

**OVERVIEW OF THE FLORA AND FAUNA
CLEARY BROS (BOMBO) PROPERTY AT GERROA**



A report prepared by
KEVIN MILLS & ASSOCIATES PTY LIMITED

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Front cover: Panorama of the typical vegetation in the investigation area at Gerroa. This includes Swamp Oak Forest, channels lined with native wetland vegetation and extensive areas of grazing land.

OVERVIEW OF THE FLORA AND FAUNA CLEARY BROS (BOMBO) PROPERTY AT GERROA

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OVERVIEW OF THE FLORA AND FAUNA CLEARY BROS (BOMBO) PROPERTY AT GERROA MUNICIPALITY OF KIAMA – CITY OF SHOALHAVEN

1 INTRODUCTION

1.1 BACKGROUND

This report was prepared by Kevin Mills & Associates, Ecological and Environmental Consultants, on behalf of Cleary Bros (Bombo) Pty Limited, of Port Kembla, operators of the Gerroa Sand Quarry. The purpose of the report is to provide an overview of the flora and fauna of the whole of the property surrounding the sand quarry. Numerous reports have previously been prepared on various aspects of the sand quarry, including environmental impact statements, flora and fauna assessments and monitoring reports over the past few years. Most of these reports have been prepared by Kevin Mills & Associates.

The aim of the current report is to draw together all existing information on the flora, vegetation communities, fauna, habitats and conservation values of the property surrounding the sand quarry at Gerroa owned by Cleary Bros (Bombo) Pty Limited. In particular, those matters listed under the NSW *Threatened Species Conservation Act 1995* are described in detail.

The study property is referred to in this report as the “investigation area”. It covers about 350 hectares and is located between the access road to the farm in the north, the South Coast Railway in the west, Seven Mile Beach or Gerroa Road in the east, and the Berry Beach Road in the south. The land straddles the border of the Municipality of Kiama to the north and the City of Shoalhaven to the south. The extent of the investigation area is shown on Figure 1.

1.2 THE INVESTIGATION AREA

The investigation area is located about three kilometres to the southwest of Gerroa; see Figure 1. The area is almost level land close to sea level, the highest point is about three metres in altitude. Most of it was originally a large coastal swamp known as Foy's Swamp; this swamp has been drained for many years. The drains across the land form a prominent component of the landscape of the farm.

The area is mainly underlain by coastal sand dunes in the east and clayey, alluvial soil in the west. The area is located at the northern end of the extensive Seven Mile Beach dune system. The site is from about 700 metres to 2,700 metres inland from Seven Mile Beach. The sand quarry that has operated for many years and is located directly north and west of Berry Beach Road and Seven Mile Beach Road, respectively; i.e. in the far south-eastern corner of the investigation area. Drainage from the area is eastwards towards Blue Angle Creek, this watercourse crosses the boundary of the investigation area near its far north-eastern corner. This creek is a tributary of the Crooked River, located about 1.5 kilometres to the north.

1.3 SURVEY METHODS

This study is largely a “desk top” review of all existing information on the flora and fauna within the investigation area. The consultants are very familiar with this land, having been carrying out surveys there for many years. A full list of our reports is provided in the References at Section 5.

The information in this report is largely drawn from these reports, although new fieldwork was undertaken in January 2005 to extend and refine the vegetation map for the area and to gather information on those parts of the property, mainly in the west, that had not been studied previously.

The vegetation map was prepared in the field, using a colour aerial photograph at a scale of about 1:3,570. The boundaries of all vegetation communities were checked in January 2005 and marked directly onto the aerial photograph. Generally, there were only slight changes to the previous vegetation maps prepared by the consultant, although some areas not previously mapped are now included.

Notes were made in the field on the characteristics of each vegetation community identified, including a list of the composite species.

A plant species list was prepared from previous reports by the consultant, and a significant number of species were added during the January 2005 surveys.

The recording of fauna species during the most recent surveys was largely opportunistic; extensive lists already exist for the investigation area and the surrounding land.

Records of threatened plants and animals in the locality were sought from all available sources and documented. Those species actually recorded in the investigation area are particularly noted and discussed.

2 VEGETATION

2.1 PLANTS

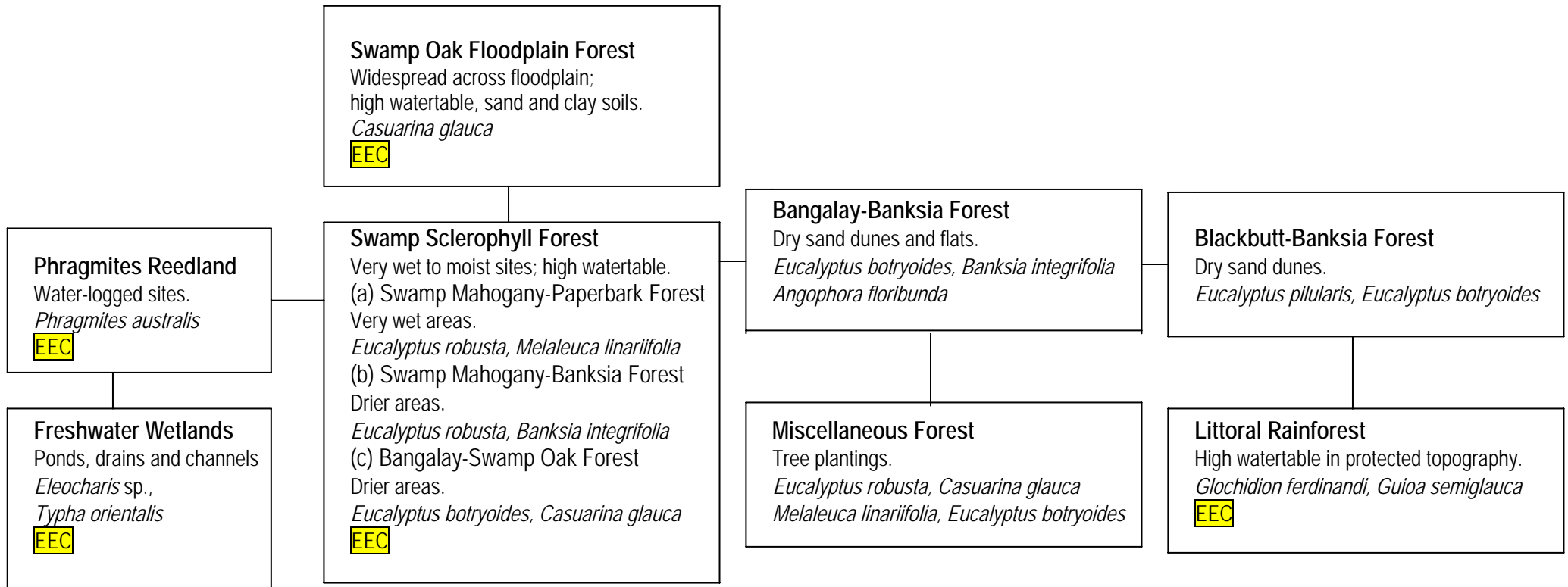
A plant species list for the investigation area was compiled from all previous studies and some recent field inspections undertaken for this project. This list is provided in Appendix 1, where the species name, both botanical and common names, and the family to which each belongs, is documented. The list contains the names of 137 native species and 65 exotic (introduced) species, a total of 202 plant species.

The species can readily be divided into three main groups, viz. native forest species, native wetland species and exotic species.

2.2 VEGETATION COMMUNITIES

The vegetation communities identified within the investigation area are summarised in Table 1; where a total of eight communities are listed, two of which are artificial. A description of each community is provided below the table. The relationships between the identified communities are shown schematically in Figure 3. All but two of the natural communities are floodplain communities. A map showing the distribution of the vegetation communities is provided in Figure 2, which is attached.

FIGURE 3
RELATIONSHIPS BETWEEN VEGETATION COMMUNITIES IN THE INVESTIGATION AREA AT GERROA



EEC Endangered Ecological Communities under the NSW *Threatened Species Conservation Act 1995*.

Table 1**Ecological Communities in the Investigation Area**

Community Name¹/Map Unit	Equivalent in other Studies	Status
Littoral Rainforest SIM-LRF	<u>KMA (2003)</u> na <u>Mills (1998)</u> Simple Littoral Rainforest	Endangered Ecological Community ² Rare and restricted to small stands scattered along coast.
Blackbutt - Banksia Forest PIL-BAN	<u>KMA (2003)</u> Blackbutt-Banksia Tall Forest <u>Mills (1998)</u> PIL-BAN Blackbutt - Banksia Forest	Common and widespread in the Shoalhaven, less common in Kiama Municipality.
Bangalay – Banksia Forest BOT-BAN	<u>KMA (2003)</u> Bangalay-Banksia Forest <u>Mills (1998)</u> Bangalay Forest	Common and widespread in the Shoalhaven, less common in Kiama Municipality.
Swamp Sclerophyll Forest on Coastal Floodplains ROB-MEL	<u>KMA (2003)</u> Swamp Mahogany – Paperbark Forest Phragmites Reedland <u>Mills (1998)</u> Swamp Mahogany-Paperbark Forest	Endangered Ecological Community ² Mostly cleared; rare on swampy sites along coast.
Swamp Oak Floodplain Forest CAS-GLA	<u>KMA (2003)</u> Swamp Oak Forest <u>Mills (1998)</u> Swamp Oak Forest	Endangered Ecological Community ² Mostly cleared, moderately common on floodplains along coast.

Ecological Communities in the Investigation Area

Community Name ¹ /Map Unit	Equivalent in other Studies	Status
Freshwater Wetlands on Coastal Floodplains PHR-RDL (only map unit used)	<u>KMA (2003)</u> Spike-rush Sedgeland Phragmites Reedland <u>Mills (1998)</u> ELE-SDG Spike-rush Sedgeland JUN-FRH Fresh Juncus Rushland PHR-RDL Phragmites Reedland TYP-RDL Cumbungi Reedland	Endangered Ecological Community ² Small occurrences are common and widespread on coastal lowlands.
Miscellaneous Forest (Planted Trees) MIS-FOR	<u>KMA (2003)</u> Miscellaneous Forest <u>Mills (1998)</u> na	Planted areas using local native species; planted for screening, stock shade or rehabilitation around dredge pond.
Introduced Grassland INT-GRL	<u>KMA (2003)</u> na <u>Mills (1998)</u> Non-native Grassland	Mainly grazing paddock supporting exotic grassland, mostly pasture improved.

1. Where relevant, the nomenclature employed in the Act is used here instead of that of Mills (1998) or Kevin Mills & Associates (2003).

2. Endangered Ecological Community under the NSW *Threatened Species Conservation Act 1995*.

2.2.1 LITTORAL RAINFOREST

Alternative Name: Simple Littoral Rainforest

Code: SIM-LRF

Key Species: *Glochidion ferdinandi*, *Guioa semiglauca*, *Eucalyptus botryoides*

Description: This is a simple rainforest community, being dominated by only a handful of species. The dominant tree is Cheese Tree *Glochidion ferdinandi*, with occasional *Guioa semiglauca*. A few shrub specimens of Hairy Clerodendrum *Clerodendrum tomentosum*, Native Olive *Notelaea longifolia* and Breyntia *Breyntia oblongifolia* occur. There is an overstorey above the dense canopy of Cheese Tree composed of Bangalay *Eucalyptus botryoides* and Blackbutt *Eucalyptus pilularis*. The ground cover is mainly composed of "non-rainforest" species, such as Spiny-headed Mat-rush *Lomandra longifolia*, Wandering Sailor *Commelina cyanea* and Flax-lily *Dianella caerulea*. Creepers are relatively common, with 10 species being recorded. These include Snake Vine *Stephania japonica*, Slender Grape *Cayratia clematidea* and Wombat Berry *Eustrephus latifolius*. A list of the "rainforest species" recorded in the stand in the investigation area is provided at Appendix 2.

Occurrence: This community occurs at the base of the dunes in the eastern part of the area, between the Blackbutt Forest on higher ground and the Swamp Mahogany Forest and Bangalay Forest on the lower land. It only covers a small area, although typical rainforest species occur throughout the other forest communities.

Regional Status: Littoral rainforest is an endangered ecological community under the NSW *Threatened Species Conservation Act 1995*. This type of littoral rainforest is quite common nearby, on the eastern side of Seven Mile Beach Road, where it occurs in Seven Mile Beach National Park and on Crown land to the north.



2.2.2 BLACKBUTT - BANKSIA FOREST

Alternative Name: Blackbutt-Banksia Tall Forest

Code: PIL-BAN

Key Species: *Eucalyptus pilularis*, *Banksia integrifolia*, *Eucalyptus botryoides*

Description: This tall forest is dominated by Blackbutt *Eucalyptus pilularis*. The associated trees are Rough-barked Apple *Angophora floribunda* and Bangalay *Eucalyptus botryoides*, although these species are uncommon in the forest in the investigation area. The understorey is composed of small trees and shrubs, including Coast Banksia *Banksia integrifolia*, Cheese Tree *Glochidion ferdinandi*, Tree Broom-heath *Monotoca elliptica* and Maiden's Wattle *Acacia maidenii*. The common smaller shrubs and other plants in the forest include Spiny-headed Mat-rush *Lomandra longifolia*, Bracken *Pteridium esculentum*, Blady Grass *Imperata cylindrica* and Kangaroo Grass *Themeda australis*. Creepers such as Climbing Guinea Flower *Hibbertia scandens* and Native Raspberry *Rubus parvifolius*. Dense stands of the introduced rambling shrub Lantana *Lantana camara* occur in many places.

Occurrence: This community occurs on the higher dunes immediately to the west of Seven Mile Beach Road.

Regional Status: A common and widespread forest type of coastal dunes, along the whole of the Shoalhaven coast, but much more restricted in the Kiama area. Blackbutt Forest is quite extensive on the sand sheet behind Seven Mile Beach. Much of the forest is in a much better condition than the forest in the study area, where there are no very large trees and Lantana is abundant. Most of this forest in the locality is within Seven Mile Beach National Park.



2.2.3 BANGALAY – BANKSIA FOREST

Alternative Name: None.

Code: BOT-BAN

Key Species: *Eucalyptus botryoides*, *Banksia integrifolia*, *Angophora floribunda*, *Acacia maidenii*

Description: The trees present in this forest are mainly Bangalay *Eucalyptus botryoides* and Rough-barked Apple *Angophora floribunda*, with occasional Maiden's Wattle *Acacia maidenii*. The open understorey is a grassland of native and some introduced species, mainly the result of grazing and "underscrubbing". The common native species include Kangaroo Grass *Themeda australis*, Common Bracken *Pteridium esculentum*, Spiny-headed Mat-rush *Lomandra longifolia*, Couch Grass *Cynodon dactylon*, Small-leaved Bramble *Rubus parvifolius* and Blady Grass *Imperata cylindrica*. Scattered shrubs include Breyenia *Breyenia oblongifolia* and Corkwood *Duboisia myoporoides*.

Occurrence: Bangalay-Banksia Forest occurs on sand dunes and flats in the eastern part of the area; most has been cleared.

Regional Status: Bangalay Forest has all but gone from the Kiama area through extensive clearing for agricultural pursuits. In the Shoalhaven, it is common and widespread along the coast.



2.2.4 SWAMP SCLEROPHYLL FOREST ON COASTAL FLOODPLAINS

Alternative Name: Swamp Mahogany – Paperbark Forest

Code: ROB-MEL

Key Species: *Eucalyptus robusta*, *Melaleuca linariifolia*, *Livistona australis*, *Casuarina glauca*, *Eucalyptus botryoides*

Description: This forest contains the wetland trees Swamp Mahogany *Eucalyptus robusta*, Swamp Oak *Casuarina glauca* and Narrow-leaved Paperbark *Melaleuca linariifolia*. In drier sites, Bangalay *Eucalyptus botryoides* is common. Other characteristic species, most associated with wet sites, include Cabbage Palm *Livistona australis*, Harsh Ground Fern *Hypolepis muelleri*, Tall Sedge *Carex appressa*, Tall Saw-sedge *Gahnia clarkei*, Common Reed *Phragmites australis* and, climbing the trees, Monkey-rope Vine *Parsonsia straminea*. On drier sites the following species are prominent, Coast Banksia *Banksia integrifolia*, Golden Wattle *Acacia longifolia* and Corkwood *Duboisia myoporoides*.

Occurrence: This forest mostly occurs on very wet, swampy soils; in the investigation area it occurs below about the two metre AHD contour. On slightly higher areas the surface soils are quite dry, but the watertable is still close to the surface.

Regional Status: This community is of high conservation value because it is relatively rare in New South Wales and has been heavily cleared from the floodplains along the coast. It has been listed as part of the Swamp Sclerophyll Forest Complex, an endangered ecological community under the NSW *Threatened Species Conservation Act 1995*. The forest is also of very high fauna habitat value, because *Eucalyptus robusta* flowers during winter, when many other sources of nectar are unavailable.



2.2.5 SWAMP OAK FLOODPLAIN FOREST

Alternative Name: Swamp Oak Forest

Code: CAS-GLA

Key Species: *Casuarina glauca*, *Eucalyptus robusta*, *Eucalyptus tereticornis* (restricted)

Description: This forest is dominated by Swamp Oak *Casuarina glauca*, a tree that clearly dominates the forest; there are few other tree species present, although Swamp Mahogany *Eucalyptus robusta*, Forest Red Gum *Eucalyptus tereticornis* and Bangalay *Eucalyptus botryoides* do occur here and there. The understorey in the investigation area is a mix of native species and introduced pasture species; grazing occurs in most stands.

Occurrence: Swamp Oak Forest was once very extensive across the investigation area, covering much of the land now used for farming; it mainly occurred on clay soils. Today, it is mostly restricted to small stands and a few larger stands.

Regional Status: This forest is listed as an endangered ecological community under the NSW *Threatened Species Conservation Act 1995*.



