina lineata</i>	Barred Cuckoo-shrike	V	-	p
Aves	Charadriidae	<i>Charadrius mongolus</i>	Lesser Sand Plover	V	-	u
Aves	Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E	-	p
Aves	Climacteridae	<i>Climacteris picumnus</i>	Brown Treecreeper	V	-	u
Aves	Columbidae	<i>Ptilinopus magnificus</i>	Wompoo Fruit-Dove	V	-	p
Aves	Columbidae	<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V	-	p
Aves	Columbidae	<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V	-	p
Aves	Haematopodidae	<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V	-	u
Aves	Haematopodidae	<i>Haematopus longirostris</i>	Pied Oystercatcher	V	-	u
Aves	Halcyonidae	<i>Todiramphus chloris</i>	Collared Kingfisher	V	-	u
Aves	Jacanidae	<i>Irediparra gallinacea</i>	Comb-crested Jacana	V	-	u
Aves	Meliphagidae	<i>Grantiella picta</i>	Painted Honeyeater	V	-	u
Aves	Meliphagidae	<i>Xanthomyza phrygia</i>	Regent Honeyeater	E	E	u
Aves	Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler (eastern subsp.)	V	-	u
Aves	Psittacidae	<i>Cyclopsitta diophthalma coxeni</i>	Double-eyed Fig-parrot (Coxen's Fig-parrot)	E	E	u
Aves	Psittacidae	<i>Lathamus discolor</i>	Swift Parrot	E	E	p

CLASS	FAMILY	SCIENTIFIC NAME	COMMON NAME	TSC Act	EPBC Act	Likelihood of occurrence*
Aves	Scolopacidae	<i>Calidris tenuirostris</i>	Great Knot	V	-	u
Aves	Scolopacidae	<i>Limosa limosa</i>	Black-tailed Godwit	V	-	u
Aves	Strigidae	<i>Ninox connivens</i>	Barking Owl	V	-	u
Aves	Strigidae	<i>Ninox strenua</i>	Powerful Owl	V	-	u
Aves	Tytonidae	<i>Tyto capensis</i>	Grass Owl	V	-	u
Aves	Tytonidae	<i>Tyto novaehollandiae</i>	Masked Owl	V	-	u
Aves	Tytonidae	<i>Tyto tenebricosa</i>	Sooty Owl	V	-	u
Mammalia	Dasyuridae	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	V	u
Mammalia	Dasyuridae	<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	u
Mammalia	Dasyuridae	<i>Planigale maculata</i>	Common Planigale	V	-	u
Mammalia	Molossidae	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	p
Mammalia	Petauridae	<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	u
Mammalia	Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	u
Mammalia	Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	V	-	p
Mammalia	Potoroidae	<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	V	u
Mammalia	Pteropodidae	<i>Pteropus alecto</i>	Black Flying-fox	V	-	l
Mammalia	Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	l
Mammalia	Pteropodidae	<i>Syconycteris australis</i>	Common Blossom-bat	V	-	l
Mammalia	Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	p
Mammalia	Vespertilionidae	<i>Chalinolobus nigrogriseus</i>	Hoary Bat	V	-	p
Mammalia	Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	p
Mammalia	Vespertilionidae	<i>Kerivoula papuensis</i>	Golden-tipped Bat	V	-	p
Mammalia	Vespertilionidae	<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	p
Mammalia	Vespertilionidae	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	p
Mammalia	Vespertilionidae	<i>Myotis adversus</i>	Large-footed Myotis	V	-	p
Mammalia	Vespertilionidae	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	p
Reptilia	Cheloniidae	<i>Caretta caretta</i>	Loggerhead Turtle	E	E	u
Reptilia	Cheloniidae	<i>Chelonia mydas</i>	Green Turtle	V	V	u
Reptilia	Elapidae	<i>Hoplocephalus stephensii</i>	Stephens' Banded Snake	V		u

