Proposed Redevelopment of the Deepwater Motorboat Club in Deepwater Park, Milperra, Bankstown Local Government Area

Fauna Survey and Assessment

Prepared For:

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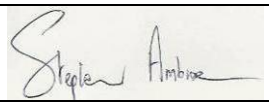
Signature:	
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INTRODUCTION

1.1 INTRODUCTION

The purpose of this report is to provide a fauna assessment of the potential impacts of the proposed modifications and extension to the Deepwater Motorboat Club (the "proposed development") in Deepwater Park, Milperra in the Bankstown Local Government Area (Figure 1).

The fauna assessment:

- identifies key fauna habitats within the development site ("the subject site");
- reviews literature and databases relevant to the subject site;
- describes the methodology and results of the fauna surveys;
- addresses potential impacts on fauna and their habitats resulting from the proposed development;
- proposes appropriate impact mitigation measures; and
- provides an assessment of the likelihood of significant impacts on threatened species and populations, and endangered ecological communities, according to Section 5A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act), NSW *Threatened Species Conservation Act, 1995* (TSC Act) and Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act). This was done to determine the need for a Species Impact Statement (SIS) under the TSC Act or an application for development under the EPBC Act.

1.2 SUBJECT SITE

The subject site is Lot D in DP 391154 and Lot A in DP 405225, 30 Webster Street, Milperra which, collectively, is 4.08 ha in size (Figure 2).

The following development occurs on the subject site:

- a duel carriage concrete road (Webster Street) leading from its intersection with Henry Lawson Drive, to the existing two-storey former Deepwater Motor Club building;
- a road branching off the main entrance road to two existing boat ramps and associated hard stand car parking area;
- the existing two storey motorboat club consisting of storage at ground level and the habitable club area at first floor level;
- an associated pool area with brick outbuilding is located to the north of the Club building;
- a two-coat bitumen car parking area, with no formal line markings, located to the east of the Club building; and

- a pedestrian pathway wandering generally along the Georges River foreshore running along the south and east of the site.

An original survey of trees on the subject site was conducted by Morton (2010), but Clements *et al*. (2011) updated and corrected some errors in Morton's report.

A total of 140 trees occur on the subject site (around the current motor boat club and parking areas) (Plates 1 to 3). According to Clements *et al*. (2011), these include:

- 66 trees surveyed by Morton (2010) of which there were:

  (a) 19 trees that were definitely or probably remnant, and in good health (Tree No. 1, 2, 3, 5, 7b, 9, 10, 11, 12, 13, 14, 15a, 16, 17, 18, 19, 20, 21, 23a; Note: some of these were assessed as being in 'fair health' by Morton, 2010); and

  (b) 47 trees that were either planted, or possible or likely remnant and in very poor health (Tree No. 4, 6, 7, 7a, 8, 15, 22, 23, 23b (group of 20 Cocos Palms), 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42).

- An additional 74 trees, not previously assessed by Morton (2010), comprising

  (a) 35 trees that were definitely remnant and in good to moderate health (Trees 72, 74, 75, 81, 82, 83, 84, 85, 86, 88, 89, 90, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 115, 116, 117, 118, 119);

  (b) 14 trees that were probably remnant and in good health (Trees 49, 53, 54, 55, 66, 68, 69, 70, 71, 76, 77, 78, 80, 87);

  (c) 14 trees that were EITHER probably planted OR probably remnant but growing in fill and/ or in poorer health (Trees 120, 47, 48, 50, 51, 52, 57, 59, 60, 61, 62, 63, 67, 79); and

  (d) 11 trees that were definitely planted, or if remnant in very poor health (score of 2 or less) (Trees 56, 58, 64, 65, 73, 91, 92, 111, 112, 113, 114).

The locally native trees are Grey Box (*Eucalyptus moluccana*), River-Red Gum (*Eucalyptus tereticornis*, although some have been planted on the site), Grey Ironbark (*Eucalytpus paniculata*), Broad-leaved Ironbark (*Eucalyptus fibrosa*), Thin-leaved Stringybark (*Eucalyptus eugenioides*), Blue Box (*Eucalyptus baueriana*), Bosisto's Box [(*Eucalyptus bosistoana*), incorrectly identified as "*E.* sp. (*viminalis*)" by Morton (2010)].

The trees considered non-local native and likely to have been planted are: Narrow-leaved Ironbark (*Eucalyptus crebra*), Spotted Gum (*Eucalyptus maculata*) Flooded Gum (*Eucalyptus grandis*), River Oak (*Casuarina cunninghamiana*) Illawarra Flame Tree (*Brachychiton acerifolius*),

The exotic trees that occur on the subject site are the Cocos Palm (*Syagrus romanzoffiana*, (misquoted in the Development Impact Assessment Report of Morton (2010), (33 individuals), African Olive (*Olea europea* var. *cuspidata*) (two individuals) and Bhutan Cypress (*Cupressus torulosa* (four individuals).

The Deepwater Motorboat Club is located on the northern shoreline of the Upper Georges River (Plate 4). Sydney Coastal River Flat Forest occurs north, east and west of the subject site (Plates 5 and 6). A mix of Estuarine vegetation (*Casuarina glauca/Melaleuca ericifolia* Open Scrub and Mangrove Forest) and Cooks River/Castlereagh Ironbark Forest occurs on either side of the access Road (Webster Street) (Figure 3) (Plates 7 to 9).

A natural drainage line with Mangrove Forest growing along its banks drains water from two large wetlands located in the central area of Deepwater Regional Park into the Georges River (Plate 10). This drainage line passes under Webster Street, approximately 130 m east of the Deepwater Motorboat Club.

1.3 PROPOSED DEVELOPMENT

The proposal (Figure 4) includes:

- partial demolition, alterations and additions to existing premises (Deepwater Motorboat Club);
- creation of a 5 storey building, including associated amenities, kitchen and bar areas;
- use of the premises as a function centre to operate seven days a week;
- associated car parking;
- resurfacing part of Webster Street; and
- Widening the intersection of Webster Street with Henry Lawson Drive (Figure 5).

The works along Webster Street would consist primarily of resurfacing to ensure a level exit road. No trees or substantial vegetation is to be removed as part of the regrading/resurfacing works.

Elsewhere, the development proposal will require the removal of: 22 (32%) of the 68 definite and possible remnant trees in good to moderate health as assessed in Clements *et al*. (2011) with:

- 8 trees located under or near the building or pool (Tree #3, 7b, 9, 10, 11, 12, 14, and 23a); and
- 14 trees not under or near the building or pool (Tree #49, 53, 54, 55, 93, 101, 102, 103, 108, 109, 110, 117, 118, 119).

There are an additional 65 (85%) of 76 trees (including the additional four planted trees in the proposed Amphitheatre area), that were definitely or probably planted or remnants in poor health, proposed to be removed on Existing Tree Plan and Schedule, Drawing Ref No: LSK 10646-101-B (Context July, 2011):

It was further recommended that the remainder of the 'remnant' and 'possible remnant' trees in good health be retained where practicable.

It is proposed to replace the removed trees with approximately 120 native trees in other parts of the subject site as part of the proposed landscape plan (Figure 4).

The upgrading of the intersection at Webster Street and Henry Lawson Drive at the road entrance to Deepwater Park (Figure 5) will likely involve some tree pruning of locally indigenous species (*Eucalyptus fibrosa* and *E. longifolia*) and disturbance of the mainly weed infested road verge.

1.4 STATUTORY FRAMEWORK

1.4.1 NSW Legislation

(a) Environmental Planning & Assessment Act, 1979 (EP&A Act)

Section 78A of the EP&A Act enables a person to apply to a consent authority to carry out development that is permissible under an environmental planning instrument.

In assessing a development application a consent authority must, pursuant to 79C of the EP&A Act take into consideration, where relevant, the likely impacts of the development on the natural and built environments.

Section 4 of the EP&A Act lists the factors to be taken into consideration in assessing a development application in deciding whether there is likely to be a significant effect on a threatened species or population, endangered ecological community, or their habitats (the eight-part test). If a significant impact is likely to occur then a species impact statement (SIS) must be prepared in accordance with Division 2 of Part 6 of the TSC Act.

An SIS provides a more detailed assessment of threatened biota issues and proposes measures to manage and mitigate adverse impacts on the threatened species, populations or ecological communities, or their habitats, resulting from the proposal.

This report examines the factors relating to fauna and their habitats, the likely impacts of the proposed development, and determines whether or not an SIS is required.

(b) Native Vegetation Management Act, 2003

The objective of the Native Vegetation Management Act 2003 (NVM Act) is to allow for the conservation and management of native vegetation in NSW in accordance with the principles of ecologically sustainable development (ESD). The NVM Act is administered by the Department of Natural Resources (DNR).

Under this Act, a permit must be issued by DNR for the destruction or clearing of native vegetation or vegetation on State Protected Land unless the subject land is exempt. State Protected Land includes the following categories under the NVM Act:

- any land with a slope greater than 18 degrees from the horizontal, or

- any land that is situated within, or within 20 metres of the bed or bank of any part of a river or lake specified in the order, or
- any land that the Minister believes to be environmentally sensitive or affected or liable to be affected by soil erosion, siltation or land degradation.

(c) Water Management Act, 2000

The *Water Management Act 2000* (WM Act), administered by the Department of Land and Water Conservation, protects the stability of river channels and lakes by regulating excavation, including dredging, and reclamation. A permit is usually required for works in the bed, or within 40 m of the banks, unless the *Crown Lands Act 1989* applies, as is the case for most tidal waterways.

(d) Fisheries Management Act, 1994

The *Fisheries Management Act 1994* (FM Act) gives NSW Fisheries legislative responsibility to manage "fish" and marine vegetation in NSW. The term "fish" under the Act not only refers to finfish, but includes all aquatic animals whether alive or dead (eg worms, shellfish, snails, aquatic insects etc). However, it does not include marine mammals, reptiles, birds or amphibians, which are covered under legislation enforced by the NPWS.

Under the *Fisheries Management Act*, "waters" refers to all waters that are within the limits of the State and can include tidal waters below mean high water mark as well as perennial (flowing) streams, ephemeral (irregularly flowing) streams, gullies, rivers, lakes and coastal lagoons, wetlands and other forms of natural or man-made water bodies on both private and public land.

NSW Fisheries requires permits for dredging, reclamation and the destruction of marine vegetation. Where a permit is required under this Act, NSW Fisheries can refuse or modify a proposed development if damage to aquatic habitats is thought likely.

The Fisheries Management Amendment Act 1997 includes provisions based on the *Threatened Species Conservation Act 1995*, but applying to fish and marine vegetation.

Under the *Fisheries Management Act 1994*, NSW Fisheries have also developed the following plans:

- Fish Habitat Protection Plan No.1 - General, which deals with dredging and reclamation activities;
- Habitat Protection Plan No.2 - Seagrasses, concerned specifically with seagrass protection; and
- Habitat Protection Plan No.3 - Hawkesbury-Nepean River System Habitat Protection, an integrated management tool to assist in the protection of key fish habitats.

Habitat Protection Plan No. 3 applies to all waters and associated habitats within the Hawkesbury-Nepean catchment. It provides greater protection to habitats that were previously not considered to be adequately protected under other legislation. The habitats covered by the plan are those essential for the spawning, nursery, shelter and feeding requirements of fish as defined in the Act and include:

- the water itself

- deep pools and reservoirs
- riffles (shallow areas of rapid flow)
- wetlands (both freshwater and estuarine)
- floodplains
- mud, silt and sand substrates
- gravel
- rocky reefs
- snags
- artificial hard substrates (such as wharves and seawalls)
- seagrasses
- marine macroalgae (seaweeds)
- mangroves
- saltmarshes
- reeds and other riparian (streamside) vegetation
- freshwater macrophytes (water plants), including ribbonweed (*Valisneria* spp.)

1.4.2 Commonwealth Legislation

The *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act) regulates the assessment and approval of actions that have a significant impact on matters of national environmental significance. These may include:

- wetlands protected by international treaty (the Ramsar Convention);
- nationally listed threatened species and ecological communities; and
- nationally listed migratory species.

An action that is likely to have a significant impact requires the approval of the Commonwealth Minister for the Environment. Actions are projects, developments, undertakings, activities, series of activities or alteration of any of these actions. Guidelines for assessing the national significance of impacts are presented on the Department of Sustainability, Environment, Water, Population and the Community (SEWPAC) website.

This report assesses if the proposed development will significantly impact on matters of national environmental significance in relation to listed nationally-threatened and migratory fauna species and their habitats. If a significant impact is likely, then the matter needs to be referred to SEWPAC.

1.4.3 Planning Instruments

The planning instruments that are also considered in the present report are:

- Deepwater Reserve Plan of Management 2002;
- Draft Bushland Plan of Management: Reserves at Milperra 2003;
- Bankstown City Council Biodiversity Strategy 2003; and
- State Environmental Planning Policy No. 44 (SEPP 44) – Koala Habitat Protection.

1.5 STRUCTURE OF REPORT

This report comprises four chapters and one appendix. The contents of subsequent sections of the report are as follows:

Chapter 2 outlines the methods used to survey and assess key fauna habitats within the subject site. This includes reviews of databases and literature, and descriptions of survey techniques and survey effort for fauna species, including threatened species.

Chapter 3 describes the existing fauna and their habitats within the subject site and their overall conditions and conservation significance.

Chapter 4 identifies potential impacts of the proposed development on native fauna and their habitats. It also recommends appropriate measures for avoiding or minimising impacts on fauna and their habitats that may occur as a result of the proposed development.

Appendix A presents Seven-Part Tests of Significance for NSW-threatened fauna species and populations that would be potentially impacted on by the proposed development.

