Environmental

Services

Background Report on Flora, Fauna, and Riparian Issues - Rezoning Investigations

Fera Property
Mount Pleasant
Wollongong Local Government Area
October 2006

Our Reference: 6299

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Wollongong Local Government Area

Prepared October 2006

for

Cardno Forbes Rigby

PROJECT TEAM:

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EXECUTIVE SUMMARY

This report has described the biological environment of the Fera Property at Mt Pleasant which is the subject of a rezoning proposal, as documented in a previous study by Graham Mitchell Planning Pty Ltd (1993).

This report has reviewed the potential constraints on the proposed rezoning with respect to flora, fauna and riparian issues, on the basis of a desktop analysis of existing regional datasets pertaining to these issues, distribution of threatened species and their habitats within the locality, and a brief site inspection. The report identified that the eastern parts of the property have been heavily disturbed and are likely to be of relatively low conservation value in comparison to the relatively undisturbed native vegetation and associated habitats which occur in the western parts of the property.

Notwithstanding the degraded nature of the habitats with the eastern parts of the property, the analysis undertaken for the report suggests that this area continues to support potential habitat for threatened flora and fauna and a degraded but possibly important habitat and riparian corridor along Cabbage Tree Creek.

The report identifies the following as the most likely potential ecological constraints to the proposed rezoning:

a) the potential for threatened flora to occur in parts of the study area associated with zoning to permit future dwellings and associated infrastructure;

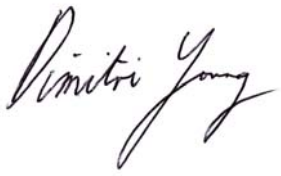
b) the potential for breeding or roosting habitat of hollow-dependent threatened fauna to occur in parts of the study area associated with zoning to permit future dwellings and associated infrastructure ; and

c) the potential requirement to provide a riparian corridor along the eastern parts of Cabbage Tree Creek. .

However it is concluded that, given the nature of the proposal and the condition of the habitats within the eastern parts of the study area, the likelihood for threatened flora or fauna to constrain the rezoning proposal is relatively low.

The potential for a riparian corridor along Cabbage Tree Creek to constrain the proposal is high if a Category 1 or 2 riparian corridor is required. However it is concluded that the environmental objectives of Category 3 riparian corridors as defined by DIPNR (2004) are realistic environmental objectives for the riparian corridor of Cabbage Tree Creek within the eastern parts of the study area, and would comprise a substantial improvement on the corridors existing environmental capacity and condition.

Notwithstanding these conclusions, in order to assess the potential for the study area to support the proposed rezoning layout, it is concluded that further studies are required to more precisely identify ecological constraints. These further studies are specified in the recommendations in Section 7 as are a number of other measures to limit the impacts of the proposed rezoning on threatened species, populations, ecological communities or their habitats, and on flora and fauna in general.



Dimitri Young

Manager

Environmental Services Division

NPWS Scientific Licence Number: S10596
Animal Care and Ethics Approval from NSW Agriculture
Animal Research Authority from NSW Agriculture

1. INTRODUCTION

1.1 Background

This report has been prepared by Bushfire and Environmental Services (BES) at the request of Cardno Forbes Rigby Pty Ltd, on behalf of Mr A. Fera, to provide a preliminary analysis pertaining to flora, fauna and riparian issues associated with a rezoning proposal at the 'Fera Property', Mt Pleasant.

The rezoning proposal was originally developed in the context of the "fair trading" arrangements adopted by Wollongong City Council (WCC) which were intended to bring high conservation value lands along the Illawarra Escarpment into public ownership. Consequently, two potential building envelopes were identified in the eastern parts of the study area which were sought as additional development entitlements in exchange for transfer into WCCs ownership of some 22 hectares of native vegetation in the west of the property.

Previous investigations pertaining to the proposal, prepared by Graham Mitchell Planning Pty Ltd (1993), addressed a number of issues including geotechnical and bushfire constraints, but did not include investigations pertaining to flora, fauna and riparian issues.

1.2 The Study Area and Locality

The study area for the purposes of this report is the whole 'Fera Property' which comprises two contiguous land parcels, as shown in Figure 1 (Appendix A), and described as Lot 61 and Part Lot 54 in DP 751301 Mt Ousley Road, Mt Pleasant.

The term locality for the purposes of this report describes the land within an area of 10 km x 10 km centred on the study area.

1.3 The Proposal

The proposal comprises an application to rezone the site under the Escarpment Local Environmental Plan process and enable two additional dwellings and the subdivision required to create the dwelling entitlements. The locations of the proposed dwelling footprints, hereafter referred to as the western and eastern dwellings, are shown in Figure 1 (Appendix A).

For the purposes of this report, it is assumed that the proposal will include disturbances typically associated with dwelling construction such as driveways, creek crossings and effluent disposal. The report has also considered the bushfire protection measures that are likely to be required as identified in a preliminary analysis of the bushfire issues associated with the proposal (BES 2006).

The proposal includes measures to ensure the protection and long-term management for conservation purposes of the extensive native vegetation communities and associated habitats

in the western parts of the study area, however the basis under which this protection and management will be established had not been finalised at the time of the preparation of this report. However, it is understood that the proposal will include a framework to provide for the ongoing funding of the management of the western parts of the study area for conservation purposes.

1.4 Aims

The aims of this report were:

1. to provide a preliminary analysis pertaining to flora, fauna and riparian issues associated with the rezoning proposal at the 'Fera Property', Mt Pleasant; and
2. to provide recommendations identifying any further flora, fauna or riparian studies that may be necessary to assess the capability of the study area to support the rezoning proposal.

2. METHODOLOGY

2.1 Review of Existing Data

The preparation of this report has involved:

a) reviewing available literature including relevant flora, fauna and riparian studies, other relevant studies pertaining to the study area, legislation, environmental planning instruments, topographic maps, and aerial photographs of the study area;

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

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

d) a brief field inspection of those parts of the study area that are being considered for future development as a result of the rezoning.

The data gathered were analysed to provide the basis for the review and recommendations detailed in this report.

3. THE EXISTING ENVIRONMENT

3.1 Topography, Geology, Drainage and Soils

The topography, geology, drainage and soils of the study area are described in detail in Graham Mitchell Planning Pty Ltd (1993).

The study area lies at an altitude between 215-440 metres Australian Height Datum and contains predominantly steep to moderately sloping lands associated with the northern slopes of Mount Keira and includes the headwaters of Cabbage Tree Creek, which drains the western and central parts of the study area. More gently sloping lands in the eastern parts of the study area have been developed for grazing and residential purposes.

The study area is underlain by the upper members of the Narrabeen Group, which include interbedded sandstone, siltstone and claystone units. The study area supports Illawarra Escarpment Soil Landscapes (Hazelton and Tille 1990), which are characterised by colluvial material or talus in places, and brown sandy clay loams over moderately pedal clay loam on mid-slopes.