Flora species

* y = Present; u = Unlikely; p = Potential to occur; l = Likely to occur

FAMILY	SCIENTIFIC NAME	TSC Act	EPBC Act	Likelihood of occurrence*
Apocynaceae	<i>Cynanchum elegans</i>	E	E	p
Apocynaceae	<i>Parsonsia dorrigoensis</i>	V	E	u
Asclepiadaceae	<i>Marsdenia longiloba</i>	E	V	u
Cyperaceae	<i>Eleocharis tetraquetra</i>	E	-	p
Euphorbiaceae	<i>Chamaesyce psammogeton</i>	E	-	u
Fabaceae (Caesalpinioideae)	<i>Senna acclinis</i>	E	-	p
Fabaceae (Faboideae)	<i>Pultenaea maritima</i>	V	-	u
Fabaceae (Faboideae)	<i>Sophora tomentosa</i>	E	-	u
Orchidaceae	<i>Phaius australis</i>	E	E	p
Polygonaceae	<i>Persicaria elatior</i>	V	V	p
Rutaceae	<i>Acronychia littoralis</i>	E	E	p
Rutaceae	<i>Boronia umbellata</i>	V	V	u
Rutaceae	<i>Zieria prostrata</i>	E	E	u
Santalaceae	<i>Thesium australe</i>	V	V	y
Sapotaceae	<i>Amorphospermum whitei</i>	V		u
Simaroubaceae	<i>Quassia sp. Moonee Creek</i>	E	E	u

7.2 APPENDIX 2 - Plant Species Recorded on Subject Site

* = Introduced species

Scientific name	Common Name	Site 1	Site 2	Site 3	Site 4
<i>Acacia longifolia</i> ssp. <i>sophorae</i>	Coastal Wattle	•		•	
<i>Acronychia imperforata</i>	Beach Acronychia			•	
<i>Ageratum houstonianum</i> *	Blue Billy-goat Weed	•		•	
<i>Alectryon coriaceus</i>	Beach Alectryon			•	
<i>Anagallis arvensis</i> *	Scarlet Pimpernel	•			
<i>Aster subulatus</i> *	Wild Aster				•
<i>Axonopus compressus</i> *	Broad-leaved Carpet Grass	•			•
<i>Babingtonia angusta</i>	Babingtonia angusta		•		
<i>Baccharis halimifolia</i> *	Groundsel Bush	•		•	
<i>Bacopa monnieri</i>	Bacopa				•
<i>Banksia integrifolia</i> ssp. <i>integrifolia</i>	Coast Banksia	•	•	•	
<i>Baumea juncea</i>	Grey Twig Rush				•
<i>Bidens pilosa</i> *	Cobblers Pegs	•	•		
<i>Bidens subalternans</i> *	Greater Beggar's Ticks		•		
<i>Billardiera scandens</i> var. <i>sericata</i>	Hairy Apple Berry		•		
<i>Breynia oblongifolia</i>	Coffee Bush			•	
<i>Cassipouira glabella</i> forma <i>glabella</i>	Devil's Twine		•	•	
<i>Casuarina glauca</i>	Swamp Oak	•	•	•	
<i>Cayratia clematidea</i>	Cayratia	•			
<i>Centella asiatica</i>	Pennywort	•	•		
<i>Chorizema parviflorum</i>	Eastern Flame Pea		•		
<i>Chrysanthemoides monilifera</i> ssp. <i>rotundata</i> *	Bitou	•	•	•	
<i>Ciclospermum leptophyllum</i> *	Slender Celery Weed				
<i>Conyza</i> sp*	Fleabane	•			
<i>Corymbia intermedia</i>	Pink Bloodwood		•		
<i>Crotalaria brevis</i>	Crotalaria brevis				
<i>Crotalaria lanceolata</i> ssp. <i>lanceolata</i> *	Crotalaria lanceolata ssp. lanceolata	•			
<i>Cryptocarya triplinervis</i> var. <i>triplinervis</i>	Three-veined Laurel			•	
<i>Cupaniopsis anacardioides</i>	Tuckeroo			•	
<i>Curculigo ensifolia</i>	Curculigo ensifolia	•			
<i>Cymbopogon refractus</i>	Barbed-wire Grass			•	
<i>Cynodon dactylon</i>	Queensland Blue Couch				•
<i>Cyperus prolifer</i> *	Cyperus prolifer				•
<i>Cyperus sphaeroideus</i>	Cyperus sphaeroideus	•			
<i>Dampiera purpurea</i>	Dampiera purpurea		•		
<i>Desmodium gunnii</i>	Desmodium gunnii	•	•		
<i>Desmodium uncinatum</i> *	Silver-leaf Desmodium			•	
<i>Dianella caerulea</i>	Blue Flax Lily	•			
<i>Dichelachne micrantha</i>	Shorthair Plumegrass	•	•		
<i>Dichondra repens</i>	Kidney Weed	•			
<i>Digitaria parviflora</i>	Small-flowered Finger Grass	•			
<i>Echinopogon caespitosus</i>	Bushy Hedgehog Grass	•			
<i>Eclipta platyglossa</i>	Eclipta		•		•
<i>Elaeocarpus reticulatus</i>	Blueberry Ash			•	
<i>Eleocharis spachelata</i>	Spike Sedge				•