FIGURE 1 LOCATION OF SUBJECT SITE

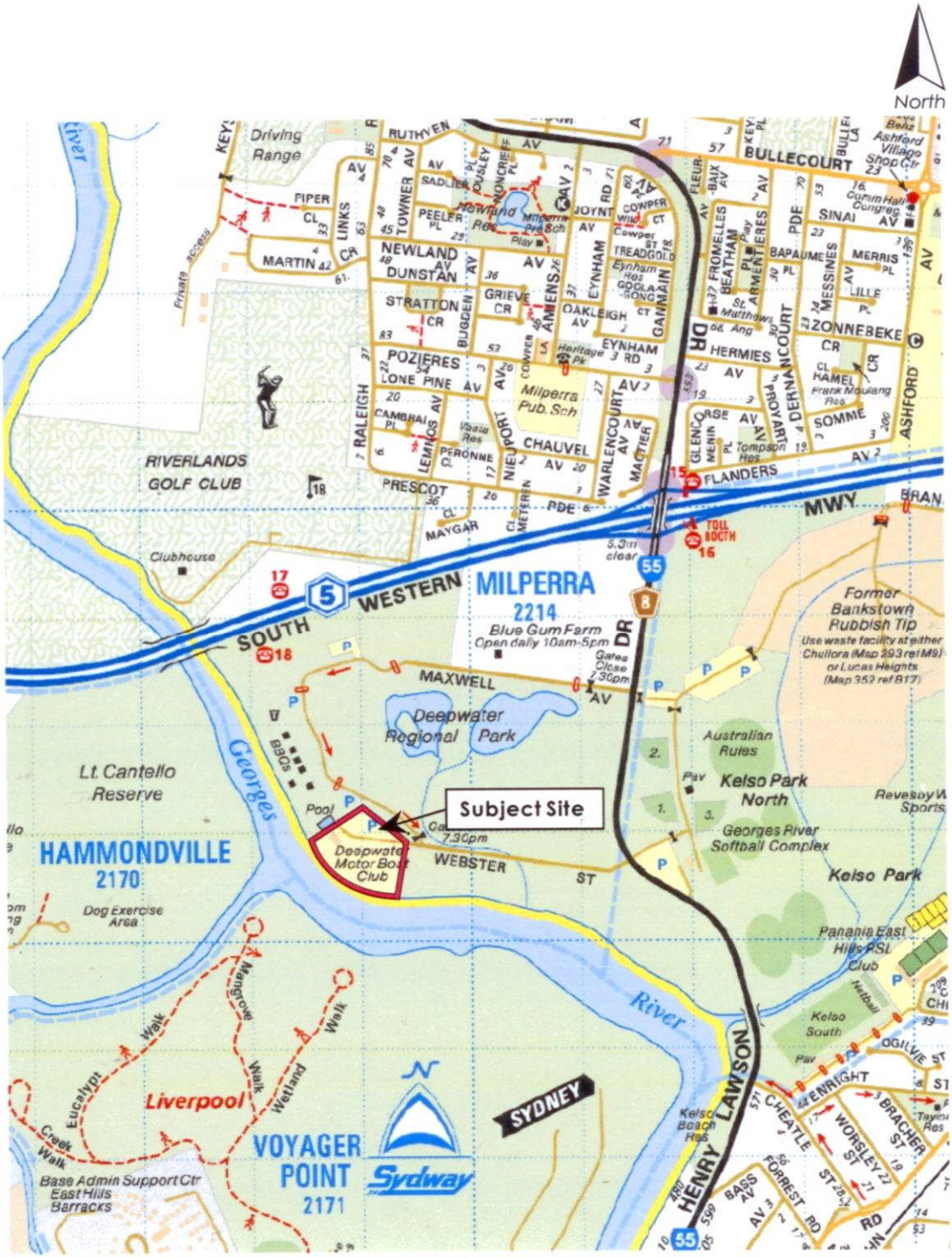

FIGURE 2 AERIAL VIEW OF SUBJECT SITE AND SURROUNDING LANDSCAPE

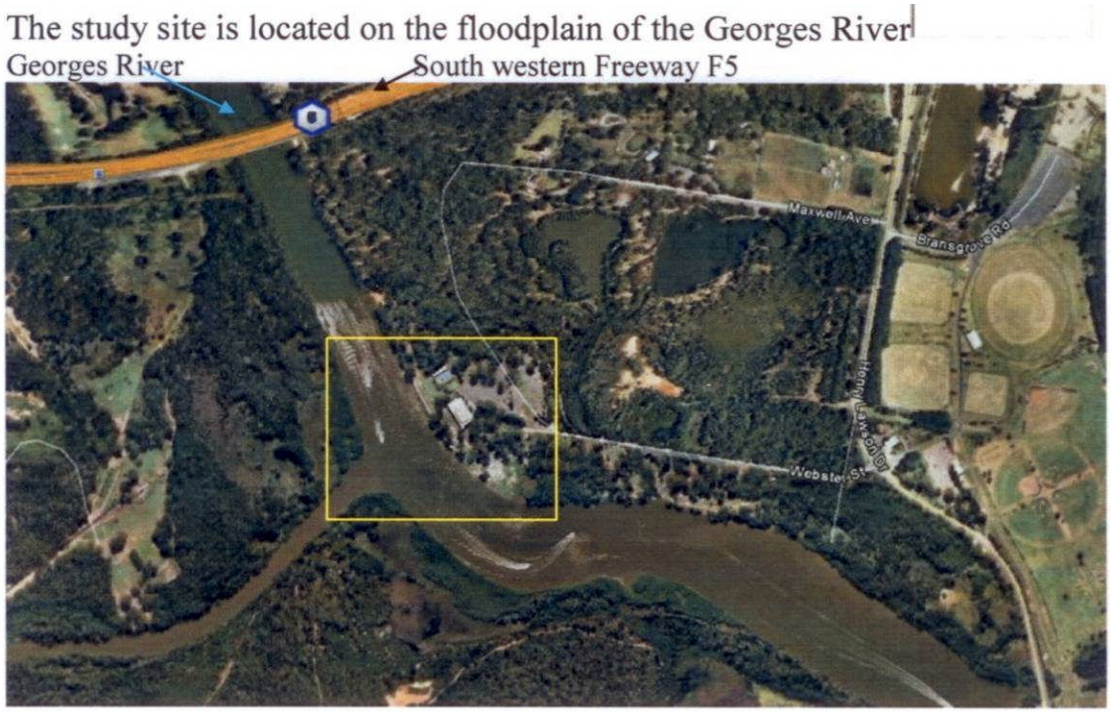

Figure 2 Insert

(reference Sinclair Knight & Metz 2009)

FIGURE 3 VEGETATION COMMUNITIES WITHIN DEEPWATER REGIONAL PARK (ECO LOGICAL 2002)

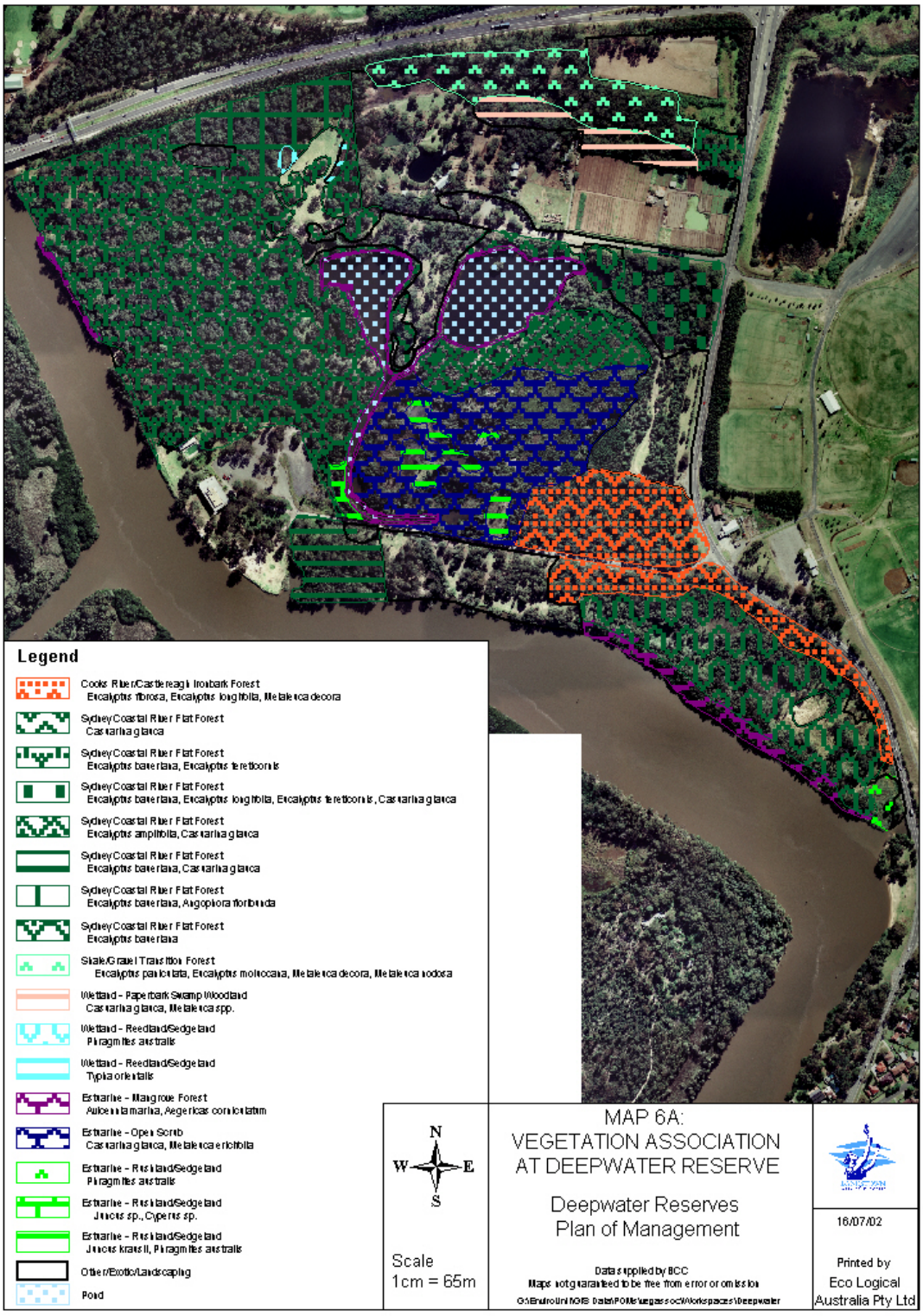

FIGURE 4 PROPOSED MODIFICATIONS TO THE DEEPWATER MOTORBOAT CLUB COURSE

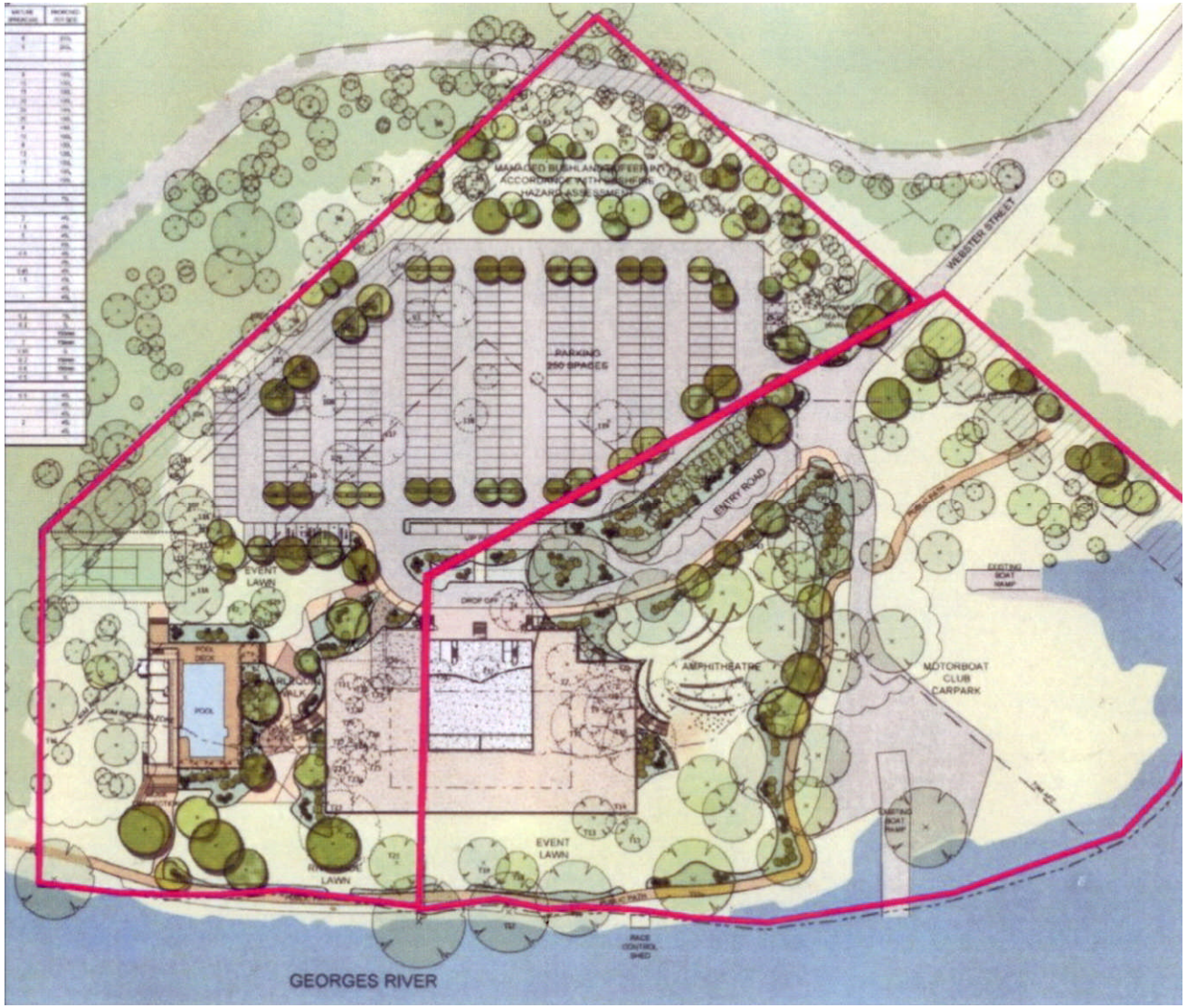

FIGURE 5 PROPOSED INTERSECTION UPGRADE AT WEBSTER STREET/HENRY LAWSON DRIVE

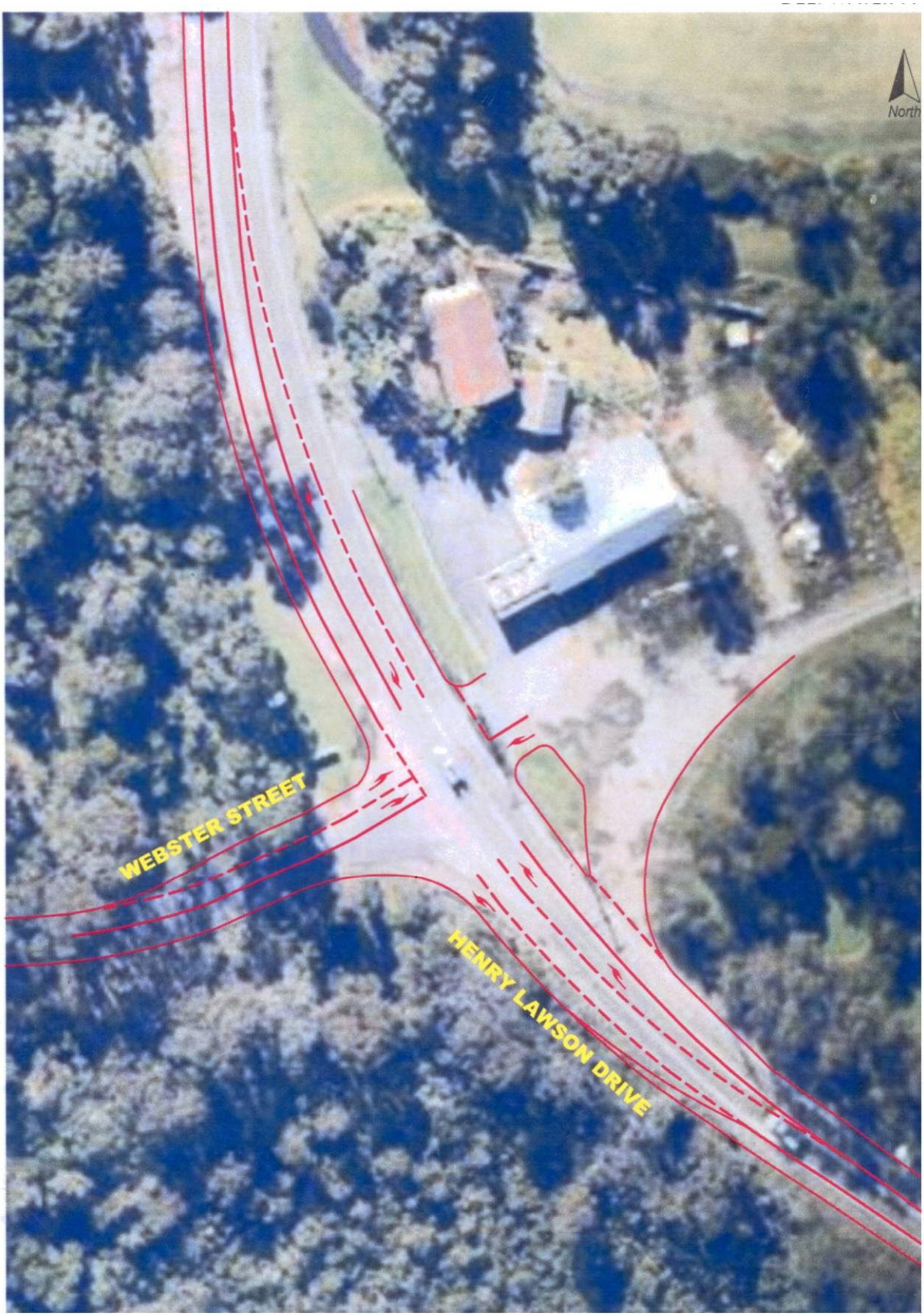

Plate 1 Treed Area Immediately East of the Deepwater Motorboat Club

Plate 2 Treed Area Immediately South of the Deepwater Motorboat Club

Plate 3 Treed Area Near Swimming Pool, West of Deepwater Motorboat Club

Plate 4 Northern Bank of Georges River, immediately south of Deepwater Motorboat Club

Plate 5 **Sydney Coastal River Flat Forest (*Eucalyptus baueriana)* immediately west of the subject site**

Plate 6 **Sydney Coastal River Flat Forest (*Casuarina glauca*) immediately east of the subject site**

Plate 7 Estuarine Open Scrub on northern side of Webster Street.

Plate 8 Mangrove Forest on northern side of Webster Street

Plate 9 Cooks River (Castlereagh) Ironbark Forest on southern side of Webster Street

Plate 10 Natural drainage line flowing under Webster Street

2

METHODOLOGY

2.1 OVERVIEW

Fauna issues relating to the application for development of the subject site were identified by reviewing relevant literature and databases and conducting field surveys. The methods by which this information was collected and analysed are presented below.

2.2 EXISTING RECORDS

Existing literature relevant to the study area, in particular technical environmental reports produced by NPWS, other consultancies and Bankstown Council, were reviewed to determine the presence of terrestrial and aquatic habitats, and fauna species of conservation significance, within the locality (a 5 km radius around the subject site).

