Environmental

Services

Preliminary Flora and Fauna Investigation

Lot 15 DP 1002772
Sealark Road
Hare Bay
Shoalhaven

February 2005

Our Reference: 04623

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Prepared February 2005

for

Hare Bay Development Consortium

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1. INTRODUCTION

1.1 Background

This report has been prepared by Bushfire and Environmental Services (BES) for the Hare Bay Development Consortium to document the outcome of a preliminary flora and fauna investigation at Lot 15 DP 1002772 Sealark Road, Hare Bay (hereafter referred to as Lot 15).

Lot 15 comprises approximately 6.46 ha of freehold land situated at the eastern edge of Callala Bay village. The location of Lot 15 is shown in Figure 1 (Appendix A).

This report is the outcome of the preliminary flora and fauna investigations undertaken by BES on Lot 15 in February 2005.

1.2 The Study Area

The study area for the purposes of this report comprises the whole of Lot 15 and lands immediately adjoining the property boundaries as shown in Figure 2 (Appendix A).

The study area is bounded by residential development in the west, vacant freehold land zoned for urban uses and a drainage reserve in the south, Wowly Creek in the east and Jervis Bay National Park in the north. The south-western portion of Lot 15 is separated from the remainder of the property by Monarch Place, which services a recently-constructed residential development to the south of Lot 15.

1.3 Aims and Objectives

The aims of this investigation were:

1. To undertake a preliminary flora and fauna investigation on Lot 15.
2. To determine the potential flora and fauna constraints to the development of Lot 15.

The objectives of this investigation were:

a) To review relevant literature including aerial photographs and relevant flora and fauna studies pertaining to the Callala Bay area.

b) To search the Atlas of NSW Wildlife and the Commonwealth Environment Protection and Biodiversity Conservation Act Protected Matters Search Tool for threatened flora and fauna species recorded in the Callala Bay area.

c) To undertake a preliminary inspection of the study area for the purposes of identifying general flora and fauna attributes.

d) To provide a general description of the vegetation communities and habitats present in the study area and their condition.

e) To correlate the ecological attributes of the study area with the results of threatened flora and fauna database searches and determine the threatened species likely to occur in the study area.

f) To provide preliminary advice regarding the conservation significance of the flora and fauna attributes of the study area.

g) To provide a map showing the potential flora and fauna constraints of the study area.

2. METHODOLOGY

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

a) reviewing available literature including cadastral maps, topographic maps, aerial photographs and flora and fauna studies of the Callala area;

b) searching the Atlas of NSW Wildlife for threatened flora and threatened fauna species recorded in the Callala area; and

c) searching the Commonwealth Environment Protection & Biodiversity Conservation Act Protected Matters Search Tool for matters of national environmental significance recorded in the Callala area.

The study area was traversed along 19 transects on 23 and 24 February 2005 by Dimitri Young of BES, in the locations shown in Figure 2 (Appendix A). Qualitative and quantitative observations of vegetation communities, flora species, fauna species and habitats were made during the traverses along these transects.

Two vegetation plots were established in the locations shown in Figure 2 (Appendix A) and all plant species in these plots recorded along with cover/abundance scores and strata heights.

The data gathered during the fieldwork and from the review of literature was analysed and interpreted to provide commentary regarding the conservation significance of the study area and any potential flora and fauna constraints.

3. THE EXISTING ENVIRONMENT

3.1 Topography, Geology, and Soils

The study area lies at an altitude of approximately 0-10 m Australian Height Datum (AHD) and is generally flat to gently-sloping land with an overall aspect to the south. A tidal tributary of Wowly Creek is situated in the north-east of Lot 15. This tributary is not part of Lot 15. Two open drains flow through the south-western part of Lot 15. These drains carry stormwater from the urban area in the west and appear to flow into the southern part of the tidal tributary of Wowly Creek.

The study area appears to be underlain by Quaternary Alluvium, beach sand and dune sand adjacent to Wowly Creek in the east, with Permian Wandrawandian Silstone of the Shoalhaven Group underlying the remainder of the study area (Nowra – Jervis Bay Geological Map unpublished). These have weathered to form poorly-drained clayey soils over the majority of Lot 15, and well-drained sandy soils adjacent to Wowly Creek in the east.

3.2 Disturbances

Generally the study area shows very high levels of disturbance except to the east of the tidal tributary of Wowly Creek. The isolated south-western portion of the study area has been completely cleared of native vegetation except for a few remnant eucalypts. The ground has all but been scraped completely bare with the soil exposed to the elements.

The central portion of the study area has been slashed such that the majority of plants are regenerating individuals less then 0.3 m in height. Part of the central area in the north is also bare of vegetation and exhibits exposed soil. The slashing has stopped about 10 m short of the western bank of the tidal tributary of Wowly Creek in the east and continues almost to the boundary in the south.

Two open drains have been excavated across the central south of the study area and the overburden deposited on the northern side to form a berm. This berm is covered with introduced grasses. Land adjacent to these drains showed evidence of weed infestations and garden escapes.

Slashing of native vegetation has also occurred to the south of these drains where the substrate was waterlogged during the inspection. Some regrowth scrub occurs in the south to the east of an open drainage pond on the adjoining property. This pond appears to lie in a drainage reserve and receives water from the urban development in the south.

Bank erosion is evident along Wowly Creek where the water appears to undercut the bank. The bank in this location comprises a groundcover of introduced grasses amongst native species.