Scientific name	Common Name	Site 1	Site 2	Site 3	Site 4
<i>Entolasia stricta</i>	Wiry Panic	•	•		
<i>Eragrostis</i> sp.	Eragrostis			•	
<i>Eucalyptus tereticornis</i>	Forest Red Gum	•	•		
<i>Eustrephus latifolius</i>	Wombat Berry	•	•	•	
<i>Ficus coronata</i>	Sandpaper Fig			•	
<i>Galactia tenuiflora</i> var. <i>lucida</i>	Galactia tenuiflora var. lucida	•			
<i>Glochidion ferdinandi</i>	Cheese Tree	•		•	
<i>Glycine clandestina</i>	Glycine	•	•		
<i>Gonocarpus teucroides</i>	Gonocarpus	•			
<i>Goodenia paniculata</i>	Goodenia	•			
<i>Hibbertia riparia</i>	Guinea Flower		•		
<i>Hovea heterophylla</i>	Hovea	•			
<i>Hydrocotyle bonariensis</i> *	Pennywort				•
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort		•		
<i>Hypericum gramineum</i> *	Small St John's Wort	•			
<i>Hypochaeris radicata</i> *	Catsear	•			
<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass	•	•	•	
<i>Isolepis nodosus</i>	Club Rush				•
<i>Jacksonia scoparia</i>	Dogwood		•		
<i>Lachnagrostis filiformis</i>	Blowngrass	•			•
<i>Lantana camara</i> *	Lantana		•	•	
<i>Leersia hexandra</i>	Swamp Ricegrass				•
<i>Lepironia articulata</i>	Lepironia				•
<i>Lobelia anceps</i>	Lobelia anceps	•			
<i>Lomandra longifolia</i>	Spiny Mat Rush	•	•	•	
<i>Lomandra multiflora</i> ssp. <i>multiflora</i>	Many-flowered Mat Rush	•	•		
<i>Lonicera japonica</i> *	Honeysuckle	•			
<i>Lophostemon suaveolens</i>	Swamp Box	•	•		
<i>Marsilea mutica</i>	Nardoo				•
<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	•	•	•	•
<i>Monotoca elliptica</i>	Tree Broom-heath			•	
<i>Murdannia graminea</i>	<i>Murdannia graminea</i>	•			
<i>Notelaea longifolia</i>	Large Mock Olive	•		•	
<i>Nymphaea caerulea</i> ssp. <i>zanzibarensis</i> *	Cape Waterlily				•
<i>Nymphoides indica</i>	Water Snowflake				•
<i>Ochna serrulata</i> *	Mickey Mouse Bush			•	
<i>Oxalis corniculata</i> *	Oxalis	•			
<i>Parsonia straminea</i>	Milky Silkpod		•		
<i>Paspalum distichum</i>	Water Couch				•
<i>Paspalum wettsteinii</i> *	Broad-leaved Paspalum	•	•	•	
<i>Patersonia sericea</i>	Silky Purple-flag		•		
<i>Persicaria decipiens</i>	Slender Knotweed				•
<i>Persoonia stradbrokeensis</i>	Geebung	•			
<i>Phyllidrum lanuginosum</i>	Frogmouth				•
<i>Physalis peruviana</i> *	Cape Gooseberry			•	
<i>Pimelia linifolia</i>	Riceflower	•	•		
<i>Pittosporum revolutum</i>	Rough Fruit Pittosporum		•	•	
<i>Plantago lanceolata</i> *	Plantain	•	•		

Scientific name	Common Name	Site 1	Site 2	Site 3	Site 4
<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy		•		
<i>Polygala japonica</i> *	Dwarf Milkwort	•			
<i>Polymeria calycina</i>	Polymeria	•	•		
<i>Poranthera microphylla</i>	Poranthera		•		
<i>Pratia purpurascens</i>	Whiteroot	•			
<i>Pteridium esculentum</i>	Bracken Fern			•	
<i>Ranunculus lappaceus</i>	Common Buttercup		•		•
<i>Rubus parvifolius</i>	Native Raspberry	•	•	•	
<i>Senecio lautus ssp. maritimus</i>	Variable Groundsel	•	•	•	
<i>Senna pendula var. glabrata</i> *	Senna	•		•	
<i>Setaria sphacelata</i> *	South African Pigeon Grass	•			
<i>Sisyrinchium species A</i> *	Scourweed	•			
<i>Smilax australis</i>	Wait-a-while			•	
<i>Smilax glycyphylla</i>	Sweet Sarsaparilla			•	
<i>Solanum nigrum</i> *	Black-berry Nightshade	•			
<i>Sonchus oleraceus</i> *	Common Sowthistle	•			
<i>Spiranthes sinensis</i>	Lady's Tresses Orchid		•		
<i>Sporobolus fertilis</i> *	Giant Parramatta Grass	•			
<i>Stephania japonica var. discolor</i>	Snake Vine	•		•	
<i>Syzygium australe</i>	Brush Cherry			•	
<i>Syzygium smithii</i>	Lilly Pilly			•	
<i>Themeda australis</i>	Kangaroo Grass	•	•	•	
<i>Thesium australe (Vulnerable; TSCAct & EPBC Act)</i>	Austral Toadflax	•			
<i>Thysanotus tuberosus ssp. tuberosus</i>	Common Fringe Lily		•		
<i>Tricoryne elatior</i>	Yellow Rush Lily	•	•	•	
<i>Triglochin procerum</i>	Water Ribbons				•
<i>Verbena rigida</i> *	Veined Verbena	•		•	
<i>Viola betonicifolia</i>	Native Violet	•			
<i>Viola hederacea</i>	Ivy-leaved Native Violet	•			
<i>Wikstroemia indica</i>	Wikstroemia	•		•	
<i>Zoysia macrantha</i>	Prickly Couch				•