3.2 Disturbances

Those parts of the study area where the proposed building envelopes and associated infrastructure are to be located have been subject to extensive disturbances primarily in association with historic and ongoing grazing. As a result of historic and ongoing land uses the study area and immediate surrounds exhibit varying degrees of weed infestation. There have also been extensive disturbances to riparian habitats along the lower parts of Cabbage Tree Creek, in the eastern parts of the study area, where much of the native vegetation has been removed or otherwise heavily modified.

3.3 Flora

The vegetation within the study area has not been assessed in detail, however the NSW National Parks and Wildlife Service (NPWS) have mapped the vegetation within the study area as part of a bioregional assessment undertaken in the Wollongong local government area (NPWS 2002b).

NPWS (2002b) map those parts of the study area proposed for future building envelopes as supporting Cleared Lands and Acacia Scrub, with adjacent less disturbed areas supporting Escarpment Blackbutt Forest and Coachwood Warm Temperate Rainforest as identified in Figure 2 (Appendix A). The western parts of the study area support a large patch of remnant native vegetation associated with the steep escarpment slopes and a gully supporting the headwaters of Cabbage Tree Creek. This vegetation covers the bulk of the study area and is mapped by NPWS (2002b) as supporting predominantly Coachwood Warm Temperate Rainforest, but also including patches of Moist Coastal White-box Forest, Moist Gully Gum

Forest and on top of the escarpment, Escarpment Edge Silvertop Ash Forest as shown in Figure 2.

Based on the existing vegetation mapping of the study area (NPWS 2002b) and the brief field inspection undertaken for this report, the study area provides potential habitat for several threatened flora species and a number of regionally or locally significant species. These habitats are primarily associated with the extensive area of remnant vegetation in the western parts of the study area. Threatened flora species are discussed further in Section 4.

3.4. Fauna

The fauna of the study area have not been assessed in detail. However given the diversity of potential habitats within the study area as identified by the vegetation mapping of NPWS (2002b), the study area could be expected to provide habitat for a diverse range of the fauna known from the locality.

Based on the existing vegetation mapping of the study area (NPWS 2002b) and the brief field inspection undertaken for this report, the study area provides potential habitat for a number of threatened fauna. These habitats are primarily associated with the extensive area of remnant vegetation in the western parts of the study area.

The potential effects of the proposal on threatened fauna are discussed further in subsequent sections of the report.

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 *TSC Act* classifies threatened flora and fauna species, populations and ecological communities as Endangered (Schedule 1, Part 1), Critically Endangered (Schedule 1A), 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 on 4 July 2006 for records of threatened flora, threatened fauna and migratory species within an area of 10 km x 10 km centred on the study area.

On the basis of the habitat descriptions provided by relevant studies pertaining to the study area, and the author's understanding of the distribution of threatened species and their habitats within the locality, the potential for threatened species known from the locality to occur within the study area, and the importance of any habitats there, are assessed in the following sections of this report.

4.1 Threatened Flora

The outcomes of database searches for threatened flora are shown in Table 2 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 and the importance of the habitats there are discussed in Table 2.

Threatened species known from the locality but for which the study area does not provide suitable habitat, such as species known to be restricted to areas above the escarpment, are not addressed in Table 1.

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

THREATENED FLORA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA
	TSC Act	EPBC Act	
Cynanchum elegans White-flowered Wax Plant	E	E	This climber is found mainly in the ecotone between dry subtropical rainforest and sclerophyll forest/woodland communities but has also been recorded in littoral rainforest, coastal scrub, Forest Red Gum and Spotted Gum open forests and woodlands, and in *Melaleuca armillaris* scrub. The study area provides sub-optimal habitat for the species however there is a record of the species near the study area at Balgownie. It is considered unlikely but possible that the species would occur within the study area. Whilst much of the habitat for the species is likely to be associated with the habitats in the western parts of the study area, there is some potential habitat associated with the margins of the forested and cleared areas within the eastern parts of the study area.
Daphnandra sp. Illawarra Illawarra Socketwood	E	E	This medium sized rainforest tree is restricted to the Illawarra and is known from 36 locations between Scarborough and Broughton Vale. The species occupies rocky hillsides on soils derived from volcanic or fertile sedimentary rocks and is associated primarily with subtropical rainforest but also occurs in warm temperate rainforests with subtropical elements and is occasionally found in moist eucalypt forest. The study area provides potential habitat for the species, including on the edges of the proposed building envelopes. There is only one known occurrence of the species north of Avondale, 27 km to the north at Scarborough. It is unlikely but possible that the species occurs within the study area.
Haloragis exalata subsp. *exalata* Square Raspwort	V	-	This species is known from a few scattered locations in south-eastern NSW including Lake Illawarra, Berry, Coledale, Coalcliff and Stanwell Park. It is associated with soil disturbance to the margins of rainforests, and often grows with abundant weed species. Very little is known about the ecology of this species, but it may only be present at some sites within the soil stored seedbank and may not germinate until one or two years after appropriate disturbances such as fire, tree fall, or clearing have occurred. Given the species' life cycle and the abundance of potentially suitable habitats in the locality, it could be present but undetected throughout much of the escarpment foothills and slopes. The study area provides potential habitat for the species particularly in association with the proposed building envelopes which are on the margins of rainforest.
Solanum celatum	E	-	This species is found in rainforest clearings and the understorey of wet Eucalyptus forest. The species is thought to occur from Wollongong to Nowra and west to Bungonia. The species is very rare with the majority of records prior to 1960. Recent searching of known sites over 2.5 days found only a single plant in Macquarie Pass National Park, however approximately 360 plants were recently detected by BES in recently under-scrubbed regrowth on the edge of grazed pastures, Coastal Grassy Red Gum Forest, Dry Subtropical Rainforest and Moist Box-Red Gum Foothills Forest at a site at Tongarra. The study area provides potential habitat for the species particularly in association with the proposed building envelopes which are on the margins of rainforest.

Note: Habitat requirements for flora species in Table 1 have been sourced from: Bofeldt, A. pers. comm. (2006), DEC (2005a & b), Fairly (2004), NPWS (2002b & c), NPWS www.npws.nsw.gov.au (accessed 2006) www.threatenedspecies.environment.nsw.gov.au (accessed 2006).

No threatened flora species have been recorded in the study area (after Atlas of NSW Wildlife accessed 4.7.2006), however the study area contains marginal potential habitat for the threatened species White–flowered Wax Plant, Illawarra Socketwood, Square Raspwort, and *Solanum celatum*. Much of the potential habitat for the White–flowered Wax Plant and Illawarra Socketwood is associated with the extensive areas of rainforest and wet sclerophyll forest in the west of the study area. However, the Square Raspwort and *Solanum celatum* are associated with disturbed habitats such as those that occur on the margins of the remnant native vegetation in the vicinity of the proposed building envelopes.

The potential ecological constraints to future development within the study area posed by threatened flora species are discussed in subsequent sections of this report.