Reports that were consulted for this purpose include:

- Ambrose, S.J. (2008a). Proposed Modifications to Riverlands Golf Course & Adjoining Land, Milperra, Bankstown Local Government Area: Fauna Survey and Assessment. Report Prepared for Demian Developments Pty Ltd by Ambrose Ecological Services Pty Ltd (dated 31 July 2008).

- Ambrose, S.J. (2008b). Proposed New Access Road to Riverlands Golf Course & Adjoining Land, Milperra, Bankstown Local Government Area: Fauna Survey and Assessment. Report Prepared for Demian Developments Pty Ltd by Ambrose Ecological Services Pty Ltd (dated 3 November 2008).

- Ambrose, S.J. (2008c). Green and Golden Bell Frog Surveys, Riverlands Golf Course, Milperra in October and November 2008. Report prepared by Ambrose Ecological Services Pty Ltd for Demian Developments Pty Ltd (dated December 2008).

- Bankstown Council Biodiversity Strategy 2002.

- Eco Logical (2002). Bushland Plan of Management: Deepwater Reserve. Report prepared by EcoLogical Australia Pty Ltd for Bankstown Council (dated 23 July 2002).

Records of threatened fauna species, listed under the schedules of the TSC and EPBC Acts and species of regional conservation significance, were obtained from databases for the Bankstown LGA.

The databases searched were:

- DECCW Wildlife Atlas Database;
- NSW Field Ornithologists' Club Atlas Database;
- Birds Australia Atlas Database (1977-81) and (1998 onwards);
- EPBC database; and

- Australian Museum specimen collection database.

These databases only contain indicative records of fauna species in the locality and are not the result of a systematic fauna survey. Database records for individual species will vary in quality, reliability and accuracy of the geographic co-ordinates. Therefore, some species records are highly accurate in space and time such as the Birds Australia Atlas Database and the Australian Museum Specimen Collection Database. However, others are more tentative or only contain estimates of geographical locations, for instance, records from the NPWS Wildlife Atlas Database have a limited accuracy based on a 1 km^2 recording grid.

2.3 TAXONOMY

The following references were used to identify and classify animal groups:

- birds - Simpson & Day (2010), Christidis & Boles (2008);
- mammals (excluding bats) - Menkhorst & Knight (2004), Strahan & van Dyck (2008);
- bats - Richards and Hall (1993), Reinhold *et al*. (2001), Pennay *et al*. (2004);
- amphibians - Cogger (2000), Griffiths (2006); Anstis (2002);
- reptiles – Cogger (2000), Griffiths (2006), Wilson & Swan (2010); and
- terrestrial snails – Stanisic *et al*. (2010).

2.4 FIELD SURVEYS

2.4.1 Overview

The conservation value of the subject site and adjoining areas for native fauna was assessed during:

- diurnal inspections on 14 April 2011 (1000 to 1300 hrs) and 15 April 2011 (1200 to 1600 hrs); and
- dusk and nocturnal inspections from 1730 to 2100 hrs on 14 April 2011

The areas surveyed include the subject site and habitats on both sides of Webster Street to a width of 50 metres on either side of the street.

2.4.2 Fauna Habitat Assessment and Survey

(a) Fauna Habitat Assessment

It was not possible to determine with certainty all the fauna that utilise habitats in the surveyed areas. This is because of the likely seasonal occurrences of some fauna species, the occasional occurrence of vagrant species, and because some species are difficult to detect because of their timid or cryptic behaviour. Therefore, fauna investigations comprised an assessment of fauna habitats present in the surveyed areas and an indication of their potential to support native wildlife populations and, in particular, threatened species.

The assessment criteria included:

Mammals: extent of ground cover, shrub layer and tree canopy, hollow-bearing trees, substrate type (for burrowing etc), evidence such as droppings, diggings,

	footprints, scratches on trees, nests, burrow paths and runways.
Birds:	structural features such as the extent and nature of the canopy, understorey and ground strata and flowering characteristics, bird species.
Reptiles and Amphibians:	cover, shelter, suitable substrate, basking and breeding site availability. Reptiles and frogs sought in likely sheltering places.
Invertebrates	logs and other debris, leaf and bark accumulations around bases of trees, grass clumps, loose soil for burrowing.
Wildlife Corridor Values	Importance of the creek systems and riparian vegetation as movement corridors for fauna, especially birds, aquatic fauna, mammals (e.g. microchiropteran bats) & amphibians.

(b) Fauna Survey

A search for fauna species on the subject site was conducted during each site inspection. Information collected was used in conjunction with other surveys and records in determining fauna use of the subject site and, in particular, use or potential use of the subject site by threatened species.

Weather conditions were also recorded during the time of the surveys. In addition to fauna habitat assessment, the results of systematic surveys and incidental sightings of terrestrial vertebrates were used to determine faunal assemblages on the subject site. These techniques are described in greater detail below:

(i) Bird Surveys

Within treed areas, area searches for birds were conducted in which the observer walked at random through the remnant, stopping at will, with a search effort equivalent to a 2 ha coverage over a 30-minute period. All bird species that were observed or heard during the survey were noted. Opportunistic observations of birds in the green field part of the subject site were also recorded.

Owl presence was investigated at night by playing the calls of owls that could potentially occur in the locality and subsequently searching for owls that may be responding to these calls.

(ii) Reptiles and Amphibians

Reptiles and amphibians were identified using indirect observation methods. Species were searched for in fallen logs, suitable rock basking substrates and underneath other fallen material. During the nocturnal survey, responses to playback recordings, together with spotlighting, helped identify frog species that could have potentially occurred in water-logged areas of the subject site.

(iii) Microchiropteran Bats

Microchiropteran bats often fly through woodland or forest habitats by moving along creeks and open areas of forest. They are most easily detected around dusk when they emerge from their day-time roosts and begin to actively forage for food. A hand-held Anabat II Bat

Detector (Titley Electronics) was used in the survey areas from 1730 to 2100 hrs on 14 April 2011 to record the ultrasonic calls of bats that may have been in or near the subject site.

Bat calls that are recorded during surveys are routinely identified with the assistance of Anabat 6.3 Software (Titley Electronics), Richards *et al*. (1993), Reinhold *et al*. (2001) and Pennay *et al*. (2004).

(iv) Other Mammals

Opportunistic observations were recorded if mammals were seen at night during spotlighting surveys and during the day when searching for other fauna.

(v) Cumberland Plain Land Snail

Treed areas were searched on foot for the presence of the Cumberland Plain Land Snail (*Meridolum corneovirens*), which is listed as Endangered under the schedules of the TSC Act. This involved searching for snails underneath fallen bark at the base of tree trunks, fallen ground debris (e.g. branches, tree limbs and leaf litter), under grass tussocks, and under human garbage.

2.4.3 Species of Conservation Significance

Native fauna species and populations considered threatened in New South Wales are listed in Schedules 1 and 2 of the *Threatened Species Conservation (TSC) Act 1995*. A Seven-Part Test was conducted for all those threatened species detected on or adjacent to the subject site or for those considered to potentially occur there due to the availability of habitat.

2.5 ASSESSMENT OF CONSERVATION VALUE

The conservation value of fauna habitats on the subject site was determined by reference to the following criteria:

- *representativeness* - whether the vegetation communities of the site are unique, typical or common in the bioregion. In addition, the criteria takes into account whether or not such vegetation units are presently held in conservation reserves;
- the presence of threatened or regionally significant species on the site;
- The extent of human influence on the natural environment of the site and the condition of habitats (e.g. the presence of weeds, fire frequency etc.);
- the uniqueness of the natural values of the site;
- the amount of native vegetation to be cleared or modified by the proposed development in relation to what remnant vegetation will remain in the locality; and
- the relative importance of a site as a corridor for the movement of wildlife.

2.6 KOALA HABITAT ASSESSMENT

An assessment of Koala habitat on the subject site, according to the *State Environment Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44), was completed on 14 & 15 April 2011 as part of the overall fauna survey and assessment.

It is necessary to identify whether the site consists of *potential* and/or *core* Koala habitat as defined under SEPP 44 when seeking development consent in local government areas to which the policy applies.

Potential Koala habitat is defined as "*areas of native vegetation where the trees of the types listed in Schedule 2 (of SEPP 44) constitute at least 15% of the total number of trees in the upper or lower strata of the tree compone*nt". Trees listed in Schedule 2 are presented in Table 2.1

Core Koala habitat means "*an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings and historical records of a Koala population*". The subject site in the present study is not Potential or Core Habitat according to these definitions.

Table 2.1 TREES LISTED IN SCHEDULE 2 OF SEPP 44

Scientific Name	Common Name
Eucalyptus albens	White Box
Eucalyptus camaldulensis	River Red Gum
Eucalyptus haemastoma	Broad-leaved Scribbly Gum
Eucalyptus microcorys	Tallowwood
Eucalyptus populnea	Bimble Box
Eucalyptus punctata	Grey Gum
Eucalyptus robusta	Swamp Mahogany
Eucalyptus signata	Scribbly Gum
Eucalyptus tereticornis	Forest Red Gum
Eucalyptus viminalis	Ribbon Gum

3

RESULTS

3.1 OVERVIEW

This chapter describes the native fauna and their habitats on the subject site and adjoining areas. It describes the fauna habitats that are present within the surveyed areas, assesses their conservation values and discusses the possibility of threatened and locally significant species occurring there.

3.2 VEGETATION COMMUNITIES

The floristic diversity and structure of vegetation communities on the subject site and adjacent areas are described in detail by Clements *et al*. (2011)

3.3 FAUNA PARAMETERS

3.3.1 Fauna Habitats

There are two main habitats for native fauna on the subject site and adjoining areas:

- Treed Areas and forest remnants;
- Cleared Land/Grassland
- Aquatic/Riparian Habitats

Each of these habitats is discussed in detail below.

(a) Treed Areas and Forest Remnants

Occurrence: Treed areas without an understorey occur on the subject site as parkland trees immediately adjacent to the Deepwater Motorboat Club (Plates 1 to 3). Forested areas occur on each side of Webster Street (Plates 7 to 10) and as more intact remnants outside the subject site, along the Georges River (Plates 5 & 6).

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Habitat Elements: The tree canopy has the potential of producing seeds, nectar and/or fruits for nectarivorous and frugivorous birds and bats, and arboreal mammals. It also provides potential nesting and roosting sites for common native birds (e.g. honeyeaters, pardalotes, gerygones, thornbills, corvids and artamids) and for some arboreal mammals (e.g. possums). There are no trees within the surveyed areas with hollows that are large enough to be used as roosting and breeding habitat and shelter by microchiropteran bats, hollow-dependent birds (e.g. treecreepers, owls, cockatoos and parrots), some arboreal mammals (e.g. gliders, possums, marsupial mice and rats), reptiles and amphibians.

Hollow logs within intact forested areas on the northern and southern sides of Webster Street are potential shelter and refuge sites for reptiles, amphibians and small ground-dwelling mammals (e.g. marsupial mice, rats and bandicoots). Other fallen timber in these

areas (e.g. fallen branches) also provides refuge for these species and for the endangered Cumberland Plain Land Snail.

There is very little leaf litter except in patches of bushland that have native understorey and shrub layers. Leaf litter layers provide potential refuge habitat for small reptiles, amphibians and ground-dwelling marsupials, foraging habitat for ground-foraging birds (e.g. Superb Fairy-wrens, Brown Thornbills and White-browed Scrubwrens), and shelter for Cumberland Plain Land Snails.

The seeds of unmown native and exotic grasses are potential food for native finches (e.g. Red-browed Firetail Finches) and grass-feeding parrots (e.g. Red-rumped Parrots).

Disturbance: The treed areas around the Deepwater Motorboat Club and in picnic areas south of Webster Street have mown lawns.

Intact forest areas on either side of Webster Street area infested with weeds, mostly Bridal Creeper (*Asparagus asparagoides*) on the southern side of the road and Panic Veldt Grass (*Ehrhata erecta*) on the northern side.

(b) Grassland/Cleared Land

Occurrence: Among the treed areas around the Deepwater Motorboat Club and picnic areas south of Webster Street.

Habitat Elements: The cleared or disturbed grassland areas of the surveyed area provide potential foraging habitat for common ground-foraging bird species, such as Masked Lapwings (*Vanellus miles*), Galahs (*Cacatua roseicapilla*), Red-rumped Parrots (*Psephotus haematonotus*), Magpie-larks (*Grallina cyanoleuca*) and Australian Magpies (*Gymnorhina tibicen*).

Disturbance: Mostly a mown native groundcover or lawn area below the tree canopy.

(c) Aquatic/Riparian Habitats

Occurrence: Georges River and its northern bank. The estuarine drainage line that flows to the Georges River from the regional wetlands in the central areas of the park, and which flows under Webster Street.

Habitat Elements: The water bodies provide potential calling, breeding and foraging habitat for adult frogs and foraging habitat for tadpoles. The estuarine habitat along Georges River and its associated drainage line also provide potential foraging habitat for some waterfowl species (e.g. grebes and ducks), gallinules (coots, swamphens and moorhens), rails and crakes, and wading birds (egrets and herons), and drinking and bathing habitat for bushland birds.

The mangrove and River Oak canopies along the drainage line provide potential resting habitat for estuarine birds (e.g. cormorants, darters and raptors) and form a local wildlife corridor link through Deepwater Park and along Georges River. Waters within the mangrove forests are also important breeding grounds for estuarine fish species.

Disturbance: Riparian vegetation along the northern bank of the Georges River within the subject site (i.e. south of the Deepwater Motorboat Club) has largely been cleared (Plate 4). Exotic plant species dominate the groundcover along this section of the bank and include Wild Aster (*Aster subulatus*), Catsear (*Hypochaeris radicata*), Perennial Ryegrass (*Lolium perenne*) and Kikuyu (*Pennisetum clandestinum*). Some juvenile Grey Mangrove (*Avicennia marina*) individuals also occur in small, isolated patches in this part of the bank.

3.3.2 Fauna

One hundred and eighty-nine (189) fauna species (two frog species, nine reptile species, 181 bird species, four mammal species and one significant invertebrate species) have been recorded in Deepwater Park (Table 3.1).

Seven of these species are listed as threatened under the TSC and/or EPBC Acts, 17 are regionally-rare, nine are exotic species, and the other 156 species have relatively widespread distributions throughout the Sydney Basin Bioregion.

Only 22 fauna species were recorded on the subject site or in surveyed habitat areas alongside Webster Street during the present study. All of these species are common urban-tolerant species and have widespread distributions in the Sydney Basin Bioregion. The small proportion of species recorded within these areas is due largely to the extremely degraded nature of habitats and small survey areas.

3.3.3 Threatened Fauna Species

Threatened fauna species that have been detected in the locality (a 5-km radius around the subject site), their habitat requirements, and their likelihood of occurring on the subject site or in fauna habitat areas along Webster Street are shown in Table 3.2.

No threatened fauna species were detected in these areas during the present study. However, potential habitat occurs for the Green and Golden Bell Frog (*Litoria aurea*), Black Bittern (*Ixobrychus flavicollis*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Square-tailed Kite (*Lophoictinia isura*), Swift Parrot (*Lathamus discolor*), Barking Owl (*Ninox connivens*), Regent Honeyeater (*Xanthomyza phrygia*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Large-footed Myotis (*Myotis adversus*), Greater Broad-nosed Bat (*Scoteanax ruepelli*), Eastern Bent-wing Bat (*Miniopterus schreibersii*) and Cumberland Plain land Snail (*Meridolum corneovirens*).

Three of these species (the Square-tailed Kite, Swift Parrot and Regent Honeyeater) only occur in the locality as irregular vagrants. If they visit Deepwater Park, they would occur infrequently and in low numbers. Therefore, the proposed development is most unlikely to significantly impact upon the status of these species.

Potential impacts of the proposed development on the status of the Cumberland Land Snail, Green and Golden Bell Frog, Glossy Black-Cockatoo, Barking Owl, Grey-headed Flying-fox, East Coast Freetail Bat, Eastern Bent-wing Bat, Eastern False Pipistrelle, Large-eared Mouse-eared Bat and Greater Broad-nosed Bat, and their habitats, are discussed in Chapter 4 and in Appendix A.

Table 3.1 FAUNA SPECIES RECORDED IN DEEPWATER PARK

E: Endangered Species under the NSW *Threatened Species Conservation Act, 1995* and/or Commonwealth *Environmental Protection & Biodiversity Conservation Act, 1999*.
V: Vulnerable Species under the NSW *Threatened Species Conservation Act, 1995.*
R: Regionally significant species.
J: Listed on the Japanese and Australian Migratory Bird Agreement (JAMBA).
C: Listed on the Chinese and Australian Migratory Bird Agreement (CAMBA).
* Exotic (introduced) species.