7.3 APPENDIX 3 - EPBC Act Matters

Matters of National Environmental Significance

Wetlands of International Significance (Ramsar Sites)

- LITTLE LLANGOTHLIN NATURE RESERVE

Study site is within same catchment (Clarence) as the above Ramsar site.

Migratory Species or species habitat likely to occur within area

- ***Haliaeetus leucogaster* White-bellied Sea-Eagle**
- *Hirundapus caudacutus* White-throated Needletail
- ***Monarcha melanopsis* Black-faced Monarch**
- ***Monarcha trivirgatus* Spectacled Monarch**
- *Myiagra cyanoleuca* Satin Flycatcher
- ***Rhipidura rufifrons* Rufous Fantail**
- *Xanthomyza phrygia* Regent Honeyeater

Migratory Wetland Species or species habitat may occur within area

Gallinago hardwickii Latham's Snipe, Japanese Snipe

Rostratula benghalensis s. lat. Painted Snipe

Other Matters Protected by the EPBC Act

Species or species habitat may occur within area and/or breeding likely to occur within area

Apus pacificus Fork-tailed Swift

***Ardea alba* Great Egret, White Egret**

***Ardea ibis* Cattle Egret**

Gallinago hardwickii Latham's Snipe, Japanese Snipe

***Haliaeetus leucogaster* White-bellied Sea-Eagle**

Hirundapus caudacutus White-throated Needletail

Lathamus discolor Swift Parrot

***Merops ornatus* Rainbow Bee-eater**

***Monarcha melanopsis* Black-faced Monarch**

***Monarcha trivirgatus* Spectacled Monarch**

Myiagra cyanoleuca Satin Flycatcher

***Rhipidura rufifrons* Rufous Fantail**

Rostratula benghalensis s. lat. Painted Snipe

7.4 APPENDIX 4 - 7-part Tests

As indicated in Section 4 above, the proposed activity has the potential to affect threatened species, populations, ecological communities, or their habitats, namely the Austral Toadflax *Thesium australe*, and the Endangered Ecological Community 'Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion', therefore the application of the "7-part test" is required in accordance with S5A of the EP&A Act (1979).

7.4.1 7-part test - Austral Toadflax *Thesium australe*

Note: this 7-part test should be read in conjunction with the proposed ameliorative measures for Austral Toadflax described in section 5.5 of this report.

- 1. 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.**

The local population of Austral Toadflax is not likely to be placed at risk of extinction by the proposed action. Over one third of the plants on the subject site are proposed to be protected within a LEP Zone 7A environmental protection reserve, and habitat managed to maintain existing colonies and improve recruitment opportunities to enhance the local population. Another quarter of the plants on the subject site will not be directly impacted by the proposed action, and their Kangaroo Grass habitat will be retained where appropriate within the development footprint, on nature strips, in yards and within other open space areas.

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

No endangered population is affected by the proposed action.

- 3. In the case of an endangered ecological community or critically 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,

Austral Toadflax is not an endangered or critically endangered ecological community.

- 4. 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.