A number of walking tracks are present in the open forest vegetation in the east with localised disturbance from congregating humans.

3.3 Vegetation

The study area supports a number of vegetation communities in various states of disturbance as listed below:

a) Disturbed woodland dominated by Hard-leaved Scribbly Gum *Eucalyptus sclerophylla* in the south-west;

b) Slashed heath dominated by regenerating Finger Hakea *Hakea dactyloides*, *Melaleuca thymifolia*, Paperbark Tea-tree *Leptospermum trinervium*, Wiry Panic *Entolasia stricta*,

Weeping Meadow Grass *Microlaena stipoides* and Scale Rush *Lepyrodia scariosa* in the north and to the south of the open drains;

c) Disturbed scrub/heath re-growth in the central south with infestations of Senna *Senna pendula* and Vasey Grass *Paspalum urvillei*;

d) Reeds in the open drains dominated by Cumbungi *Typha orientalis*;

e) Regenerating heath and shrubland dominated by Swamp Paperbark *Melaleuca ericifolia* and Tall Saw-sedge *Gahnia clarkei* on the northern bank of the tidal tributary of Wowly Creek; and

f) open forest vegetation dominated by Bangalay *Eucalyptus botryoides*, with Swamp Oak *Casuarina glauca* lining the banks of Wowly Creek and its tidal tributary.

The locations of these vegetation communities are shown in Figure 3 (Appendix A).

The vegetation in the study area has been mapped by Kevin Mills and Associates (1996) as cleared with a large area of Paperbark Shrubland dominated by *Melaleuca ericifolia* across the central south of the study area, and Bangalay Forest in the east. This preliminary investigation by BES has confirmed the presence of Bangalay Forest in the east, but the Paperbark Shrubland appears to be restricted to the riparian areas associated with the watercourses in the east.

3.4. Fauna Habitats

The fauna habitats present in the study area are those generally associated with disturbed heath, tidal watercourses, open drains with emergent vegetation, and open forests.

The study area contains foraging resources in the form of flowering heathland shrubs and groundcovers. Most of these plants have been reduced to prostrate or regenerating growth forms by repeated slashing. These areas appear to have been browsed by macropods and introduced rabbits.

Scattered Red Bloodwood trees and mature Bangalay trees in the east provide nectar resources in the canopy. Some of the Red Bloodwoods in the south show evidence of sap-feeding by arboreal mammals.

Additional foraging resources for forest-dwelling arboreal mammals, flying mammals and birds are provided by fleshy fruit-bearing Sweet Pittosporum *Pittosporum undulatum* plants, flowering acacias and tree or shrub banksias scattered throughout the open forest in the east. Many bird species were observed utilising such resources in this part of the study area.

The study area contains at least 8 trees with hollows in the east, some with large branch and trunk hollows, which could provide suitable denning, breeding, nesting or roosting habitats for hollow-dependent fauna species.

Fallen logs are evident in the open forest to the east and some of these contain hollows that could provide shelter for terrestrial fauna species. Shelter for such species provided by understorey and groundcover vegetation is limited in the west as a result of slashing, and available in the east where these strata are well-developed and generally undisturbed. Evidence of terrestrial fauna in the form of conical diggings probably made by bandicoots was observed during the inspection.

Wowly Creek and its tidal tributary both contained water during the inspection, as did the two open drains. The water in the creeks was likely to be saline, whilst that in the drains was likely to be fresh. The open drains could provide suitable habitat for amphibians, with shelter, foraging resources and basking resources available. These drains do not appear to provide dispersal routes for amphibians as they are piped underneath the urban area to the west. Two species of frog were heard calling during the inspection. Rock habitats were not observed in the study area, but a Red-bellied Black-snake was observed basking in the sun adjacent to one of the open drains.

The study area is connected to areas of proximate habitats along the northern boundary that adjoins other vegetated lands, and along the banks of Wowly Creek. These adjoining areas of habitat are reserved as part of Jervis Bay National Park.

4. CONSERVATION SIGNIFICANCE

The *NSW Threatened Species Conservation Act 1995* (*TSC Act*) and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) provide for the listing of threatened flora and fauna species. The *EPBC Act* also provides for the listing of migratory species. The *NSW Fisheries Management Act 1994* (*FM Act*) provides for the listing of threatened fish species and marine vegetation.

The *TSC Act* classifies threatened flora and fauna species as Endangered (Schedule 1, Part 1), Vulnerable (Schedule 2), or Presumed Extinct (Schedule 1, Part 4). Records of these species may be obtained by searching the Atlas of NSW Wildlife.

The *EPBC Act* classifies threatened flora and fauna species as Extinct, Critically Endangered, Endangered or Vulnerable. An indication of the threatened and migratory species likely to be encountered in a locality may be obtained by using the *EBPC Act* Protected Matters Search Tool.

Both of these databases were searched in February 2004 for records of threatened flora, threatened fauna and migratory species within an area of 10 km x 10 km centred on the study area.

The *FM Act* classifies threatened fish and marine vegetation as Endangered, Vulnerable, or Presumed Extinct. An indication of the species likely to be encountered in a locality may be

obtained by reviewing the recommendations for threatened species listed on the schedules of the *FM Act*.