2.2.6 FRESHWATER WETLANDS ON COASTAL FLOODPLAINS

Alternative Name: Spike-rush Sedgeland and Phragmites Reedland

Code: only one used on map, PHR-RDL

Key Species: *Typha orientalis*, *Schoenoplectus validus*, *Juncus kraussii*, *Elaeocharis sphacelata*, *Phragmites australis*

Description: A variable community with several different wetland plants dominating in any one place. Common species include Cumbungi *Typha orientalis*, River Club-rush *Schoenoplectus validus*, Sea Rush *Juncus kraussii*, Tall Spike-rush *Elaeocharis sphacelata* and Water Ribbons *Triglochin procerum*. A full list of the native wetland plants in the investigation area is provided at Appendix 3. Several non-native species also occur in the wetlands, including Umbrella Sedge *Cyperus eragrostis* and Club-rush *Isolepis prolifera*. No saltmarsh occurs in the investigation area, as there is only a minor saltwater influence along the most northern part of Blue Angle Creek; this creek is saline immediately to the north of the area. The estuarine plant Swamp Lily *Crinum pedunculatum* occurs in this area.

Occurrence: This community occurs in the ponds, channels and dams across the investigation area. The occurrences are mainly unnatural, having developed on excavated dredge ponds and along drainage channels.

Regional Status: This community is listed as an endangered ecological community under the NSW *Threatened Species Conservation Act 1995*.



2.2.7 MISCELLANEOUS FOREST (PRIMARILY PLANTED TREES)

Alternative Name: None.

Code: MIS-FOR

Key Species: *Casuarina glauca*, *Eucalyptus botryoides*, *Eucalyptus robusta*, *Melaleuca linariifolia*, *Acacia maidenii*, *Acacia longifolia*

Description: These areas support planted trees, most of which are local native species, particularly Swamp Oak *Casuarina glauca*, Bangalay *Eucalyptus botryoides*, Swamp Mahogany *Eucalyptus robusta*, Narrow-leaved Paperbark *Melaleuca linariifolia*, Maiden's Wattle *Acacia maidenii* and Golden Wattle *Acacia longifolia*. Many native plants are colonising these areas, although introduced plants are common and often dominate the ground cover, particularly Rhodes Grass *Chloris gayana*.

Occurrence: This community occurs mainly around the southern end of the main dredge pond, planted as part of the rehabilitation of this area following completion of sand extraction. Native trees are also planted in copses across the farmland in the west of the area. The introduced Coral Tree *Erythrina x sykesii* is occasional.

Regional Status: Useful as habitat for native fauna and flora as well as providing habitat linkages between native stands of forest. The value of these areas will increase in future.



2.2.8 INTRODUCED GRASSLAND

Alternative Names: Exotic Grassland, Improved Pasture, Non-Native Grassland

Code: INT-GRA

Key Species: *Pennisetum clandestinum*, *Axonopus affinis*, *Paspalum dilatatum*

Description: This unnatural community is composed of exotic (introduced) herbaceous plant species. The main species present are pasture species, such as Kikuyu Grass *Pennisetum clandestinum*, Carpet Grass *Axonopus affinis*, White Clover *Trifolium repens* and Paspalum *Paspalum dilatatum*. Near the forest, a few characteristic native species occur, including Common Bracken *Pteridium esculentum*, Bergalia Tussock *Carex longebractiata* and Spiny-headed Mat-rush *Lomandra longifolia*. Other introduced species include pasture weeds such Fireweed *Senecio madagascariensis*, Ribbed Plantain *Plantago lanceolata* and Spear Thistle *Cirsium vulgare*.

Occurrence: This grassland covers most of the property.

Regional Status: This unnatural community has no special conservation value.



2.3 SIGNIFICANT PLANT SPECIES

Despite many surveys over the years, no threatened or other rare plant species have been found on the land. Various species occur in the district, and these have been assessed in previous reports, but none have been found on this site.

The threatened species *Zieria granulata* (Rutaceae) has been planted on the bund wall to the northeast of the main dredge pond, as part of the early rehabilitation works; some of these plants are still alive. The sand dune soils on the property are not the habitat of this plant and it has not been found on such soils anywhere in the region where it naturally occurs. Further planting is not recommended.

2.4 SIGNIFICANT VEGETATION COMMUNITIES

As noted in Table 1, four endangered ecological communities occur in the investigation area; these are:

- Littoral Rainforest, mapped as SIM-LRF in this study;
- Swamp Sclerophyll Forest on Coastal Floodplains, mapped as ROB-MEL in this study;
- Swamp Oak Floodplain Forest, mapped as CAS-GLA in this study; and
- Freshwater Wetlands on Coastal Floodplains, a complex of communities, generally not mapped in this study because of their small occurrences.

The distribution of the above communities is shown on Figure 2. Originally, most of the investigation area was covered in a mosaic of the above floodplain communities. Nearly all of this original vegetation was cleared many years ago to provide high quality farmland.

The Final Determinations made by the NSW Scientific Committee for each of the above endangered ecological communities are provided in Appendices 4 to 7.

3 FAUNA

3.1 ANIMALS

A fauna species list for the investigation area and the surrounding land was compiled from all previous studies and from additional information gained from recent field studies; see Appendix 8. The list contains 204 species names, including 33 mammals, 147 birds, 15 reptiles and nine frogs; this includes eight introduced mammal species, and six introduced bird species.

The fauna can readily be divided into three main animal groups, viz. native forest species, native wetland species and species of farmland, including native and introduced species.

3.2 HABITATS

The habitats in the investigation area correspond closely to the vegetation communities described in Section 2.2. These habitats are primarily tall forest, swamp forest, woodland (planted trees), wetlands (including ponds, drains and the large dredge pond) and cleared land supporting introduced grassland.

The most important fauna habitats in the investigation area are:

- swamp forest (swamp sclerophyll forest containing *Eucalyptus robusta*);
- treeless wetlands, particularly in the southern part of the dredge pond.

3.3 SIGNIFICANT ANIMAL SPECIES

The most important animal species in terms of conservation are listed in the schedules to the *NSW Threatened Species Conservation Act 1995*; these species are listed as threatened in New South Wales, that is endangered or vulnerable. Previous studies have identified several threatened species that are known to occur or that could occur in the investigation area and nearby. These species are listed in Table 2. Below the table, comment is provided on each species, and their known or likely occurrence in the investigation area.

Table 2
Threatened Fauna Species recorded in the Seven Mile Beach Area

Common Name	Habitat and Occurrence
Schedule 1 - Endangered species	
Amphibians	
Green and Golden Bell Frog <i>Litoria aurea</i>	Fresh wetlands; occurs at Coomonderry Swamp and adjacent ponds and dams. Also reported in the southern end of the existing dredge pond within the investigation area.
Birds	
Regent Honeyeater <i>Xanthomyza phrygia</i>	Recorded from Seven Mile Beach in 1993 and 1995.
Schedule 2 - Vulnerable species	
Birds	
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i>	Reported from Shoalhaven Heads in 1994. No habitat in the investigation area.
Australian Bittern <i>Botaurus poiciloptilus</i>	Known to be resident at Coomonderry Swamp; one record from the small dredge pond in the investigation area, in January 2003.
Black Bittern <i>Ixobrychus flavicollis</i>	Recorded on Blue Angle Creek, just outside the investigation area, in 1990.
Swift Parrot <i>Lathamus discolor</i>	Reported from Shoalhaven Heads in 1984.
Powerful Owl <i>Ninox strenua</i>	Recorded in forest at Seven Mile Beach; two birds were killed by motor vehicle on Seven Mile Beach Road in 2004.
Masked Owl <i>Tyto novaehollandiae</i>	A road-killed bird was found near Gerroa in 1980.
Mammals	
Spotted-tailed Quoll <i>Dasyurus maculatus</i>	There is one record of a road-killed animal on Seven Mile Beach Road in 1987.
Large Bentwing-bat <i>Miniopterus schreibersii</i>	Possible record in the investigation area in 2002.

Table 2 (contd)

Threatened Fauna Species recorded in the Seven Mile Beach Area

Common Name	Habitat and Occurrence
Yellow-bellied Sheath-tail-bat <i>Saccolaimus flaviventris</i>	Recorded in Seven Mile Beach National Park by Murphy (1998).
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	Recorded in Seven Mile Beach National Park by Murphy (1998).

Green and Golden Bell Frog

The Green and Golden Bell Frog has been reported in the southern end of the dredge pond (G. Leonard pers. comm.); this is the oldest part of the pond and supports stands of reeds. There is a known population nearby to the south, in the Coomonderry Swamp area.

Regent Honeyeater

This species is occasionally recorded in the Illawarra region, where it is mainly a summer visitor. It has been seen at Seven Mile Beach in 1993 and 1995. The winter flowering Swamp Mahogany *Eucalyptus robusta* may be an important food source if the species visits at that time of the year.

Glossy Black-Cockatoo

The Glossy Black-Cockatoo was recorded at Shoalhaven Heads in 1994. Its primary food tree is Black She-oak *Allocasuarina littoralis*, a species that does not occur in the investigation area. The chances of this species occurring there are slight; it does not feed on Swamp Oak *Casuarina glauca*.

Australasian Bittern

A resident population of the Australasian Bittern occurs at Coomonderry Swamp, just to the south of the investigation area. The only observation within the investigation area is of a bird flushed from reeds in the far southern end of the small dredge pond in January 2003.

Black Bittern

This rare species mainly inhabits the lower estuarine reaches of coastal rivers and coastal lagoons and lakes. There is one record from along Blue Angle Creek, in July 1990, just to the north of the investigation area.

Swift Parrot

This is a non-breeding winter visitor to the forests along the coast; birds are not seen every year (Mills 2004a). A small flock was observed at Shoalhaven Heads in 1984; it is probably an irregular visitor to the forests at Seven Mile Beach. Its favoured food plants are Swamp Mahogany *Eucalyptus robusta* and Coast Banksia *Banksia integrifolia*, both of which flower in winter when the birds visit the region. The area of Swamp Mahogany Forest in the investigation area is prime habitat for the Swift Parrot.

Powerful Owl

The Powerful Owl is present at Seven Mile Beach (Murphy 1998), where there is an abundance of arboreal mammals, the owl's main prey species. Two birds were found killed by motor vehicles on Seven Mile Beach Road in 2004 (Mills 2004b). The forest in the study area is probably within the home range of the owls living in the forests behind Seven Mile Beach. There are, however, unlikely to be any nest trees in the investigation area; these trees are too small and do not have the large hollows required by the owls for nesting.

Masked Owl

There is a record of road-killed Masked Owl near Gerroa in 1980. The absence of other records from the Seven Mile Beach area suggests that the species may not be resident in the forests there.

Spotted-tailed Quoll

There is one report of a road-killed quoll on the Seven Mile Beach Road in 1987. Murphy (1998) suggests that this species "may still occur as vagrant individuals" at Seven Mile Beach. It seems unlikely that the quoll is resident in the investigation area.

Grey-headed Flying-fox

This bat is a common migrant to the Illawarra during summer; it can be seen in forest and gardens, as well as isolated trees at that time of year. It would probably not roost in the investigation area, but it would certainly visit the eucalypt forests in the area to forage. Flowering Bangalay *Eucalyptus botryoides* trees are visited for nectar in late summer-early autumn.

Large Bentwing-bat

This bat is very widespread in New South Wales and can be expected to turn up on almost any site. It roosts in caves and the like, including unnatural structures such as buildings and drains. There is very little opportunity for the species to roost in the investigation area, although it is very likely to regularly forage over the area in summer.

Eastern Freetail-bat

This species was recorded in 1995 by Murphy (1998), in forest within Seven Mile Beach National Park. This is a forest-dwelling species that roosts in tree hollows. The forest in the investigation area would provide suitable habitat for this species.

Yellow-bellied Sheath-tail-bat

This bat inhabits a very wide range of habitats and roosts in tree hollows. It is a summer migrant to southern Australia. This species was recorded in 1995 by Murphy (1998), in forest within Seven Mile Beach National Park. The forest in the investigation area provides suitable habitat for this bat.

Greater Broad-nosed Bat

This bat is found in a range of forest types and roosts in tree hollows and sometimes the roofs of buildings. This species was recorded in 1995 by Murphy (1998), in forest within Seven Mile Beach National Park. The forest in the investigation area would provide suitable habitat for this species, although hollows appear to be uncommon.

In summary, the following species are known to occur in the investigation area or immediately adjacent to it:

- Swift Parrot
- Australasian Bittern
- Black Bittern
- Powerful Owl
- Green and Golden Bell Frog

- Grey-headed Flying-fox.

The following species are likely to occur there, at least from time to time:

- Large Bentwing-bat
- Eastern Free-tail Bat
- Yellow-bellied Sheathtail-Bat
- Greater Broad-nosed Bat.

4 CONCLUSION

This report has provided a detailed description of the flora and fauna of the investigation area at Gerroa. It has particularly identified the conservation values on the site.

In summary, the report identifies:

- the presence of 202 plant species, including 137 native species in the area;
 - the presence of 204 animal species, including 190 native species, on and adjacent to the area;
 - six major natural vegetation communities, most of which are floodplain communities, and provides a vegetation map;
 - the presence of four endangered ecological communities, namely:
 - Littoral Rainforest;
 - Swamp Sclerophyll Forest on Coastal Floodplains;
 - Swamp Oak Floodplain Forest;
 - Freshwater Wetlands on Coastal Floodplains.
 - the presence or likely presence of several threatened species, namely: Australasian Bittern, Black Bittern, Powerful Owl, Swift Parrot, Green and Golden Bell Frog and Grey-headed Flying-fox;
 - a low probability of threatened plant species occurring in the area.
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APPENDICES

- 1 List of Plant Species for the Investigation Area
- 2 List of Rainforest Species in Littoral Rainforest Stand
- 3 List of Native Wetland Plants for the Investigation Area
- 4 Final Determination: Littoral Rainforest
- 5 Final Determination: Swamp Sclerophyll Forest
- 6 Final Determination: Swamp Oak Floodplain Forest
- 7 Final Determination: Freshwater Wetlands on Coastal Floodplains
- 8 List of Animal Species for the Investigation Area
- 9 Annotated List of Wetland Birds Recorded on the Dredge Ponds

APPENDIX 1

LIST OF PLANT SPECIES FOR THE INVESTIGATION AREA

PTERIDOPHYTA (Ferns)

DENNSTAEDTIACEAE

<i>Hypolepis muelleri</i> Wakef.	Harsh Ground Fern
<i>Pteridium esculentum</i> (Forster f.) Cockayne	Common Bracken

SINOPTERIDACEAE

<i>Pellaea falcata</i> (R. Br.) Fee	Sickle Fern
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ANGIOSPERMAE (Flowering Plants)

ALISMATACEAE

<i>Alisma plantago-aquatica</i> L.	Water Plantain
* <i>Sagittaria graminea</i> Michx.	Sagittaria

AMARYLLIDACEAE

<i>Crinum pedunculatum</i> R. Br.	Swamp Lily
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APIACEAE

<i>Centella asiatica</i> (L.) Urban	Indian Pennywort
<i>Hydrocotyle laxiflora</i> DC.	Stinking Pennywort
* <i>Foeniculum vulgare</i> Miller	Fennel
* <i>Hydrocotyle bonariensis</i> Lam.	American Pennywort
<i>Lilaeopsis polyantha</i> (Gand.) H. Eichler	Creeping Crantzia

APOCYNACEAE

<i>Parsonsia straminea</i> (R. Br.) F. Muell.	Monkey-rope Vine
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ARECACEAE

<i>Livistona australis</i> (R. Br.) Mart.	Cabbage Palm
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ASCLEPIADACEAE

* <i>Araujia hortorum</i> Fourn.	Moth Vine
* <i>Gomphocarpus fruticosus</i> (L.) R. Br.	Narrow-leaved Cotton Bush
<i>Marsdenia rostrata</i> R. Br.	Common Milk Vine
<i>Tylophora barbata</i> R. Br.	Bearded Tylophora

ASTERACEAE

<i>Cassinia aculeata</i> (Labill.) R. Br.	Common Cassinia
<i>Cassinia quinquefaria</i> R. Br.	Rosemary Cassinia
<i>Ozothamnus diosmifolius</i> (Vent.) DC.	Everlasting
<i>Senecio bipinnatisectus</i> Belcher	Groundsel
<i>Senecio hispidulus</i> A. Rich.	Rough Fireweed
<i>Sigesbeckia orientalis</i> L.	Indian Weed
* <i>Aster subulatus</i> Michx.	Bushy Starwort
* <i>Bidens pilosa</i> L.	Cobbler's Pegs
* <i>Chrysanthemoides monilifera</i> (L.) Norlindh	Bitou Bush
* <i>Cirsium vulgare</i> (Savi) Ten.	Spear Thistle
* <i>Conyza</i> sp.1	Fleabane
* <i>Conyza</i> sp.2	Fleabane

* <i>Gnaphalium americanum</i> Miller	American Cudweed
* <i>Hypochaeris radicata</i> L.	Flatweed
* <i>Senecio madagascariensis</i> Poiret	Fireweed
* <i>Sonchus oleraceus</i> L.	Common Sowthistle
* <i>Tagetes minuta</i> L.	Stinking Roger
* <i>Xanthium occidentale</i> Bertol.	Noogoora Burr

BIGNONIACEAE

<i>Pandorea pandorana</i> (Andrews) Steenis	Wonga Vine
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BRASSICACEAE

* <i>Hirschfeldia incana</i> (L.) Lagr. -Fossat	Buchan Weed
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CAMPANULACEAE

<i>Wahlenbergia gracilis</i> (Forster f.) A. DC.	Australian Bluebell
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CASUARINACEAE

<i>Casuarina glauca</i> Sieber ex Sprengel	Swamp Oak
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CHENOPODIACEAE

* <i>Chenopodium ambrosioides</i> L.	Mexican Tea
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CLUSIACEAE

<i>Hypericum gramineum</i> Forster f.	Small St John's Wort
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COMMELINACEAE

<i>Commelina cyanea</i> R. Br.	Wandering Sailor
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CONVOLVULACEAE

<i>Dichondra repens</i> Forster & Forster f.	Kidney Weed
* <i>Ipomoea purpurea</i> (L.) Roth	Morning Glory

CYPERACEAE

<i>Baumea articulata</i> (R. Br.) S. T. Blake	Jointed Twig-rush
<i>Carex appressa</i> R. Br.	Tall Sedge
<i>Carex longebrachiata</i> Boeck.	Bergalia Tussock
<i>Eleocharis acuta</i> R. Br.	Common Spike-rush
<i>Eleocharis equisetina</i> C. Presl	Spike-rush
<i>Eleocharis sphacelata</i> R. Br.	Tall Spike-rush
<i>Gahnia clarkei</i> Benl	Tall saw-sedge
<i>Isolepis nodosa</i> (Rottb.) R. Br.	Knobby Club-rush
<i>Schoenoplectus validus</i> (Vahl) A. & D. Love	River Club-rush
* <i>Cyperus eragrostis</i> Lam.	Umbrella Sedge
* <i>Isolepis prolifera</i> (Rottb.) R. Br.	Club-rush

DILLENIACEAE

<i>Hibbertia obtusifolia</i> DC.	Grey Guinea Flower
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EPACRIDACEAE

Monotoca elliptica (Smith) R. Br.