Family	Scientific Name	Common Name	Conservation Status	Deepwater POM	Present Study	
					Around Deepwater Motorboat Club	Webster Street
AMPHIBIANS						
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet		X		X
	Limnodynastes tasmaniensis	Spotted Grass Frog		X		X
REPTILES						
Agamidae	*Pogona barbata*	Bearded Dragon		X		
Scincidae	*Lampropholis guichenoti*	Grass Sun-skink		X	X	X
	Eulamprus quoyi	Eastern Water Skink		X		X
	Saiphos equalis	Three-toed Skink		X		
	Tiliqua scincoides	Eastern Blue-tongued Lizard		X		X
Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake		X		
	Pseudonaja textilis	Eastern Brown Snake		X		
Typhlopidae	*Ramphotyphlops nigrescens*	Blackish Blind Snake		X		
Cheluidae	*Chelodina longicollis*	Eastern Long-necked Turtle		X		

Family	Scientific Name	Common Name	Conservation Status	Deepwater POM	Present Study	
					Around Deepwater Motorboat Club	Webster Street
BIRDS						
Turnicidae	*Coturnix ypsilophora*	Brown Quail		X		
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican		X		
Anhingidae	*Anhinga melanogaster*	Darter		X		
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant		X		
	Phalacrocorax sulcirostris	Little Black Cormorant		X		
	Phalacrocorax varius	Pied Cormorant		X		
	Phalacrocorax melanoleucos	Little Pied Cormorant		X		
Podicepidae	*Tachybaotus novaehollandiae*	Australasian Grebe		X		
	Policephalus poliocephalus	Hoary-headed Grebe		X		
	Podiceps novaehollandiae	Little Grebe		X		
Anseranatidae	*Cygnus atratus*	Black Swan		X		
Anatidae	*Chenonetta jubata*	Australian Maned Duck		X		
	Anas castanea	Chestnut Teal		X		
	Anas gracilis	Grey Teal		X		
	Anas platyrhynchos *	Mallard		X		
	Anas superciliosa	Pacific Black Duck		X		
	Aythya australis	White-eyed Duck		X		
	Biziura lobata	Musk Duck	R	X		
Rallidae	*Gallirallus philippensis*	Buff-banded Rail		X		
	Gallinulla tenebrosa	Dusky Moorhen		X		
	Fulica atra	Eurasian Coot		X		
	Porphyrio porphyrio	Purple Swamphen		X		
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	V	X		
	Ixobrychus flavicollis	Black Bittern	V	X		

Family	Scientific Name	Common Name	Conservation Status	Deepwater POM	Present Study	
					Around Deepwater Motorboat Club	Webster Street
	Ixobrychus minutus	Little Bittern		X		
	Ardea ibis	Cattle Egret	J, C	X		
	Ardea alba	Great Egret	R, J, C	X		
	Ardea intermedia	Intermediate Egret		X		
	Ardea pacifica	Pacific Heron		X		
	Egretta novaehollandiae	White-faced Heron		X		
	Nycticorax caledonicus	Rufous Night-Heron		X		
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis		X		
	Platalea regia	Royal Spoonbill		X		
	Platalea flavipes	Yellow-billed Spoonbill		X		
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork		X		
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe	R, J, C	X		
Charadriidae	*Vanellus miles*	Masked Lapwing		X	X	X
	Elseyornis melanops	Black-fronted Dotterel		X		
	Erythrogonys cinctus	Red-kneed Dotterel		X		
	Charadrius ruficapillus	Red-capped Plover		X		
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt		X		
Laridae	*Larus novaehollandiae*	Silver Gull		X		
Accipitridae	*Hieraaestus morphnoides*	Little Eagle		X		
	Haliaeetus leucogaster	White-bellied Sea-eagle	R, C	X		
	Aquila audax	Wedge-tailed Eagle	R	X		
	Circus approximans	Marsh Harrier		X		
	Accipiter novaehollandiae	Grey Goshawk	R	X		
	Accipiter fasciatus	Brown Goshawk		X		
	Accipiter cirrhocephalus	Collared Sparrowhawk		X		

Family	Scientific Name	Common Name	Conservation Status	Deepwater POM	Present Study	
					Around Deepwater Motorboat Club	Webster Street
	Haliastur sphenurus	Whistling Kite	R	X		
	Elanus axillaries	Black-shouldered Kite		X		
	Lophoictinia isura	Square-tailed Kite	V	X		
Falconidae	*Falco longipennis*	Australian Hobby		X		
	Falco cenchroides	Australian Kestrel		X		
	Falco peregrinus	Peregrine Falcon	R	X		
Columbidae	*Streptopelia chinensis* *	Spotted Turtledove		X		
	Columba livia *	Feral Pigeon		X	X	
	Ocyphaps lophotes	Crested Pigeon		X	X	X
	Lopholaimus antarcticus	Topknot Pigeon		X		
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo		X	X	
	Cacatua tenuirostris	Long-billed Corella		X		
	Cacatua sanguinea	Little Corella		X		
	Cacatua roseicapilla	Galah		X		
	Calyptorhynchus lathami	Glossy Black-Cockatoo	V	X		
	Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo		X		
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet		X		
	Glossopsitta pusilla	Little Lorikeet		X		
	Glossopsitta concinna	Musk Lorikeet		X		
	Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet		X		
	Afsterus scapularis	Australian King-Parrot		X		
	Platycercus elegans	Crimson Rosella		X		
	Platycercus eximius	Eastern Rosella		X	X	X
	Psephotus haematonotus	Red-rumped Parrot		X		
	Melopsittacus undulatus	Budgerigar		X		

Family	Scientific Name	Common Name	Conservation Status	Deepwater POM	Present Study	
					Around Deepwater Motorboat Club	Webster Street
Strigidae	*Ninox novaeseelandiae*	Southern Boobook		X		
Tytonidae	*Tyto alba*	Barn Owl		X		
Podargidae	*Podargus strigoides*	Tawny Frogmouth		X		
Cuculidae	*Eudynamys scolopacea*	Common Koel		X		
	Cacomantis flabelliformis	Fan-tailed Cuckoo		X		
	Cuculus pallidus	Pallid Cuckoo		X		
	Chrysococcyx gouldii	Golden Bronze-cuckoo		X		
	Chrysococcyx basalis	Horsfield's Bronze-cuckoo		X		
	Chrysococcyx lucidus	Shining Bronze-cuckoo		X		
Caprimulgidae	*Eurostopidous mystacallis*	White-throated Nightjar		X		
Apodidae	*Apus pacificus*	Fork-tailed Swift	R, J, C	X		
	Hirundapus caudacutus	White-throated Needletail	R, J, C	X		
Halcyonidae	*Dacelo novaeguinea*	Laughing Kookaburra		X	X	X
Alcedinae	*Alcedo azurea*	Azure Kingfisher		X		
	Todiramphus sanctus	Sacred Kingfisher		X		
Coraciidae	*Eurystomus orientalis*	Dollarbird		X		
Neosittidae	*Daphoenositta chrysoptera*	Varied Sitella		X		
Climacteridae	*Cormobates sagittatus*	White-throated Treecreeper		X		
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole		X		
Meliphagidae	*Manorina melanocephala*	Noisy Miner		X	X	X
	Anthochaera carunculata	Red Wattlebird		X		
	Anthochaera chrysoptera	Little Wattlebird		X		
	Philemon corniculatus	Noisy Friabird		X		
	Philemon citreogularis	Little Friarbird	R	X		
	Melithreptus gularis	Black-chinned Honeyeater	R	X		

Family	Scientific Name	Common Name	Conservation Status	Deepwater POM	Present Study	
					Around Deepwater Motorboat Club	Webster Street
	Melithreptus brevirostris	Brown-headed Honeyeater		X		
	Melithreptus lunatus	White-naped Honeyeater		X		
	Lichenostomus chrysops	Yellow-faced Honeyeater		X		
	Lichenostomus leucotis	White-eared Honeyeater		X		
	Lichenostomus fuscus	Fuscous Honeyeater		X		
	Lichenostomus pennicillatus	White-plumed Honeyeater		X		
	Lichmera indistincta	Brown Honeyeater	R	X		
	Phylidonyris novaehollandiae	New Holland Honeyeater		X		
	Phylidonyris nigra	White-cheeked Honeyeater		X		
	Xanthomyza phrygia	Regent Honeyeater	E	X		
	Myzomela sanguinolenta	Scarlet Honeyeater		X		
	Plectorhynchia lanceolata	Striped Honeyeater		X		
	Acanthorhynchus tenuirostris	Eastern Spinebill		X		
Cinclosomatidae	*Psophodes olivaceus*	Eastern Whipbird		X		
Maluridae	*Malurus cyaneus*	Superb Fairy-wren		X	X	X
	Malurus leucopterus	White-winged Fairy-wren		X		
Acanthizidae	*Acanthiza pusilla*	Brown Thornbill		X		
	Acanthiza chrysoptera	Yellow-rumped Thornbill	R	X		
	Acanthiza lineata	Striated Thornbill		X		
	Acanthiza nana	Yellow Thornbill		X		
	Acanthiza reguloides	Buff-rumped Thornbill	R	X		
	Sericornis frontalis	White-browed Scrubwren		X		
	Smicrornis brevirostris	Weebill		X		
	Gerygone mouki	Brown Gerygone		X		
	Gerygone olivacea	White-throated Gerygone		X		

Family	Scientific Name	Common Name	Conservation Status	Deepwater POM	Present Study	
					Around Deepwater Motorboat Club	Webster Street
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote		X		X
	Pardalotus striatus	Striated Pardalote		X		
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin		X		
	Petroica phoenicea	Flame Robin		X		
	Petroica rosea	Rose Robin		X		
	Petroica multicolor	Scarlet Robin		X		
	Melanodryas cucullata	Hooded Robin	V	X		
	Microeca fascinans	Jacky Winter		X		
Pachycephalidae	*Falcunculus frontatus*	Crested Shrike-tit		X		
	Pachycephala rufiventris	Rufous Whistler		X		
	Pachycephala pectoralis	Golden Whistler		X		
	Pachycephala olivacea	Olive Whistler		X		
	Colluricincla harmonica	Grey Shrike-thrush		X		
Dicruridae	*Rhipidura fuliginosa*	Grey Fantail		X		
	Rhipidura leucophrys	Willie Wagtail		X		
	Monarcha melanopsis	Black-faced Monarch		X		
	Myiagra rubecula	Leaden Flycatcher		X		
	Myiagra inquieta	Restless Flycatcher		X		
	Myiagra cyanoleuca	Satin Flycatcher		X		
	Grallina cyanoleuca	Magpie-lark		X	X	X
	Dicrurus bracteatus	Spangled Drongo		X		
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole		X		
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		X		
	Coracina papuensis	White-bellied Cuckoo-shrike		X		
Hirundinidae	*Hirundo neoxena*	Welcome Swallow		X	X	X

Family	Scientific Name	Common Name	Conservation Status	Deepwater POM	Present Study	
					Around Deepwater Motorboat Club	Webster Street
	Hirundo nigricans	Tree Martin		X		
	Hirundo ariel	Fairy Martin		X		
Motacillidae	*Anthus novaeseelandiae*	Australian Pipit		X		
Campephagidae	*Lalage suerii*	White-winged Triller		X		
Artamidae	*Artamus cyanopterus*	Dusky Woodlswallow		X		
	Artamus leucorhynchus	White-browed Woodswallow		X		
	Cracticus torquatus	Grey Butcherbird		X		
	Strepera graculina	Pied Currawong		X	X	X
	Gymnorhina tibicen	Australian Magpie		X	X	X
Corvidae	*Corvus coronoides*	Australian Raven		X	X	X
Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough	R	X		
Passeridae	*Passer domesticus* *	House Sparrow		X		
Fringillidae	*Carduelis carduelis* *	European Goldfinch		X		
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird		X		
Zosteropidae	*Zosterops lateralis*	Silvereye		X		
Estrildidae	*Neochmia temporalis*	Red-browed Firetail Finch		X		
	Taeniopygia bichenovii	Double-barred Finch		X		
	Taenipygia guttata	Zebra Finch		X		
	Lonchura castaneothorax	Chestnut-breasted Mannikin	R	X		
	Lonchura punctulata	Nutmeg Mannikin		X		
Sylvidae	*Coracina tenuirostris*	Cicadabird		X		
	Acrocephalus stentoreus	Clamorous Reed-warbler		X		
	Cisticola exilis	Golden-headed Cisticola		X		
Muscicapidae	*Turdus merula* *	Common Blackbird		X		
Sturnidae	*Acridotheris tristis* *	Indian Mynah		X	X	X

Family	Scientific Name	Common Name	Conservation Status	Deepwater POM	Present Study	
					Around Deepwater Motorboat Club	Webster Street
	Sturnus vulgaris *	Common Starling		X		
Pycnonotidae	*Pycnonotus jocosus* *	Red-whiskered Bulbul		X		
MAMMALS						
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna		X		
Dasyuridae	*Antechinus stuartii*	Brown Antechinus		X		
Phalangeridae	*Trichosurus vulpecula*	Brushtail Possum		X	X	
Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum		X		X
INVERTEBRATES						
Camaenidae	*Meridolum corneovirens*	Cumberland Plain Land Snail	E	X		

Table 3.2 THREATENED FAUNA SPECIES RECORDED IN LOCALITY (5 KM OF SUBJECT SITE) IN THE LAST 10 YEARS

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven Part Test required?
AMPHIBIANS					
Litoria aurea	Green and Golden Bell Frog	V*	E	Large permanent swamps and ponds with plenty of emergent vegetation, especially bulrushes. In areas free of the Plague Minnow (*Gambusia holbrooki*). Potential habitat occurs in swampy areas alongside Webster Street and along the drainage line that flows under Webster Street. However, this habitat is considered marginal because of its estuarine nature and the relative intolerance of most frog species to highly saline environments.	Yes
BIRDS					
Ixobrychus flavicollis	Black Bittern		V	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, this species may occur in flooded grassland, forest woodland, rainforest and mangroves. May potentially occur within mangrove areas along the George River, adjacent to the golf course, and in riparian habitats alongside Webster Street.	Yes
Lophoictinia isura	Square-tailed Kite		V	Open forests, riverine woodlands, scrubs and heathlands, mostly in inland NSW. May very occasionally occur in the subject site as a vagrant when inland populations disperse during drought periods, but the probability of this occurring is extremely low. Therefore, the proposed development would not limit resources available to this species in NSW.	No
Calaptorhynchus lathami	Glossy Black-Cockatoo		V	Eucalypt forests of eastern Australia. Feeds almost exclusively on *Allocasuarina* (sheoak) seeds, particularly *A. littoralis* and *A. torulosa,* occasionally on the seed of *Casuarina* species. May potentially forage in the tree canopy and sub-canopy in relatively intact bushland areas, especially in Sydney Coastal River Flat Forest remnants that are dominated by River Oak.	Yes
Lathamus discolor	Swift Parrot	E*	V*	Breeds in Tasmania and migrates to mainland between March and September to feed on eucalypt blossoms. May very occasionally occur in the subject site as a vagrant when inland populations disperse during drought periods, but the probability of this	No

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven Part Test required?
				occurring is extremely low. Therefore, the proposed development would not limit resources available to this species in NSW.	
Ninox connivens	Barking Owl		V	Inhabits forest, woodland and most common in savannah. Potential foraging and roosting habitat within the tree canopy within the subject site and alongside Webster Street.	Yes
Pyrrholaemus sagittata	Speckled Warbler			In NSW, this species inhabits eucalypt and cypress woodlands on the slopes west of the Great Dividing Range, with an extension of range into the cypress woodlands of the northern Riverina. Speckled Warblers inhabit woodlands with a grassy understorey, often on ridges or gullies. The preferred foraging habitat of the Speckled Warbler includes areas with a combination of open grassy patches, leaf litter and shrub cover. Outside core range of species. Not detected on site.	No
Anthochaera phrygia	Regent Honeyeater	E*	E	Semi-nomadic, occurring in temperate eucalypt woodland forest in south-eastern Australia. Most records are from box-ironbark forests dominated by Swamp Mahogany, Spotted Gum and Riverina Casuarina woodlands. May very occasionally occur in the subject site as a vagrant when inland populations disperse during drought periods, but the probability of this occurring is extremely low. Therefore, the proposed development would not limit resources available to this species in NSW.	No
MAMMALS					
Dasyurus maculatus	Spotted-tailed Quoll		V	Wet and dry sclerophyll forests, rainforests, woodlands and coastal heaths. No recent records of this species in the locality. Highly unlikely to occur on the subject site or in fauna habitat areas alongside Webster Street.	No
Petaurus norfolcensis	Squirrel Glider		V	Inhabits dry sclerophyll forest and woodland. In s.e Australia it has been recorded in stands of *E. botryoides*, Blackbutt (*E. pilularis*) and Spotted Gum (*Corymbia maculata*). No habitat available. Unlikely to occur on site.	No
Pteropus policephalus	Grey-headed Flying-fox		V	Wet and dry sclerophyll forests, rainforests, paperbark swamps and mangroves to 700 m elevation. Potential wildlife corridor and foraging habitat within forested areas of the subject site.	Yes
Mormopterus norfolkensis	East Coast Freetail Bat		V	Sclerophyll forests, woodlands and, occasionally, rainforests. . Potential wildlife corridor and foraging habitat within forested areas of the subject site.	Yes
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V	Wet forests and woodlands, preferring gullies and highland areas up to 1500 m above sea level. Potential wildlife corridor and foraging habitat within forested	Yes

Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Habitat Requirements and Likelihood of Occurrence	Seven Part Test required?
				areas of the subject site.	
Miniopterus orianae oceanensis	Eastern Bentwing Bat		V	From Kimberly to the Top End and from Cape York Peninsula on eastern side of the Great Dividing Range through to the south-east corner of South Australia. Found in rainforest, wet and dry sclerophyll forests, woodland and grasslands. Roosts in culverts and mines. Potential wildlife corridor and foraging habitat within forested areas of the subject site.	Yes
Myotis macropus	Large-footed Myotis		V	Sclerophyll forests, mangroves, paperbark swamps, woodlands and rainforests near slow-moving creeks, lakes and estuaries. Potential foraging habitat available in forested and woodland areas of subject site and wetlands.	Yes
Scoteanax ruepellii	Greater Broad-nosed Bat		V	Found in sclerophyll forests, rainforests, woodlands and moist gullies below 500 m above sea level. Potential wildlife corridor and foraging habitat within forested areas of the subject site.	Yes
INVERTEBRATES					
Meridolum corneovirens	Cumberland Land Snail		E	Restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River Flat Forest, especially where it meets Cumberland Plain Woodland. Potential habitat areas in intact forest areas on the northern and southern sides of Webster Street. Not detected there despite targeted searches.	Yes

Notes:
** = Listed under the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).*
E1 = Endangered under Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act).
E4 = Presumed Extinct under Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act).
E1 = Endangered under Schedule 1 of the TSC Act and EPBC Act.*
E4 = Presumed Extinct under Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act).*
V = Vulnerable under Schedule 2 of the TSC Act.
V = Vulnerable under Schedule 2 of the TSC Act and EPBC Act.*

3.3.4 Regionally-rare Species

Fauna species that are considered to be rare in western Sydney and which have been recorded previously in Deepwater Park include the Musk Duck (*Biziura lobata*), Great Egret (*Ardea alba*), Latham's Snipe (*Gallinago hardwickii*), White-bellied Sea-eagle (*Haliaeetus leucogaster*), Wedge-tailed Sea-eagle (*Aquila audax*), Grey Goshawk (*Accipiter novaehollandiae*), Whistling Kite (*Haliastur sphenurus*), Peregrine Falcon (*Falco peregrinus*), Fork-tailed Swift (*Apus pacificus*), White-throated Needletail (*Hirundapus caudacutus*), Little Friarbird (*Philemon citreogularis*), Black-chinned Honeyeater (*Melithreptus gularis*), Brown Honeyeater (*Lichmera indistincta*), Yellow-rumped Thornbill (*Acanthiza pusilla*), Buff-rumped Thornbill (*Acanthiza reguloides*), White-winged Chough (*Corcorax melanorhamphos*), Chestnut-breasted Mannikin (*Lonchura castaneothorax*) and Sugar Glider (*Petaurus breviceps*).

None of these species were recorded on the subject site or in surveyed habitat areas alongside Webster Street during the present study. There are no hollow-bearing trees in these areas that could potentially be used as a den site for Sugar Gliders. There were no Sugar Glider food- or tree-climbing scars detected on tree trunks within the subject site.

The proposed development would result in an insignificant amount of habitat available in the locality for these species being removed or modified. Therefore, the proposed development would not significantly impact on the status of local populations of any of these species or their habitats.

3.3.5 Listed Migratory Species

Migratory species that are protected under the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) are listed under the schedules of the EPBC Act.

The habitat requirements of listed migratory species that have been recorded in the locality, and their likelihood of occurring on the subject site are shown in Table 3.4.

The Black-faced Monarch (*Monarcha melanopsis*), Satin Flycatcher (*Myiagra cyanoleuca*), Rufous Fantail (*Rhipidura rufifrons*) and Regent Honeyeater, may occasionally forage within the canopy in forested areas of the subject site. The Swift Parrot (*Lathamus discolor*) may occasionally forage within the canopy in woodland areas of the subject site, but this species is likely to be, at best, occasional vagrants to the site. Latham's Snipe (*Gallinago hardwicki*), Cattle Egrets (*Ardea ibis*) and Great Egrets (*Ardea alba*) may occasionally forage in the disturbed, cleared areas of the subject site. Fork-tailed Swifts (*Apus pacificus*) and White-throated Needletails (*Hirundapus caudacutus*) may occasionally fly high over the subject site. The areas of habitat on the subject site are negligible amounts available to these species.

3.4 WILDLIFE CORRIDORS

The regional wildlife corridor is outside the subject site, along the southern bank of the Georges River. The riparian vegetation along the northern bank of the Georges River probably contributed to the width of this corridor in the past, however, it has been significantly narrowed and fragmented in the suburbs of Milperra and Hammondville

because of encroaching urban development. Therefore, the proposed development will not fragment or isolate the existing regional wildlife corridor.

3.5 KOALA HABITAT ASSESSMENT

Although one food tree species, the Forest Red Gum (*Eucalyptus tereticornis*), is common in Deepwater Park, there are no known records of Koalas occurring on the subject site or within a 5 km radius of the site.

No Koala scats or tree scratchings were observed on trees within the subject site or neighbouring bushland areas, suggesting that Koalas do not use these areas on a regular basis and, at best, are likely to be occasional vagrants. Koalas are most unlikely to occur on the subject site because of the urbanised nature of the surrounding landscape (including busy roads), the site's isolation from remnant areas of bushland, its small size, and the lack of recent records of Koalas occurring in the locality in recent times.

Table 3.3 NATIONALLY-LISTED MIGRATORY SPECIES RECORDED WITHIN LOCALITY (5 KM OF SUBJECT SITE)

Legend:
E: *Environmental Protection & Biodiversity Conservation Act, 1999*..
J: Listed on the Japanese and Australian Migratory Bird Agreement (JAMBA).
C: Listed on the Chinese and Australian Migratory Bird Agreement (CAMBA).
R: Listed on the Republic of Korea and Australian Migratory Bird Agreement (ROKAMBA).

Family	Scientific Name	Common Name	EPBC Act Status	Habitat Requirements and Likelihood of Occurrence	Significant Development Impact?
Ardeidae	*Ardea ibis*	Cattle Egret	J, C	Occurs in fields, marshes, freshwater wetlands, pastures, livestock pens, swamps, garbage tips and along air strips. Often associated with the presence of cattle because the livestock stir up insects that are eaten by the birds. Nests in colonies in swamp woodland. There are no nesting colonies of cattle egrets on or adjacent to the subject site. More likely to nest in mangrove areas along the western bank of the Georges River, which would not be impacted on by the proposed development. An occasional individual may forage in open areas of the subject site, but this is considered marginal habitat because of the absence of domesticated livestock on the site.	No
Ardeidae	*Ardea alba*	Great Egret	J, C	Occurs in shallows of rivers and estuaries; tidal mudflats, freshwater wetlands; sewage ponds, irrigation areas, larger dams, etc. Nests in the canopy of trees over water in swamp woodland and in mangroves. There are no nesting colonies of cattle egrets on or adjacent to the subject site. More likely to nest in mangrove areas along the western bank of the Georges River, which would not be impacted on by the proposed development. An occasional individual may forage along the shoreline of Georges River, or in the creeks and mangrove areas adjacent to the subject site. These areas are considered to be a negligible amount of total habitat available for this species at a local, regional or broader geographical level.	No
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe	R, J, C	Usually found on soft wet ground or in shallow water that contains grass tussocks or other green or dead vegetation. Also	No

Family	Scientific Name	Common Name	EPBC Act Status	Habitat Requirements and Likelihood of Occurrence	Significant Development Impact?
				occurs in wet paddocks, seepage areas below dams, irrigated areas, in scrub or open woodland areas, saltmarshes and along the fringes of mangroves. Small numbers of individuals may occasionally occur in open, disturbed areas of the subject site, particularly within the subject site's floodplain. This species has not been recorded on the subject site and the amount of potential habitat to be cleared or modified is a negligible amount of habitat available for this species at a local, regional or broader geographical level.	
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-eagle	C	Forages along coasts, estuaries, inlets, large rivers and on inland lakes and reservoirs. Nests in tall, live trees (usually eucalypts) near water. Potential foraging habitat occurs along the Georges River. No White-bellied Sea-eagle nests have been detected on the subject site, but potential nesting habitat does occur in forested areas. This habitat will be retained and improved as habitat for native fauna. However, this species is more likely to nest in mangrove areas on the western bank of the Georges River, rather than on the subject site.	No
Psittacidae	*Lathamus discolor*	Swift Parrot	E	Occurs in forests, woodlands and urban parks and gardens, especially where there are eucalypts. Does not breed in mainland Australia. Likely to be a very occasional vagrant to treed areas of the subject site. Potential habitat on the subject site represents a negligible amount of marginal foraging habitat available for this species at the local, regional or broader geographical level.	No
Dicruridae	*Monarcha melanopsis*	Black-faced Monarch		Occurs in rainforests, eucalypt woodlands and coastal scrub. May occur in more open woodland when on seasonal migration. Likely to be a very occasional vagrant to treed areas of the subject site. Potential habitat on the subject site represents a negligible amount of marginal foraging habitat available for this species at the local, regional or broader geographical level.	No

Family	Scientific Name	Common Name	EPBC Act Status	Habitat Requirements and Likelihood of Occurrence	Significant Development Impact?
Dicruridae	*Myiagra cyanoleuca*	Satin Flycatcher		Occurs in heavily vegetated gullies in forests and taller woodlands, usually above the shrub layer. During migration it may occur in coastal forests, woodlands, mangroves, trees in open country and in gardens. Likely to be a very occasional vagrant to treed areas of the subject site. Potential habitat on the subject site represents a negligible amount of marginal foraging habitat available for this species at the local, regional or broader geographical level.	No
Dicruridae	*Rhipidura rufifrons*	Rufous Fantail		Occurs in the undergrowth of open forests/wetter eucalypt forests/gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves and riparian vegetation; and urban parks and gardens. Likely to be a very occasional vagrant to treed areas of the subject site. Potential habitat on the subject site represents a negligible amount of marginal foraging habitat available for this species at the local, regional or broader geographical level.	No
Meliphagae	*Xanthomyza phrygia*	Regent Honeyeater	E	Semi-nomadic, occurring in temperate eucalypt woodland forest in south-eastern Australia. Most records are from box-ironbark forests dominated by Swamp Mahogany, Spotted Gum and Riverina Casuarina woodlands. Likely to be a very occasional vagrant to treed areas of the subject site. Potential habitat on the subject site represents a negligible amount of marginal foraging habitat available for this species at the local, regional or broader geographical level.	No
Apodidae	*Apus pacificus*	Fork-tailed Swift	R, J, C	Aerial flier over most habitats across Australia. Usually flies high in sky in association with cold- or storm-fronts. Flocks may fly high above the subject site. Would not be impacted by the proposed development.	No
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	R, J, C	Aerial flier over most habitats across Australia. Usually flies high in sky in association with cold- or storm-fronts. Flocks may fly high above the subject site. Would not be impacted by the proposed development.	No

4

CONCLUSIONS AND RECOMMENDATIONS

4.1 OVERVIEW

This chapter evaluates if the proposed development will significantly impact on ecological processes and the conservation value of the subject site, especially with respect to threatened fauna species and their habitats, and on the ecological integrity of the landscape. It also recommends ways in which impacts can be minimised or avoided.

The potential impacts may be grouped into the following categories:

- loss of fauna habitat (Section 4.2.1);
- disturbance to wildlife (Section 4.2.2);
- increased road mortality of wildlife in Deepwater Park (Section 4.2.3);
- impacts on the status of threatened species (Section 4.2.4)
- impacts on the status of listed migratory species (Section 4.2.5);
- impacts on the status of Sugar Gliders: a locally-rare species (Section 4.2.6)
- impacts on aquatic and riparian habitats (Section 4.2.7); and
- extent of compliance with statutory planning instruments, including relevant plans of management (Section 4.3).

Each of these impacts already exists in Deepwater Park to a significant extent. However, each is discussed in detail below with respect to the proposed development.

4.2 POTENTIAL IMPACTS

4.2.1 Loss of Fauna Habitat

(a) Biodiversity Values

Biodiversity is the diversity and richness of living things. This includes the variety of plant communities and animal habitats, and the number of different species. Most natural areas support a complex mixture of different species and plant communities. Biodiversity in disturbed areas is generally lower than in more pristine areas. An awareness of native biodiversity emphasises the conservation of the variety of native life, rather than just rare or threatened species.

There are three important principles associated with ESD. These are:

- maintenance of native biodiversity;
- erring on the side of caution when assessing and taking risks with the biological environment; and
- passing on to future generations a natural environment that is at least as good and enjoyable as our own.

Many species of woodland and forest flora and fauna are threatened both nationally and within New South Wales. This is largely as a result of the clearing of this native habitat.

The proposed development is unlikely to result in the loss of biodiversity at a local, regional, state or national level. This is because of the relatively small area to be developed, the degraded nature of habitats that presently occurs over much of the subject site, the unlikelihood of the status of threatened or regionally significant species being significantly placed at risk, and the broader distribution of other fauna and flora species. Compensatory fauna habitat would also be created as part of the proposed landscape plan.

(b) No Net Loss Policy

All Australian Governments committed themselves, through the Natural Heritage Trust, to a reversal, across the entire Australian landscape, in the long-term decline in the extent and quality of native vegetation, and thus leading to a net gain and a first target of no net loss by the end of 2001 (ANZECC 2000).

This goal is known as the "no net loss" goal. The notion of "no net loss" provides one of the bases for assessing the use of ecologically sustainable resources. The no net loss goal contains the following key concepts:

- no net loss will be measured across the entire Australian landscape;
- there will be no net loss in extent and quality of vegetation; and
- there will be an eventual net gain in the extent and quality of vegetation.

The proposed development would be on land that has already been cleared of most of the original fauna habitat. Clements *et al*. (2011) show that the development proposal will require the removal of 22 (32%) of the 68 definite and possible remnant trees in good to moderate health with:

- 8 trees located under or near the building or pool (Tree #3, 7b, 9, 10, 11, 12, 14, and 23a); and

- 14 trees not under or near the building or pool (Tree #49, 53, 54, 55, 93, 101, 102, 103, 108, 109, 110, 117, 118, 119).

There are 65 (85%) of the 76 trees (including the additional four planted trees in the proposed Amphitheatre area), that were definitely or probably planted or remnants in poor health, proposed for removal on Existing Tree Plan and Schedule, Drawing Ref No: LSK 10646-101-B (Context July, 2011):

- 42 trees under or near the building or pool, and
- 23 trees not under or near building or pool

The removal of these trees is unlikely to result in the loss of biodiversity at a local, regional, state or national level.

4.2.2 *Disturbance to Wildlife*

There is the potential for increased localised noise and light disturbances during the operational (post-construction) phase of the proposed development.

Light spillage already occurs from the existing building whenever there are night-time functions. It is likely that increased light pollution from the modified building would deter some native fauna from using potential habitat areas within the proposed landscaped area of the subject site at night time.

Existing functions at Deepwater Motorboat Club already produce noise pollution, which is likely to deter fauna from using potential habitat areas immediately adjacent to the building. This impact is likely to increase in duration if noisy functions are to be held at a greater frequency.

However, better quality fauna habitat areas of Deepwater Park to the north of the car park, west and east of the building, and north of Webster Street would be buffered from light and noise pollution by distance, the tall timber baton wall around part of the subject site and the dampening effects of retained vegetation remnants. Light and noise pollution would cease at midnight and would occur only on days or nights when there are functions at the Deepwater Motorboat Club.

4.2.3 *Increased Road Mortality of Wildlife*

Increased vehicular traffic flow along Webster Street as a result of increased patronage at the Deepwater Motorboat Club has the potential to increase injury or mortality to wildlife crossing that road. This increase is not likely to be significant provided that the existing 10 km/hr speed limit along Webster Street is enforced.

4.2.4 *Impacts on Threatened Species*

There is potential habitat for an additional 10 threatened species, three of which (Square-tailed Kite, Regent Honeyeater and Swift Parrot) are infrequent vagrants to the locality and would not be regular visitors to the subject site.