4.2 Flora of Regional or Local Conservation Significance

The analysis undertaken for this report suggests that the study area provides potential habitat for a number of regionally or locally significant flora particularly in association with the extensive areas of Coachwood Warm Temperate Rainforest in the west of the study area. These species include but are not limited to *Adiantum diaphanum*, *Aneilema biflorum,* Bangalow Palm *Archontophoenix cunninghamiana*, Kurrajong *Brachychiton populneus*, *Sphaerocionium lyallii*, *Cyathea cooperi*, *Deeringia amaranthoides*, *Korthalsella rubra*, and *Typhonium eliosurum.*

The potential ecological constraints to future development within the study area posed by flora of local or regional conservation significance species are discussed in subsequent sections of this report.

4.3 Threatened Fauna

The outcomes of database searches for threatened fauna 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 and the importance of the habitats there are discussed in Table 2.

Additional species detected in the study area or that may inhabit the study area have also been included by correlating species' habitat requirements with the existing environment.

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 WITHIN THE STUDY AREA
	TSC Act	EPBC Act	
Mammals			
Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis*	V	-	This bat uses predominantly caves as roosting sites although it has also been known to use mines and road culverts. There may suitable caves within the study area however they would be restricted to the western parts of the property. The nearest maternity cave is thought to be at Bungonia. The species has been recorded at numerous sites within the Wollongong LGA, mostly in habitats above the escarpment. The species utilises predominantly forests for foraging so suitable foraging habitat occurs throughout the forested parts of the study area. The foraging habitat within the study area would form only a small portion of this species expected foraging area. It may forage in the study area from time to time but is unlikely to utilise the habitats there on a regular basis nor be dependent upon them.
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	This bat roosts in tree hollows and forages in forests. There are a few records of the species from the Wollongong LGA and it is expected to occur in small numbers in forests associated with creek lines above the escarpment. A small amount of potentially suitable foraging habitat is present in the study area particularly in association with Cabbage Tree Creek. There may also be potential roosting habitat where suitable hollow-bearing trees occur. The foraging habitat in the study area is very small compared to the vast home range of the species. The species may forage in the study area from time to time and may potentially roost in the study area if suitable roosting habitat is available.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	The species roosts in permanent camps and forages for nectar in flowering trees and shrubs over vast areas. There are no known camps in the study area and the amount of available foraging habitat is very small compared to the vast home range of the species. The species may forage in the study area from time to time but the foraging habitat within the study area is very small compared to foraging habitat available elsewhere in the locality and elsewhere within the Wollongong LGA.
Large-eared Pied Bat *Chalinolobus dwyeri*	-	V	This bat uses predominantly caves as roosting sites although it has also been known to use mines and road culverts. There may suitable caves within the study area however they would be restricted to the western parts of the property. The nearest maternity cave is thought to be at Bungonia. The species has been recorded at numerous sites with the Wollongong LGA, mostly in habitats above the escarpment. The species utilises predominantly forests for foraging so suitable foraging habitat occurs throughout the forested parts of the study area. The foraging habitat within the study area would form only a small portion of this species expected foraging area. It may forage in the study area from time to time but is unlikely to utilise the habitats there on a regular basis or be dependent upon them.

THREATENED FAUNA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS WITHIN THE STUDY AREA
	TSC Act	EPBC Act	
Large-footed Myotis *Myotis adversus*	V	-	This bat roosts predominantly in caves but will also use tree hollows and man made structures and is associated with a wide range of habitats as long as water is nearby. There is unlikely to be any suitable foraging habitat within the study area although there may be some potential roosting habitat associated with any hollow-bearing trees that may occur in the study area. It is unlikely but possible that the species may roost in study area if suitable roosting habitat is available.
Long-nosed Potoroo *Potorous tridactylus*	V	V	This species requires thick contiguous undergrowth where the soil is light and sandy. There is no suitable habitat for the species within the study area and it would not occur there. The nearest known population of the species occurs on the Budderoo Plateau to the south of the Wollongong LGA.
Koala *Phascolarctos cinereus*	V	-	Two koala populations occur in Wollongong LGA, one in the Nepean Catchment Special Area and one in the Wedderburn Area. Both populations occur above the Escarpment. It is extremely unlikely that any individuals from these populations would occur within the study area.
Southern Brown Bandicoot *Isoodon obesulus*	E	E	This species requires thick contiguous undergrowth where the soil is light and sandy. This species is sparsely distributed in disjunct populations and is not known to occur in the locality. There is no suitable habitat for the species within the study area and it would not occur there.
Spotted-tailed Quoll *Dasyurus maculatus*	V	V	The species prefers moist forest types and is often associated with escarpments. The less disturbed habitats in the western parts of the study area provide potential habitat for the species although it is thought to be locally extinct in the northern Illawarra and there have not been any records in the locality since 1972, despite targeted trapping surveys. It is possible but unlikely that the species would occur in the study area from time to time.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	This species roosts in tree hollows and buildings and forages in a wide range of habitats. There are only a few records from the Wollongong LGA although the species is thought to be wide ranging across eastern Australia. A small amount of potentially suitable foraging habitat is present in the study area. There may also be potential roosting habitat in the study area where suitable hollow-bearing trees occur. However the foraging habitat in the study area is very small compared to the vast home range of the species. The species may forage in the study area from time to time and may potentially roost in the the study area if suitable roosting habitat is available.
Birds			
Black Bittern *Ixobrychus flavicollis*	V	-	This species is found in wetlands and associated creeks containing dense vegetation and in the Illawarra it is usually recorded in watercourses with either Swamp Oak *Casuarina glauca* or River Oak *Casuarina cunninghamiana*. There is no suitable habitat for the species in the study area. The species is unlikely to occur in the study area and would not be dependent upon it.