4.1 Threatened Flora

The outcome of database searches for threatened flora is shown in Table 1 below with the status of each species listed as endangered (E) or Vulnerable (V). The potential for each of these species to occur in the study area is discussed in Table 1 and a decision made regarding the need or otherwise for further survey and assessment.

Table 1: Threatened flora species recorded or likely to occur in the locality.

THREATENED FLORA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS FOUND THERE	FURTHER SURVEY AND ASSESSMENT REQUIRED
	TSC Act	EPBC Act		
Chamaesyce psammogeton Sand Spurge	-	E	The species occurs on unstable sand dunes near the sea, sporadically north from Jervis Bay. It is usually associated with the beach strand side of the foredune. The species habitat is present adjacent to the study area, but this habitat will not be affected by the proposal. The habitat is separated from the study area by Wowly Creek.	No
Cryptostylis hunteriana Leafless Tongue Orchid	V	V	This terrestrial orchid is known from swamp-heath and open forest on sandy soils in coastal districts. Analysis using the indicator species model prepared by Clark et. Al. 2003, suggests that 2 flora species usually associated with the orchid and 2 flora species usually not associated with the orchid, occur in the study area. This suggests that the study area does not appear to provide suitable habitat for the species. The species would not have been detectable at this time of the year as flowering in the 2004/2005 season was earlier than usual due to seasonal conditions. The species is only detectable when it is in flower and slashing before the flowering period can disrupt flowering.	Yes. A population of the species has been recorded in close proximity to the study area and there appears to be some suitable habitat in the study area, so targeted surveys for the species will need to be undertaken during the appropriate flowering period. Slashing of the area to be surveyed must not occur in the year preceding the targeted surveys.

THREATENED FLORA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS FOUND THERE	FURTHER SURVEY AND ASSESSMENT REQUIRED
	TSC Act	EPBC Act		
Prasophyllum affine Jervis Bay Leek Orchid	E	E	This orchid occurs on clayey soils overlain by sand in heathland and sedgeland at Vincentia and Currarong. The study area contains land covered with slashed heathland vegetation on clay, and the species recorded in the heath vegetation are indicative of those associated with the orchid as listed by NPWS (2003)., the study area may provide suitable habitat for the species as the habitat attributes of this orchid are not very well known. The species is only detectable in November/December when it is in flower and slashing before the flowering period can disrupt flowering.	Yes. A population of the species has been recorded in close proximity to the study area and there appears to be some suitable habitat in the study area, so targeted surveys for the species will need to be undertaken during the appropriate flowering period. Slashing of the area to be surveyed must not occur in the year preceding the targeted surveys.
Prostanthera densa Villous Mint-bush	V	V	This aromatic shrub grows to a height of 2 m in sclerophyll forest, low woodland and shrubland, chiefly on sandstone on coastal headlands and near coastal ranges. The study area is not underlain by sandstone and the species was not detected during the traverses of the 19 transects. It is unlikely to occur there.	No
Wilsonia backhousei Wilsonia	V	V	This mat-forming perennial herb occurs on the landward margins of salt-marshes. Suitable habitat occurs adjacent to the study area in Wowly Creek and its tidal tributary. Avoiding disturbances near these areas, providing appropriate drainage for the development and providing suitable vegetated riparian buffers should ensure that impacts on this species are negligible.	No

Note: Habitat requirements for flora species in Table 1 have been sourced from Clarke et.al (2003), Harden (1994) and www.npws.nsw.gov.au (accessed 2005).

Suitable habitat is present in the study area for *Cryptostylis hunteriana* and *Prasophyllum affine*.

4.2 Threatened Fauna

The outcomes of database searches for threatened fauna and the review of recommendations for threatened species listed on the schedules of the *FM Act* are shown in Table 2 below with the status of each species listed as endangered (E) or Vulnerable (V). The potential for each of these species to occur in the study area is discussed in Table 2 and a decision made regarding the need or otherwise for further survey and assessment.

Additional species that may inhabit the study area have also been included by correlating habitat requirements with the attributes of the study area.

Marine and oceanic species have been omitted as they would not occur in the study area.

Table 2: Threatened fauna species recorded or likely to occur in the locality.

THREATENED FAUNA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS FOUND THERE	FURTHER SURVEY AND ASSESSMENT REQUIRED
	TSC Act	EPBC Act		
Mammals				
Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*	V	-	This bat uses caves as roosting sites and forests for foraging. Caves are not present in the study area and the amount of available foraging habitat is very small compared to the vast home range of the species. It may forage in the study area from time to time but is unlikely to utilise the habitats in the study area on a regular basis.	No
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	This bat roosts predominantly in tree hollows and forages in forests, seeming to prefer wet habitats with larger trees. The open forest in the east of the study area provides suitable foraging and breeding habitat for the species.	Yes Targeted surveys will need to be undertaken for the species in the warm months if trees with hollows in the open forest are to be removed.
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	This bat roosts in tree hollows and forages in forests. Suitable foraging habitat is available in the open forest, and trees with hollows provide suitable roosting habitat.	Yes Targeted surveys will need to be undertaken for the species in the warm months if trees with hollows in the open forest are to be removed.
Large-footed Myotis *Myotis adversus*	V	-	This bat roosts in caves and tree hollows near watercourses, and forages over rivers and streams. The species may hunt for prey over the open water habitats in the east of the study area and may use trees with hollows in the open forest for breeding.	Yes Targeted surveys will need to be undertaken for the species in the warm months if trees with hollows in the open forest are to be removed.
Yellow-bellied Glider *Petaurus australis*	V	-	The species dens in tree hollows and forages in open forests where it's preferred feed trees are found. The study area contains some Red Bloodwood trees, which are sometimes preferred by the species, and trees with hollows suitable for denning in the open forest. The characteristics of the forest suggest that the species is unlikely to occur there but its presence cannot be completely discounted.	Yes Fauna surveys should target this species if disturbances to the open forest are proposed.