Seven-part tests in Appendix A conclude that the proposed development would not significantly impact on the status of the Green and Golden Bell Frog, Black Bittern, Glossy Black-Cockatoo, Barking Owl, Grey-headed Flying-fox, Eastern False Pipistrelle, Large-footed Myotis, Greater Broad-nosed Bat, Eastern Bent-wing Bat and Cumberland Plain land Snail.

Three additional threatened species (the Square-tailed Kite, Swift Parrot and Regent Honeyeater) only occur in the locality as irregular vagrants. If they visit Deepwater Park, they would occur infrequently and in low numbers. Therefore, the proposed development is most unlikely to significantly impact upon the status of these species or their habitats.

One nationally vulnerable fauna species (the Grey-headed Flying-fox) may potentially occur within the forested areas of the subject site. Two nationally endangered fauna species (Swift Parrot, Regent Honeyeater) may very occasionally occur on the subject site as vagrants.

Under the EPBC Act, a nationally vulnerable species is significantly impacted on if a proposal is likely to:

- lead to a long-term decrease in the size of an important population of a species; or
- reduce the area of occupancy of an important population; or
- fragment an existing important population into two or more populations; or
- adversely affect habitat critical to the survival of a species; or
- disrupt the breeding cycle of an important population; or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; or
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or
- interfere substantially with the recovery of a species.

The Grey-headed Flying-fox is a highly mobile species and the proposed development would not hinder the movement of this species to the extent that a population would be fragmented. In the Sydney region, this species congregates in areas where there is prolific flowering of Swamp Mahogany (*Eucalyptus robusta*) and/or Coast Banksia (*Banksia integrifolia*). Neither of these species occurs within the subject site.

Under the EPBC Act, a nationally endangered species is significantly impacted on if a proposal is likely to:

- lead to a long-term decrease in the size of a population; or
- reduce the area of occupancy of a species; or
- fragment an existing population into two or more populations; or
- adversely affect habitat critical to the survival of a species; or
- disrupt the breeding cycle of a population; or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; or
- result in invasive species that are harmful to a endangered species becoming established in the endangered species' habitat; or
- interfere substantially with the recovery of a species.

The Swift Parrot and Regent Honeyeater may occasionally feed on the nectar of eucalypts and other trees when these trees are flowering within the subject site. However, there are no limiting resources for these two species on the subject site.

4.2.5 Impacts on Migratory Species

Under the EPBC Act, a migratory species is significantly impacted on if a proposal will or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species; or

- result in invasive species that are harmful to the migratory species becoming established in an area of important habitat of the migratory species; or

- seriously disrupt the life cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

The Regent Honeyeater and Swift Parrot (*Lathamus discolor*) may occasionally forage within the canopy in bushland areas of the subject site, but these species are likely to be, at best, occasional vagrants to the site. Latham's Snipe (*Gallinago hardwicki*) may occasionally forage in the disturbed, cleared areas of the subject site. Fork-tailed Swifts (*Apus pacificus*) and White-throated Needletails (*Hirundapus caudacutus*) may occasionally fly high over the subject site. The area of habitat that would be cleared from the subject site is a negligible amount of area available to these species. Therefore, neither road option is likely to have a significant impact on the status of migratory species.

4.2.6 Impacts on Sugar Gliders: A Locally Rare Species

There are no hollow-bearing trees in the subject site or alongside Webster Street that could potentially be used as a den site for Sugar Gliders. There were no Sugar Glider food- or tree-climbing scars detected on tree trunks within the subject site. Tree removal from the subject site would not fragment or isolate areas of potential habitat for this species within Deepwater Park.

Light and noise pollution from the Deepwater Motorboat Club is likely to deter Sugar Gliders from using treed areas immediately adjacent to the building. However, this impact is already likely to exist to a significant extent. Better quality habitat areas north, east and west of the subject site are likely to be buffered from these pollution impacts (see Section 4.2.2).

4.3 COMPLIANCE WITH STATUTORY PLANNING INSTRUMENTS

4.3.1 Deepwater Park Plan of Management 2002

Section 9.4 of the Deepwater Plan of Management states:

"*Maxwell Avenue in the north and Webster Street in the south of Deepwater Park, are currently linked by a semi-circular road that is in various stages of disrepair. This plan of management supports the recommended closure of part of this link road contained in the Georges River Open Space Plan of Management. The road is encouraging dumping of cars and industrial waste and littering, trampling of native vegetation and weed colonisation.*

"*The roads currently have a gravel surface that requires regular upgrading. The sealing of the road would reduce the potential for erosion from stormwater or during flood events*."

The road works that are proposed as part of the proposed development would provide and maintain the upgrade required in the Deepwater Plan of Management. Section 4.4 recommends the implementation of a regular and long-term weed control program as part of the road upgrade.

Section 9.5 states:

" *Large sections of the shrub layer in the area between the circuit road and the Georges River has been cleared. The canopy layer in the northwest is relatively intact and the ground cover consists mostly of mown native grass. It is recommended that mowing eventually cease in this area*

pending availability of Council funds for regeneration and demand for recreation activities. A suitable buffer of 5 metres either side of water courses and ponds needs to be maintained."

A buffer that is more than five metres in width will be maintained between the edge of the modified building and watercourses (including Georges River). The proposed landscape plan provides for the planting of an increase in the numbers of trees and bushes on the subject site. This should improve the subject site as a wildlife corridor link along the northern bank of the Georges River.

Section 9.10 states:

" *Weed infestation is the major management issue within Deepwater Reserve. In general, the overall condition of Deepwater Reserve is fair to poor. The weed infestation is due to:*

- *Disturbance of soil profile and clearing of native vegetation;*
- *Transportation and attachment to people pursuing recreation activities;*
- *Transportation by floodwater and stormwater;*
- *Impacts caused by current landuse activities.*

" *… The major areas of dense weed infestation are along the edges of all the roads including the M5, the "bushland areas" in Bluegum Farm and bushland areas in the west of the Park. There are less dense areas of weed infestation south of Maxwell Street and the area between the ponds and Henry Lawson Drive. Councils' Catchment Officer is treating aquatic weed infestations such as Alligator weed.*

" *There are occurrences of Alligator weed (W1) in the ponds in the centre of the Park and in the Paperbark Swamp Woodland in the northern section of Bluegum Farm. The area of bushland in the north of Bluegum Farm contains Blackberry (W2), Green Cestrum (W2), Pampus Grass (W2) and Lantana (W2). These Lantana and Green Cestrum infestations are some of the worst infestations in the Bankstown Local Government Area. They also extend into the adjoining bushland. There is also an outbreak of Green Cestrum (W2) in the bushland near the road-edge south of Maxwell Street.*

" *There is an outbreak of Blackberry (W2) near the stormwater channel near the entrance to Maxwell Avenue and on the M5 embankment. Lantana (W2) also occurs on the embankment.* "

Increased traffic flow along Webster Street is likely to increase weed invasion in the Park. Therefore, there would be a need for an ongoing weed removal program along the edges of Webster Street, with priority given to the removal of noxious weeds and detaching climbers, in accordance with the general recommendation of weed control in the Deepwater Plan of Management.

4.3.2 Blacktown City Council Biodiversity Strategy 2002

The Biodiversity Strategy prescribes the following measures for enhancing core habitat in Deepwater Reserve:

- undertake detailed mapping of the location and extent of weed infestation;
- identify priorities and costs associated with bush regeneration works;

- identify areas for revegetation. This should be done in accordance with the Corridor Strategy;
- identify areas for habitat construction, in particular, frog ponds and bird habitat, consistent with Strategies 6A & 6B;
- undertake baseline fauna survey;
- develop an enhancement plan for each pilot area that will regenerate all weed infested areas and revegetate as required;
- establish infrastructure for Bushcare groups at each pilot area;
- produce an educational pamphlet outlining the damage done to the reserve through garden escapees, etc and inviting people to become members of their Bushcare group. This pamphlet to be targeted at reserve neighbours;
- provide a supplementary pamphlet detailing works that can be undertaken to improve the biodiversity value of neighbours' yards;
- identify exact locations of threatened plants and incorporate into PoMs; and
- commence on-ground works.

The proposed development would not prevent these measures from being undertaken.

4.3.3 Draft Bushland Plan of Management for Reserves at Milperra 2003

This Plan of Management is applicable only to Auld Reserve, Newland Reserve, Piper Reserve, Vale of Ah Reserve, Whittle Reserve and Lot 5, Prescot Parade. Therefore, it is not relevant to the present study.

4.3.4 SEPP 44 – Protection of Koala Habitat

The subject site does not contain Potential or Core Koala Habitat, as defined under the schedules of SEPP 44. Therefore, the proposed development will have no impact on Koalas or their habitats.

4.4 RECOMMENDATIONS

- **Silt fences and sediment ponds should be appropriately placed around construction areas on the subject site and along Webster Street** to prevent runoff of sediment and nutrient-enriched waters into nearby bushland areas and drainage lines. The effectiveness of these traps should be closely monitored during construction, ensuring that treated site run-off meets EPA guidelines.

- **Trees and other vegetation that are to be removed from the subject site should be conducted with minimal disturbance to the soil.**

- **Trees that are to be cleared from the subject site, should be checked first for the presence of active nests of birds (that is, those nests containing fertile eggs or nestlings) and arboreal mammals (such as possums).** These trees should not be removed or pruned until animals that are nesting in them have completed their breeding cycle.

- **Trees or bushes that are cleared or pruned should be checked for animals before and after felling or pruning**. Injured animals should be taken to a local vet or the local wildlife rescue service should be notified.

- **Construction wastes will require appropriate management to prevent accidental discharge of chemicals, truck washings or other pollutants into waterways and vegetation on the subject site and downstream**

- **The proposed widening of Webster Street should be done in accordance with the recommendations of Clements *et al*. (2011), mainly:**

  (a) that the widening is largely restricted to weed-infested existing road verges; and

  (b) the vegetation immediately adjoining Webster Street is carefully bush regenerated routinely with dense local native vegetation to be established to the edge of Webster Street to reduce risk of indirect impacts from edge effects and roadside invasion by exotic species.

  This approach will also reduce any indirect impacts on native fauna using the area. If trees are to be pruned, then such trees should be thoroughly checked for native wildlife before works commence.

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Appendix A

Seven-part Tests of Significance

APPENDIX A
SEVEN-PART TESTS OF SIGNIFICANCE

INTRODUCTION

The Seven-Part Test is a standard set of questions devised by the Scientific Committee established under the *Threatened Species Conservation Amendment Act 2002.* The Test should be applied individually to all threatened species, populations and ecological communities and their habitats that are to be, or likely to be, on the site to be developed.

The results of a Seven-Part Test help determine the nature and significance of impacts of the proposed development or activity on threatened species, populations or ecological communities, or their habitats, and whether the preparation of *Species Impact Statement* (SIS) is required.

An SIS provides a more detailed assessment of threatened biota issues and proposes measures to manage and mitigate adverse impacts on the threatened species, populations or ecological communities, or their habitats, resulting from the proposal.

Appendix A provides Seven-part tests for the following threatened fauna in relation to the proposed development:

Frogs

- Green and Golden Bell Frog (*Litoria aurea*)

Birds:

- Black Bittern (*Ixobrychus flavicollis*);
- Glossy Black-Cockatoo (*Calytorhynchus lathami*); and
- Barking Owl *(Ninox corneovirens*).

Microchiropteran Bats:

- Grey-headed Flying-Fox (*Pteropus policephalus*);
- East Coast Freetail Bat (*Mormopterus norfolkensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Common Bent-wing Bat (*Miniopterus schrebersii*);
- Large-footed Mouse-eared Bat (*Myotis adversus*); and
- Greater Broad-nosed Bat (*Scoteanax ruepelli*).

Invertebrates:

- Cumberland Plain Land Snail (*Meridolum corneovirens*).

GREEN AND GOLDEN BELL FROG (*Litoria aurea*)

1. SPECIES PROFILE

The following profile summarises information provided in the Draft Recovery Plan for the Green and Golden Bell Frog in NSW (DEC 2005).

Description

The Green and Golden Bell Frog is a relatively large frog with a stout body form. Adult size ranges from approximately 45 to 100 mm snout to vent length (SVL), with most individuals being in the 60 to 80 mm size class. Males are generally smaller than females (maximum size 70 mm) and when mature, tend to have a yellowish darkening of the throat area. Males also develop nuptial pads on the inner finger and appears as a brown pigmented patch. Mature females are larger bodied (maximum size 90 to 100 mm) (White and Pyke 1996).

The dorsal coloration is quite variable being a vivid pea green splotched with an almost metallic brass brown or gold. The backs of some individuals may be almost entirely green while in others the golden brown markings may almost cover the dorsum. When the frogs are inactive coloration can darken to almost black. A glandular creamish white stripe extends from behind the eye almost to the groin. The lower margin of this dorso-lateral stripe is black or dark brown, the upper margin is edged gold.

The belly is usually an immaculate granular creamish white. The lateral margins of the body are adorned with raised glandular creamish spots of irregular size. Legs are a variegated green and gold with the groin area and inside leg a brilliant electric blue. The fingers and toes have expanded terminal pads but are rarely wider than the toe/finger itself. The toes are heavily webbed. The eye has a horizontal elliptical pupil and a golden yellow iris. Juveniles are similar to adults and metamorphose at 25 to 30 mm SVL.

Tadpoles are relatively large, reaching 65 to 80 mm. They are deep bodied and possess long tails with a high fin that extend almost to mid-body. They swim actively and evade capture. As tadpoles become larger, the golden dorso-lateral stripe and a green tinge to the back can be observed just before the limb growth commences (White 1995).

Distribution

The Green and Golden Bell Frog was formerly distributed from the NSW north coast near Brunswick Heads southwards along the NSW coast to Victoria where it extends into Queensland (White & Pyke 1996; Gillespie 1996), west to Bathurst, Tumut and the ACT (Moore 1961, Osborne *et al.* 1996). There are records from the NSW tableland areas such as Armidale/Ulong (New England Tableland) and Canberra, Cobargo and Jindabyne (Monaro Tableland).

In the 1960s the species was considered widespread, abundant and commonly encountered. Declines were noticed in the 1970s and became severe in the 1980s such that today the species exists as a series of isolated populations within its former known range. Since 1990 there have been approximately 50 locations in NSW where the species is confirmed to still exist (only 11 in conservation reserves). There are six populations of substantial size (numbers over 300); two are located in the Sydney metropolitan area, two in the Shoalhaven area, and two on the mid north coast (White and Pyke 1996).

Habitat

The habitat preference and requirements of the Green and Golden Bell Frog is not well understood and the species has, on occasions, turned up in the most unlikely locations. It inhabits marshes, dams and stream sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water bodies which are unshaded, free of the predatory fish *Gambusia holbrooki,* have a grassy area nearby and diurnal sheltering sites such as vegetation and/or rocks (White and Pyke 1996). Some sites, particularly in the Greater Sydney region, are in highly disturbed areas such as disused industrial sites, brick pits, landfill areas and cleared land.

Refuge habitat is least well understood, but is required by the species during periods of metabolic quiescence, particularly during cooler parts of the year ("over-wintering habitat") and at other times when not diurnally active or seeking shelter from adverse conditions or predators. Types of refuge habitats that have been identified include dense tussock-forming vegetation (Hamer 1998; Patmore 2001), deep fissures in mud (M. Christy, cited by Patmore 2001), among rocks (White & Pyke 1996; Hamer 1998), within rotting logs or under embedded logs and timber piles (Pyke & White 2001) and other human refuse, e.g. sheet iron, fibro, bricks, etc. (Pyke & White 2001).

Reproduction

The Green and Golden Bell Frog is frequently active by day and usually breeds in summer when conditions are warm and wet (Cogger 2000). Males call while floating in water and females produce a raft of eggs which initially float before settling to the bottom, often among the vegetation (Harrison 1922). Tadpoles take approximately six weeks to develop, though this varies considerably and is dependent on temperature and other conditions (Pyke and White 1996). Tadpoles feed on algae and other vegetative matter while adults are voracious insectivores and will also readily eat other frogs and juveniles of their own species. They are preyed upon by snakes and various wading birds, and are presumably fed on as larvae by eels, other fish and tortoises.

Predator/Prey Relationships

Adult Green and Golden Bell Frogs are known to feed on a range of aquatic and terrestrial invertebrates (e.g. insect larvae), crickets, cockroaches, dragonflies, earthworms, flies, grasshoppers, mosquito wrigglers, isopods, freshwater crayfish and slugs) and frogs (especially tadpoles).

Tadpoles predominantly graze on algal, bacterial scum or other vegetative matter growing on submerged rocks or other substrata. Occasionally, they may scavenge or become carnivorous on other aquatic organisms.