THREATENED FAUNA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS WITHIN THE STUDY AREA
	TSC Act	EPBC Act	
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	Gang-gang cockatoos live as pairs inhabiting woodlands and forests of south-eastern Australia. The species feeds predominantly on the seeds of eucalypts and acacias. Nest sites are usually within medium sized hollows in living eucalypts. Foraging resources occur throughout the study area and there may be potential breeding habitat in any suitable hollows that occur there. The potential foraging resources within the study area are highly limited in extent in comparison to that available elsewhere in the locality. The species may forage in the study area from time to time and may potentially breed in there if suitable breeding habitat is available. However it would be unlikely to breed within the study area given the rarity of the species in the locality and the absence of breeding records.
Glossy Black-cockatoo *Calyptorhynchus lathami*	V	-	The species is regarded as a scarce resident in the Illawarra region generally occurring on the southern or western margins of the LGA. The species is very rarely recorded below the escarpment however there are records from Bulli in early 2003. The species feeds predominantly on the cones of Casuarina species and particularly Black She-oak *Allocasuarina littoralis*. The study area may include some Forest Oak *Allocasuarina torulosa* which is common along the escarpment in the northern Illawarra particularly in association with Escarpment Blackbutt Forest. As such, the potential foraging resources within the study area are highly limited in comparison to those available to the species elsewhere in the locality. There may be some potential breeding habitat in the study area if suitable hollows are available however, whilst the species may forage in the study area from time to time it would be unlikely to breed there given its rarity in the locality and the absence of breeding records.
Masked Owl *Tyto novaehollandiae*	V	-	This species breeds in large tree hollows and forages mostly on terrestrial mammals. It is associated primarily with woodlands and more open habitats and is considered a rare resident in the Illawarra. There are no records of the Masked Owl occurring below the escarpment in the Northern Illawarra. The study area provides some potentially suitable foraging habitat for this species primarily in association with the cleared areas. There may also be some potential roosting or breeding habitat in association with any suitable hollows that occur within the study area.
Olive Whistler *Pachycephala olivacea*	V	-	This species is usually associated with moist forests at higher elevations. It is considered a rare nomad in the Illawarra where it may occur irregularly, particularly in the high elevation areas in the south of the LGA. It is unlikely to occur in the study area on a regular basis and would not breed there.
Pink Robin *Petroica rodinogaster*	V	-	This species is associated with gullies in rainforests and eucalypt forests. The species breeds at higher altitudes over summer and partially migrates to lower altitudes during winter. The species is considered a rare visitor to the Wollongong LGA. A small amount of potential foraging habitat for the species occurs within the study area, but this represents an insignificant proportion of that available elsewhere in the locality. The species is unlikely to utilise the habitats in the study area on a regular basis nor be dependent upon them.

THREATENED FAUNA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS WITHIN THE STUDY AREA
	TSC Act	EPBC Act	
Powerful Owl *Ninox strenua*	V	-	Preferred habitat for this species is forest containing large tree hollows for breeding and an abundance of arboreal mammals which are the species' primary prey. The species is known from the locality and is likely to occur widely along the escarpment in the northern Illawarra. Suitable foraging habitat occurs throughout the study area and there may be suitable breeding habitat in the western parts of the study area. The study area may also provide some potential roosting habitat for the species particularly in association with the rainforest along the headwaters of Cabbage Tree Creek. The species may forage in the study area from time to time and may roost or breed there. However it is likely that any roosting or breeding habitat would occur in the extensive areas of rainforest and moist sclerophyll forest in the western parts of the study area.
Regent Honeyeater *Xanthomyza phrygia*	E	E	This migrant to the region forages in winter-flowering trees such as Woollybutt, and Swamp Mahogany but is also associated with coastal vegetation with an abundance of Banksia in the region. The study area does not provide suitable habitat for the species and it is highly unlikely to occur there.
Sooty Owl *Tyto tenebricosa*	V	-	This species is typically associated with closed forests and tall wet open forest, but is known to also occur in a wider range of habitats. Pairs are thought to maintain permanent home ranges of between 200 and 800 ha. The species chooses the darkest and most secluded positions in the forest to roost, choosing large hollows, tangles of vegetation, cliff ledges and caves. The species has been recorded in a number of areas on the Illawarra Escarpment and would be expected to occur in the study area from time to time. Suitable foraging habitat occurs throughout the study area and there may be suitable breeding or roosting habitat in the western parts of the study area. The species is likely to forage in the study area from time to time and could possibly roost of even breed in any suitable breeding hollows that may occur in the western parts of the study area.
Amphibians			
Giant Burrowing Frog *Heleioporus australiacus*	V	V	This species may be found in a range of habitats from forest to heath, usually in sandy soils and breeds in ephemeral ponds often underlain with sandstone, or within burrows. The species appears intolerant of clearing and poor water quality. Habitat modelling for the species in the Wollongong LGA predicts the upland swamps, heaths and woodland communities above the escarpment as the highest quality habitat. There are no records of the species below the escarpment. There is no suitable habitat for the species in the study area and it is considered extremely unlikely that it would occur there.

THREATENED FAUNA SPECIES	STATUS		POTENTIAL TO OCCUR IN THE STUDY AREA AND IMPORTANCE OF HABITATS WITHIN THE STUDY AREA
	TSC Act	EPBC Act	
Littlejohn's Tree Frog *Litoria littlejohni*	V	V	The species is known predominantly from forested environments where it calls mainly in late winter and spring from elevated positions beside ponds and creeks. The species occurs adjacent to slow flowing unpolluted water. This species appears to occur at mid to high altitudes and there are no records in the Wollongong LGA below the escarpment. It is considered unlikely that the species would occur in the study area, but the western parts of the study area may provide some potentially suitable habitat.
Green and Golden Bell Frog *Litoria aurea*	E	V	This species prefers permanent, unshaded water bodies containing emergent vegetation. The species is known from the Woonona area where it occurred in association with a disused quarry. It has also been recorded in Tramway Creek at Bulli. The study area does not provide suitable habitat for the species and it would not occur there.
Red-crowned Toadlet *Pseudophryne australis*	V	-	This litter-dwelling frog occurs in variety of vegetation communities on the sandstone geologies of the Sydney Basin. Habitat modelling for the species in the Wollongong LGA suggests that the study area does not provide habitat for the species and there are no records of the species below the escarpment. It is considered unlikely that the species occurs in the study area.
Stuttering Frog *Mixophyes balbus*	E	V	The species occurs in rainforest or wet sclerophyll forest and has suffered a major contraction of its range and abundance in recent times. In the Illawarra the species is now known only from Macquarie Pass. Whilst the western parts of the study area potentially contain suitable water habitats for this species, it is considered extremely unlikely that the species occurs there given its rarity.

Note: Habitat requirements for fauna species in Table 2 have been sourced from Biosphere Environmental Consultants (2006) Blakers *et .al*. (1984), Churchill (1998), Clout (1989), Cogger (1996), DEC (2006), Ehmann (1997), NSW NPWS (1998), NSW NPWS (2002a), DEC http://www.threatenedspecies.environment.nsw.gov.au (accessed 2006), Strahan (1995), DEH http://www.deh.gov.au/biodiversity/threatened (accessed 2006).

The study area provides potential foraging habitat for a number of threatened fauna species, and in particular threatened large forest owls and microchiropteran bats. There also may be potential roosting or breeding habitat for hollow-dependent fauna in any suitable hollows or in association with cliffs and caves or suitably dense vegetation. Suitable breeding or roosting habitat for these species within the study area is likely to be associated with the extensive areas of rainforest and wet sclerophyll forest in the western parts of the study area, which will be retained and protected within the rezoning proposal.

The ecological constraints to future development within the study area posed by threatened large forest owls and microchiropteran bats are discussed in subsequent sections of this report.

4.4 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.