THREATENED FAUNA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS FOUND THERE	FURTHER SURVEY AND ASSESSMENT REQUIRED
	TSC Act	EPBC Act		
Birds				
Black-tailed Godwit *Limosa limosa*	V	-	The Black-tailed Godwit is primarily found along the coast on sand spits, lagoons and mudflats. Suitable habitat occurs adjacent to the study area in Wowly Creek and its tidal tributary. Avoiding disturbances near these areas, providing appropriate drainage for the development and providing suitable vegetated riparian buffers should ensure that impacts on this species are minimal.	No.
Broad-billed Sandpiper *Limicola falcinellus*	E	E	Whilst in Australia, Broad-billed Sandpipers are known to favour estuarine mudflats, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms and within shallow freshwater lagoons. In NSW, the species tends to favour intertidal sand and mudflats in estuaries. Suitable habitat occurs adjacent to the study area in Wowly Creek and its tidal tributary. Avoiding disturbances near these areas, providing appropriate drainage for the development and providing suitable vegetated riparian buffers should ensure that impacts on this species are minimal.	No
Glossy Black Cockatoo *Calyptorhynchus lathami*	V	-	This species occurs in forests and woodlands where She-oak feeding resources are prevalent and large tree hollows exist for breeding. There are some She-oak feeding resources in the open forest and tree hollows large enough for the species. No feeding evidence was observed during the preliminary inspection.	Yes. Fauna surveys should target the species by searching under potential feed trees for evidence of foraging. If hollow trees are to be removed, then targeted surveys will be required during the breeding season of the species.
Ground Parrot *Pezoporus wallicus*	V	-	This species is usually associated with heathland and sedgeland vegetation. As a result of slashing, the height of heath in the study area is too low for the species. It is unlikely to occur there.	No.

THREATENED FAUNA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS FOUND THERE	FURTHER SURVEY AND ASSESSMENT REQUIRED
	TSC Act	EPBC Act		
Birds continued				
Lesser Sand Plover *Charadrius mongolus*	V	-	In Australia, the species is known to favour coastal environs including beaches, mudflats and mangroves. Within NSW, individuals have been observed on intertidal sand and mudflats in estuaries or roosting on sandy beaches or rocky shores at high tide. The Lesser Sand Plover forages either individually or in scattered flocks on wet intertidal flats, usually away from the water's edge. Prey is usually detected visually, with the plover making short, quick runs, with abrupt stops to lunge at the ground or to look for prey. Their diet includes crustaceans, molluscs, insects and marine worms, although they have been recorded eating seeds. Suitable habitat occurs adjacent to the study area in Wowly Creek and its tidal tributary. Avoiding disturbances near these areas, providing appropriate drainage for the development and providing suitable vegetated riparian buffers should ensure that impacts on this species are minimal.	No.
Little Tern *Sterna albifrons*	E	E	The species is a summer migrant to the area breeding on beaches and sand flats. The beach adjacent to the study area does not contain any known breeding sites, which are monitored each year by the NSW National Parks & Wildlife Service. Avoiding disturbances near this area and providing suitable vegetated riparian buffers to Wowly Creek should ensure that impacts on this species are minimal.	No.
Masked Owl *Tyto novaehollandiae*	V	-	This species may hunt for prey in the open forest in the study area from time to time but the vegetation would form a very small amount of the species' vast home range. There are large hollows suitable for breeding by the species.	Yes. Fauna surveys should target this species if disturbances are proposed to the open forest in the east.
Powerful Owl *Ninox strenua*	V	-	This species may hunt for prey in the open forest in the study area from time to time but the vegetation would form a very small amount of the species' vast home range. There are large hollows suitable for breeding by the species.	Yes. Fauna surveys should target this species if disturbances are proposed to the open forest in the east.

THREATENED FAUNA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS FOUND THERE	FURTHER SURVEY AND ASSESSMENT REQUIRED
	TSC Act	EPBC Act		
Birds continued				
Sooty Oystercatcher *Haematopus fuliginosus*	V	-	This species favours rocky headlands, rocky shelves, beaches, muddy estuaries and offshore islands. Suitable habitat occurs adjacent to the study area in Wowly Creek and its tidal tributary. Avoiding disturbances near these areas, providing appropriate drainage for the development and providing suitable vegetated riparian buffers should ensure that impacts on this species are minimal.	No.
Swift Parrot *Lathamus discolor*	E	E	This winter migrant to the region forages in winter-flowering trees such as Spotted Gum and Swamp Mahogany, which do not occur in the study area.	No.
Amphibians				
Green and Golden Bell Frog *Litoria aurea*	E	V	This species prefers permanent, unshaded water bodies containing Cumbungi. Such habitats occur within the open drains in the study area. These provide suitable foraging, dispersal and basking sites for the species.	Yes. Fauna surveys should target this species if disturbances are proposed to the open drains.