Tree Broom-heath

EUPHORBIACEAE

Breynia oblongifolia Muell. Arg.

Glochidion ferdinandi (Muell. Arg.) Bailey var. *ferdinandi*

Glochidion ferdinandi (Muell. Arg.) Bailey var. *pubens*

Homalanthus populifolius Graham

Breynia

Cheesetree

Hairy Cheesetree

Bleeding Heart

EUPOMATIACEAE

Eupomatia laurina R. Br.

Bolwarra

FABACEAE

FABOIDEAE (subfamily)

Desmodium varians (Labill.) G. Don.

Glycine clandestina J.C. Wendl.

Kennedia rubicunda (Schneev.) Vent.

**Erythrina x sykesii* Barneby & Krukoff

**Lotus corniculatus* L.

**Trifolium pratense* L.

**Trifolium repens* L.

Slender Tick-trefoil

Twining Glycine

Dusky Coral-pea

Coral Tree

Birds-foot Trefoil

Red clover

White Clover

MIMOSOIDEAE (subfamily)

Acacia binervata DC.

Acacia implexa Benth.

Acacia longifolia (Andrews) Willd.

Acacia maidenii F. Muell.

Acacia mearnsii De Wild.

Acacia suaveolens (Smith) Willd.

Acacia ulicifolia (Salisb.) Court

Two-veined Hickory

Hickory Wattle

Golden Wattle

Maiden's Wattle

Black Wattle

Sweet Wattle

Prickly Moses

GERANIACEAE

Geranium solanderi Carolin

Native Geranium

GOODENIACEAE

Goodenia bellidifolia Smith

Rocket Goodenia

HALORAGACEAE

Gonocarpus teucroides DC.

Raspwort

HYDROCHARITACEAE

Ottelia ovalifolia (R. Br.) Rich.

Swamp Lily

JUNCACEAE

**Juncus articulatus* L.

Juncus kraussii Hochst.

Juncus planifolius R. Br.

Juncus prismatocarpus R. Br.

Juncus usitatus L.A.S. Johnson

Rush

Sea Rush

Broad Rush

Branching Rush

Common Rush

JUNCAGINACEAE

Triglochin procerum R. Br.

LAMIACEAE*Lycopus australis* R. Br.

Australian Gypsywort

LAURACEAE*Cassytha pubescens* R. Br.

Downy Dodder-laurel

Endiandra sieberi Nees

Hard Corkwood

LOBELIACEAE*Lobelia alata* Labill.

Angled Lobelia

Pratia purpurascens (R. Br.) E. Wimmer

Lobelia Pratia

LOMANDRACEAE*Lomandra longifolia* Labill.

Spiny-headed Mat-rush

LORANTHACEAE*Amyema pendulum* (Sieber ex Sprengel) Tieghem

Drooping Mistletoe

LYTHRACEAE*Lythrum hyssopifolia* L.

Hyssop Loosestrife

Lythrum salicaria L.

Purple Loosestrife

MALVACEAE**Modiola caroliniana* (L.) G. Don

Red-flowered Mallow

**Sida rhombifolia* L.

Paddy's Lucerne

MELIACEAE*Synoum glandulosum* (Smith) A. Juss.

Rosewood

MENISPERMACEAE*Stephania japonica* (Thunb.) Miers

Snake Vine

MORACEAE*Ficus coronata* Spin

Sandpaper Fig

Ficus macrophylla Desf. ex Pers.

Moreton bay Fig

Ficus obliqua Forster f.

Small-leaved Fig

Ficus superba Miq.

Deciduous Fig

MYOPORACEAE**Myoporum boninense* Koidz.

Coastal Boobialla

MYRSINACEAE*Rapanea howittiana* Mez

Muttonwood

MYRTACEAE*Angophora floribunda* (Smith) Sweet

Rough-barked Apple

Eucalyptus botryoides Smith

Bangalay

Eucalyptus pilularis Smith

Blackbutt

Eucalyptus robusta Smith

Swamp Mahogany

Eucalyptus tereticornis Smith

Forest Red Gum

Leptospermum juniperinum Smith

Prickly Teatree

Melaleuca ericifolia Smith

Swamp Paperbark

Melaleuca linariifolia Smith

Narrow-leaved Paperbark

<i>Melaleuca styphelioides</i> Smith * <i>Eucalyptus maculata</i> Hook.	Prickly-leaved Paperbark Spotted Gum
NYMPHAEACEAE * <i>Nympheae</i> sp.	Water Lily
OLEACEAE <i>Notelaea longifolia</i> Vent.	Native Olive
ONAGRACEAE * <i>Ludwigia peploides</i> (Kunth) Raven	Water Primrose
ORCHIDACEAE <i>Acianthus fornicatus</i> R. Br. <i>Dendrobium teretifolium</i> R. Br.	Pixie Caps Rat's-tail Orchid
PASSIFLORACEAE * <i>Passiflora edulis</i> Sims	Edible Passionfruit
PHILESIACEAE <i>Eustrephus latifolius</i> R. Br. <i>Geitonoplesium cymosum</i> (R. Br.) A. Cunn. ex Hook.	Wombat Berry Scrambling Lily
PHILYDRACEAE <i>Philydrum lanuginosum</i> Banks & Sol. ex Gaertn.	Frog's Mouth
PHORMIACEAE <i>Dianella caerulea</i> Sims	Flax-lily
PHYTOLACCACEAE * <i>Phytolacca octandra</i> L.	Inkweed
PITTOSPORACEAE <i>Billardiera scandens</i> Smith <i>Citriobatus pauciflorus</i> Cunn. ex Ettingsh. <i>Pittosporum revolutum</i> Aiton <i>Pittosporum undulatum</i> Vent.	Common Apple-berry Orange Thorn Yellow Pittosporum Sweet Pittosporum
PLANTAGINACEAE * <i>Plantago lanceolata</i> L.	Ribbed Plantain
POACEAE <i>Cymbopogon refractus</i> (R. Br.) A. Camus <i>Cynodon dactylon</i> (L.) Pers. <i>Dichelachne crinita</i> (L.) Hook. f. <i>Echinopogon caespitosus</i> C. E. Hubb. <i>Echinopogon ovatus</i> (G. Forst.) P. Beauv. <i>Entolasia stricta</i> (R. Br.) Hughes <i>Eragrostis ? brownii</i> (Kunth) Nees <i>Hemarthria uncinata</i> R. Br. <i>Imperata cylindrica</i> P. Beauv. var. <i>major</i> (Nees) C. E. Hubb. <i>Microlaena stipoides</i> (Labill.) R. Br.	Barbed Wire Grass Couch Grass Longhair Plumegrass Tufted Hedgehog-grass Forest Hedgehog-grass Wiry Panic Common Love-grass Mat Grass Blady Grass Weeping Grass

<i>Oplismenus aemulus</i> (R. Br.) Roem. & Schult.	Australian Basket-grass
<i>Oplismenus imbecillus</i> (R. Br.) Roem. & Schult.	Pademelon Grass
<i>Paspalum distichum</i> L.	Water Couch
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Common Reed
<i>Themeda australis</i> (R. Br.) Stapf	Kangaroo Grass
* <i>Andropogon virginicus</i> L.	Whisky Grass
* <i>Axonopus affinis</i> Chase	Carpet grass
* <i>Briza maxima</i> L.	Quaking Grass
* <i>Bromus cartharticus</i> Vahl.	Prairie Grass
* <i>Chloris truncata</i> R. Br.	Windmill Grass
* <i>Echinochloa crus-gallii</i>	Barnyard Grass
* <i>Holcus lanatus</i> L.	Yorkshire Fog
* <i>Lolium</i> sp.	Ryegrass
* <i>Paspalum dilatatum</i> Poir.	Paspalum
* <i>Paspalum urvillei</i> Steud.	Vasey Grass
* <i>Pennisetum clandestinum</i> Hochst. ex Chiov.	Kikuyu Grass
* <i>Phalaris</i> sp.	Phalaris
* <i>Setaria</i> sp. 1	Pigeon Grass
* <i>Setaria</i> sp. 2	Pigeon Grass
* <i>Sporobolus indicus</i> (L.) R. Br.	Parramatta Grass

POLYGONACEAE

<i>Persicaria decipiens</i> (R. Br.) K. L. Wilson	Slender Knotweed
<i>Persicaria strigosa</i> (R. Br.) Gross	Spotted Knotweed
* <i>Acetosella vulgaris</i> Fourr.	Sheep Sorrel
* <i>Rumex crispus</i> L.	Curled Dock

POTOMOGETONACEAE

<i>Potamogeton tricarlinatus</i> F. Muell & A. Benn. ex A. Benn.	Floating Pondweed
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PRIMULACEAE

* <i>Anagallis arvensis</i> L.	Scarlet Pimpernel
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PROTEACEAE

<i>Banksia integrifolia</i> L. f.	Coast Banksia
* <i>Hakea salicifolia</i> (Vent.) B. L. Burt.	Willow Hakea
<i>Persoonia linearis</i> Andrews	Narrow-leaved Geebung

RANUNCULACEAE

<i>Clematis aristata</i> R. Br. ex DC.	Australian Clematis
<i>Ranunculus inundatus</i> R. Br. ex DC.	River Buttercup

RESTIONACEAE

<i>Restio tetraphyllus</i> Labill. subsp. <i>meiostachyus</i> L. Johnson & O. D. Evans	Tassel Cord-rush
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RHAMNACEAE

<i>Alphitonia excelsa</i> (Fenzl) Reisseck ex Benth.	Red Ash
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ROSACEAE

Rubus parvifolius L.

**Malus x domestica* Borkh.

**Rubus* sp.

Native Raspberry

Apple

Blackberry

RUBIACEAE

Morinda jasminoides Cunn.

Morinda

RUTACEAE

Melicope micrococca (F. Muell.) T. Hartley

Zieria smithii Jackson

**Citrus limonia*

**Zieria granulata* (F. Muell.) C. Moore ex Benth.

White Euodia

Sandfly Zieria

Bush Lemon

Illawarra Zieria

SAPINDACEAE

Dodonaea triquetra Wendl.

Guioa semiglauca (F. Muell.) Radlk.

Long-leaved Hop-bush

Guioa

SCROPHULARIACEAE

Bacopa monniera (L.) Pennell

**Veronica anagallis - aquatica* L.

Bacopa

Blue Speedwell

SMILACACEAE

Smilax glycyphylla Sm.

Thornless Sarsaparilla

SOLANACEAE

Duboisia myoporoides R. Br.

**Physalis peruviana* L.

**Solanum nigrum* L.

**Solanum pseudocapsicum* L.

Corkwood

Cape Gooseberry

Black Night-shade

Madiera Winter Cherry

SPARGANIACEAE

Sparganium antipodum Graebner

Floating Bur-reed

STACKHOUSIACEAE

Stackhousia viminea Smith

Slender Stackhousia

STERCULIACEAE

Commersonia fraseri Gay

Bush Kurrajong

TYPHACEAE

Typha orientalis C. Presl

Broad-leaved Cumbungi

VERBENACEAE

Clerodendrum tomentosum R. Br.

**Lantana camara* L.

**Verbena bonariensis* L.

Hairy Clerodendrum

Lantana

Purpletop

VIOLACEAE

Viola hederacea Labill.

Native Violet

VISCACEAE

Notothixos subaureus Oliver

Golden Mistletoe

VITACEAE

Cayratia clematidea (F. Muell.) Domin

Slender Grape

Cissus hypoglauca A. Gray

Water Vine

* Introduced Species.

APPENDIX 2

LIST OF RAINFOREST SPECIES IN LITTORAL RAINFOREST STAND

Trees

Duboisia myoporoides
Glochidion ferdinandi
Guioa semiglauc
Pittosporum undulatum

Shrubs/Small Trees

Alphitonia excelsa
Breynia oblongifolia
Clerodendrum tomentosum
Livistona australis
Melicope micrococca
Notelaea longifolia
Pittosporum revolutum
Synoum glandulosum

Vines and Creepers

Cayratia clematidea
Cissus hypoglauc
Eustrephus latifolius
Hibbertia scandens
Marsdenia rostrata
Pandorea pandorana
Smilax glycyphylla
Stephania japonica

APPENDIX 3

LIST OF NATIVE WETLAND PLANTS FOR THE INVESTIGATION AREA

<i>Alisma plantago-aquatica</i>	Water Plantain
<i>Bacopa monniera</i>	Bacopa
<i>Baumea articulata</i>	Jointed Twigrush
<i>Carex appressa</i>	Tall Sedge
<i>Casuarina glauca</i>	Swamp Oak
<i>Centella asiatica</i>	Indian Pennywort
<i>Crinum paniculatum</i>	Swamp Lily
<i>Cynodon dactylon</i>	Couch Grass
<i>Cyperus</i> sp.	Sedge
<i>Eleocharis acuta</i>	Common Spike Rush
<i>eleocharis equisetina</i>	Spike-rush
<i>Eleocharis sphacelata</i>	Tall Spike Rush
<i>Eucalyptus robusta</i>	Swamp Mahogany
<i>Gahnia clarkei</i>	Tall Saw-sedge
<i>Hemarthria uncinata</i>	Mat Grass
<i>Hypolepis Muelleri</i>	Harsh Ground Fern
<i>Isolepis nodosa</i>	Knobby Club-rush
<i>Juncus continuus</i>	Rush
<i>Juncus kraussii</i>	Sea Rush
<i>Juncus planifolius</i>	Broad Rush
<i>Juncus prismatocarpus</i>	Branching Rush
<i>Juncus usitatus</i>	Common Rush
<i>Lobelia alata</i>	Angled Lobelia
<i>Lilaeopsis polyantha</i>	Lilaeopsis
<i>Lycopus australis</i>	Australian Gypsywort
<i>Lythrum hyssopifolia</i>	Hyssop Loosestrife
<i>Lythrum salicaria</i>	Purple Loosestrife
<i>Melaleuca ericifolia</i>	Swamp Paperbark
<i>Melaleuca linariifolia</i>	Narrow-leaved Paperbark
<i>Ottelia ovalifolia</i>	Swamp Lily
<i>Paspalum distichum</i>	Water Couch
<i>Persicaria decipiens</i>	Slender Knotweed
<i>Persicaria strigosa</i>	Knotweed
<i>Philydrum lanuginosum</i>	Frog's-mouth
<i>Phragmites australis</i>	Common Reed
<i>Potamogeton tricarinatus</i>	Floating Pondweed
<i>Ranunculus inundatus</i>	River Buttercup
<i>Restio tetraphyllus</i>	Tassel Cord-rush
<i>Sparganium antipodum</i>	Floating Bur-reed
<i>Schoenoplectus validus</i>	River Club-rush
<i>Triglochin procerum</i>	Water Ribbons
<i>Typha orientalis</i>	Cumbungi

NSW Scientific Committee
Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act, and as a consequence, to omit reference to the Sutherland Shire Littoral Rainforest from Part 3 of Schedule 1 (Endangered Ecological Community) of the Act. Listing of endangered ecological communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions is generally a closed forest, the structure and composition of which is strongly influenced by proximity to the ocean. The plant species in this ecological community are predominantly rainforest species with evergreen mesic or coriaceous leaves. Several species have compound leaves, and vines may be a major component of the canopy. These features differentiate littoral rainforest from sclerophyll forest or scrub, but while the canopy is dominated by rainforest species, scattered emergent individuals of sclerophyll species, such as *Angophora costata*, *Banksia integrifolia*, *Eucalyptus botryoides* and *E. tereticornis* occur in many stands. Littoral Rainforest in NSW is found at locations along the entire NSW Coast in the NSW North Coast Bioregion, Sydney Basin Bioregion and South East Corner Bioregion. The areas mapped for inclusion in State Environmental Planning Policy 26 Littoral Rainforest are examples of the Littoral Rainforest ecological communities, but the mapping for SEPP 26 is not exhaustive and stands of the Littoral Rainforest ecological community occur at locations not mapped under SEPP 26. Some stands may be regrowth or in the process of regenerating. The Sutherland Shire Littoral Rainforest Endangered Ecological Community which was previously listed as an endangered ecological community is included within this Community.

2. Littoral rainforest occurs on both sand dunes and on soils derived from underlying rocks (McKinley *et al.* 1999). Stands on headlands exposed to strong wind action may take the form of dense windpruned thickets (for example the Bunga Head Rainforest illustrated by Keith & Bedward 1999, or MU5 Littoral Windshear Thicket in NPWS 2002). In more sheltered sites, and in hind dunes, the community is generally taller, although still with wind pruning on the windward side of stands. Floristically there is a high degree of similarity between stands on different substrates. Most stands of Littoral Rainforest occur within 2 km of the sea, but may occasionally be found further inland, but within reach of maritime influence.