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 WITHIN THE STUDY AREA
Black-faced Monarch *Monarcha melanopsis*	This migratory species is known to breed in damp forest types and forage in rainforest and eucalypt forest. Potential habitat for the species is present within the study area and the species may forage or potentially breed there from time to time.
Orange-bellied Parrot *Neophema chrysogaster*	This migratory species breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the coast of south-eastern South Australia and southern Victoria. Typical winter habitat is saltmarsh and strandline/foredune vegetation communities within 3 km of the coast. Birds forage in low samphire herbland or taller coastal shrubland. Suitable habitat is not present in the study area.
Regent Honeyeater *Xanthomyza phrygia*	This migrant to the region forages in winter-flowering trees such as Woollybutt, and Swamp Mahogany but is also associated with coastal vegetation with an abundance of banksias. The study area does not provide suitable habitat for the species and it is highly unlikely to occur there.
Rufous Fantail *Rhipidura rufifrons*	This species is known to utilise dense understorey in damp forests or beside rivers. Potential habitat for the species is present within the study area and the species may forage or potentially breed there from time to time.
Satin Flycatcher *Myiagra cyanoleuca*	This migratory species inhabits lowland eucalypt forests. It is known to nest in dense gully vegetation. Potential habitat for the species is present within the study area and the species may forage or potentially breed there from time to time.
Swift Parrot *Lathamus discolor*	This winter migrant to the region forages in winter-flowering trees such as Swamp Mahogany or vegetation with a high concentration of Coast Banksia *Banksia integrifolia* subsp. *integrifolia*, neither of which occurs within the study area. The study area does not provide any foraging resources for the species and it is considered extremely unlikely that it would occur there.
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. The species is unlikely to forage or breed in the study area.
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 species would not occur within the study area.

Note: Habitat requirements for migratory species in Table 3 have been sourced from Schodde & Tidemann (1997).

The study area provides potential foraging and breeding habitat for the migratory species, Black-faced Monarch, Rufous Fantail, and Satin Flycatcher. The ecological constraints to future development within the study area posed by these species are discussed in subsequent sections of this report.

4.5 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 locality. No further consideration or assessment is given to endangered populations in this report.

4.6 Threatened Ecological Communities

The *TSC Act* and *EPBC Act* provide for the listing of threatened ecological communities. None of the vegetation communities within the study area, as described by NPWS (2002b) have characteristics associated with threatened ecological communities listed on either the *TSC Act* or *EPBC Act*.

4.7 Koala Habitat

There is no evidence of koalas occurring below the escarpment within the locality recently and it is highly unlikely that Koalas would occur within the study area. Subsequently, it is highly unlikely that the study area would support core koala habitat pursuant to *NSW State Environmental Planning Policy No 44 – Koala Habitat Protection* (*SEPP No. 44*).

4.8 Habitat Corridor and Connectivity Values

The study area occurs on the mid and upper-slopes of the Illawarra Escarpment and consequently is part of the important north – south habitat corridor associated with the Illawarra Escarpment. However the proposal is expected to have negligible effects on this important habitat corridor.

The study area is bordered to the east by Mount Ousley Road, which comprises a significant barrier to less mobile fauna. Notwithstanding the barrier provided by Mount Ousley Road, the study area forms part of a habitat corridor along Cabbage Tree Creek, which traverses the study area, and potentially links vegetation on the escarpment to remnant vegetation east of Mount Ousley Road.

5. ECOLOGICAL CONSTRAINTS

5.1 Threatened Flora

Whilst no threatened flora species have been recorded within the study area, the study area provides potential habitat for a number of threatened flora as identified in Table 1. Whilst the vast majority of the potential habitat for these species is associated with the extensive areas of native vegetation in the western parts of the property, some of these species may potentially occur within those parts of the study area that may be directly affected by future uses associated with the proposed rezoning.

Given the apparent presence of potential habitat for threatened flora within the study area and the absence of information regarding the presence or otherwise of threatened flora populations there, further studies involving targeted field surveys in potential habitat that will be affected by future uses associated with the rezoning, are required before the rezoning layout can be finalised.

5.2 Threatened Fauna

The study area provides potential habitat for a range of highly mobile threatened fauna and particularly for threatened large forest owls and microchiropteran bats. These species are not expected to be restricted to the study area, and are likely to forage over large areas of suitable foraging habitat available elsewhere in the locality. In any case, the rezoning proposal will result in land uses likely to modify only a tiny fraction of the potential foraging habitat within the study area which are highly unlikely to adversely affect the ability of these species to forage in the study area. On the contrary, by securing funding for the management of the habitats in the western parts of the study area for conservation purposes, the proposal is likely to positively affect potential foraging habitat for these species.

There is also potential for the study area to provide important roosting, nesting or breeding habitat for hollow dependent fauna, and in particular threatened large forest owls and microchiropteran bats. Again, these habitats are more likely to be located in the extensive less disturbed habitats in the western parts of the study area, beyond those areas they may be affected by future uses associated with the proposed rezoning. As such, if these habitats occur within the study area, then the proposal is likely to improve biodiversity conservation outcomes by securing them within a protective zoning and management framework.

Notwithstanding this, it is recommended that any areas to be affected by future uses associated with the proposed rezoning should be subject to further studies involving targeted field surveys for roosting habitat of threatened large forest owls and nesting and roosting habitat of hollow-dependent fauna in general.

5.3 Vegetation Communities

Based on existing vegetation mapping (NPWS 2002b) and the brief field inspection undertaken in association with the preparation of this report, none of the vegetation communities that occur in the study area have characteristics associated with threatened ecological communities listed on either the *TSC Act* or *EPBC Act*. The vegetation communities likely to be directly affected by future uses associated with the rezoning proposal are primarily vegetation communities indicative of heavy disturbances such as Acacia Scrub. Notwithstanding this, higher conservation value communities such as Escarpment Blackbutt Forest and Coachwood Warm Temperate Rainforest may also occur in the vicinity of any future dwellings. However these communities are widespread in the locality.

Given the limited extent of the likely vegetation clearing or modification associated with the proposed rezoning, vegetation communities are unlikely to provide significant constraints to rezoning. On the contrary, the proposed rezoning is likely to secure the protection and management for conservation purposes of the vast majority of the remnant native vegetation that occurs within the study area.

5.4 Regionally or Locally Significant Flora

The vegetation communities within the study area provide potential habitat for a range of regionally or locally significant species particularly in association with the Coachwood Warm Temperate Rainforest. These habitats occur predominantly in the extensive less disturbed habitats in the western parts of the study area, beyond those areas that may be affected by future uses associated with the proposed rezoning. Under these circumstances, it is unlikely that the proposed rezoning would be constrained by locally or regionally significant flora. However, given the apparent presence of potential habitat for regionally significant flora within those parts of the study area where future development may occur, further studies involving field surveys in potential habitat should be undertaken before the rezoning layout is finalised.