Note: Habitat requirements for fauna species in Table 2 have been sourced from Blakers et.al. (1984), Churchill (1998), Clout (1989), Cogger (1996), Daly and Murphy (1996), Ehmann (1997), McDowell (1996), NSW NPWS (1998), NSW NPWS (2000), Strahan (1995) and www.npws.nsw.gov.au (accessed 2005)

Suitable habitat is present in the study area for the Eastern False Pipistrelle, Greater Broad-nosed Bat, Large-footed Myotis, Yellow-bellied Glider, Glossy Black Cockatoo, Masked Owl, Powerful Owl and Green and Golden Bell Frog. In addition, the conical diggings detected in the open forest suggest that the vegetation may provide suitable habitat for the Southern Brown Bandicoot.

4.3 Migratory Species

The outcome of the database search for migratory species is shown in Table 3 below. The potential for each of these species to occur in the study area is discussed in Table 3 and a decision made regarding the need or otherwise for further assessment in this report. None of these species were detected during the survey period.

Species encountered in marine and wetland environments have been omitted as these habitats do not occur in the study area.

Table 3: Migratory species recorded or likely to occur in the locality.

SPECIES	POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS FOUND THERE	FURTHER SURVEY AND ASSESSMENT REQUIRED
Black-faced Monarch *Monarcha melanopsis*	This migratory species is known to breed in damp forest types and forage in rainforest and eucalypt forest. The species may forage in the east of the study area from time to time but the study area would form a very small part of its home range.	No.
Regent Honeyeater *Xanthomyza phrygia*	This winter migrant to the region forages in winter-flowering trees such as Spotted Gum and Swamp Mahogany, which do not occur in the study area. The species is unlikely to occur in the habitats found there.	No.
Rufous Fantail *Rhipidura rufifrons*	This migratory species is known to utilise dense understorey in damp forests or beside rivers. Suitable habitat occurs in the east of the study area in the dense understorey associated with the watercourses. Avoiding disturbances near these areas, providing appropriate drainage for the development and providing suitable vegetated riparian buffers should ensure that impacts on this species are negligible.	No.
Satin Flycatcher *Myiagra cyanoleuca*	This migratory species inhabits lowland eucalypt forests. It is known to nest in dense gully vegetation. The species may forage in the study area from time to time, but the study area would form a very small part of its home range. Suitable nesting habitat does not occur there.	No.
White-bellied Sea-eagle *Haliaeetus leucogaster*	This migratory species inhabits coastal environments such as islands, reefs, headlands, beaches, bays, estuaries, mangroves, inland swamps, lagoons, rivers and floodplains. Suitable habitat occurs adjacent to the study area in Wowly Creek and its tidal tributary. Avoiding disturbances near these areas, providing appropriate drainage for the development and providing suitable vegetated riparian buffers should ensure that impacts on this species are minimal.	No.
White-throated Needletail *Hirundapus caudacutus*	This migratory species is associated with hillsides and is thought to spend all of its time in the air whilst in Australia. The study area is not on a prominent hillside so the species is unlikely to occur there.	No.

4.4 Endangered Populations

The *TSC Act* provides for the listing of endangered populations on Schedule 1, Part 2. There are no endangered populations listed on the schedules of the *TSC Act* found in the Shoalhaven City local government area.

4.5 Endangered Ecological Communities

The *TSC Act* and *EPBC Act* provide for the listing of endangered ecological communities. The open forest adjacent to Wowly Creek and its tidal tributary in the east of the study area appears to exhibit the characteristics of the endangered ecological community Swamp Sclerophyll Forest in the North Coast, Sydney Basin and South East Corner Bioregions. The precise locations of the boundaries of this community were not identified due to the limited fieldwork for this report, but it generally occurs within 10-20 m of the banks of these watercourses and associated swales as shown in Figure 4 (Appendix A).

5. FLORA AND FAUNA CONSTRAINTS

In accordance with the data gathered for this report, the likely flora and fauna constraints of the study area identified by this study are set out below and shown in Figure 4 (Appendix A).

5.1 Potential Threatened Orchid Habitat

Lot 15 provides suitable habitat for the Leafless Tongue-orchid *Cryptostylis hunteriana* and Jervis Bay Leek Orchid *Prasophyllum affine*.

Populations of these species are known to occur within a few hundred metres of the study area in heathy vegetation. If the parts of the study area mapped as slashed heath are to be disturbed by a development proposal, then targeted surveys will need to be undertaken in the study area during the species' flowering periods between November and February to discount their presence.

Although the Leafless Tongue-orchid is unlikely to occur in the study area as the habitat is not optimal, there is a possibility that the species may impose some constraints to the development of the part of the study area mapped as slashed heath.

The part of the study area mapped as slashed heath provides suitable habitat for the Jervis Bay Leek Orchid and there is a possibility that the species may impose some constraints to the development of this part of the study area.

Surveys for these species were not undertaken for this study as flowering in the 2004/2005 season was in severe decline before this study had been commissioned. In any case, the recent slashing of the study area would have affected the efficacy of any survey and imposed severe limitations on the value of any data collected.

In order for the efficacy of orchid surveys to be maximised, slashing of the study area must not occur during 2005.