They are preyed upon by snakes, various wading birds, large invertebrates (e.g. water beetles, water scorpions), occasionally by raptors, and are presumably fed on as larvae by eels, other fish (e.g. Plague Minnow) and tortoises.

Threats to Status of Green and Golden Bell Frogs

Threats to this species include:

- Habitat loss, modification and disturbance (including the Key Threatening Processes "clearing of native vegetation" and "alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands").
- Fragmentation and isolation of habitat.
- Road mortality where populations are already small due to other threats (Daly 1996).
- Predation by exotic fish, particularly the Plague Minnow *Gambusia holbrooki* (a Key Threatening Process).
- Infection of frogs by amphibian chytrid fungus that causes the disease chytridiomycosis (a Key Threatening Process).
- Water pollution.
- Predation by feral animals such as foxes and cats (a Key Threatening Process).

1. SEVEN-PART TEST

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The subject site is within the range of the Lower Georges River key population, which is referred to as the Hammondville population in the Draft Recovery Plan for the Green and Golden Bell Frog (see Figure A1 of present report). This population has apparently undergone severe declines in recent years and its current status is likely to be precarious (A. White, cited by DECC 2007). DECC states that "*the level of knowledge and understanding of this population is limited and generally has not been gathered in a systematic way. Migratory patterns and measures of recruitment are unknown. This key population is currently being investigated and a management plan being prepared by DECC.*"

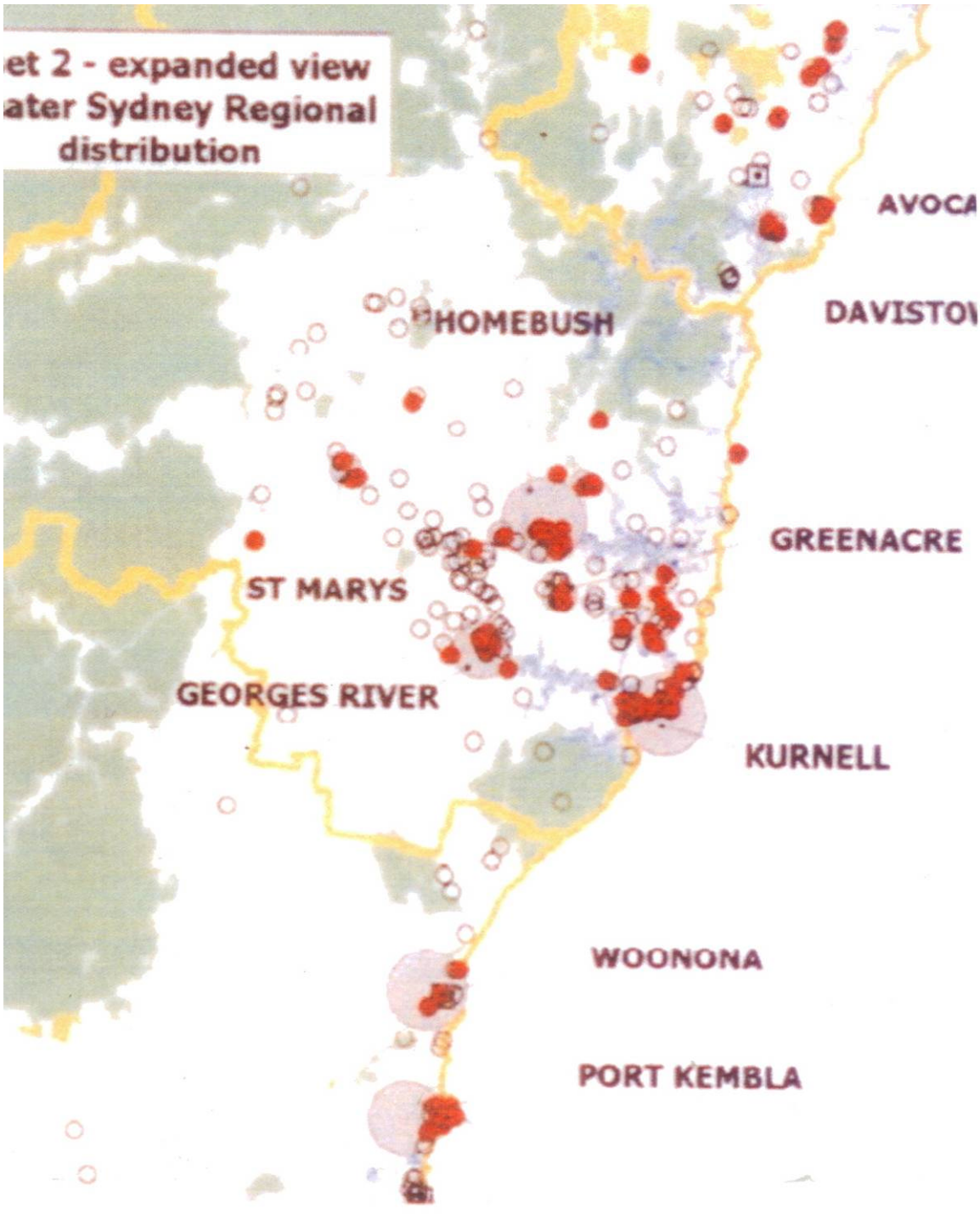
There are 40 records of the Green and Golden Bell Frog occurring within 10 km of the subject site, 12 of which are within 1 km of the subject site, and six of these records are less than 15 years old. This species has been recorded to both the north and south of the subject site, although those to the north are more than 25 years old.

Green and Golden Bell Frogs are capable of moving up to 1-1.5 km in a single night (Pyke & White 2001; A. White, cited by DECC 2007) and tagged individuals have moved up to 3 km over longer periods of time (Pyke & White 2001). Some individuals have been recorded several kilometres from the nearest breeding habitat (Gillespie 1996; Pyke & White 2001) or demonstrated significant movements within a presumed home range (Murphy 1996; Hamer 1998; Patmore 2001 & Daly 2001).

No Green and Golden Bell Frogs were detected in the surveyed areas, including wetland, swampy and riparian habitat adjacent to Webster Street, despite targeted surveys for them. However, parts of the floodplain within Deepwater Park that have emergent wetland vegetation [especially Kikuyu (*Pennisetum clandestinum*), Sea Rush (*Juncus krausii*) and Common Reed (*Phragmites australis*)] may provide corridor, foraging and breeding habitat for the Green and Golden Bell Frog. This habitat is likely to be marginal because of the high incidence of weeds in and around the water bodies the apparent low water quality [e.g. saline waters as a result of estuarine conditions, high turbidity, discoloration and apparent acidity (contamination from acid sulphate soils)] of creeks and dams draining onto the floodplain from other parts of the subject site.

Figure B1 DISTRIBUTION OF KNOWN POPULATIONS OF THE GREEN AND GOLDEN BELL FROG IN THE GREATER SYDNEY AREA (extracted from DEC 2005)

Red dots = recent records (< 17 years old). White dots = pre-1990 records. Light brown areas = expected range of extant population.



The Plague Minnow (*Gambusia holbrooki*), an introduced predator that feeds on the eggs and larvae of the Green and Golden Bell Frog, is also known to occur within wetlands and creeks in Deepwater Park and the adjoining Riverlands Golf Course.

Although there is a possibility of some movement of Green and Golden Bell Frogs into the subject site and potential habitat areas along Webster Street from the south, it is unlikely that there have been recent movements from north of the site. Green and Golden Bell Frogs have not been detected on Riverlands Golf Course in recent years (Ambrose 2008a,b), despite extensive and targeted surveys for them. There is no suitable habitat in areas immediate north of Riverlands Golf Course because of the extensive sand mining that has occurred in land north of the golf course in recent times, the presence of roads with busy traffic (Newbridge/Milperra Road, Auld Avenue to the north of the sand mine site, Raleigh Road and Henry Lawson Drive to the north-west and west) and residential development to north and west of the golf course. Therefore, if some Green and Golden Bell Frog individuals occur immediately to the north and south of the subject site, then these two 'sub-populations' are likely to already be physically isolated.

However, if individual Green and Golden Bell Frogs do occasionally disperse across land in Deepwater Park, they are likely to use the continuous remnant vegetation corridor north of the subject site and Webster Street. This corridor would not be impacted on by the proposed development.

In summary, no Green and Golden Bell Frogs were detected on the subject site during targeted surveys, potential marginal habitat that occurs on or near the subject site is highly degraded as a result of extensive weed infestation, polluted water bodies, and the presence of Plague Minnows, all of which are recognised Key Threatening Processes. However, Deepwater Park may act as dispersal habitat for small numbers of Green and Golden Bell Frogs. If the above recommendations are adopted, it is most unlikely that the proposed development will not adversely effect the life cycle of the Green and Golden Bell Frog such that a viable local population of the species is placed at risk of extinction.

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

There are no listed endangered populations of the Green and Golden Bell Frog in the locality.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. The Green and Golden Bell Frog is listed as a threatened species rather than as an endangered or critically endangered ecological community.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

(i) Parts of the floodplain adjacent to the subject site and Webster Street that have emergent wetland vegetation [especially Kikuyu (*Pennisetum clandestinum*), Sea Rush (*Juncus krausii*) and Common Reed (*Phragmites australis*)] may provide marginal habitat for the Green and Golden Bell Frog. These areas will be protected from the impacts of the proposed development through the use of silt curtains and sediment ponds around construction areas.

(ii) As indicated in Part(a), although there is a possibility of some movement of Green and Golden Bell Frogs into Deepwater Park from the south, it is unlikely that there have been recent movements from north of Deepwater Park because the species has not been recorded on Riverlands Golf Course in recent years. Extensive sand mining has occurred on land immediately north of Riverlands Golf Course and there are roads with busy traffic sourrounding these areas (Newbridge/Milperra Road, Auld Avenue to the north of the sand mine site, Raleigh Road and Henry Lawson Drive to the north-west and west) and residential development to north and west of the golf course. Therefore, if some Green and Golden Bell Frog individuals occur immediately to the north and south of the subject site, then these two 'sub-populations' are likely to already be physically isolated.

(iii) No Green and Golden Bell Frogs were found on the subject site or in potential habitat areas along Webster Street. Habitat in these areas is only likely to be marginal because of its highly degraded nature. It is highly unlikely that the subject site currently acts as a continuous corridor between sub-populations to the north and south of the subject site. Therefore, the subject site is not considered important for the long-term survival of the species.

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

No critical habitat for Green and Golden Bell Frogs occurs in the locality.

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

The specific objectives of the draft Green and Golden Bell Frog draft recovery plan (February 2005) are to:

- increase the security of key Green and Golden Bell Frog (GGBF) populations by way of preventing further loss of GGBF habitat at key populations across the species' range and where possible secure opportunities for increasing protection of habitat areas;

- ensure extant GGBF populations are managed to eliminate or attenuate the operation of factors that are known or discovered to be detrimentally affecting the species;

- implement habitat management initiatives that are informed by data obtained through investigations into the general biology and ecology of the GGBF through a systematic and coordinated monitoring program;

- establish, within more than one institution, self-sustaining and representative captive populations (particularly 'at risk' populations) of the GGBF for the primary purpose of maintaining 'insurance' colonies for re-establishment and supplementation of populations of the species; and

- increase the level of regional and local awareness of the conservation status of the GGBF and provide greater opportunity for community involvement in the implementation of the recovery plan.

The proposed development of the subject site is consistent with the objectives of this recovery plan provided that the recommendations stated in Part (a) are implemented.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Draft Green and Golden Bell Frog Recovery Plan lists the following Key Threatening Processes (KTPs), from Schedule 3 of the TSC Act 1995, as threats to the status of the Green and Golden Bell Frog:

- Predation by the introduced plague Minnow or Mosquito Fish (*Gambusia holbrooki*).
- Alteration to the natural flow regimes of rivers and streams and their floodplains and their wetlands.
- Infection of frogs by amphibian chytrid fungus that causes the disease chytridiomycosis.
- Clearing of native vegetation (destruction of habitat, fragmentation of vegetation and degradation of riparian zone vegetation).
- Predation by the European Red Fox (*Vulpes vulpes*).

The Plague Minnow already exists in water bodies in Deepwater Park. The proposed development is unlikely to result in a significant change in that situation.

It is not known if the chytrid fungus occurs in Deepwater Park. However, as a precaution, it is recommended that:

- Members of construction teams involved in the proposed development be instructed during site inductions about the risks that chytrid fungus poses to frogs, and the work-place measures to be implemented to prevent the fungus from spreading.

- All equipment and muddy and wet footwear used on the construction site, including vehicle tyres, should be cleaned with disinfectant and dried before being taken off the site.

- Construction workers and golf club patrons should be warned to touch frogs on the subject site only when absolutely necessary. If touched, then disposable gloves, sample bags and sterile equipment only should be used. People should also be warned not to collect frogs or move frogs from one area top another.

If these measures are implemented, then it is unlikely that the proposed development would significantly increase the risk of the chytrid fungus being spread to other sites.

The European Red Fox already occurs on the subject site. The proposed development is unlikely to increase the incidence of this species occurring on the site.

2. CONCLUSION

The proposed development of the subject site will not significantly impact on the status of the Green and Golden Bell Frog or its habitats. Therefore, a Species Impact Statement is NOT required for this species in relation to the proposed development.

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BIRD SPECIES

1. SPECIES PROFILES

The Black Bittern inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation (Marchant & Higgins 1990). Where permanent water is present, this species may occur in flooded grassland, forest woodland, rainforest and mangroves (Marchant & Higgins 1990).

The Black Bittern has a wide distribution from southern NSW north to Cape York, along the entire coastline of the Kimberley region, and in south-western WA (Marchant & Higgins 1990). In NSW, records of the species are scattered along the east coast. Individuals are rarely recorded south of Sydney and in inland regions (Marchant & Higgins 1990).

Black Bitterns forage on reptiles, fish and invertebrates, including dragonflies, shrimps and crayfish (Barker & Vestjens 1989). Individuals generally feed at dusk, and at night and during they day they may roost in trees or on the ground among dense reeds (Marchant & Higgins 1990).

The species is generally solitary, but may occur in pairs during the breeding season, which is thought to be from December to March (Marchant & Higgins 1990). Nests may be located on a branch overhanging water and consists of a bed of sticks and reeds on a base of larger sticks (Marchant & Higgins 1990).

There is limited information regarding breeding. The clutch size is thought to be between 3 and 5 eggs (Gilmore & Parnaby 1994) and both the male and female are involved in incubation and rearing of the young (Marchant & Higgins 1990).

Threats to Black Bitterns include (Gilmore & Parnaby 1994):

- grazing and trampling of riparian vegetation by cattle;
- predation by feral cats on eggs and juveniles;
- clearing of riparian vegetation for agriculture;
- drainage, salinisation, siltation and pollution of wetlands and waterbodies; and
- poor representation of preferred habitats in conservation reserves.

Glossy Black-Cockatoo (*Calyptorhynchus lathami*)

The Glossy Black-Cockatoo (Family Cacatuidae) is a dusky-black bird about 50 centimetres in length The two large tail panels are bright red in males, barred and speckled with yellow in females and immatures. Females are also heavily speckled with yellow on the head (Pizzey, 1980; Schodde and Tidemann, 1993).

This species inhabits mountain forests, coastal woodland, open forest, riparian vegetation and partially cleared areas from sea level up to 500-1000 metres. Its distribution is linked to the

distribution of the primary food source, the seeds of *Allocasuarina torulosa, A. verticillata* and *A. littoralis.*

Glossy Black-Cockatoos are confined largely to forests growing on low nutrient soils. However, it is a highly mobile species, often roaming long distances in search for food. It is more likely to occur in drier forest types and appears to prefer intact and less rugged landscapes where forests have not been cleared, such as in the Lower Clarence Valley and the Northern Tablelands (Higgins, 1999).

*Allocasuarina*s need to be present as dense stands if they are to provide adequate food for flocks of Glossy Black-Cockatoos because the trees are dioecious and only about half bear cones. Moreover, Clout (1989) found that the Glossy Black-Cockatoo is a selective feeder, spending about 88% of its day foraging, and extracting seeds only from closed and newly-matured (russet-coloured) cones. The cockatoos also tend to visit those trees with the greatest crop of cones. Clout (1989) noted that only 24% of the 1,672 cone-bearing trees in his subject site had been fed upon by the cockatoos. Secondary food sources include wood-boring grubs, *Angophora* fruit, *Acacia* seeds and, near Sydney, sunflower seeds (Blakers *et al.,* 1984).

The Glossy Black-Cockatoo breeds between March and August, but the main breeding season is from April to June. It requires large tree hollows for nesting and breeding (Forshaw, 1989; Simpson and Day 1993) and shows a preference for tall eucalypts in more open forest types. Females lay a single egg which is incubated for four weeks.