5.5 Migratory Species

The study area provides potential foraging and breeding habitat for three migratory species Black-faced Monarch, Rufous Fantail, and Satin Flycatcher which are listed as protected matters by the *EPBC Act*. The coastal distribution for the Black-faced Monarch extends from Victoria in the south to northern Queensland and that of the Rufous Fantail from the Northern Territory and northern Queensland to Victoria. The distribution of the Satin Flycatcher extends from Tasmania in the south through coastal eastern Australia and into Papua New Guinea, where it over winters.

The area of available habitat for these migratory species in the study area is small and primarily comprises foraging habitat, although any of these species may potential breed within the study area, particularly in association the rainforest along the creek that traverses the study area. The vast majority of these habitats are beyond those parts of the study area likely to be affected by future uses associated with the proposed rezoning, and there are abundant habitats that could be utilised by these species for foraging or breeding elsewhere in the locality. Under these circumstances listed migratory species are not considered to constrain the proposed rezoning.

5.6 Habitat Corridors and Connectivity

As identified in Section 4.8, the study area is part of the important north – south habitat corridor associated with the Illawarra Escarpment. However the proposal is expected to have negligible direct effects on this important habitat corridor and would not be constrained by it. On the contrary, the proposed rezoning is likely to secure the protection and management for conservation purposes of the vast majority of the remnant native vegetation that occurs within the study area, and will thus benefit this corridor.

The study area is traversed by the upper reaches of Cabbage Tree Creek. The creek channel may provide a habitat corridor, via a culvert, that potentially links habitats on the escarpment to the west of Mount Ousley Road with the remnant vegetation on the escarpment foothills to the east of Mount Ousley Road.

It is not possible to assess the importance of this potential habitat corridor on the basis of a primarily desktop analysis. However, the proposal is unlikely to adversely affect habitat corridors as long as the vegetation along Cabbage Tree Creek is retained such that connectivity is not further disrupted.

The likely need to retain and enhance vegetation along Cabbage Tree Creek in order to maintain or improve a habitat corridor provides a potential constraint to the proposed rezoning particularly as it may influence the location and dimensions of Asset Protection Zones (APZs) for the proposed dwellings. However, as identified by BES (2006), it is possible to maintain APZs such that habitat corridor objectives are achieved.

The proposed rezoning layout may need to be adjusted to identify and appropriately zone a vegetated habitat corridor along Cabbage Tree Creek within the study area. The riparian corridor along Cabbage Tree Creek is discussed further in Section 5.7.

5.7 Riparian Corridors

The Wollongong Riparian Corridor Management Strategy (DIPNR 2004) classifies Cabbage Tree Creek, which traverses the study area, as a Category 1 riparian corridor. DIPNR (2004) recommends that Category 1 riparian corridors comprise a 40 m core riparian zone from the top of bank with an additional 10 m vegetated buffer zone to mitigate against edge effects. These measures constrain the proposed rezoning in that they appear to preclude a building envelope north of Cabbage Tree Creek.

The primary objective of the Category 1 classification is to maintain riparian connectivity between one key destination and another for the movement of aquatic and terrestrial fauna and flora. Key destinations are stated as including wetlands of regional or state significance, remnant stands of high conservation value vegetation or linkages between the escarpment and the coast.

The connectivity of remnant vegetation along the riparian corridor of Cabbage Tree Creek is disrupted in the eastern parts of the study area, over a distance of approximately 150 m, where much of the riparian vegetation has long been cleared in association with historical and ongoing land-uses. Riparian vegetation connectivity further to east has been completely severed by Mount Ousley Road, where Cabbage Tree Creek flows through a culvert more than 30 m long. The riparian vegetation in the western parts of the study area is largely intact, as is the riparian vegetation along Cabbage Tree Creek to the immediate east of Mount Ousley Road.

Given the disruption to the connectivity of riparian vegetation associated with Mount Ousley Road, it would appear unlikely that those aquatic or terrestrial fauna that may utilise the habitats along Cabbage Tree Creek for access to habitats in the east would be larger species requiring wider corridors, *i.e*. macropod species. Given the disruption to the east, it seems inappropriate to require a Category 1 riparian corridor along the approximately 150 m of disturbed habitats within the study area.

It would appear, on the basis of the analysis undertaken for this report, that the rezoning should include a riparian corridor along Cabbage Tree Creek that achieves the maintenance of bank stability and water quality as its primary environmental objectives, *i.e.* Category 3. On the basis of the brief site inspection and the analysis above, it would be expected that the values of Cabbage Tree Creek as a riparian and habitat corridor would be appropriately enhanced under a Category 3 management regime.

The appropriate environmental objectives of the riparian corridor of Cabbage Tree Creek within the eastern parts of the study area should be assessed in more detail and the proposed rezoning layout adjusted to identify and appropriately zone riparian corridors within the study area. In particular, the potential for aquatic and terrestrial fauna and flora to traverse the barrier provided by Mount Ousley Road should be further assessed.

5.8 Bushfire Protection Measures

An accompanying report was prepared to analyse the bushfire planning issues associated with future development within the study area (BES 2006). The following section reviews the potential effects on rezoning of relevant bushfire protection measures identified in BES (2006).

Asset Protection Zones

As identified by BES (2006), given the location of future dwellings within areas already cleared, of native vegetation, the associated APZs are, for the most part, already in place. As discussed above, given the disturbed nature of the locations of the two future dwellings and the relatively small amount of additional disturbance likely to be necessary, the proposed rezoning is unlikely to be constrained by threatened flora, fauna, communities, populations, or other species of conservation significance. However, the APZs do provide a potential constraint where their location overlaps the riparian corridor along Cabbage Tree Creek.

BES (2006) suggests that an APZ of 20 m is required between the proposed site of the future northern dwelling and the riparian corridor along Cabbage Tree Creek, if the remnant vegetation along the creek is limited to the riparian zone and the vegetation beyond continues to be managed so it is of low bushfire hazard. This management regime could be established with a Category 3 riparian corridor along Cabbage Tree Creek, but is unlikely to be supportable if a higher riparian corridor category is required, *i.e*. Category 1 or 2.

As discussed in Section 5.7, it would appear on the basis of the analysis undertaken for this report that a Category 1 riparian corridor is not consistent with the realistic environmental objectives of Cabbage Tree Creek in the eastern parts of the study area. Furthermore, the existing condition of the riparian corridor in this area is generally lower than the standards that characterise a Category 3 riparian corridor.

As identified by BES (2006), the objectives of APZs and riparian corridors are not necessarily mutually exclusive. In appropriate circumstances, APZ specifications can be designed to retain riparian vegetation and maintain a level of leaf litter or ground fuel, which is consistent with both the maintenance of appropriate bushfire protection measures and the environmental objectives of a riparian corridor. This is particularly the case where the riparian zone is dominated by low hazard vegetation such as rainforest species.

Given the existing condition of the Cabbage Tree Creek riparian corridor it would appear that rehabilitating the corridor to a Category 3 standard, dominated by rainforest species, would comprise a substantial improvement to the overall environmental capacity of the corridor not the least as a corridor for the movement of aquatic and terrestrial fauna. This outcome would also enable the APZ requirements of the two future dwellings to be met within a zoning that reflects a realistic environmental objective for the Cabbage Tree Creek riparian corridor within the study area.