5.2 Potential Threatened Bandicoot and Hollow-dependent Fauna Habitat

The open forest in the east of the study area provides suitable habitat for the threatened Southern Brown Bandicoot and a range of threatened hollow-dependent fauna species such as

the Eastern False Pipistrelle, Greater Broad-nosed Bat, Large-footed Myotis, Yellow-bellied Glider, Glossy Black Cockatoo, Masked Owl and Powerful Owl.

If the parts of the study area mapped as open forest are to be disturbed by a development proposal, then targeted surveys will be required as follows:

a) Trapping surveys using small cage traps for a minimum of 100 trap-nights (34 traps set for 3 nights) will need to be undertaken to determine whether the Southern Brown Bandicoot inhabits the forest.

b) Nocturnal ANABAT detection and stagwatching of trees and stags with hollows in the warm months of the year for a minimum of two nights to determine whether the Eastern False Pipistrelle, Greater Broad-nosed bat, Large-footed Myotis and other hollow-dependent microchiropteran bat species inhabit the forest.

c) Nocturnal call playback techniques, spotlighting and stagwatching of trees and stags with hollows will need to be undertaken for a minimum of two nights to determine whether the Yellow-bellied Glider inhabits the study area.

d) Diurnal searches of Black She-oak trees for the presence of crushed cones will need to be undertaken in the forest to determine whether the Glossy Black-cockatoo forages there.

e) Nocturnal stagwatching will need to be undertaken during the Glossy Black-cockatoo breeding season for a minimum of two evenings, to determine whether the species uses trees with large hollows for breeding.

f) Nocturnal call playback techniques, spotlighting, stagwatching and diurnal searches for whitewash, pellets and prey remains, will need to be undertaken for a minimum of two evenings during these species' breeding seasons to determine whether the Masked Owl and/or Powerful Owl inhabit the forest.

The probability of the Southern Brown Bandicoot occurring on the property is considered low, but if surveys detect the species it may impose constraints to the development of the parts of the study area mapped as open forest.

It may be possible to avoid the need for targeted hollow-dependent fauna surveys if stags and trees with hollows can be retained as part of any development proposal. If surveys detect threatened hollow-dependent species using trees with hollows, then these species may impose constraints to the development of the parts of the study area mapped as open forest.

5.3 Potential Threatened Frog Habitat

The open drains in the study area contain unshaded emergent vegetation in the form of Cumbungi, a habitat which is known to be favoured by the Green and Golden Bell Frog. The species may shelter, forage and bask within the open drains, so targeted surveys for the species would need to be undertaken if the drains were proposed to be disturbed.

These surveys would involve nocturnal call detection, call playback and searching for frogs with spotlights over a minimum of two nights. The work would need to be undertaken in summer, preferably after rain.

The probability of the Green and Golden Bell Frog occurring on the property is considered low, but if surveys detect the species it may impose constraints to the development of the parts of the study area mapped as open drains.

5.4 Endangered Ecological Community and Vegetated Buffer

The vegetation adjacent to Wowly Creek and its tidal tributary has been identified as Swamp Sclerophyll Forest, an endangered ecological community listed on the schedules of the *NSW Threatened Species Conservation Act 1995*.

Mapping of the precise extent of the community in the study area was beyond the scope of this study, but fieldwork allowed its approximate extent to be determined. The community appears to lie within about 10-20 m of the banks of Wowly Creek and its tidal tributary. The tidal tributary appears to extend further to the south than indicated on the deposited plan, via a series of periodically inundated swales.

This vegetation provides a constraint to the development of these parts of the study area and would need to be retained and managed for conservation along with a vegetated buffer to protect its integrity.

The requirements of the NSW Department of Infrastructure, Planning and Natural Resources may result in additional constraints in these areas as vegetated riparian buffers to Wowly Creek and its tributary may be in the order of 40 m from the tops of the banks of these watercourses.