3. Littoral Rainforest comprises the *Cupaniopsis anacardioides* – *Acmena* spp. alliance of Floyd (1990). This alliance as described by Floyd includes five sub-alliances – *Syzygium leuhmannii* – *Acmena hemilampra*, *Cupaniopsis anacardioides*, *Lophostemon confertus*, *Drypetes* – *Sarcomelicope* – *Cassine* – *Podocarpus* and *Acmena smithii* – *Ficus* – *Livistona* – *Podocarpus*. The distribution of some of these sub-alliances is geographically restricted – the *Syzygium leuhmannii* – *Acmena hemilampra* sub-alliance is restricted to the north coast, while the most widespread sub-alliance *Acmena smithii* – *Ficus* – *Livistona* – *Podocarpus* is the only one present on the coast south of Sydney. The *Lophostemon confertus* suballiance, synonymous with Forest Type 25 Headland Brush Box (Forestry Commission of NSW 1989) is restricted to exposed headlands in the North Coast Bioregion. There is considerable floristic variation between stands and in particular areas localised variants may be recognised (for example on the south coast a number of variants within the *Acmena smithii* – *Ficus* – *Livistona* – *Podocarpus* sub-alliance have been described, see Mills 1996, Mills & Jakeman 1995; Keith & Bedward 1999, NCC 1999, NPWS 2002). Small, depauperate stands may be difficult to assign to sub alliances. A number of species characteristic of Littoral Rainforest in

NSW reach their southern limits at various places along the coast (for example *Cupaniopsis anacardioides* reaches its southern limit between Sydney and the Illawarra) but a number of temperate species are restricted to the south coast, and the total Littoral Rainforest flora declines from north to south. Characteristic species of littoral rainforest include:

<i>Acacia binervata</i>	<i>Acmena hemilampra</i>
<i>Acmena smithii</i>	+ <i>Acronychia imperforata</i>
<i>Acronychia oblongifolia</i>	+ <i>Alpinia caerulea</i>
<i>Alectryon coriaceus</i>	<i>Alyxia ruscifolia</i>
+ <i>Aphananthe philippinensis</i>	+ <i>Archontophoenix cunninghamiana</i>
<i>Arthropteris tenella</i>	+ <i>Arytera divaricata</i>
<i>Asplenium australasicum</i>	+ <i>Baloghia marmorata</i>
<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>	+ <i>Beilschmiedia obtusifolia</i>
<i>Breynia oblongifolia</i>	+ <i>Bridelia exaltata</i>
+ <i>Calamus muelleri</i>	<i>Canthium coprosmoides</i>
+ <i>Capparis arborea</i>	<i>Cayratia clematidea</i>
<i>Celtis paniculata</i>	<i>Cissus antarctica</i>
<i>Cissus hypoglauca</i>	<i>Cissus sterculiifolia</i>
<i>Claoxylon australe</i>	+ <i>Cordyline congesta</i>
+ <i>Cordyline stricta</i>	<i>Cryptocarya glaucescens</i>
<i>Cryptocarya microneura</i>	+ <i>Cryptocarya triplinervis</i>
<i>Cupaniopsis anacardioides</i>	<i>Cynanchum elegans</i>
<i>Dendrocnide excelsa</i>	+ <i>Dendrocnide photinophylla</i>
<i>Dioscorea transversa</i>	<i>Diospyros australis</i>
<i>Diospyros pentamera</i>	<i>Doodia aspera</i>
<i>Duboisia myoporoides</i>	+ <i>Dysoxylum fraserianum</i>
<i>Ehretia acuminata</i>	+ <i>Elaeocarpus obovatus</i>
+ <i>Elattostachys nervosa</i>	<i>Endiandra discolor</i>
<i>Endiandra sieberi</i>	<i>Eucalyptus botryoides</i>
<i>Eucalyptus tereticornis</i>	<i>Eupomatia laurina</i>
<i>Eustrephus latifolius</i>	<i>Ficus coronata</i>
<i>Ficus obliqua</i>	<i>Ficus rubiginosa</i>
+ <i>Ficus watkinsiana</i>	<i>Flagellaria indica</i>
<i>Geitonoplesium cymosum</i>	<i>Glochidion ferdinandi</i>
<i>Glycine clandestina</i>	+ <i>Gossia bidwillii</i>
<i>Guioa semiglauca</i>	+ <i>Ixora beckleri</i>
+ <i>Jagera pseudorhus</i>	+ <i>Lepidozamia peroffskyana</i>
<i>Litsea reticulata</i>	<i>Livistona australis</i>
<i>Lomandra longifolia</i>	+ <i>Lophostemon confertus</i>
<i>Maclura cochinchinensis</i>	+ <i>Mallotus philippensis</i>
<i>Melaleuca quinquenervia</i>	<i>Melicope micrococca</i>
+ <i>Melicope vitiflora</i>	+ <i>Mischocarpus pyriformis</i>
+ <i>Monococcus echinophorus</i>	+ <i>Morinda jasminoides</i>
+ <i>Mucuna gigantea</i>	<i>Myoporum acuminatum</i>
<i>Notelaea longifolia</i>	+ <i>Olea paniculata</i>
<i>Oplismenus imbecillis</i>	+ <i>Pandanus pedunculatus</i>
<i>Pandorea pandorana</i>	<i>Pararchidendron pruinatum</i> var. <i>pruinatum</i>
<i>Parsonsia straminea</i>	+ <i>Pentaceras australis</i>
<i>Piper novae-hollandiae</i>	+ <i>Pisonia umbellifera</i>
<i>Pittosporum multiflorum</i>	<i>Pittosporum undulatum</i>
<i>Platynerium bifurcatum</i>	<i>Podocarpus elatus</i>

	<i>Pollia crispata</i>		<i>Polyscias elegans</i>
	<i>Pouteria australis</i>		<i>Pouteria cotinifolia</i> var. <i>cotinifolia</i>
+	<i>Pouteria myrsinoides</i>		<i>Rapanea variabilis</i>
	<i>Rhodamnia rubescens</i>	+	<i>Rhodomyrtus psidioides</i>
	<i>Ripogonum album</i>		<i>Ripogonum discolor</i>
	<i>Sarcomelicope simplicifolia</i>		<i>Scolopia braunii</i>
	<i>Smilax australis</i>		<i>Smilax glycyphylla</i>
+	<i>Sophora tomentosa</i> subsp. <i>australis</i>		<i>Stephania japonica</i> var. <i>discolor</i>
	<i>Synoum glandulosum</i>		<i>Syzygium australe</i>
+	<i>Syzygium luehmannii</i>		<i>Syzygium oleosum</i>
	<i>Syzygium paniculatum</i>	+	<i>Tetrastigma nitens</i>
	<i>Trophis scandens</i> subsp. <i>scandens</i>		<i>Viola banksii</i>
	<i>Wilkiea huegeliana</i>		

Those species marked '+' are found in littoral rainforest north of Sydney, with some restricted to the north coast or in only a few sites south of the North Coast Bioregion. The other species are geographically more widespread.

Given the small size of many stands and the history of fragmentation, the number of characteristic species in any stand is likely to be smaller than this list. In addition, the total richness of stands declines with increasing latitude and a number of the species listed above are absent or rare in the south.

4. The total species list of the community is considerably larger than that given above, with many species present in only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought condition and by its disturbance (including fire) history. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented but the assemblage in individual stands will depend on geographic location, size of stand, degree of exposure, history of disturbance and, if previously disturbed, stage of regeneration.

5. Threatened species and populations for which Littoral Rainforest is known or likely habitat include:

<i>Acronychia littoralis</i>	<i>Cryptocarya foetida</i>
<i>Archidendron hendersonii</i>	<i>Macadamia tetraphylla</i>
<i>Cynanchum elegans</i>	<i>Hicksbeachia pinnatifolia</i>
<i>Fontainea oraria</i>	<i>Syzygium moorei</i>
<i>Senna acclinis</i>	<i>Xylosma terrae-reginae</i>
<i>Syzygium paniculatum</i>	Bush-hen
<i>Amaurornis olivaceus</i>	Barred Cuckoo-shrike
<i>Coracina lineata</i>	Mangrove Honeyeater
<i>Lichenostomus facioularis</i>	White-eared Monarch
<i>Monarchia leucotis</i>	Powerful Owl
<i>Ninox strenua</i>	Osprey
<i>Pandion halliaetus</i>	Wompoo Fruit-dove
<i>Ptilinopus magnificus</i>	Rose-crowned Fruit-dove
<i>Ptilinopus regina</i>	Superb Fruit-dove
<i>Ptilinopus superbus</i>	Sooty Owl
<i>Tyto tenebricosa</i>	Spotted-tailed Quoll
<i>Dasyurus maculatus</i>	Golden-tipped Bat
<i>Kerivoula papuensis</i>	

<i>Mormopterus beccarii</i>	Beccari's Freetail-bat
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat
<i>Myotis adversus</i>	Large-footed Myotis
<i>Nyctimene robinsoni</i>	Eastern Tube-nosed Bat
<i>Potorous tridactylus</i>	Long-nosed Potoroo
<i>Pteropus alecto</i>	Black Flying Fox
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox
<i>Syconycteris australis</i>	Eastern Blossom Bat
<i>Thylogale stigmatica</i>	Red-legged Pademelon
<i>Coeranoscincus reticulatus</i>	Three-toed Snake-tooth Skink
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake
<i>Thersites mitchellae</i>	Mitchell's Rainforest Snail
Emu, <i>Dromaius novaehollandiae</i> , population in the NSW North Coast Bioregion and Port Stephens Local Government Area	
<i>Menippus fugitivus</i> (Lea), a beetle population in the Sutherland Shire	

Most of the species included in this list are found at only some sites, or vary in occurrence and abundance. As such they are not regarded as part of the characterisation of the community. Nevertheless, they are of conservation significance and need to be considered in recovery planning.

6. Littoral Rainforest occurs in numerous, small stands and in total comprises less than 1% of the total area of rainforest in NSW. The largest known stand occurs in Iluka Nature Reserve, which is approximately 136 ha. Many, but not all, stands of Littoral Rainforest have been included in mapping for State Environmental Planning Policy 26 Littoral Rainforest, but degradation of the ecological community is still occurring.

7. Weed species that threaten the integrity of particular stands include *Ambrosia artemisifolia*, *Anredera cordifolia*, *Arecastum romanzoffianum*, *Asparagus* spp., *Cardiospermum grandiflorum*, *Chrysanthemoides monilifera*, *Coprosma repens*, *Ehrharta* spp., *Gloriosa superba*, *Ipomoea* spp; *Impatiens walleriana*, *Lantana camara*, *Macfadyena unguis-cati*, *Rivina humilis*, *Pennisetum clandestinum*, *Schefflera actinophylla*, *Senna septemtrionalis*, *Solanum mauritianum* *Thunbergia alata* and *Tradescantia fluminensis*.

8. Other threats include loss of canopy integrity arising from salt and wind damage as a result of clearing or damage to stand margins; clearing of understorey (including for firewood collection); grazing and physical disturbance of understorey including by feral deer; inappropriate collection of a range of plant species (including, but not restricted to, epiphytes); fire, particularly fire incursion along boundaries: visitor disturbance including soil compaction, soil disturbance, erosion from foot, cycle, trail bike and 4 wheel drive tracks, introduction of pathogens, and disturbance from creation of new planned and unplanned tracks; increased visitation and resulting increased demand for and use of, visitor facilities such as walking tracks, viewing platforms, toilet blocks, picnic areas etc; dumping of garden waste causing weed infestation; car and other rubbish dumping. Loss of fauna due to predation by feral animals, road kill, loss of habitat and feeding resources, disturbance from human visitation (faunal elements are essential to the ecological functioning of littoral rainforest and loss, or reduction, in pollinators and seed dispersal agents will adversely affect long term vegetation health); fragmentation resulting in loss of connectivity and possibly reduced genetic exchange between populations. For stands not protected by State Environmental Planning Policy 26, clearing and development remains a possibility. (Adam 1987, 1992; Floyd 1990; Mills 1996).

9. In view of the above the Scientific Committee is of the opinion that Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

Associate Professor Paul Adam, Chairperson, Scientific Committee

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NSW Scientific Committee
Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act, and as a consequence to omit reference to Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion from Part 3 of Schedule 1 of the Act. Listing of endangered ecological communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree stratum is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. Typically these forests, scrubs, fernlands, reedlands and sedgelands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (e.g. Pressey 1989a).

The composition of Swamp Sclerophyll Forest on Coastal Floodplains is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil. Composition also varies with latitude. The community is characterised by the following assemblage of species:

<i>Acacia irrorata</i>	<i>Acacia longifolia</i>
<i>Acmena smithii</i>	<i>Adiantum aethiopicum</i>
<i>Allocasuarina littoralis</i>	<i>Banksia oblongifolia</i>
<i>Banksia spinulosa</i>	<i>Baumea articulata</i>
<i>Baumea juncea</i>	<i>Blechnum camfieldii</i>
<i>Blechnum indicum</i>	<i>Breynia oblongifolia</i>
<i>Callistemon salignus</i>	<i>Calochlaena dubia</i>
<i>Carex appressa</i>	<i>Casuarina glauca</i>
<i>Centella asiatica</i>	<i>Dianella caerulea</i>
<i>Dodonaea triquetra</i>	<i>Elaeocarpus reticulatus</i>
<i>Entolasia marginata</i>	<i>Entolasia stricta</i>
<i>Eucalyptus botryoides</i>	<i>Eucalyptus longifolia</i>
<i>Eucalyptus resinifera</i> subsp. <i>hemilampra</i>	<i>Eucalyptus robusta</i>
<i>Ficus coronata</i>	<i>Gahnia clarkei</i>
<i>Gahnia sieberiana</i>	<i>Glochidion ferdinandi</i>
<i>Glycine clandestina</i>	<i>Gonocarpus tetragynus</i>
<i>Hydrocotyle peduncularis</i>	<i>Hypolepis muelleri</i>

<i>Imperata cylindrica</i> var. <i>major</i>	<i>Isachne globosa</i>
<i>Leptospermum polygalifolium</i> subsp. <i>polygalifolium</i>	<i>Livistona australis</i>
<i>Lomandra longifolia</i>	<i>Lophostemon suaveolens</i>
<i>Melaleuca ericifolia</i>	<i>Melaleuca linariifolia</i>
<i>Melaleuca quinquenervia</i>	<i>Melaleuca sieberi</i>
<i>Melaleuca styphelioides</i>	<i>Morinda jasminoides</i>
<i>Omalthus populifolius</i>	<i>Oplismenus aemulus</i>
<i>Oplismenus imbecillis</i>	<i>Parsonsia straminea</i>
<i>Phragmites australis</i>	<i>Polyscias sambucifolia</i>
<i>Pratia purpurascens</i>	<i>Pteridium esculentum</i>
<i>Stephania japonica</i> var. <i>discolor</i>	<i>Themeda australis</i>
<i>Villarsia exaltata</i>	<i>Viola banksii</i>
<i>Viola hederacea</i>	

2. The total species list of the community is considerably larger than that given above, with many species present at only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance (including fire, grazing, flooding and land clearing) history. The number and relative abundance of species will change with time since fire, flooding or significant rainfall, and may also change in response to changes in grazing regimes. At any one time, above-ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

3. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven but may occur elsewhere in these bioregions. Bioregions are defined in Thackway and Creswell (1995). Major examples once occurred on the floodplains of the Tweed, Richmond, Clarence, Macleay, Hastings and Manning Rivers, although smaller floodplains would have also supported considerable areas of this community.

4. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has an open to dense tree layer of eucalypts and paperbarks, which may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. For example, stands dominated by *Melaleuca ericifolia* typically do not exceed 8 m in height. The most widespread and abundant dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybut). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including *Callistemon salignus* (sweet willow bottlebrush), *Casuarina glauca* (swamp oak) and *Eucalyptus resinifera* subsp. *hemilampra* (red mahogany), *Livistona australis* (cabbage palm) and *Lophostemon suaveolens* (swamp turpentine). A layer of small trees may be present, including *Acacia irrorata* (green wattle), *Acmena smithii* (lilly pilly), *Elaeocarpus reticulatus* (blueberry ash), *Glochidion ferdinandi* (Cheese Tree), *Melaleuca linariifolia* and *M. styphelioides* (paperbarks). Shrubs include *Acacia longifolia* (Sydney golden wattle), *Dodonaea triquetra* (a hopbush), *Ficus coronata* (sandpaper fig), *Leptospermum polygalifolium* subsp. *polygalifolium* (lemon-scented tea tree) and *Melaleuca* spp. (paperbarks). Occasional vines include *Parsonsia straminea* (common silkpod), *Morinda jasminoides* and *Stephania japonica* var. *discolor* (snake vine). The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei*, *Pteridium esculentum* (bracken), *Hypolepis muelleri* (batswing

fern), *Calochlaena dubia* (false bracken), *Dianella caerulea* (blue flax lily), *Viola hederacea*, *Lomandra longifolia* (spiny-headed mat-rush) and *Entolasia marginata* (bordered panic) and *Imperata cylindrica* var. *major* (blady grass). The endangered swamp orchids *Phaius australis* and *P. tankervillei* are found in this community. On sites downslope of lithic substrates or with soils of clay-loam texture, species such as *Allocasuarina littoralis* (black she-oak), *Banksia oblongifolia*, *B. spinulosa* (var. *collina* or var. *spinulosa*) (hairpin banksia), *Ptilothrix deusta* and *Themeda australis* (kangaroo grass), may also be present in the understorey. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.

5. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions provides habitat for a broad range of animals, including many that are dependent on trees for food, nesting or roosting (Law *et al.* 2000). The blossoms of *Eucalyptus robusta* and *Melaleuca quinquenervia* are also an important food source for the Grey-headed Flying Fox (*Pteropus poliocephalus*) and Common Blossom Bat (*Sycoynceteris australis*) (Law 1994), as well as the Yellow-bellied Glider (*Petaurus australis*), Sugar Glider (*Petaurus breviceps*), Regent Honeyeater (*Xanthomyza phrygia*) and Swift Parrot (*Lathamus discolor*). Other animals found in this community include the Osprey (*Pandion haliaetus*), Australasian Bittern (*Botaurus poiciloptilus*), Large-footed myotis (*Myotis adversus*), *Litoria olongburensis* and Wallum Froglet (*Crinia tinnula*).

6. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions forms part of a complex of forested and treeless wetland communities found throughout the coastal floodplains of NSW. A recent analysis of available quadrat data from these habitats identified a distinct grouping of vegetation samples attributable to this community (Keith and Scott 2005). The combination of features that distinguish Swamp Sclerophyll Forest on Coastal Floodplains from other endangered ecological communities on the coastal floodplains include: its relatively dense tree canopy dominated by *Eucalyptus robusta*, *Melaleuca quinquenervia* or *E. botryoides*, the relatively infrequent occurrence of other eucalypts, *Casuarina glauca* or *Lophostemon suaveolens*; the occasional presence of rainforest elements as scattered trees or understorey plants; and the prominence of large sedges and ferns in the groundcover. It generally occupies small alluvial flats and peripheral parts of floodplains where they adjoin lithic substrates or coastal sandplains. The soils are usually waterlogged, stained black or dark grey with humus, and show little influence of saline ground water.

7. Swamp Sclerophyll Forest on Coastal Floodplains includes and replaces Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion. It may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include Lowland Rainforest on Floodplain in the NSW North Coast bioregion, River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal River-Flat Forest in the Sydney Basin bioregion), Subtropical Floodplain Forest, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions and Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. For example, as soils become less waterlogged, Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions may adjoin or intergrade with River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. As soil salinity increases Swamp Sclerophyll Forest on Coastal Floodplains may intergrade with, and be replaced by, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. The boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices (e.g. Johnston *et al.* 2003, Stevenson 2003). The Determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats.

8. A number of vegetation surveys and mapping studies have been conducted across the range of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. This community includes the *Eucalyptus robusta* (Swamp Mahogany) community identified on coastal alluvium by Douglas and Anderson (2002) and the Coastal Alluvium Swamp Forest complex defined by Anderson and Asquith (2002). In the Comprehensive Regional Assessment of the north-eastern NSW (NPWS 1999), those areas on floodplains mapped as 'Forest Ecosystem 112, Paperbark', and those areas on floodplains mapped as 'Forest Ecosystem 142, Swamp Mahogany' are included within this community. On the Tweed lowlands, this community includes 'Eucalyptus robusta mid-high to very tall closed forest' (F7), 'Archontophoenix cunninghamiana-Melaleuca quinquenervia very tall feather palm swamp forest' (F9), those parts of *Melaleuca quinquenervia* tall to very tall open to closed forest' (F8) on alluvial soils and parts of 'Floodplain Wetland Complex' (FL) dominated by *Eucalyptus robusta* or *Melaleuca quinquenervia* (Pressey and Griffith 1992). In the lower Hunter district, this community includes 'Swamp Mahogany-Paperbark Swamp Forest' (map unit 37), Riparian Melaleuca Swamp Woodland (map unit 42) and Melaleuca Scrub (map unit 42a) of NPWS (2000). In the Sydney-Gosford region, this community includes those parts of 'Freshwater Swamp complex' (map unit 27a) dominated by *Eucalyptus robusta* or *E. botryoides* (Benson 1986, Benson and Howell 1994) and parts of the 'Freshwater wetlands – on the floodplains' of Benson and Howell (1990) and Benson et al. (1996). In the Illawarra, this community includes 'Alluvial swamp mahogany forest' (map unit 35) of NPWS (2002). On the south coast, this community includes 'Northern Coastal Lowlands Swamp Forest' (forest ecosystem 175) of Thomas et al. (2000) and 'Coastal Sand Swamp Forest' (map unit 45) of Tindall et al. (2004). Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is included within the 'Coastal Floodplain Wetlands' and 'Coastal Swamp Forest' vegetation classes of Keith (2002, 2004). There may be additional or unmapped occurrences of Swamp Sclerophyll Forest on Coastal Floodplains within and beyond these surveyed areas.

9. The extent of the Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions prior to European settlement has not been mapped across its entire range. However, one estimate based on a compilation of regional vegetation maps suggests that Coastal Floodplain Wetlands, which include Swamp Sclerophyll Forest on Floodplains, currently cover 800-1400 km², representing less than 30% of the original extent of this broadly defined vegetation class (Keith 2004). Compared to this combined estimate, the remaining area of Swamp Sclerophyll Forest on Coastal Floodplains is likely to be considerably smaller and is likely to represent much less than 30% of its original range. For example, there were less than 350 ha of native vegetation attributable to this community on the Tweed lowlands in 1985 (Pressey and Griffith 1992), less than 2500 ha on the Clarence floodplain in 1982 (Pressey 1989a), less than 700 ha on the Macleay floodplain in 1983 (Pressey 1989b), up to 7000 ha in the lower Hunter – central coast district during the 1990s (NPWS 2000), and less than 1000 ha in the Sydney – South Coast region in the mid 1990s (Tindall et al. 2004), including less than 40 ha on the Illawarra plain in 2001 (NPWS 2002) and about 450 ha on the South Coast in the 1990s (Thomas et al. 2000).

10. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has been extensively cleared and modified. Large areas that formerly supported this community are occupied by exotic pastures grazed by cattle, market gardens, other cropping enterprises (e.g. sorghum, corn, poplars, etc.) and, on the far north coast, canefields. On the Tweed lowlands, Pressey and Griffith (1992) estimated that less than 3% of the original Floodplain Wetlands and Floodplain Forest remained in 1985. Similar estimates are likely to apply to Swamp Sclerophyll Forest on Coastal Floodplains in other parts of the NSW North Coast bioregion (Goodrick 1970, Pressey 1989a, 1989b). In the lower Hunter – central coast district, about 30 % of the original area of Swamp mahogany – paperbark forest was estimated to remain in the 1990s (NPWS 2000).

11. Land clearing continues to threaten Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. A small minority of the remaining area

occurs on public land (e.g. Pressey and Griffith 1992, NPWS 2000), with most occurring on productive agricultural land or in close proximity to rural centres. The remaining stands are severely fragmented by past clearing and further threatened by continuing fragmentation and degradation, flood mitigation and drainage works, landfilling and earthworks associated with urban and industrial development, pollution from urban and agricultural runoff, weed invasion, overgrazing, trampling and other soil disturbance by domestic livestock and feral animals including pigs, activation of 'acid sulfate soils', removal of dead wood and rubbish dumping (e.g. Pressey 1989a, b; Pressey and Griffith 1992, Boulton and Brock 1999, Johnston *et al.* 2003). Anthropogenic climate change may also threaten Swamp Sclerophyll Forest on Coastal Floodplains if future flooding regimes are affected (IPCC 2001, Hughes 2003). Localised areas, particularly those within urbanised regions, may also be exposed to frequent burning which reduces the diversity of woody plant species. Clearing of native vegetation; Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; Anthropogenic climate change; High frequency fire and Removal of dead wood and dead trees are listed as Key Threatening Processes under the Threatened Species Act (1995).

12. Large areas of habitat formerly occupied by Swamp Sclerophyll Forest on Coastal Floodplains have been directly drained by construction of artificial channels (e.g. Pressey 1989a, Boulton and Brock 1999). While much of the early drainage works were associated with agricultural development, more recently they are associated with urban expansion. Additional areas that have not been directly drained may have been altered hydrologically by changed patterns of flooding and drainage following flood mitigation works, particularly the construction of drains, levees and floodgates (Pressey and Griffith 1992). On the north coast of NSW, expansion of *Melaleuca quinquenervia* into open floodplain swamps has been attributed to artificial drainage and shortening of the hydroperiod (Johnston *et al.* 2003, Stevenson 2003). These changes appear to be closely associated with enhanced acidity, altered ionic ratios, increased dissolved organic carbon and sulfide oxidation in the soil profile (Johnston *et al.* 2003).

13. Relatively few examples of Swamp Sclerophyll Forest on Coastal Floodplains remain unaffected by weeds. The causes of weed invasion include physical disturbance to the vegetation structure of the community, dumping of landfill rubbish and garden refuse, polluted runoff from urban and agricultural areas, construction of roads and other utilities, and grazing by domestic livestock. The principal weed species affecting Swamp Sclerophyll Forest on Coastal Floodplains include *Andropogon virginicus* (whiskey grass), *Anredera cordifolia* (Madeira vine), *Ageratina adenophora* (crofton weed), *Baccharis halimifolia* (groundsel bush), *Cinnamomum camphora* (camphor laurel), *Lantana camara* (lantana), *Ligustrum sinense* (small-leaved privet), *Lonicera japonica* (Japanese honeysuckle) and *Ludwigia peruviana* (Keith and Scott 2005).

14. Small areas of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions are contained within existing conservation reserves, including Bungawalbin, Tuckean and Moonee Beach Nature Reserves, and Hat Head, Crowdy Bay, Wallingat, Myall Lakes and Garigal National Parks. These occurrences are unevenly distributed throughout the range and unlikely to represent the full diversity of the community. In addition, wetlands within protected areas are exposed to hydrological changes that were, and continue to be initiated outside their boundaries. Some areas of Swamp Oak Floodplain Forest are protected by State Environmental Planning Policy 14, although this has not always precluded impacts on wetlands from the development of major infrastructure.

15. Given the dynamic hydrological relationship between Swamp Sclerophyll Forest on Coastal Floodplains, Coastal Saltmarsh and other endangered ecological communities on coastal floodplains, future management of water and tidal flows may result in the expansion of some communities at the expense of others. Proposals for the restoration of natural hydrological regimes and for the rehabilitation of acid sulfate soils may also result in changes to the distribution and composition of floodplain communities. Co-ordinated planning and management approaches across whole catchments will be required to address and resolve priorities between different management objectives.

16. In view of the above the Scientific Committee is of the opinion that Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

Associate Professor Paul Adam
Chairperson
Scientific Committee

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NSW Scientific Committee
Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions, as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act. Listing of endangered ecological communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Swamp Oak Floodplain Forest generally occurs below 20 m (rarely above 10 m) elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. Typically these forests, woodlands, scrubs and reedlands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (e.g. Pressey 1989a).

The composition of Swamp Oak Floodplain Forest is primarily determined by the frequency and duration of waterlogging and the level of salinity in the groundwater. Composition also varies with latitude. The community is characterised by the following assemblage of species:

<i>Acmena smithii</i>	<i>Alphitonia excelsa</i>
<i>Alternanthera denticulata</i>	<i>Baumea juncea</i>
<i>Blechnum indicum</i>	<i>Callistemon salignus</i>
<i>Carex appressa</i>	<i>Casuarina glauca</i>
<i>Centella asiatica</i>	<i>Commelina cyanea</i>
<i>Crinum pedunculatum</i>	<i>Cupaniopsis anacardioides</i>
<i>Cynodon dactylon</i>	<i>Dianella caerulea</i>
<i>Entolasia marginata</i>	<i>Enydra fluctuans</i>
<i>Flagellaria indica</i>	<i>Gahnia clarkei</i>
<i>Geitonoplesium cymosum</i>	<i>Glochidion ferdinandi</i>
<i>Glochidion sumatranum</i>	<i>Hypolepis muelleri</i>
<i>Imperata cylindrica</i> var. <i>major</i>	<i>Isolepis inundata</i>
<i>Juncus kraussii</i> subsp. <i>australiensis</i>	<i>Juncus planifolius</i>
<i>Juncus usitatus</i>	<i>Lobelia alata</i>
<i>Lomandra longifolia</i>	<i>Lophostemon suaveolens</i>
<i>Maundia triglochoides</i>	<i>Melaleuca alternifolia</i>
<i>Melaleuca ericifolia</i>	<i>Melaleuca quinquenervia</i>
<i>Melaleuca styphelioides</i>	<i>Myoporum acuminatum</i>
<i>Oplismenus imbecillis</i>	<i>Parsonsia straminea</i>
<i>Persicaria decipiens</i>	<i>Persicaria strigosa</i>
<i>Phragmites australis</i>	<i>Selliera radicans</i>
<i>Smilax australis</i>	<i>Stephania japonica</i> var. <i>discolor</i>
<i>Viola banksii</i>	

2. The total species list of the community is considerably larger than that given above, with many species present at only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance (including fire, grazing, flooding and land clearing) history. The number and relative abundance of species will change with time since fire, flooding or significant rainfall, and may also change in response to changes in grazing regimes. At any one time, above-ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

3. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes, Port Stephens, Maitland, Newcastle, Cessnock, Lake Macquarie, Wyong, Gosford, Pittwater, Warringah, Hawkesbury, Baulkham Hills, Hornsby, Lane Cove, Blacktown, Auburn, Parramatta, Canada Bay, Rockdale, Kogarah, Sutherland, Penrith, Fairfield, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Bioregions are defined in Thackway and Creswell (1995). Major examples once occurred on the floodplains of the Clarence, Macleay, Hastings, Manning, Hunter, Hawkesbury, Shoalhaven and Moruya Rivers.

4. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions has a dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species northwards from Bermagui. Other trees including *Acmena smithii* (lilly pilly), *Glochidion* spp. (Cheese Trees) and *Melaleuca* spp. (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and *Melaleuca ericifolia* is the only abundant tree in this community south of Bermagui (Keith and Bedward 1999). The understorey is characterised by frequent occurrences of vines, *Parsonsia straminea* (common silkpod), *Geitonoplesium cymosum* (scrambling lily) and *Stephania japonica* var. *discolor* (snake vine), a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter. The composition of the ground stratum varies depending on levels of salinity in the groundwater. Under less saline conditions prominent ground layer plants include forbs such *Centella asiatica* (pennywort), *Commelina cyanea*, *Persicaria decipiens* (slender knotweed) and *Viola banksii*; graminoids such as *Carex appressa* (tussock sedge), *Gahnia clarkei* (a saw-sedge), *Lomandra longifolia* (spiny-headed mat-rush), *Oplismenus imbecillis*; and the fern *Hypolepis muelleri* (batswing fern). On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, *Alexfloydia repens*, as well as *Baumea juncea*, *Juncus kraussii* subsp. *australiensis* (sea rush), *Phragmites australis* (common reed), *Selliera radicans* and other saltmarsh species. The composition and structure of the understorey is also influenced by grazing history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.

5. Unlike most other coastal floodplain communities, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions are not a significant habitat for waterbirds (Goodrick 1970). However, they do sometimes provide food resources for the Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*), and Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) (Marchant and Higgins 1990). The fauna of Swamp Oak Floodplain Forest also includes the Squirrel Glider (*Petaurus norfolcensis*) and several species of frogs in the families Myobatrachidae (southern frogs) and Hylidae (tree frogs).

6. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions forms part of a complex of forested wetland and treeless wetland communities found throughout

the coastal floodplains of NSW. A recent analysis of available quadrat data from these habitats identified a distinct grouping of vegetation samples attributable to this community (Keith and Scott 2005). The combination of features that distinguish Swamp Oak Floodplain Forest from other endangered ecological communities on the coastal floodplains include: its dominance by a tree canopy of either *Casuarina glauca* or, more rarely, *Melaleuca ericifolia* with or without subordinate tree species; the relatively low abundance of *Eucalyptus* species; and the prominent groundcover of forbs and graminoids. It generally occupies low-lying parts of floodplains, alluvial flats, drainage lines, lake margins and fringes of estuaries; habitats where flooding is periodic and soils show some influence of saline ground water. This latter habitat feature sets it apart from other floodplain communities.

7. Swamp Oak Floodplain Forest may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include Lowland Rainforest on Floodplain in the NSW North Coast bioregion, Subtropical Floodplain Forest of the NSW North Coast bioregion, River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal River-Flat Forest in the Sydney Basin bioregion), Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion) and Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. For example, in less saline habitats, Swamp Oak Floodplain Forest may adjoin or intergrade with several other endangered ecological communities including River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions and Subtropical Floodplain Forest of the NSW North Coast bioregion. The most saline forms of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions may adjoin or intergrade with Coastal Saltmarsh of the NSW North Coast, Sydney Basin and South East Corner bioregions. The boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices (e.g. Johnston *et al.* 2003). The Determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats.

8. A number of vegetation surveys and mapping studies have been conducted across the range of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. This community includes 'Sheoak Swamps' in the general coastal wetlands classification of Goodrick (1970). In the Tweed valley lowlands, this community includes 'Casuarina glauca tall to very tall open to closed forest' (F10) of Pressey and Griffith (1992) and parts of the 'Floodplain Wetland Complex' (FL) that include *Casuarina glauca* with *Melaleuca* spp. (Pressey and Griffith 1992). In the Comprehensive Regional Assessment of the north-eastern NSW (NPWS 1999), areas mapped as 'Forest Ecosystem 143, Swamp Oak', fall within this community. In the lower Hunter valley, 'Swamp Oak – Rushland Forest' (map unit 40) and 'Swamp Oak Sedge Forest' (map unit 41) of NPWS (2000) fall within this community. On the Cumberland Plain, 'Riparian Woodland' (map unit 5) of Tozer (2003) and parts of 'Alluvial Woodland' (map unit 11) dominated by *Casuarina glauca* (Tozer 2003) are included within this community, while those parts of Benson's (1992) 'River Flat Forest' (map unit 9f) dominated by *C. glauca* also fall within this community, as do parts of the 'River-flat forests' of Benson and Howell (1990) and Benson *et al.* (1996) that are dominated by *C. glauca*. On the Illawarra Plain, 'Coastal Swamp Oak Forest' (map unit 36) of NPWS (2002) occurs within this community. In the Comprehensive Regional Assessment of southern New South Wales (Thomas *et al.* 2000), this community includes 'Coastal Wet Heath Swamp Forest' (forest ecosystem 24), 'South Coast Swamp Forest' complex (forest ecosystem 25) and those parts of 'Ecotonal Coastal Swamp Forest' (forest ecosystem 27) dominated by *Casuarina glauca*. In the Sydney - South Coast region, this community includes parts of 'Floodplain Swamp Forest' (map unit 105) dominated by *Casuarina glauca*, 'Estuarine Fringe Forest' (map unit 106) and 'Estuarine Creek Flat Scrub' (map unit 107) of Tindall *et al.* (2004). In the Eden region, this community includes 'Estuarine Wetland Scrub' (map unit 63) of Keith and Bedward (1999) and parts of 'Floodplain Wetlands' (map unit 60) that include *Casuarina glauca* or

Melaleuca ericifolia (Keith and Bedward 1999). Swamp Oak Floodplain Forest South East Corner is included within the 'Coastal Floodplain Wetlands' vegetation class of Keith (2002, 2004). There may be additional or unmapped occurrences of Swamp Oak Floodplain Forest within and beyond these surveyed areas.