In general, given the heavily disturbed nature of those parts of the study area being considered for future uses as dwelling sites, the implementation of the potential APZs are unlikely to result in any substantial effects on threatened flora, fauna, or riparian corridors. However, more detailed assessment of the effects of the required APZs on threatened species and riparian corridors should be undertaken at prior to finalising the rezoning layout.

Perimeter Fire Trails

BES (2006) identifies the need for perimeter trails either of walking or vehicle standard around future building envelopes. Given the level of disturbance within the areas being considered for future uses as dwelling sites, any perimeter trails are unlikely to substantially affect features of conservation significance. Furthermore, sympathetic alignment of any perimeter trails, which would be located within the associated APZ, should be able to minimise the need for tree removal and avoid any areas or features of higher conservation significance that may be identified by further studies.

Where any vehicular crossing of Cabbage Tree Creek is required, the route should follow the existing crossing where possible with appropriate upgrading to mitigate adverse effects on water quality or riparian habitats.

Under these circumstances it is considered unlikely that the provision of perimeter trails would have any substantial effects on threatened flora or fauna, or other features of conservation significance. However, more detailed assessment of the effects of the required perimeter trails on threatened species and riparian corridors should be undertaken at prior to finalising the rezoning layout.

5.9 Rehabilitation

The proposed rezoning will limit future development within the study area to the most heavily disturbed areas, which have long been used and continue to be used for grazing. The vegetation in these areas consequently comprises primarily pasture grasses, weeds and common native species typical of such habitats such as Common Bracken Fern *Pteridium esculentum*. This is in contrast to the extensive area of relatively undisturbed native vegetation in the western parts of the study area.

The rezoning proposal includes provisions to ensure that the relatively undisturbed native vegetation in the western parts of the study area is protected and managed for conservation purposes in the long term. The precise framework by which the proposed management regime will be established had not been determined at the time of the preparation of this report, however transfer to public ownership has been previously proposed. Regardless of the final tenure and management responsibility arrangement, it is envisaged that funding may be available for necessary rehabilitation works.

Given a primarily conservation management objective for the western parts of the study area, appropriate management criteria may include:

a) Preventing further adverse impacts on vegetation and associated habitats;

b) Controlling weeds with the aim of achieving a relatively weed free environment (*i.e*. keeping weed cover below a threshold of say 10%); and

c) Recovering native vegetation communities and associated habitats in the long-term.

On the basis of the analysis undertaken for this report, assisted recovery rehabilitation strategies are likely to be the most appropriate and cost effective long term management strategies to achieve the management criteria described above. Assisted recovery rehabilitation strategies are characterised by an approach where the natural processes that lead to the recovery of the native vegetation are triggered by appropriate management actions. Given the relatively undisturbed nature of the vegetation in the western parts of the property, the recovery potential of the vegetation is likely to be good. Consequently, active rehabilitation strategies, such as revegetation, are unlikely to be appropriate or cost effective, except in highly disturbed areas, which are expected to be relatively localised.

Appropriate management strategies to achieve the identified management criteria may include but would not be limited to:

a) **Restricting Access** – Access for stock should be excluded and human access restricted to pedestrian access in those areas where associated impacts are low;

b) **Weed Control** – A weed assessment should be undertaken and management strategies developed to control particularly threatening weed species. Based on the outcomes of the weed assessment appropriate control actions, which would be expected to comprise primarily low impact bush regeneration methods, should be implemented and maintained in the long term. Weed control strategies should be planned to be consistent with other recovery strategies such as appropriate fire management.

c) **Habitat Management** – Any key habitats that occur, *i.e*. habitats for threatened flora or fauna, should be prioritised for appropriate recovery actions.

d) **Fire Management** – Fire management regimes appropriate for the subject vegetation communities should be maintained as far as possible. Give the predominance of rainforest, the exclusion of fire is likely to be the most appropriate fire management strategy. However, some fire prone vegetation occurs in the far west of the study area in association with the Escarpment Edge Silvertop Ash Forest. Appropriate fire management should be implemented in cooperation with neighbours.

e) **Revegetation** – Where the recovery potential of the vegetation has been severely reduced in association with chronic weed infestation or modification of the substrate, appropriate revegetation actions should be implemented. As suggested above, on the basis of the analysis undertaken for this report, revegetation strategies are unlikely to necessary except in restricted circumstances within the study area.

Additional management criteria and strategies are likely to be identified after more detailed assessment of the conservation significance and condition of the habitats in the western parts of the study area.

The proposed rezoning, whilst enabling limited additional residential development within those parts of the study area which, given the extent and nature of historic and ongoing disturbances are likely to have lowest conservation value provides an opportunity to develop and fund a plan to appropriately manage parts of the study area with higher conservation values and to assist the ongoing recovery of the endemic native vegetation communities that occur there, in the long-term.

6. CONCLUSIONS

This report has described the biological environment of the Fera Property at Mt Pleasant which is the subject of a rezoning proposal, as documented in a previous study (Graham Mitchell Planning Pty Ltd 1993) which did not include analysis of flora, fauna and riparian issues. Consequently this report has reviewed the potential constraints on the proposed rezoning with respect to flora, fauna and riparian issues, on the basis of a desktop analysis of existing regional datasets pertaining to these issues, the distribution of threatened species and their habitats within the locality, and a brief site inspection.

The study area includes a large area of relatively undisturbed native vegetation in the west associated with the upper slopes of the Illawarra Escarpment and the headwaters of Cabbage Tree Creek, which is proposed to be managed for conservation purposes. The eastern parts of the study area, where the proposed zoning to permit future dwellings and associated infrastructure is located, is dominated by heavily disturbed lands that have long been used for primarily grazing purposes and are consequently unlikely to support important habitats for threatened flora or fauna.

Notwithstanding the degraded nature of much of the habitats with the eastern parts of the study area, the analysis undertaken for the report suggests that this area continues to support potential habitat for threatened flora and fauna and a degraded but possibly important habitat and riparian corridor.

It is concluded that whilst no threatened flora species listed on the schedules of the *NSW Threatened Species Conservation Act 1995* and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* have been recorded there to date, the study area, including areas likely to be directly affected by future dwellings, provides potential habitat for a number of threatened flora and fauna species.

On the basis of the mapping of NPWS (2002b) and the brief site inspection it is concluded that none of the vegetation communities that occur in the study area have characteristics associated with threatened ecological communities listed on either the *Threatened Species Conservation Act 1995* or the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* and that no endangered populations are present within the study area.

The study area also provides potential habitat for three migratory species listed on the schedules of the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* and potential habitat for a range of flora of local or regional conservation significance, but these are unlikely to substantially constrain the rezoning of the land.

The study area is unlikely to contain any core Koala habitat pursuant to *NSW State Environmental Planning Policy No 44 – Koala Habitat Protection*.