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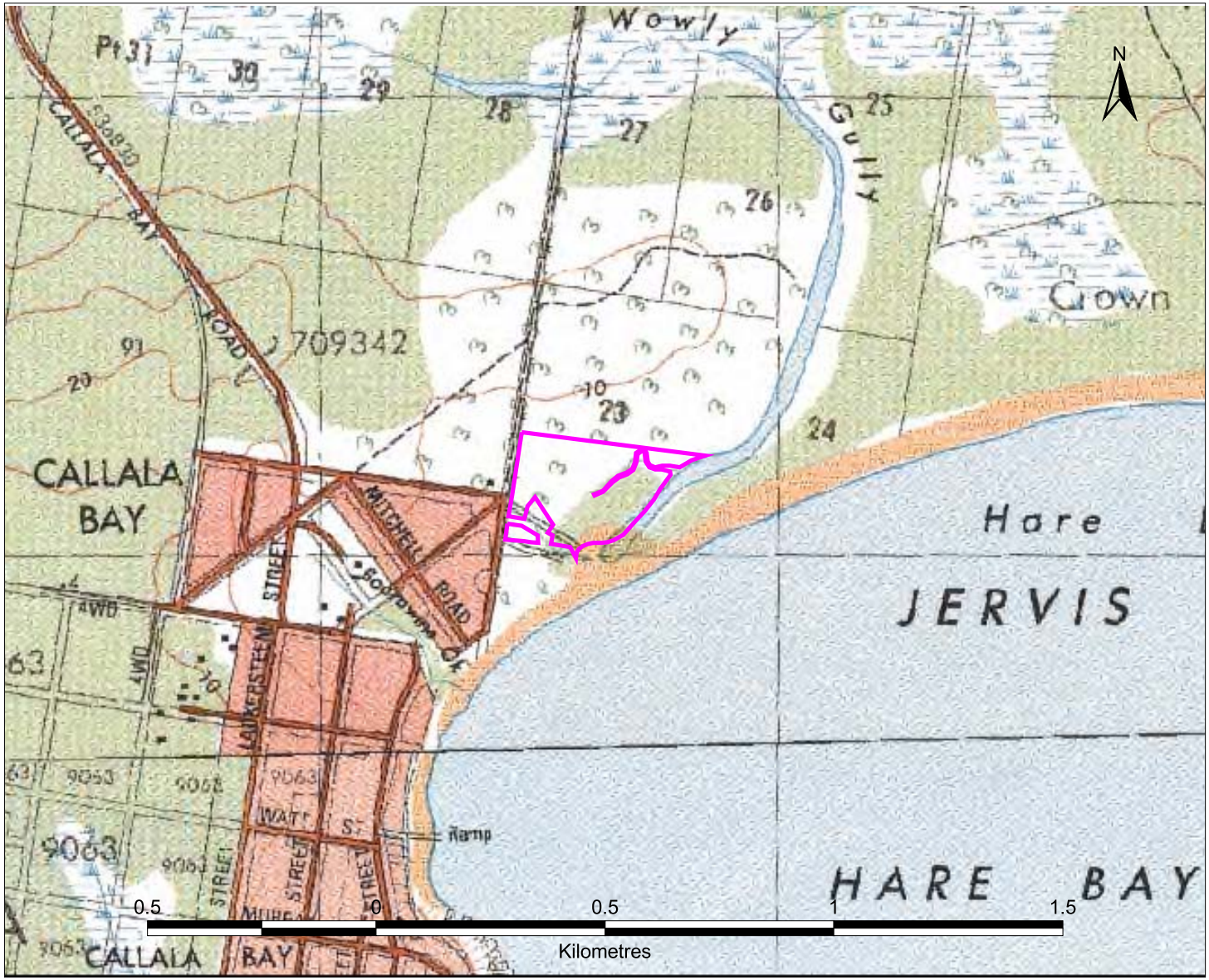
NPWS Scientific Licence Number: S10596