9. The extent of the Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions prior to European settlement has not been mapped across its entire range. However, one estimate based on a compilation of regional vegetation maps suggests that Coastal Floodplain Wetlands, which include Swamp Oak Floodplain Forest, currently cover 800-1400 km², representing less than 30% of the original extent of this broadly defined vegetation class (Keith 2004). Compared to this combined estimate, the remaining area of Swamp Oak Floodplain Forest is likely to be considerably smaller and is likely to represent much less than 30% of its original range. Major occurrences include: less than 350 ha on the Tweed lowlands in 1985 (Pressey and Griffith 1992); less than 650 ha on the lower Clarence floodplain in 1982 (Pressey 1989a); less than 400 ha on the lower Macleay floodplain in 1983 (Pressey 1989b); less than 3200 ha in the lower Hunter – central Hunter region in the 1990s (NPWS 2000); less than 5200 ha in the Sydney - South Coast region in the mid 1990s (Tindall *et al.* 2004), including up to 4700 ha on the Cumberland Plain in 1998 (Tozer 2003) and less than 250 ha on the Illawarra Plain in 2001 (NPWS 2002); and less than 1000 ha in the Eden region in 1990 (Keith and Bedward 1999).

10. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions has been extensively cleared and modified. Large areas that formerly supported this community are occupied by exotic pastures grazed by cattle, market gardens, other cropping enterprises (e.g. sorghum, corn, poplars, etc.) and, on the far north coast, canefields. On the Tweed lowlands, Pressey and Griffith (1992) estimated that less than 3% of the original Floodplain Wetlands and Floodplain Forest remained in 1985. Similar estimates are likely to apply to Swamp Oak Floodplain Forests in other parts of the NSW North Coast bioregion (Pressey 1989a, 1989b, NPWS 1999). In the lower Hunter – central coast region, less than 30-40% was estimated to have remained during the 1990s (NPWS 2000), while approximately 13% remained on the Cumberland Plain in 1998 (Tozer 2003). In the Sydney – South Coast region, less than 20% was estimated to remain in the mid 1990s (Tindall *et al.* 2004), in the Eden region about 30% was estimated to remain during the 1990s (Keith and Bedward 1999).

11. Land clearing continues to threaten Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. A small minority of the remaining area occurs on public land (e.g. Pressey 1989a, b; Pressey and Griffith 1992), with most occurring on productive agricultural land or in close proximity to rural centres. The remaining stands are severely fragmented by past clearing and further threatened by continuing fragmentation and degradation, flood mitigation and drainage works, landfilling and earthworks associated with urban and industrial development, pollution from urban and agricultural runoff, weed invasion, overgrazing, trampling and other soil disturbance by domestic livestock and feral animals including pigs, activation of 'acid sulfate soils' and rubbish dumping (e.g. Pressey 1989a, b; Pressey and Griffith 1992, Boulton and Brock 1999, Johnson *et al.* 2003). Anthropogenic climate change may also threaten Swamp Oak Floodplain Forest if sea levels rise as predicted or if future flooding regimes are affected (IPCC 2001, Hughes 2003). Localised areas, particularly those within urbanised regions, may also be exposed to frequent burning which reduces the diversity of woody plant species. Clearing of native vegetation; Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; Anthropogenic climate change and High frequency fire are listed as Key Threatening Processes under the Threatened Species Conservation Act (1995).

12. Large areas of habitat formerly occupied by Swamp Oak Floodplain Forest have been directly drained by construction of artificial channels (e.g. Pressey 1989a, Boulton and Brock 1999). By the early 1900s, drainage unions or trusts were formed on the major floodplains to enable adjacent landholders to arrange for co-ordinated drainage systems, which were designed and constructed by the NSW Department of

Public Works. Additional areas that have not been directly drained may have been altered hydrologically by changed patterns of flooding and drainage following flood mitigation works, particularly the construction of drains, levees and floodgates (Pressey and Griffith 1992). On the north coast of NSW, expansion of *Melaleuca quinquenervia* and *Casuarina glauca* into open floodplain swamps has been attributed to artificial drainage and shortening of the hydroperiod (Johnston *et al.* 2003, Stevenson 2003). There have also been anecdotal reports of recruitment by *Casuarina glauca* in pastures during extended dry periods, though not necessarily by other components of the community. These changes appear to be closely associated with enhanced acidity, altered ionic ratios, increased dissolved organic carbon and sulfide oxidation in the soil profile (Johnston *et al.* 2003). Alteration of tidal flows may have lead to decreased soil salinity and localised expansion of *Casuarina glauca* into areas that previously supported Coastal Saltmarsh or mangroves (Stevenson 2003).

13. Very few examples of Swamp Oak Floodplain Forest remain unaffected by weeds. The causes of weed invasion include physical disturbance to the vegetation structure of the community, dumping of landfill rubbish and garden refuse, polluted runoff from urban and agricultural areas, construction of roads and other utilities, and grazing by domestic livestock. The principal weed species affecting Swamp Oak Floodplain Forest include *Araujia sericiflora* (moth plant), *Asparagus asparagoides* (bridal creeper), *Baccharis halimifolia* (groundsel bush), *Cyperus eragrostis* (umbrella sedge), *Cinnamomum camphora* (camphor laurel), *Conyza* spp. (fleabanes), *Hydrocotyle bonariensis* (American pennywort), *Ipomoea cairica*, *I. purpurea* and *I. indica* (morning glories), *Lantana camara*, *Paspalum dilatatum* (paspalum), *Pennisetum clandestinum* (kikuyu) *Rubus fruticosus* agg. (blackberries), *Solanum pseudocapsicum* (Madeira winter cherry), *S. nigrum* (black-berry nightshade), *Tradescantia fluminensis* (wandering jew) and *Verbena bonariensis* (purpletop), (Tozer 2003, Keith and Scott 2005). In general, remaining examples of Swamp Oak Floodplain Forest from the most saline environments are in better condition, while those from less saline habitats are generally more degraded.

14. Small areas of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions are contained within existing conservation reserves, including Stotts Island, Ukerebagh, Tuckean, Pambalong, Wamberal, Towra Point and Cullendulla Creek Nature Reserves and Bongil Bongil, Myall Lakes and Conjola National Parks. These occurrences are unevenly distributed throughout the range and unlikely to represent the full diversity of the community. In addition, wetlands within protected areas are exposed to hydrological changes that were, and continue to be initiated outside their boundaries. Some areas of Swamp Oak Floodplain Forest are protected by State Environmental Planning Policy 14, although this has not always precluded impacts on wetlands from the development of major infrastructure.

15. Given the dynamic hydrological relationship between Swamp Oak Floodplain Forest, Coastal Saltmarsh and other endangered ecological communities on coastal floodplains, future management of water and tidal flows may result in the expansion of some communities at the expense of others. Proposals for the restoration of natural hydrological regimes and for the rehabilitation of acid sulfate soils may also result in changes to the distribution and composition of floodplain communities. Co-ordinated planning and management approaches across whole catchments will be required to address and resolve priorities between different management objectives.

16. In view of the above the Scientific Committee is of the opinion that Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

Associate Professor Paul Adam
Chairperson
Scientific Committee

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NSW Scientific Committee
Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act. Listing of endangered ecological communities is provided for by Part 2 of the Act. The Scientific Committee has found that:

1. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Freshwater Wetlands on Coastal Floodplains generally occur below 20 m elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from sedgelands and reedlands to herbfields, and woody species of plants are generally scarce. Typically these wetlands form mosaics with other floodplain communities, and often they include or are associated with ephemeral or semi-permanent standing water (e.g. Goodrick 1970).

The composition of Freshwater Wetlands on Coastal Floodplains is primarily determined by the frequency, duration and depth of waterlogging and may be influenced by the level of nutrients and salinity in the water and substrate. The community is characterised by the following assemblage of species:

<i>Alisma plantago-aquatica</i>	<i>Azolla filiculoides</i> var. <i>rubra</i>
<i>Azolla pinnata</i>	<i>Baumea articulata</i>
<i>Baumea rubiginosa</i>	<i>Bolboschoenus caldwellii</i>
<i>Bolboschoenus fluviatilis</i>	<i>Brasenia schreiberi</i>
<i>Carex appressa</i>	<i>Centipeda minima</i>
<i>Ceratophyllum demersum</i>	<i>Cyperus lucidus</i>
<i>Eclipta platyglossa</i>	<i>Eclipta prostrata</i>
<i>Eleocharis acuta</i>	<i>Eleocharis equisetina</i>
<i>Eleocharis minuta</i>	<i>Eleocharis sphacelata</i>
<i>Fimbristylis dichotoma</i>	<i>Gratiola pedunculata</i>
<i>Hemarthria uncinata</i>	<i>Hydrilla verticillata</i>
<i>Hydrocharis dubia</i>	<i>Juncus polyanthemos</i>
<i>Juncus usitatus</i>	<i>Leersia hexandra</i>
<i>Lemna</i> spp.	<i>Lepironia articulata</i>
<i>Ludwigia peploides</i> subsp. <i>montevidensis</i>	<i>Marsilea mutica</i>
<i>Maunderia triglochinos</i>	<i>Myriophyllum crispatum</i>
<i>Myriophyllum latifolium</i>	<i>Myriophyllum propinquum</i>
<i>Myriophyllum variifolium</i>	<i>Najas marina</i>
<i>Najas tenuifolia</i>	<i>Nymphaea gigantea</i>
<i>Nymphoides geminata</i>	<i>Nymphoides indica</i>
<i>Ottelia ovalifolia</i>	<i>Panicum obseptum</i>
<i>Panicum vaginatum</i>	<i>Paspalum distichum</i>

Persicaria attenuata
Persicaria hydropiper
Persicaria strigosa
Phragmites australis
Potamogeton ochreateus
Potamogeton tricarinatus
Ranunculus inundatus
Schoenoplectus mucronatus
Spirodella spp.
Typha orientalis
Vallisneria spp.

Persicaria decipiens
Persicaria lapathifolia
Philydrum lanuginosum
Potamogeton crispus
Potamogeton perfoliatus
Pseudoraphis spinescens
Schoenoplectus litoralis
Schoenoplectus validus
Triglochin procera sensu lato
Utricularia australis
Wolffia spp.

2. The total species list of the community is considerably larger than that given above, with many species present at only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance history (including grazing, flooding, land clearing and pollution in the catchment). The number and relative abundance of species will change with time since flooding or significant rainfall, and may also change in response to changes in grazing regimes and land use in the catchment. At any one time, above-ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

3. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes, Port Stephens, Maitland, Newcastle, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Penrith, Fairfield, Liverpool, Wollondilly, Camden, Campbelltown, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Bioregions are defined in Thackway and Creswell (1995). Examples include Swan Bay, Gundurimba wetland, Bungawalbin Swamp, Dyraaba Creek and Tuckean Swamp on the Richmond floodplain; Southgate wetlands and Trenayr Swamp on the Clarence floodplain; Seven Oaks Swamp, Swan Pool, Kinchela Creek and Upper Belmore Swamp on the Macleay floodplain; Great Swamp on the Manning floodplain; Wentworth Swamp, Hexham Swamp, Wallis Creek and Ellalong Lagoon on the Hunter floodplain; Bushells, Pitt Town, Long Neck and Broadwater Lagoons on the Hawkesbury floodplain; Coomonderry Swamp on the Shoalhaven floodplain; Pedro and Old Man Bed Swamps on the Moruya floodplain; and Jellat Jellat Swamp on the Bega floodplain (Goodrick 1970).

4. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime (Yen and Myerscough 1989, Boulton and Brock 1999). Wetlands or parts of wetlands that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including *Paspalum distichum* (water couch), *Leersia hexandra* (swamp rice-grass), *Pseudoraphis spinescens* (mud grass) and *Carex appressa* (tussock sedge). Wetlands or parts of wetlands subject to regular inundation and drying may include large emergent sedges over 1 metre tall, such as *Baumea articulata*, *Eleocharis equisetina* and *Lepironia articulata*, as well as emergent or floating herbs such as *Hydrocharis dubia* (frogbit), *Philydrum lanuginosum* (frogmouth), *Ludwigia peploides* subsp. *montevidensis* (water primrose), *Marsilea mutica* (nardoo) and *Myriophyllum* spp. (milfoils). As standing water becomes deeper or more permanent, amphibious and emergent plants become less abundant, while floating and submerged aquatic herbs become more abundant. These latter

species include *Azolla filiculoides* var. *rubra*, *Ceratophyllum demersum* (hornwort), *Hydrilla verticillata* (water thyme), *Lemna* spp. (duckweeds), *Nymphaea gigantea* (giant waterlily), *Nymphoides indica* (water snowflake), *Ottelia ovalifolia* (swamp lily) and *Potamogeton* spp. (pondweeds). The threatened aquatic plants, *Aldrovanda vesiculosa* and *Najas marina*, also occur within this community. The composition and structure of the vegetation is also influenced by grazing history, changes to hydrology and soil salinity, catchment runoff and disturbance, and may have a substantial component of exotic grasses and forbs. Artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management and farm production, are not regarded as part of this community, although they may provide habitat for threatened species.

5. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has a distinctive fauna that includes frogs, fish, freshwater tortoises, waterbirds and a diversity of micro- and macro-invertebrates. The frog families represented are Myobatrachidae (southern frogs) and Hylidae (tree frogs), including the threatened Green and Golden Bell Frog (*Litoria aurea*). Waterbirds include Black Swan (*Cygnus atratus*), Pacific Black Duck (*Anas superciliosa*), Australian Grey Teal (*Anas gracilis*), Pacific Heron (*Ardea pacifica*), White-faced Heron (*Ardea novaehollandiae*), Great Egret (*Ardea alba*), Intermediate Egret (*Ardea intermedia*), Little Egret (*Ardea garzetta*), Straw-necked Ibis (*Threskiornis spinicollis*), Sacred Ibis (*Threskiornis aethiopica*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Royal Spoonbill (*Platalea regia*), Yellow-billed Spoonbill (*Platalea flavipes*), Japanese Snipe (*Gallinago hardwickii*), Black-winged Stilt (*Himantopus himantopus*), Dusky Moorhen (*Gallinula tenebrosa*), Comb-crested Jacana (*Jacana gallinacea*) and Purple swamphen (*Porphyrio porphyrio*).

6. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions forms part of a complex of forested wetland and treeless wetland communities found throughout the coastal floodplains of NSW. A recent analysis of available quadrat data from these habitats identified several types of forested wetlands that are distinct from this treeless wetland community (Keith and Scott 2005). The combination of features that distinguish Freshwater Wetlands on Coastal Floodplains from other endangered ecological communities on the coastal floodplains include its scarcity or complete absence of woody plant species and the presence of amphibious, emergent, floating or submerged aquatic forbs, grasses or sedges. It generally occupies low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes; habitats where flooding is periodic and standing fresh water persists for at least part of the year in most years. The community also occurs in backbarrier landforms where floodplains adjoin coastal sandplains (e.g. Pressey and Griffith 1992). However, it is distinct from Sydney Freshwater Wetlands, which may include a component of woody plant species and are associated with sandplains in the Sydney Basin bioregion.

7. Freshwater Wetlands on Coastal Floodplains may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include Lowland Rainforest on Floodplain in the NSW North Coast bioregion, Subtropical Floodplain Forest of the NSW North Coast bioregion, River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal River-flat Forest in the Sydney Basin bioregion), Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal Estuary Swamp Forest Complex in the Sydney Basin bioregion) and Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. For example, Freshwater Wetlands on Coastal Floodplains are sometimes fringed by trees, such as *Casuarina glauca* (swamp oak) and *Melaleuca quinquenervia* (paperbark), indicating transitional zones to forested communities of the floodplains. The boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices (e.g. Johnston *et al.* 2003, Stevenson 2003). In addition, Freshwater Wetlands on Coastal Floodplains may adjoin or intergrade with Coastal Saltmarsh of the NSW North Coast, Sydney Basin and South East Corner bioregions and Sydney Freshwater Wetlands of the Sydney Basin bioregion.

The Determinations for these communities collectively encompass the full range of intermediate assemblages.

8. A number of vegetation surveys and mapping studies have been conducted across the range of Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. This community includes 'Fresh meadows', 'Seasonal fresh swamps', 'Semi-permanent fresh swamps', and 'Open fresh waters' in the general coastal wetlands classification of Goodrick (1970). In the Tweed valley lowlands, this community includes '*Eleocharis equisetina* tall closed sedgeland' (E2) and '*Triglochin procerum* tall forbland to tall open forbland' (E3) of Pressey and Griffith (1992) and parts of the 'Floodplain Wetland Complex' (FL) that are dominated by herbaceous plants (Pressey and Griffith 1992). In the lower Hunter valley, 'Freshwater Wetland Complex' (map unit 46) of NPWS (2000) falls within this community. In the Sydney region, this community includes 'Freshwater wetlands on the floodplains' of Benson and Howell (1990); 'Freshwater reed swamps' (map unit 28a) of Benson (1992) and Ryan *et al.* (1996) in the Penrith-St Albans district; '*Lepironia* freshwater swamp' (map unit 75 and part of map unit 79) of NPWS (2002a) in the Warragamba area; and 'Freshwater wetlands' (map unit 36) of Tozer (2003) on the Cumberland Plain. On the Illawarra plain, this community includes 'Floodplain Wetland' (map unit 54) of NPWS (2002b). In the Comprehensive Regional Assessment of southern New South Wales (Thomas *et al.* 2000), this community includes 'Coastal alluvial valley floor wetlands' (map unit 189). This community also includes those parts of 'Coastal freshwater lagoon' (map unit 313) of Tindall *et al.* (2004), on the south coast of NSW, and parts of 'Floodplain Wetlands' (map unit 60) of Keith and Bedward (1999), in the Eden region, that are dominated by herbaceous aquatic plants. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is included within the 'Coastal Freshwater Lagoons' vegetation class of Keith (2002, 2004). There may be additional or unmapped occurrences of Freshwater Wetlands on Coastal Floodplains within and beyond these surveyed areas.