It is concluded that the environmental objectives of Category 3 riparian corridors as defined by DIPNR (2004) are realistic environmental objectives for the riparian corridor of Cabbage Tree Creek within the eastern parts of the study area, and would comprise a substantial improvement of the corridor's existing environmental capacity and condition.

The report identifies the following as the most likely potential ecological constraints to the proposed rezoning:

a) the potential for threatened flora to occur in parts of the study area associated with zoning to permit future dwellings and associated infrastructure;

b) the potential for breeding or roosting habitat of hollow-dependent threatened fauna to occur in parts of the study area associated with zoning to permit future dwellings and associated infrastructure ; and

c) the potential requirement to provide a riparian corridor along the eastern parts of Cabbage Tree Creek.

However, it is concluded that, given the nature of the proposal and the condition of the habitats within the eastern parts of the study area, the likelihood for threatened flora or fauna to constrain the rezoning proposal is relatively low.

Notwithstanding this conclusion, in order to assess the potential for the study area to support the proposed rezoning layout, it is concluded that further studies are required to more precisely identify ecological constraints. These further studies are specified in the recommendations in Section 7 as are a number of other measures to limit the impacts of the proposed rezoning on threatened species, populations, ecological communities or their habitats, and on flora and fauna in general.

7. RECOMMENDATIONS

The recommendations outlined below identify further studies required to assess the effects of the proposed rezoning on flora, fauna and riparian features and to further inform the rezoning process.

Additional Studies

Flora

1. Areas potentially affected directly or indirectly by the proposed rezoning (proposed dwellings and associated infrastructure including APZs and perimeter trails) should be surveyed for threatened or locally or regionally significant flora species.

Fauna

2. Areas potentially affected directly or indirectly by the proposed rezoning (proposed dwellings and associated infrastructure including APZs and perimeter trails) should be subject to targeted surveys for the habitat of threatened fauna species and targeted fauna surveys undertaken as necessary to ascertain whether these species inhabit these parts of the study area.

Riparian Corridors

3. The environmental objectives of Cabbage Tree Creek within the study area should be assessed in detail with respect to the riparian categories identified in DIPNR (2004) and adjustments to the rezoning layout made as necessary.

Proposed Zoning Principles

4. Identified ecological features of conservation significance within the study area, including known habitat and/or populations of threatened flora and fauna, identified riparian or habitat corridors, and vegetated buffers to these features should be included within zonings that protect these features, connect them to adjacent habitats where appropriate, and consolidate responsibility for their management.

Rehabilitation and management of western parts of the study area

5. A detailed assessment of the vegetation and habitats in the western parts of the study area should be undertaken and a rehabilitation and management plan prepared consistent with the objective of managing this area for conservation purposes. The plan should identify management strategies, actions, and associated costs and funding sources, in the context of the management criteria and strategies identified in Section 5.9 of this report.

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APPENDIX A: FIGURES

Figure 1: Location of study area and proposed dwelling sites

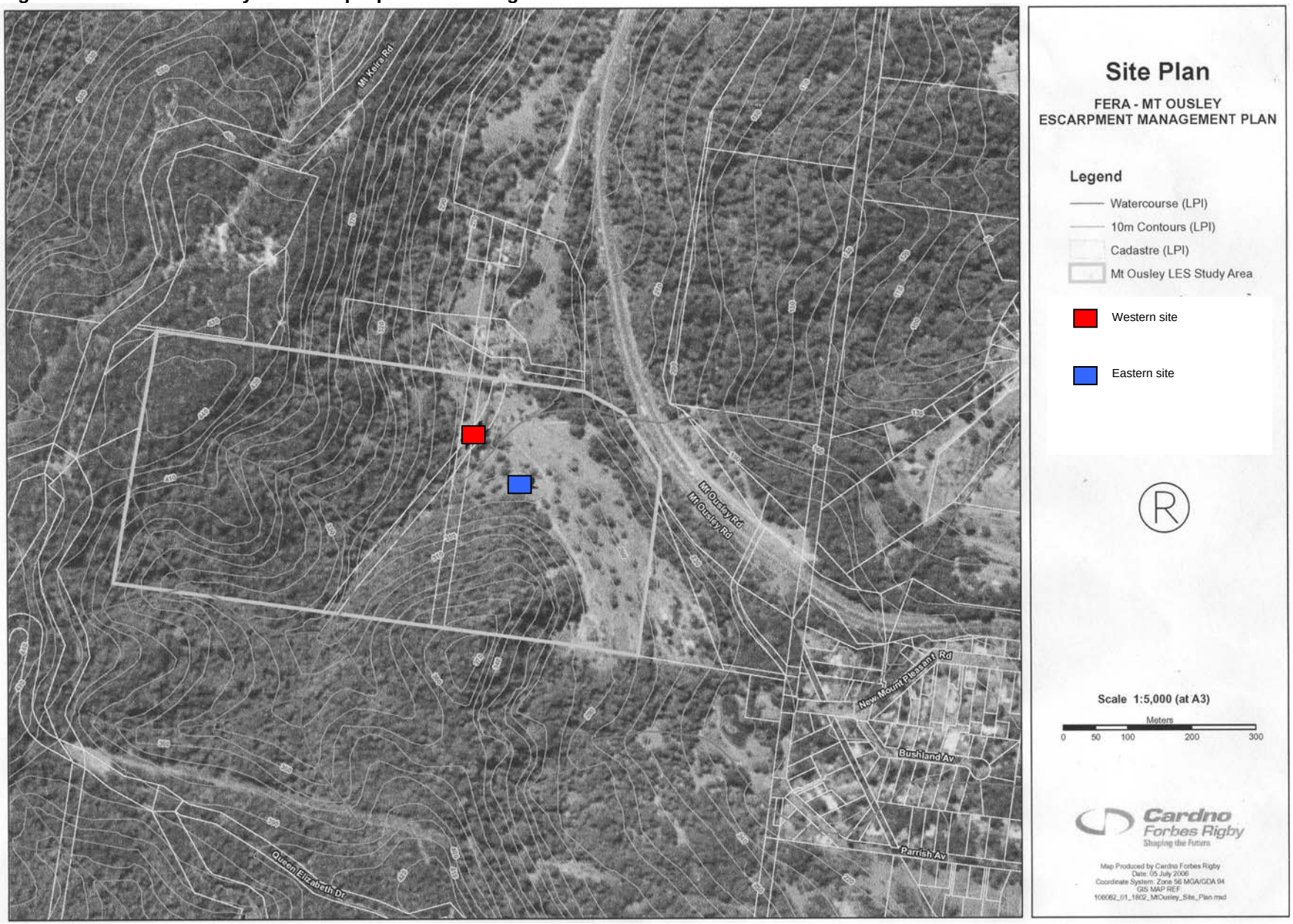

Figure 2: Vegetation of study area as mapped by NPWS (2002b)