It should be noted that the Austral Toadflax habitat on the subject site is considered to have been created through human-induced modification of the original native vegetation by clearing of much of the site for grazing of livestock. It is considered unlikely that Austral Toadflax would have occurred naturally on the subject site, or may have occurred there but in far smaller numbers than at present. Notwithstanding these observations, the following responses are provided:

(i) Approximately 0.06 hectares of occupied Austral Toadflax habitat and 0.5 hectares of unoccupied habitat is proposed for removal or modification. This habitat has been thoroughly searched, and supports approximately 300 plants of Austral Toadflax. The removal of this habitat is proposed to be offset by the protection, through secure zoning and active habitat management, of 0.2 hectares of occupied and unoccupied habitat, currently supporting at least 400 Austral Toadflax plants, combined with sympathetic management of unprotected habitat designed to enhance the local population of Austral Toadflax. Seed collected from plants proposed to be removed will be used to assist recruitment of Austral Toadflax into areas retained and managed as secure, high quality habitat for this species.

(ii) Some areas of habitat are likely to become isolated or fragmented as a result of the proposed action. However, the proposed ameliorative measures seek to consolidate and secure available habitat for Austral Toadflax.

(iii) It is considered that the habitat proposed to be removed or fragmented is not important for the long-term survival of the species in the locality. Ameliorative measures described in chapter 5 of this report seek to increase and improve the quality of Austral Toadflax habitat in the future, which is likely to result in an increase in Austral Toadflax numbers in the locality. Locally, this population, although considered to be 'artificial', is relatively large. However, well over 1300 plants of this species are protected in secure reserves within several kilometres to the north and south of the subject site, and have persisted for decades in the absence of specific habitat management.

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

There is no critical habitat in the study area, and the action is unlikely to have either a direct or indirect adverse effect on critical habitat.

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

The action proposed is not consistent with objectives in the Austral Toadflax recovery plan (Griffith 1992), however, proposed amelioration of the impacts of the action are broadly consistent with the recovery plan in that active management of Austral Toadflax habitat is considered to be a desirable action, in order to maintain and improve local populations of Austral Toadflax (refer to chapter 5 above).

7. 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 action of removal of native vegetation constitutes part of a Key Threatening Process: Clearing of Native Vegetation. However, proposed local-source planting, assisted regeneration, and protection through environmental zoning of a significant portion of the site is intended to replace and enhance original native vegetation on the subject site, improve consolidation and connectivity of local vegetation, and actively maintain and improve Austral Toadflax habitat.

7.4.2 7-part test - Endangered Ecological Community 'Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion (SCFF EEC)'

- 1. 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.**
SCFF EEC is not a threatened species.
- 2. In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**
No endangered population is affected by the proposed action.
- 3. In the case of an endangered ecological community or critically 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**

(i) The proposed action is not likely to place the local occurrence of SCFF at risk of extinction. Chapter 5 of this report details proposed ameliorative measures designed to ensure that the local occurrence of SCFF is retained where practicable, and actively regenerated and planted in a 7A reserve and no-build portions of the subject site.

(ii) The SCFF on the subject site presently consists of scattered individual overstorey tree species, several small clumps of overstorey tree species, and a mixed native/exotic understorey that was formerly grazed by livestock and is now regularly slashed. All proposed regeneration of SCFF will seek to restore the EEC to a substantially natural state. This is considered to provide for the future secure protection and improvement in condition of SCFF on the subject site.
- 4. 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) There are approximately 30 – 40 mature overstorey trees of SCFF on the subject site, and an equal number of immature specimens. As many trees will be retained on the site as practicable, but it is considered that most trees will be removed. Amelioration is proposed through the planting of local tree species to consolidate remnant native vegetation on the site. A total area of

approximately 0.53 ha is proposed to be planted and restored with examples of the SCFF EEC. This is considered to represent more than adequate amelioration for the removal of the above trees.

(ii) It is considered that the SCFF EEC currently present on the subject site is already in a fragmented and isolated condition. Proposed ameliorative measures are intended to plant and restore this EEC within a secure 7A reserve, which would recover the vegetation from its present fragmented condition, and consolidate the vegetation on-site into a valuable, protected coastal corridor of native vegetation.

(iii) It is considered that the habitat to be removed is not important to the long term survival of SCFF EEC in the locality. The proposed protection, assisted regeneration, and local-provenance planting of examples of this EEC within a 7A reserve is intended to more than offset the removal of parts of this EEC on the subject site, as well as secure the long-term future of this community in the locality.

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

There is no critical habitat in the study area, and the action is unlikely to have either a direct or indirect adverse effect on critical habitat.

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

The action proposed is not considered to be consistent with objectives or actions of a recovery plan or threat abatement plan. There is no current recovery plan for SCFF EEC.

7. 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 action of removal of native vegetation constitutes part of a Key Threatening Process: Clearing of Native Vegetation. However, proposed local-source planting, assisted regeneration, and protection through environmental zoning of a significant portion of the site is intended to replace and enhance original native vegetation on the subject site. The site will also benefit from the removal of a potentially serious naturalised species, *Cyperus prolifer*.