9. The extent of the Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions prior to European settlement has not been mapped across its entire range. Estimates of wetland area also vary, depending on the scale of mapping (coarse scale maps may exclude many small wetlands), wetland definition and the occurrence of recent flooding. Mapping carried out by Kingsford *et al.* (2004), for example, focused on areas of open water and thus excluded many wetlands attributable to this community. One estimate based on a compilation of regional vegetation maps suggests that Coastal Freshwater Lagoons, which include Freshwater Wetlands on Coastal Floodplains, currently cover 90-160 km², representing less than 60-90% of the original extent of this broadly defined vegetation class (Keith 2004). However, the remaining area of Freshwater Wetlands on Coastal Floodplains is likely to represent much less than 60-90% of its original range, because this combined estimate for the Coastal Freshwater Wetlands class (Keith 2004) is likely to include a considerable area of freshwater wetlands on coastal sandplains, which are excluded from this Determination. Goodrick (1970) estimated that approximately 21 700 ha of 'Fresh meadows', 'Seasonal fresh swamps', 'Semi-permanent fresh swamps', and 'Open fresh waters' remained on NSW coastal floodplains in 1969, representing less than 39% of their original area. Continued clearing and drainage works in the 35 years since Goodrick's (1970) survey are likely to have resulted in a substantial diminution of Freshwater Wetlands on Coastal Floodplains. More detailed surveys have identified the following areas attributable to Freshwater Wetlands on Coastal Floodplains: less than 150 ha on the Tweed lowlands in 1985 (Pressey and Griffith 1992); about 10 600 ha on the lower Clarence floodplain in 1982 (Pressey 1989a); about 11 200 ha on the lower Macleay floodplain in 1983 (Pressey 1989b); about 3500 ha in the lower Hunter – central Hunter region in 1990s (NPWS 2000); less than 2700 ha on the NSW south coast from Sydney to Moruya in the mid 1990s (Tindall *et al.* 2004), including about 660 ha on the Cumberland Plain in 1998 (Tozer 2003) and about 100 ha on the Illawarra Plain in 2001 (NPWS 2002); and less than 1000 ha in the Eden region in 1990 (Keith and Bedward 1999). The wetlands included in these estimates exist in various states of modification.

10. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has been extensively cleared and modified. Large areas that formerly supported this

community are occupied by exotic pastures grazed by cattle, market gardens, other cropping enterprises (e.g. sorghum, corn, poplars, etc.) and, on the far north coast, canefields. On the Tweed lowlands, Pressey and Griffith (1992) estimated that less than 3% of the original Floodplain Wetlands remained in 1985. Similar estimates are likely to apply to Freshwater Wetlands on Coastal Floodplains in other parts of the NSW North Coast bioregion (Pressey 1989a, 1989b). In the lower Hunter – central coast region, about two-thirds was estimated to have remained during the 1990s (NPWS 2000), while approximately 40% remained on the Cumberland Plain in 1998 (Tozer 2003). In the Sydney – South Coast region, about 70% was estimated to remain in the mid 1990s (Tindall *et al.* 2004), in the Eden region about 30% was estimated to remain during the 1990s (Keith and Bedward 1999).

11. Land clearing continues to threaten Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. A small minority of the remaining area occurs on public land (e.g. Pressey 1989a, b; Pressey and Griffith 1992), with most occurring on productive agricultural land or in close proximity to rural centres. The remaining stands are severely fragmented by past clearing and are further threatened by continuing fragmentation and degradation, flood mitigation and drainage works, filling associated with urban and industrial development, pollution and eutrophication from urban and agricultural runoff, weed invasion, overgrazing, trampling by livestock, soil disturbance by pigs, activation of 'acid sulfate soils' and rubbish dumping (e.g. Goodrick 1970; Pressey 1989a, b; Pressey and Griffith 1992; Boulton and Brock 1999, Johnston *et al.* 2003). The native fauna of Freshwater Wetlands on Coastal Floodplains is threatened by predation, particularly by mosquito fish and cane toads. Anthropogenic climate change may also threaten Freshwater Wetlands on Coastal Floodplains if sea levels rise and future flooding regimes change as predicted (IPCC 2001; Hughes 2003). Clearing of native vegetation; Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; and Anthropogenic climate change are listed as Key Threatening Processes under the Threatened Species Conservation Act (1995).

12. Large areas of habitat formerly occupied by Freshwater Wetlands on Coastal Floodplains have been directly drained by construction of artificial channels (e.g. Pressey 1989a, Boulton and Brock 1999). By the early 1900s, drainage unions or trusts were formed on the major floodplains to enable adjacent landholders to arrange for co-ordinated drainage systems, which were designed and constructed by the former NSW Department of Public Works. Additional areas that have not been directly drained may have been altered hydrologically by changed patterns of flooding and drainage following flood mitigation works, particularly the construction of drains, levees and floodgates (Pressey and Griffith 1992). On the north coast of NSW, expansion of *Melaleuca quinquenervia* and *Casuarina glauca* into open floodplain swamps has been attributed to artificial drainage and shortening of the hydroperiod (Johnston *et al.* 2003, Stevenson 2003). These changes appear to be closely associated with enhanced acidity, altered ionic ratios, increased dissolved organic carbon and sulfide oxidation in the soil profile (Johnston *et al.* 2003). Conversely, alteration of tidal flows may have led to decreased soil salinity and localised expansion of Freshwater Wetland into areas that previously supported Coastal Saltmarsh or mangroves (Stevenson 2003). Re-instatement of tidal flows and other natural hydrological processes may therefore lead to contraction of Freshwater Wetlands. In addition, sedimentation and eutrophication of wetlands is associated with development of their catchments for intensive agriculture or urban or industrial infrastructure. Harmful runoff from developed catchments may include herbicides, pesticides, fertilisers, sewerage, industrial waste and polluted stormwater. The widespread degradation of Freshwater Wetlands on Coastal Floodplains has led to regional declines in their dependent fauna including Magpie Geese (*Anseranas semipalmata*), Cotton Pygmy Geese (*Nettapus coromandelianus*), Hardhead (*Aythya australis*), Black-necked Stork (*Ephippiorhynchus asiaticus*), and Wandering Whistling Duck (*Dendrocygna arcuata*).

13. Very few examples of Freshwater Wetlands on Coastal Floodplains remain unaffected by weeds. The causes of weed invasion include physical disturbance to the vegetation structure of the community; the dumping of landfill, rubbish and garden refuse; eutrophication and polluted runoff from urban and

agricultural areas; construction of roads and other utilities; soil disturbance by feral pigs and grazing by domestic livestock. In addition, mechanical and chemical methods of controlling aquatic weeds may threaten native components of the flora. The principal weed species affecting Freshwater Wetlands on Coastal Floodplains include *Alternanthera philoxeroides* (alligatorweed), *Baccharis halimifolia* (groundsel bush), *Echinochloa crus-galli* (barnyard grass), *Eichhornia crassipes* (water hyacinth), *Hygrophila costata* (glush weed), *Ludwigia longifolia*, *L. peruviana*, *Nymphaea capensis* (Cape waterlily), *Panicum repens* (torpedo grass), *Pennisetum clandestinum* (kikuyu) and *Salvinia molesta*, (Sainty and Jacobs 1981).

14. Small areas of Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions are contained within existing conservation reserves, including Ukerebagh, Tuckean, Tabbimoble Swamp, Hexham Swamp, Pambalong and Pitt Town Nature Reserves and Bungawalbin, Scheyville and Seven Mile Beach National Parks, although these are unevenly distributed throughout the range and unlikely to represent the full diversity of the community. In addition, wetlands within protected areas are exposed to hydrological changes that were, and continue to be initiated outside their boundaries. Some Freshwater Wetlands on Coastal Floodplains are protected by State Environmental Planning Policy 14, although this has not always precluded impacts on wetlands from the development of major infrastructure.

15. Given the dynamic hydrological relationship between Freshwater Wetlands on Coastal Floodplains, Coastal Saltmarsh and other endangered ecological communities on coastal floodplains, future management of water and tidal flows may result in the expansion of some communities at the expense of others. Proposals for the restoration of natural hydrological regimes and for the rehabilitation of acid sulfate soils may also result in changes to the distribution and composition of floodplain communities. Co-ordinated planning and management approaches across whole catchments will be required to address and resolve priorities between different management objectives.

16. In view of the above the Scientific Committee is of the opinion that Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

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Chairperson
Scientific Committee

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APPENDIX 8

LIST OF ANIMAL SPECIES FOR THE INVESTIGATION AREA

Group Name	Common Name	Investigation Area ¹	Nearby ¹
1. Mammals			
Black Rat*	<i>Rattus rattus</i>		N
Brown Antechinus	<i>Antechinus stuartii</i>		N
Brown Hare*	<i>Lepus capensis</i>		N
Bush Rat	<i>Rattus fuscipes</i>		N
Cat*	<i>Felis catus</i>		N
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	A	N
Common Brushtail Possum	<i>Trichosurus vulpecula</i>		N
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	A	N
Dog*	<i>Canis lupus</i>		N
Domestic Cattle*	<i>Bos taurus</i>	A	N
Eastern Forest Bat	<i>Vespadelus pumilus</i>		N
Eastern Freetail-bat	<i>Mormopterus</i> sp.		N
Eastern Pygmy-possum	<i>Cercartetus nanus</i>		N
East-coast Freetail-bat	<i>Mormopterus norfolkensis</i>		N
Feathertail Glider	<i>Acrobates pygmacus</i>		N
Fox*	<i>Vulpes vulpes</i>	A	N
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>		N
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>		N
Greater Glider	<i>Petauroides volans</i>		N
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>		N
House Mouse*	<i>Mus musculus</i>		N
Large Bentwing-bat	<i>Miniopterus schreibersii</i>	A	
Large Forest Bat	<i>Vespadelus darlingtoni</i>	A	N
Little Forest Bat	<i>Vespadelus vulturnus</i>	A	N
Long-nosed Bandicoot	<i>Perameles nasuta</i>	A	N
Rabbit*	<i>Oryctolagus cuniculus</i>	A	N
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>		N
Southern Forest Bat	<i>Vespadelus regulus</i>		N
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>		N
Sugar Glider	<i>Petaurus breviceps</i>		N
Swamp Wallaby	<i>Wallabia bicolor</i>	A	N
White-striped Freetail-bat	<i>Nyctinomus australis</i>		N
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>		N

* Introduced species.

1. A – Present within the investigation area; N – recorded nearby, various sources.

Nomenclature follows Strahan (1995).

2. Birds

Australasian Bittern	<i>Botaurus poiciloptilus</i>	A	N
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	A	N
Australian Hobby	<i>Falco longipennis</i>		N
Australian Magpie	<i>Gymnorhina tibicen</i>	A	N
Australian Pelican	<i>Pelecanus conspicillatus</i>	A	N
Australian Raven	<i>Corvus coronoides</i>	A	N
Australian Shoveler	<i>Anas rhynchotis</i>		N
Australian White Ibis	<i>Threskiornis molucca</i>		N
Australian Wood Duck	<i>Chenonetta jubata</i>	A	N
Azure Kingfisher	<i>Alcedo azurea</i>	A	
Barn Owl	<i>Tyto alba</i>		N
Bar-tailed Godwit	<i>Limosa lapponica</i>		N
Bassian Thrush	<i>Zoothera lunulata</i>		N
Black Bittern	<i>Ixobrychus flavicollis</i>		N
Black Swan	<i>Cygnus atratus</i>	A	N
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	A	N
Black-faced Monarch	<i>Monarcha melanopsis</i>		N
Black-fronted Dotterel	<i>Euseyornis melanops</i>	A	N
Black-shouldered Kite	<i>Elanus axillaris</i>		N
Brown Falcon	<i>Falco berigora</i>		N
Brown Gerygone	<i>Gerygone mouki</i>	A	N
Brown Goshawk	<i>Accipiter fasciatus</i>		N
Brown Songlark	<i>Cincloramphus cruralis</i>		N
Brown Thornbill	<i>Acanthiza pusilla</i>	A	N
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>		N
Brush Cuckoo	<i>Cacomantis variolosus</i>		N
Cattle Egret	<i>Ardea ibis</i>	A	N
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	A	N
Chestnut Teal	<i>Anas castanea</i>	A	N
Cicadabird	<i>Coracina tenuirostris</i>		N
Clamorous Reed-Warbler	<i>Acrocephalus stentoreus</i>	A	N
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>		N
Common Koel	<i>Eudynamys scolopacea</i>	A	N
Common Myna*	<i>Acridotheres tristis</i>	A	N
Common Starling*	<i>Sturnus vulgaris</i>	A	N
Crested Pigeon	<i>Ocyphaps lophotes</i>		N
Crested Shrike-tit	<i>Falcunculus frontatus</i>		N
Crested Tern	<i>Sterna bergii</i>		N
Crimson Rosella	<i>Platycercus elegans</i>	A	N
Darter	<i>Anhinga melanogaster</i>	A	N
Dollarbird	<i>Eurystomus orientalis</i>	A	N
Double-barred Finch	<i>Taeniopygia bichenovii</i>		N
Dusky Moorhen	<i>Gallinula tenebrosa</i>	A	N
Dusky Woodswallow	<i>Artamus cyanopterus</i>		N
Eastern Curlew	<i>Numenius madagascariensis</i>		N
Eastern Rosella	<i>Platycercus eximius</i>	A	N
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	A	N
Eastern Whipbird	<i>Psophodes olivaceus</i>	A	N
Eastern Yellow Robin	<i>Eopsaltria australis</i>	A	N
Emerald Dove	<i>Chalcophaps indica</i>		N
Eurasian Coot	<i>Fulica atra</i>	A	N

European Goldfinch*	<i>Carduelis carduelis</i>		N
Fairy Martin	<i>Hirundo ariel</i>		N
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	A	N
Figbird	<i>Sphecotheres viridis</i>		N
Galah	<i>Cacatua roseicapilla</i>	A	N
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	A	N
Golden Whistler	<i>Pachycephala pectoralis</i>	A	N
Great Cormorant	<i>Phalacrocorax carbo</i>	A	N
Great Egret	<i>Ardea alba</i>	A	N
Grey Butcherbird	<i>Cracticus torquatus</i>	A	N
Grey Fantail	<i>Rhipidura fuliginosa</i>	A	N
Grey Goshawk	<i>Accipiter novaehollandiae</i>		N
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	A	N
Grey Teal	<i>Anas gracilis</i>	A	N
Hardhead	<i>Aythya australis</i>	A	N
Hoary-headed Grebe	<i>Poliocephalus poliocephalus</i>	A	N
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>		N
House Sparrow*	<i>Passer domesticus</i>	A	N
Latham's Snipe	<i>Gallinago hardwickii</i>		N
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	A	N
Leaden Flycatcher	<i>Myiagra rubecula</i>	A	N
Lewin's Honeyeater	<i>Meliphaga lewinii</i>	A	N
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	A	N
Little Eagle	<i>Hieraaetus morphnoides</i>		N
Little Egret	<i>Egretta garzetta</i>		N
Little Grassbird	<i>Megalurus gramineus</i>		N
Little Lorikeet	<i>Glossopsitta pusilla</i>		N
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	A	N
Little Wattlebird	<i>Anthochaera chrysoptera</i>	A	N
Magpie-lark	<i>Grallina cyanoleuca</i>	A	N
Masked Lapwing	<i>Vanellus miles</i>	A	N
Masked Owl	<i>Tyto novaehollandiae</i>		N
Mistletoebird	<i>Dicaeum hirundinaceum</i>	A	N
Musk Duck	<i>Biziura lobata</i>	A	N
Musk Lorikeet	<i>Glossopsitta concinna</i>		N
Nankeen Kestrel	<i>Falco cenchroides</i>	A	N
Nankeen Night Heron	<i>Nycticorax caledonicus</i>		N
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	A	N
Noisy Friarbird	<i>Philemon corniculatus</i>	A	N
Noisy Miner	<i>Manorina melanocephala</i>	A	N
Olive-backed Oriole	<i>Oriolus sagittatus</i>	A	N
Pacific Black Duck	<i>Anas superciliosa</i>	A	N
Pallid Cuckoo	<i>Cuculus pallidus</i>		N
Peregrine Falcon	<i>Falco peregrinus</i>		N
Pied Currawong	<i>Strepera graculina</i>	A	N
Powerful Owl	<i>Ninox strenua</i>		N
Purple Swamphen	<i>Porphyrio porphyrio</i>	A	N
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	A	N
Red Wattlebird	<i>Anthochaera carunculata</i>		N
Red-browed Finch	<i>Neochmia temporalis</i>	A	N
Red-whiskered Bulbul*	<i>Pycnonotus jocosus</i>	A	N
Regent Honeyeater	<i>Xanthomyza phrygia</i>		N

Richard's Pipit	<i>Anthus novaeseelandiae</i>	A	N
Rose Robin	<i>Petroica rosea</i>		N
Royal Spoonbill	<i>Platalea regia</i>		N
Rufous Fantail	<i>Rhipidura rufifrons</i>		N
Rufous Whistler	<i>Pachycephala rufiventris</i>	A	N
Sacred Kingfisher	<i>Todiramphus sanctus</i>	A	N
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	A	N
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>	A	N
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>	A	N
Silver Gull	<i>Larus novaehollandiae</i>		N
Silvereye	<i>Zosterops lateralis</i>	A	N
Southern Boobook	<i>Ninox novaeseelandiae</i>		N
Southern Emu-wren	<i>Stipiturus malachurus</i>		N
Spangled Drongo	<i>Dicrurus bracteatus</i>		N
Spotted Pardalote	<i>Pardalotus punctatus</i>	A	N
Spotted Turtle-Dove*	<i>Streptopelia chinensis</i>	A	N
Straw-necked Ibis	<i>Threskiornis spinicollis</i>		N
Striated Pardalote	<i>Pardalotus striatus</i>		N
Striated Thornbill	<i>Acanthiza lineata</i>	A	N
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	A	N
Superb Fairy-wren	<i>Malurus cyaneus</i>	A	N
Swamp Harrier	<i>Circus approximans</i>	A	N
Tawny Frogmouth	<i>Podargus strigoides</i>		N
Tawny Grassbird	<i>Megalurus timoriensis</i>		N
Topknot Pigeon	<i>Lopholaimus antarcticus</i>		N
Tree Martin	<i>Hirundo nigricans</i>		N
Varied Sittella	<i>Daphoenositta chrysoptera</i>		N
Variiegated Fairy-wren	<i>Malurus lamberti</i>	A	N
Welcome Swallow	<i>Hirundo neoxena</i>	A	N
Whistling Kite	<i>Haliastur sphenurus</i>		N
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	A	N
White-browed Scrubwren	<i>Sericornis frontalis</i>	A	N
White-faced Heron	<i>Egretta novaehollandiae</i>	A	N
White-naped Honeyeater	<i>Melithreptus lunatus</i>		N
White-necked Heron	<i>Ardea pacifica</i>		N
White-throated Needletail	<i>Hirundapus caudacutus</i>		N
White-throated Nightjar	<i>Eurostopodus mystacalis</i>		N
White-throated Treecreeper	<i>Cormobates leucophaeus</i>	A	N
Willie Wagtail	<i>Rhipidura leucophrys</i>	A	N
Yellow Thornbill	<i>Acanthiza nana</i>	A	N
Yellow-billed Spoonbill	<i>Platalea flavipes</i>		N
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	A	N
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>		N
Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	A	N

* Introduced species.