APPENDIX A: FIGURES

Figure 1: Location of Lot 15 DP 1002772 Sealark Road, Hare Bay



Lot 15 DP 1002772
Sealark Road, Hare Bay

Base topographic map
© Land and Property Information

Figure 2: Study area and locations of survey transects and plots

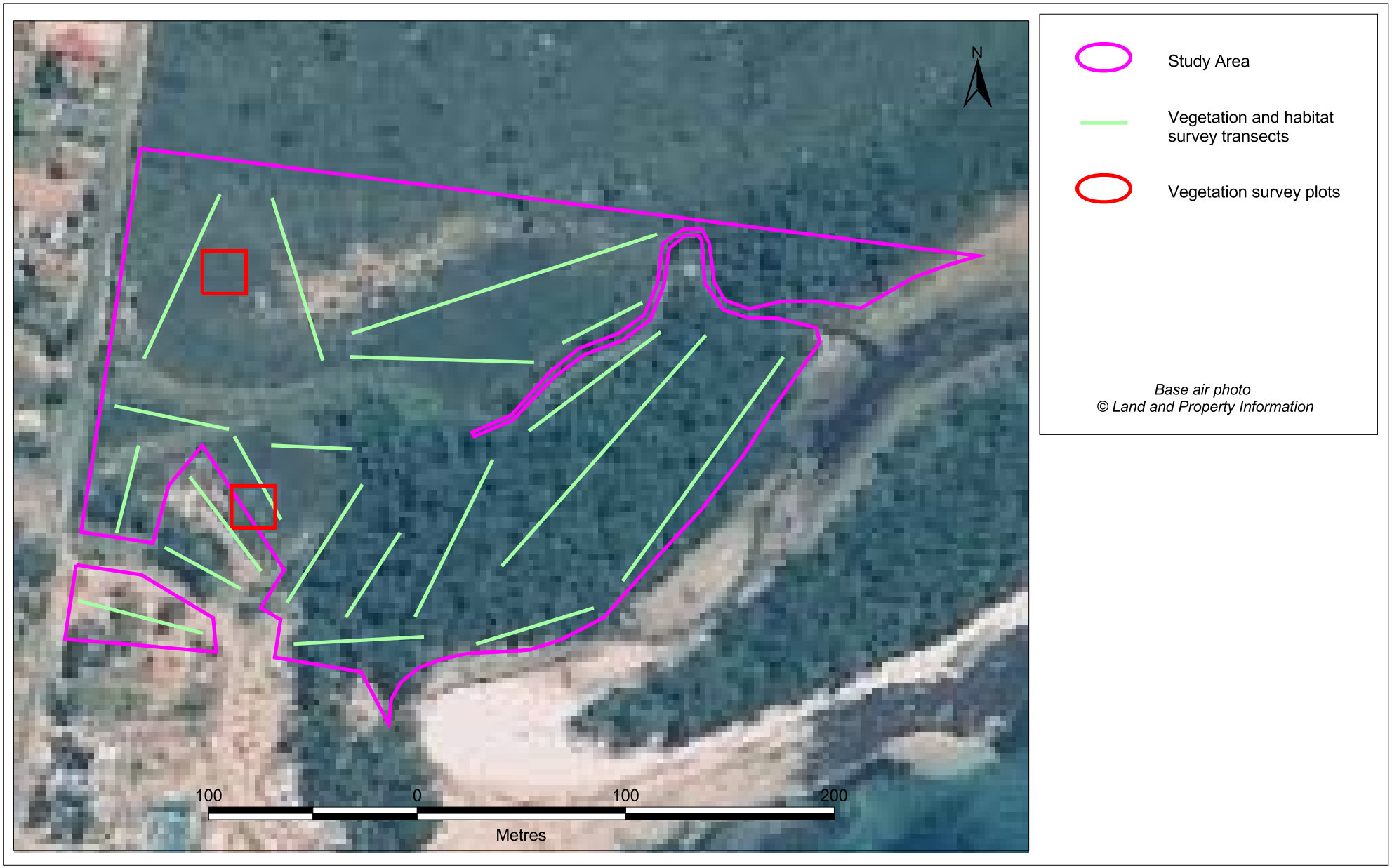
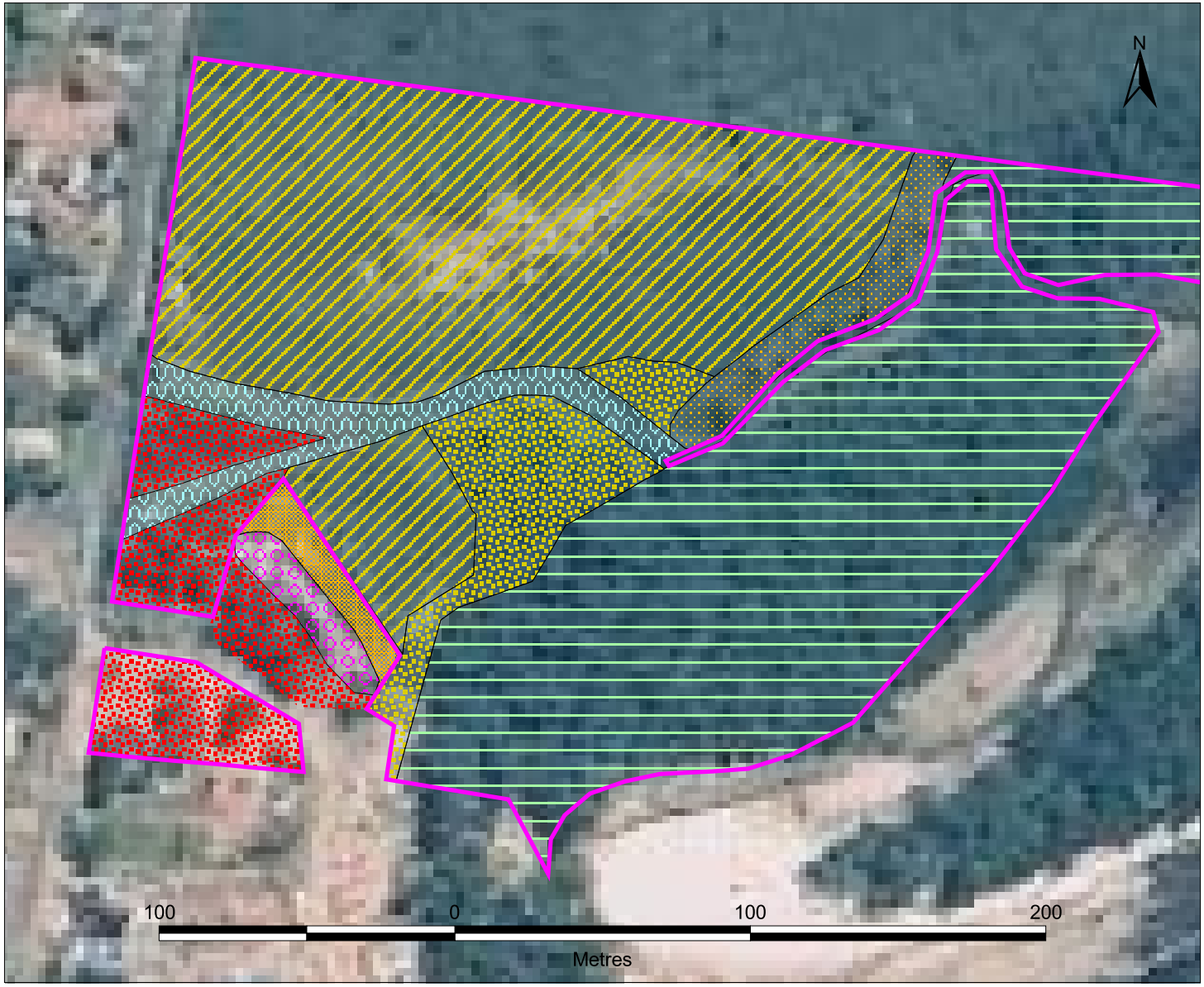


Figure 3: Vegetation of the study area



Study Area
Open Forest
Open Drain with Cumbungi
Regrowth heath/shrubland
Regrowth scrub with weeds
Slashed heath
Disturbed woodland/grassland
Heath
Open pond

Base air photo
© Land and Property Information

Figure 4: Flora and fauna constraints of the study area