1. A – Present within investigation area; N – recorded nearby.
Nomenclature follows Christidis & Boles (1994).

Reptiles

Black-bellied Swamp Snake	<i>Hemiaspis signata</i>		N
Delicate Skink	<i>Lampropholis delicata</i>		N
Diamond Python	<i>Morelia spilota</i>		N
Eastern Blue-tongued Lizard	<i>Tiliqua scincoides</i>		N
Eastern Tiger Snake	<i>Notechis scutatus</i>		N
Eastern Water Dragon	<i>Physignathus lesueurii</i>	A	N
Eastern Water Skink	<i>Eulamprus quoyii</i>	A	N
Grass Skink	<i>Lampropholis guichenoti</i>	A	N
Jacky Lizard	<i>Amphibolurus muricatus</i>		N
Lace Monitor	<i>Varanus varius</i>		N
Long-necked Tortoise	<i>Chelodina longicollis</i>		N
Oak Skink	<i>Cyclodomorphus casuarinae</i>		N
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>		N
Southern Water Skink	<i>Eulamprus heatwolei</i>		N
Three-toed Skink	<i>Saiphos equalis</i>	A	N

Frogs

Bleating Tree Frog	<i>Litoria dentata</i>		N
Brown-striped Frog	<i>Limnodynastes peronii</i>	A	N
Common Eastern Froglet	<i>Crinia signifera</i>	A	N
Green and Golden Bell Frog	<i>Litoria aurea</i>	A	N
Green Tree Frog	<i>Litoria caerulea</i>		N
Jervis Bay Tree Frog	<i>Litoria jervisiensis</i>		N
Peron's Tree Frog	<i>Litoria peronii</i>		N
Tyler's Tree Frog	<i>Litoria tyleri</i>		N
Verreaux's Tree Frog	<i>Litoria verreauxii</i>	A	N

Fish

<i>Gambusia holbrooki</i> *	Plague Minnow	A	N
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1. A – Present within investigation area; N – recorded nearby.
Nomenclature follows Cogger (1992).

APPENDIX 9

ANNOTATED LIST OF WETLAND BIRDS RECORDED ON THE DREDGE PONDS

The following annotated list documents and provides a brief discussion of all 31 wetland bird species so far recorded on the dredge ponds at the Gerroa Sand Quarry. A similar format is followed for each species. The recording rate is the number of times the species has been recorded out of the total number of counts (17), expressed as a percentage. This information has come directly from the report by Kevin Mills & Associates (2005).

Species: **Australasian Bittern** *Botaurus poiciloptilus*
Regional status: Rare; threatened (vulnerable) in NSW.
Recording rate at Gerroa: 6%
Breeding at Gerroa: Possible.
Maximum no. at Gerroa: 1
Notes: This bittern was recorded in the reeds in the far southern end of the small dredge pond on 10 January 2003. Birds probably occasionally occur in the reeds at the southern end of the large dredge pond and the small dredge pond from time to time. There is a known population in nearby Coomonderry Swamp.

Species: **Australasian Grebe** *Tachybaptus novaehollandiae*
Regional status: Common and widespread.
Recording rate at Gerroa: 59%
Breeding at Gerroa: Probable.
Maximum no. at Gerroa: 8
Notes: A relatively common species on fresh wetlands throughout the region; small numbers are fairly common on the dredge ponds.

Species: **Australian Pelican** *Pelecanus conspicillatus*
Regional status: Common and widespread.
Recording rate at Gerroa: 29%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 1
Notes: A common and widespread species in the region. More likely to occur on larger rivers and estuaries than fresh wetlands such as those in the study area.

Species: **Australian White Ibis** *Threskiornis molucca*
Regional status: Common and widespread.
Recording rate at Gerroa: 6%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 1
Notes: A common and widespread species in the region, usually seen feeding on wet and water-logged paddocks and on estuaries; less commonly seen on fresh wetlands.

Species: **Australian Wood Duck** *Chenonetta jubata*
Regional status: Very common and widespread.
Recording rate at Gerroa: 41%
Breeding at Gerroa: Probable.
Maximum no. at Gerroa: 9
Notes: A very common and widespread species in the region, most commonly seen on farm dams and the surrounding paddocks where the birds forage. Occasionally seen at Gerroa, where the deep water may not be ideal for this duck.

Species: **Azure Kingfisher** *Alcedo azurea*
Regional status: Uncommon; rare on the coast.
Recording rate at Gerroa: 12%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 2
Notes: Rather rare on the coastal streams; recorded only twice at Gerroa.

Species: **Black Swan** *Cygnus atratus*
Regional status: Common and widespread.
Recording rate at Gerroa: 59%
Breeding at Gerroa: Recorded in 2001 and 2002.
Maximum no. at Gerroa: 7
Notes: Commonly recorded on fresh and saline wetlands throughout the region, breeding occurs on the larger areas of water and occasionally on smaller dams.

Species: **Black-fronted Dotterel** *Elseya melanops*
Regional status: Uncommon, widespread.
Recording rate at Gerroa: 23%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 1
Notes: Occasionally recorded on muddy edges around the edges of fresh and saline wetlands throughout the region; occasionally turns up at Gerroa.

Species: **Chestnut Teal** *Anas castanea*
Regional status: Common and widespread.
Recording rate at Gerroa: 23%
Breeding at Gerroa: Possible.
Maximum no. at Gerroa: 8
Notes: A common and widespread duck in the region; occurs on fresh and saline wetlands. Mainly seen at Gerroa during the drought of 2002/2003.

Species: **Clamorous Reed-Warbler** *Acrocephalus stentoreus*
Regional status: Common summer migrant.
Recording rate at Gerroa: 88%
Breeding at Gerroa: Nest building observed.
Maximum no. at Gerroa: 6
Notes: A common summer migrant seen on all wetlands in the region that support reeds; observed on all visits to Gerroa where it almost certainly breeds each summer.

Species: **Darter** *Anhinga melanogaster*
Regional status: Uncommon to rare.
Recording rate at Gerroa: 23%
Breeding at Gerroa: Unlikely.
Maximum no. at Gerroa: 2
Notes: A rather uncommon bird seen on fresh and saline wetlands; thinly distributed across the region. Mainly seen at Gerroa during 2001.

Species: **Dusky Moorhen** *Gallinula tenebrosa*
Regional status: Common and widespread.
Recording rate at Gerroa: 35%
Breeding at Gerroa: Possible.
Maximum no. at Gerroa: 4

Notes: A common and widespread bird of fresh and saline wetlands throughout the region. Observed at Gerroa up to mid-2000, with only a single bird observed since then.

Species: **Eurasian Coot** *Fulica atra*
Regional status: Common and widespread.
Recording rate at Gerroa: 23%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 41

Notes: A common and widespread bird of fresh and saline wetlands throughout the region. Observed at Gerroa on several occasions; maximum of 41 birds on 10 January 2003, during the severe drought, when large flocks were present on other wetlands in the region.

Species: **Great Cormorant** *Phalacrocorax carbo*
Regional status: Common and widespread.
Recording rate at Gerroa: 29%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 6

Notes: A common and widespread cormorant, mainly on saline wetlands and along the coast. Observed several times at Gerroa between early 2002 and early 2003.

Species: **Great Egret** *Ardea alba*
Regional status: Moderately common and widespread.
Recording rate at Gerroa: 6%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 1

Notes: Moderately common and widespread in fresh and saline wetlands in the region, usually single birds are observed. Observed once at Gerroa, in 1999; absence is probably due to a lack of shallow water.

Species: **Grey Teal** *Anas gracilis*
Regional status: Common and widespread.
Recording rate at Gerroa: 6%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 2

Notes: A common duck throughout the region. Observed once at Gerroa, in January 2005 when two birds were seen in the main pond.

Species: **Hardhead** *Anthya australis*
Regional status: Uncommon and widespread.
Recording rate at Gerroa: 35%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 20

Notes: Observed at Gerroa during the drought of 2002/2003; a maximum of 20 birds were present on 9 January 2004. Six still present in October 2004.

Species: **Hoary-headed Grebe** *Poliiocephalus poliocephalus*
Regional status: Common and widespread.
Recording rate at Gerroa: 29%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 5

Notes: Moderately common bird of fresh and saline wetlands throughout the region. Mainly observed at Gerroa during the drought of 2002/2003.

Species: **Little Black Cormorant** *Phalacrocorax sulcirostris*
Regional status: Common and widespread.
Recording rate at Gerroa: 59%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 6
Notes: Fairly common on all wetlands across the region; commonly observed at Gerroa, usually in small flocks.

Species: **Little Pied Cormorant** *Phalacrocorax melanoleucos*
Regional status: Common and widespread.
Recording rate at Gerroa: 70%
Breeding at Gerroa: Not likely.
Maximum no. at Gerroa: 4
Notes: Common and widespread on all wetlands across the region. Commonly observed at Gerroa in small numbers; maximum of four birds seen on several occasions.

Species: **Marsh Harrier** *Circus aeruginosus*
Regional status: Uncommon to rare.
Recording rate at Gerroa: 12%
Breeding at Gerroa: Possible.
Maximum no. at Gerroa: 1
Notes: Rather uncommon in the region, usually seen hawking over fresh wetlands; there is a population associated with nearby Coomonderry Swamp. Seen only twice at Gerroa, in January 2001 and October 2004, flying low over reeds.

Species: **Masked Lapwing** *Vanellus miles*
Regional status: Very common and widespread.
Recording rate at Gerroa: 41%
Breeding at Gerroa: Likely.
Maximum no. at Gerroa: 4
Notes: A very common and widespread species across the region. Small numbers are often seen at Gerroa.

Species: **Musk Duck** *Biziura lobata*
Regional status: Uncommon to rare.
Recording rate at Gerroa: 59%
Breeding at Gerroa: Unlikely.
Maximum no. at Gerroa: 3
Notes: An uncommon visitor to fresh wetlands across the region, mainly present during the cooler months. Mostly present at Gerroa between April and November.

Species: **Nankeen Night Heron** *Nycticorax caledonicus*
Regional status: Uncommon and widespread.
Recording rate at Gerroa: 6%
Breeding at Gerroa: Possible.
Maximum no. at Gerroa: 1
Notes: Rare to uncommon on wetlands throughout the region, usually roosts in trees near water. Observed once at Gerroa, in November 1999.

Species: **Pacific Black Duck** *Anas superciliosa*
Regional status: Common and widespread.
Recording rate at Gerroa: 100%
Breeding at Gerroa: Probably.

Maximum no. at Gerroa: 33

Notes: A very common duck of fresh and saline wetlands. More birds were observed during the drought in 2003/2004 than previously; a maximum of 33 birds was present on 24 October 2002

Species: **Pied Cormorant** *Phalacrocorax varius*

Regional status: Uncommon to rare.

Recording rate at Gerroa: 6%

Breeding at Gerroa: Unlikely.

Maximum no. at Gerroa: 1

Notes: A rare to uncommon bird on the region's wetlands. Observed only once at Gerroa, in December 1997.

Species: **Purple Swamphen** *Porphyrio porphyrio*

Regional status: Common and widespread.

Recording rate at Gerroa: 76%

Breeding at Gerroa: Recorded several times.

Maximum no. at Gerroa: 6

Notes: Resident on many fresh wetlands supporting reeds throughout the region. Consistently observed at Gerroa, where there is a resident population. Possibly more common in 2003/2004 than in previous years; numbers may be building up as the area of reeds increases.

Species: **Royal Spoonbill** *Platalea regia*

Regional status: Uncommon, widespread.

Recording rate at Gerroa: 6%

Breeding at Gerroa: Not likely.

Maximum no. at Gerroa: 1

Notes: A rather uncommon bird of fresh and saline wetlands throughout the region. Observed once at Gerroa, in July 1999.

Species: **Welcome Swallow** *Hirundo neoxena*

Regional status: Very common and widespread.

Recording rate at Gerroa: 53%

Breeding at Gerroa: Not likely.

Maximum no. at Gerroa: 10

Notes: Commonly seen hawking over the dredge ponds at Gerroa.

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

Regional status: Moderately common along the coast.

Recording rate at Gerroa: 12%

Breeding at Gerroa: Not likely.

Maximum no. at Gerroa: 2

Notes: There appears to be one pair of birds in the Seven Mile Beach area; seen twice flying low over the Gerroa dredge ponds.

Species: **White-faced Heron** *Egretta novaehollandiae*

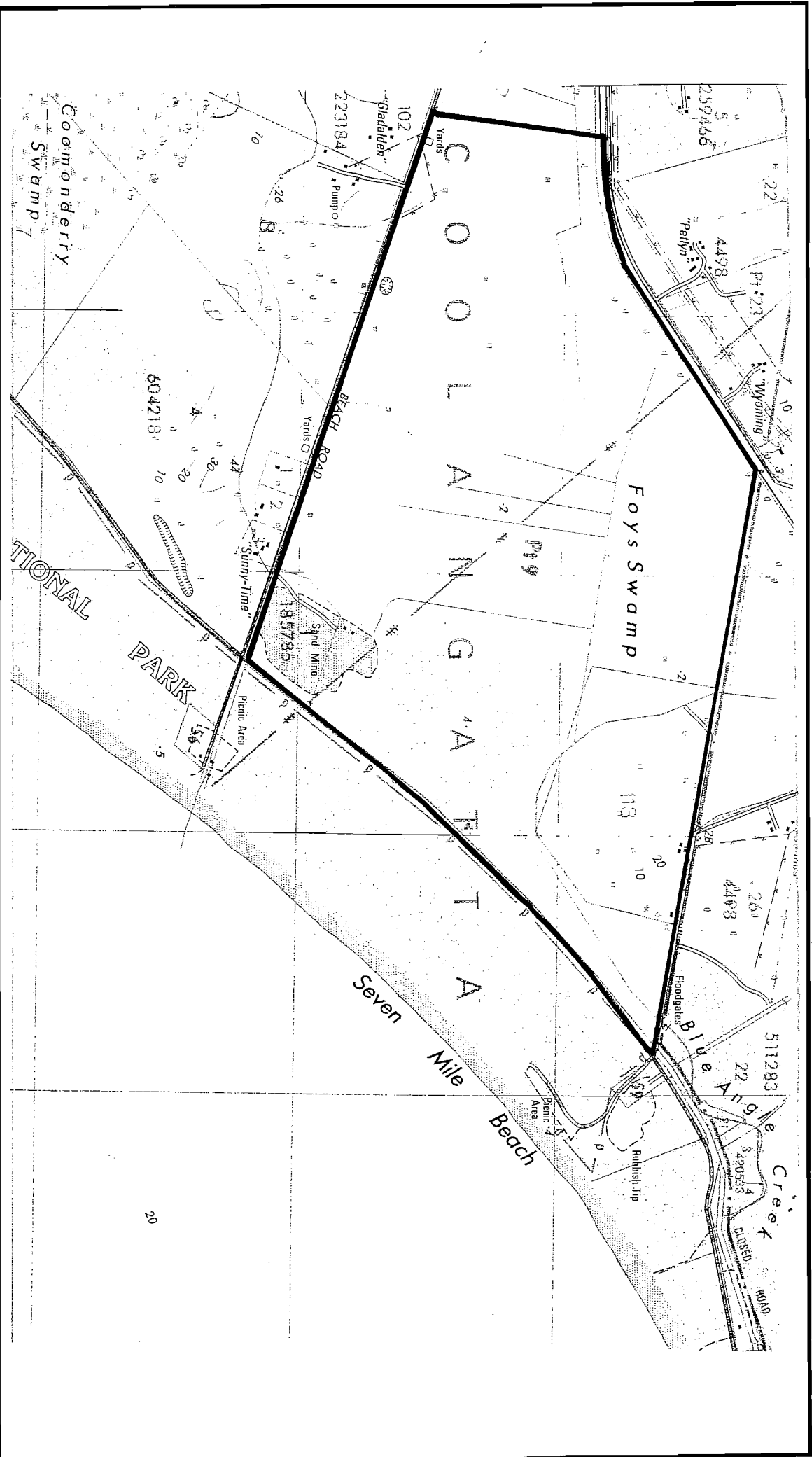
Regional status: Very common and widespread.

Recording rate at Gerroa: 18%

Breeding at Gerroa: Possible.

Maximum no. at Gerroa: 1

Notes: A common species in the region, seen on all wetland types; only observed at Gerroa in 1997 and 1999.



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FIGURE 1
 THE INVESTIGATION AREA