Habitat clearance has reduced the range of this species south and west of the Great Dividing Range (Baird 1986). Burning of fire sensitive species of Allocasuarinas can render feeding habitat unsuitable for several years (Joseph 1982, Pepper 1997). Regenration may be impeded by grazing, either by stock or rabbits. In coastal areas, residential development is an increasing threat. Fragmentation of habitat, especially when associated with agriculture, leads to penetration of competitors from more open habitats and/or ecotones (notably Common Brushtail Possums *Trichosurus vulpecula*, Little Corellas *Cacatua sanguinea* and Galahs *Eolophus roseicapilla*) and increasing competition for hollows (Crowley *et al.* 1998). Without nests being protected against such competitors, recruitment to the adult population may be minimal (Garnett *et a*l. 1999). Illegal trapping for the bird trade may be a localised problem, but is probably not a major threat.

Barking Owl (*Ninox connivens*)

This species is a medium-sized robust owl, smoky-brown above with large white spots on the wings, whitish below with dark grey to rusty streaks, feathered legs and powerful feet. Males grow larger than females. It typically roosts by day in pairs in leafy trees, sometimes in exposed conditions (Pizzey and Doyle, 1996). They are usually found in pairs which occupy 30 - 2000 hectare territories all year round (Schodde and Tidemann, 1993). This species is fairly widespread in NSW, except the far north-west of the state, and it is rare east of the divide (Pizzey and Doyle, 1996). It is distributed in well-forested hills and flats, eucalypt savannah and riverine woodland in coastal and sub-coastal eastern, northern and south-western mainland Australia.

The Barking Owl breeds from July to November and nests in an open hollow 10 - 250 centimetres deep in a trunk or spout of a tree at 3 - 30 m above ground. The chief prey are mammals and birds and it also feeds on insects and other invertebrates. It also takes young hares, rats, mice, occasional small bats and some marsupials, including possums. Birds up to the size of magpies and Tawny Frogmouths are also dietary items (Schodde and Tidemann, 1993).

Much of the habitat of the southern subspecies of the Barking Owl has been cleared (Silveira *et al*. 1997; Higgins 1999; NPWS 1999). Forestry practices, particularly those that include the felling of old-growth forests or over-mature trees, further threaten the species by reducing the availability of nesting and roosting hollows and shelter for breeding season prey (Kavanagh *et al*. 1995; Taylor & Kirsten 2000). On private land, much of the remaining habitat is fragmented and subject to further clearing, firewood collection and grazing, and there has been little regeneration (Barrett *et al*. 1994; Robinson & Traill 1996; Debus 1997, NPWS 1999).

2. SEVEN-PART TEST

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Black Bittern

Potential habitat for the Black Bittern occurs in mangrove areas along the Georges River (outside the subject site) and within the riparian zone of the drainage line that occurs alongside and under Webster Street. No Black Bitterns were recorded there at the time of the surveys, but individuals from the local population may disperse there in the future.

These habitat areas will be protected from any indirect impacts of the proposed development provided that the recommendations in the present report are adopted.

Therefore, the proposed development will not adversely affect the lifecycle of the Black Bittern to the extent that a viable local population will be placed at risk of extinction.

Glossy Black-Cockatoo

The proposed development will result in one River Oak (*Casuarina glauca*), a food tree species of the Glossy Black-Cockatoo, being removed from the subject site. River She-oaks are widespread throughout Deepwater Park and in other floodplain areas of the Georges River. Therefore, the removal of this tree will not limit food resources available to this species.

Other trees that will be removed from the subject site are potential nocturnal roost sites for Glossy Black-Cockatoos. There is no evidence that Glossy Black-Cockatoos currently use this area as a roost site, and it represents a negligible amount of roosting habitat available to this species within the locality and Sydney Basin Bioregion.

There are no hollow-bearing trees on the subject site or alongside Webster Street. Therefore, no potential nest trees of Glossy Black-Cockatoos will be removed or indirectly impacted on by the proposed development.

Therefore, the proposed development will not adversely affect the lifecycle of the Glossy Black-Cockatoo to the extent that a viable local population will be placed at risk of extinction.

Barking Owl

Barking Owls nest in large hollows and feed on young hares, rats, mice, occasional small bats and some marsupials, including possums. They are usually found in pairs, which occupy 300 - 2000 ha territories all year round (Higgins 1999). The trees that will be removed from the subject site represent a negligible amount of foraging habitat for a single pair of Barking Owls. Additional foraging habitat will be provided as part of the proposed landscaping.

Barking Owls usually roost by day below the canopy layer of riparian forest that has a dense understorey. Therefore, there is no suitable roosting habitat for this species on the subject site. It is unlikely that Barking Owls currently roost in vegetation alongside Webster Street because of the current disturbances from vehicular traffic and people using nearby picnic areas.

There are no tree hollows on the subject site or in habitat areas alongside Webster Street that could potentially be used by Barking Owls as nesting sites.

Therefore, the proposed development will not adversely affect the lifecycles of the Barking Owl to the extent that a local viable population is placed at risk of extinction.

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

Not applicable. The Black Bittern, Glossy Black-Cockatoo and Barking Owl are listed as a threatened species rather than as an endangered population.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
- **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable. The Black Bittern, Glossy Black-Cockatoo and Barking Owl are listed as a threatened species rather than as an endangered or critically endangered ecological community.

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(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

(i) The proposed development would not remove or modify potential habitat of Black Bitterns, and will remove only negligible amounts of potential foraging habitat for Glossy Black Cockatoos and Barking Owls.

(ii) The proposed development will not fragment or isolate areas of potential habitat for threatened bird species.

(iii) No breeding or likely roosting habitat of the Black Bittern, Glossy Black Cockatoo or Barking Owl will be removed as a result of the proposed development. The trees to be removed from the subject site represent a negligible proportion of potential foraging habitat that is present in the locality for both the Glossy Black-Cockatoo and Barking Owl. Potential habitat for the Black Bittern along drainage lines and wetlands near Webster Road would not be impacted on if silt curtains and sediment ponds are appropriately located around construction sites.

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

No critical habitat for Black Bitterns, Glossy Black-Cockatoos or Barking Owls occurs in the locality.

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

<u>Black Bittern</u>

Priority actions proposed by DECCW for the recovery of the Black Bittern in NSW are:

- In areas of suitable breeding habitat, seek retention and management of riparian vegetation.
- Enhancement of knowledge of the breeding locations of this species. Survey suitable habitat, e.g. vegetated wetlands during the breeding season. Investigate habitat usage particularly in Swamp Oak Forest.

The proposed development is in compliance with these priority actions.

Glossy Black Cockatoo

Priority actions proposed by DECCW for the recovery of the Glossy Black-Cockatoo in NSW are:

- Reduce the impact of burning to retain diverse understorey species and in particular to permit the regeneration of she-oaks.
- Protect existing and future hollow-bearing trees for nest sites.
- Retain and protect areas of native forest and woodland containing she-oaks.
- Establish forested corridors linking remnant areas of habitat; include local she-oak species in bush revegetation works.
- Report suspected illegal bird trapping and egg-collecting to the DECCW.

The proposed development is in compliance with these priority actions.

Barking Owl

Priority actions proposed by DECCW for the recovery of the Barking Owl in NSW are:

- Apply a mosaic pattern during fire hazard reduction to ensure the same areas are not burned too frequently.
- Retain standing dead trees and large fallen logs.
- Retain and enhance vegetation along watercourses and surrounding areas to protect important habitat of the owls and their prey.
- Protect woodland and open forest remnants, especially those containing hollow-bearing trees.
- Maintain a buffer of undisturbed native vegetation at least 200 metres radius around known nest sites.
- Fence habitat remnants and protect from heavy grazing.

The proposed development is consistent with these objectives and actions of each of this recovery plan.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed development would result in the loss of potential foraging habitat of the Glossy Black-Cockatoo and Barking Owl, which is a key threatening process. However, this habitat is, at best, very marginal habitat for Barking Owl, and the most suitable habitat on the site for this species (near the southern boundary) will be retained. The proposed development will remove a negligible amount of potential foraging habitat for Glossy Black-Cockatoos in the locality. Neither species was recorded on the subject site, despite targeted surveys for them.

The proposed development will not constitute a key threatening process to Black Bitterns or their habitats.

Therefore, the proposed development is not likely to result in the operation of, or increase the impact of, a key threatening process for threatened bird species.

3. CONCLUSION

The proposed development would significantly impact on the status of Black Bitterns, Glossy Black-Cockatoos or Barking Owls, or their habitats. Therefore, a Species Impact Statement is NOT required for these species in relation to the proposed development.

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BAT SPECIES

1. SPECIES PROFILES

Grey-headed Flying-fox *(Pteropus poliocephalus)*

Historically, Grey-headed Flying-foxes had a greater range in Australia and numbers were estimated as being in the millions. Counts of flying-foxes over the past decade suggest that the national population may have declined up to 30% (Birt 2000; Richards 2000). Regular visits to flying-fox camps during this period have shown a marked decline in the numbers using these camps (Eby 2000; Parry-Jones 2000). It has also been estimated that the population will continue to decrease by at least 20% in the next three generations given the continuation of the current rate of habitat loss and culling (Martin 2000).

This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, *Melaleuca* swamps and *Banksia* woodlands. It plays an important ecosystem function by providing a means of seed dispersal and pollination for many indigenous tree species (Eby 1996; Pallin 2000). The species also feed on introduced trees including commercial fruit crops.

Grey-headed Flying-foxes congregate in large numbers at roosting sites (camps) that may be found in rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring (Lunney & Moon 1997; Augee & Ford 1999). They forage opportunistically, often at distances from camp of up to 60-70 km per night, in response to patchy food resources (Augee & Ford 1999).

Grey-headed Flying-foxes show a regular pattern of seasonal movement. Much of the population concentrates in May and Junes in northern NSW and Queensland where animals exploit winter-flowering trees such as Swamp Mahogany *Eucalyptus robusta*, Forest Red Gum *E. tereticornis* and Paperbark *Melaleuca quinqernervia* (Eby *et al*. 1999). Food availability, particularly nectar flow from flowering gums, varies between places and from year to year.
Movement patterns of Grey-headed Flying-foxes are also irregular and unpredictable towards the edges of their distributional range. For instance, it appears that numbers in Victoria are highest in years when flowering of eucalypts in the coastal forests of southern NSW is poor. Conversely, in years when flowering in southern NSW is prolific, the number visiting Victoria is very low (Aston 1987; Parry-Jones 1987).

Grey-headed Flying-foxes are relatively long-lived mammals, with a generation length of six to 10 years. They have a low rate of reproduction because sexual maturity is reached after at least three years and generally only one offspring is produced each year (Martin *et al*. 1996).
Although mating can be observed throughout the year, males are apparently fertile only for a short period during March and April, and breeding is highly seasonal (Nelson 1965a; Martin *et al*. 1987).

Gestation lasts about six months and mot females give birth to a single young each September or October. For the first four or five weeks of life they cling to their mothers' belly fur. For a further 12 weeks young are flightless and are left in the camp while their mother forages and are suckled on return. Young are weaned at five or six months (Martin *et al*. 1987). At the end of summer food becomes scarce and the large camps break up. Many adults then lead a dispersed nomadic existence (Nelson 1965a,b), but others travel hundreds of kilometres to congregate at winter camps near reliable food supplies.

The main threat to Grey-headed Flying-foxes in NSW is the clearing or modification of native vegetation. This removes appropriate camp habitat and limits the availability of natural food resources, particularly winter feeding habitat in north-eastern NSW. The urbanisation of coastal plains of south-eastern Queensland and northern NSW has seen the removal of critical feeding sites, and this threatening process continues (Catterall *et al*. 1997; Pressey & Griffith 1992).

The use of non-destructive deterrents, such as netting and noise generators, to limit flying-fox damage to fruit crops is not universal in the horticultural industry. While licences are issue to cull limited numbers of Grey-headed Fly-foxes, uncontrolled culling using destructive methods such as shooting and electrocution occurs and large numbers of bats are culled (Vardon & Tidemann 1995; Richards 2000). The impacts of destructive methods has not been measured, but is greatest when natural food is scarce. Also, culling has a disproportionate impact on lactating and pregnant females (Parry-Jones 1993).

The species is also threatened by direct harassment at roosts, the destruction of their camps and by being possible carriers for viral pathogens (Tidemann 1999).

Grey-headed Flying-foxes face potential competition and hybridisation from Black Flying-foxes Pteropus alecto, because this latter species is extending its range south in to northern NSW (Webb & Tidemann 1995).

East Coast Freetail Bat *(Mormopterus norfolkensis)*

This species is found in sclerophyll forests, woodlands and occasionally in rainforests along the east coast of Australia from south-east Qld through to Sydney. Active mainly at night, East-coast Freetail Bats roost by day alone or in small colonies in tree hollows and crevices, under loose bark, in caves and in buildings. They hunt for insects over the forest canopy and in clearings, flying fast and direct but with limited manoeuvrability. They also forage on the ground, scurrying around searching for terrestrial insects. The species' breeding biology has not been studied but, like other freetail bats, individuals probably give birth to a single young that suckles from a teat in the mother's armpit (Cronin 2000).

Large-eared Pied Bat (*Chalinolobus dwyeri*)

The species generally occurs in drier habitats such as dry sclerophyll forests and woodland, although they have been detected in tall open eucalypt forest with an understorey of scattered small trees and palms (Churchill, 1998). It roosts in caves and mines in colonies of 3 to 37, clustered in indentations in the ceiling (Churchill, 1998). They tend to roost in the twilight

areas of the caves not far from the entrance and have been known to roost in abandoned bottle-shaped mud nests of Fairy Martins (Dwyer, 1995). This species is insectivorous and flies relatively slowly along creek beds or at mid-canopy level 6 to 10 metres above the ground (Churchill, 1998). Mating takes place in autumn or spring and young are born in November and are independent by late February (Churchill, 1998).

Eastern False Pipistrelle *(Falsistrellus tasmaniensis)*

Found in wet forests of coastal Vic., NSW, Tas. and southern Qld, preferring gullies and highland areas up to 1500 m. In cooler mainland areas they migrate from the highlands to warmer coastal areas in winter, and in Tas., they appear to hibernate from late autumn to early spring.

Eastern False Pipistrelles usually roost only in tree hollows or nest boxes, although in NSW they have occasionally been recorded roosting in caves (Hall & Richards 1979) and abandoned buildings (Cronin 2000). They usually form single-sex colonies of between 3 and 36 bats.

Males produce sperm in the late summer or autumn when food supplies are plentiful, store it through the colder months and mate in late spring and early summer. A single young is born in December and suckles from a teat in the mother's armpit.

The species has limited manoeuvrability and foraging is typically around or just below the tree canopy. Feeds on moths, beetles, bugs, ants, flies and other aerial insects.

Eastern Bent-wing Bat *(Miniopterus schreibersii)*

The Common Bentwing-bat is distributed along the entire eastern seaboard from Cape York Peninsula, Queensland to South Australia (Dwyer, 1995a). The species is highly mobile, migrating over large distances and utilising different roosts for different seasonal needs (Ferrier *et. al*., 1992). This species is found in a range of habitats from grasslands through to subtropical rainforest but are typically found in well timbered valleys. Colonies are established often in caves to meet breeding and over-wintering needs (NPWS 1996). The diet consists of small airborne insects including moths and mosquitoes (NPWS, 1996). Females form colonies during spring and summer to give birth and nurture young. They give birth to a single young around December. Maternity caves serve animals from a radius of several hundred kilometres (Dwyer 1995a).

Large-footed Mouse-eared Bat *(Myotis adversus)*

The Large-footed Myotis is a microchiropteran species that forages on fish and insects from the permanent freshwater rivers, dams and creeks of coastal eastern and northern Australia. The species makes maternity roosts in caves close to freshwater, under bridges and buildings and other such structures, and among dense foliage and pandanus leaves . Its preferred natural habitats are sclerophyll forests, mangroves, paperbark swamps, woodlands and rainforests near slow-flowing creeks, lakes and estuaries. Individual colonies usually consist of 10-15 bats, but may have as many as 200 individuals.

Males are territorial and form harems of up to 12 females when breeding. At other times the males roost alone. A single litter is produced in November-December. The single young suckles for about 8 weeks from a teat in the mother's armpit, and remains with her until independent 3-4 weeks later.

Greater Broad-nosed Bat (*Scoteanax ruepelli*)

Found in sclerophyll forests, rainforests, woodlands and moist gullies below 500 m above sea level. Active from dusk to dawn, Greater Broad-nosed Bats are one of the first bat species to emerge after sunset.

Their flight path is low and direct, and they hunt 3-6 m above ground, making only slight deviations from their flight path to catch moths, beetles and other large, slow-flying insects. They forage in forests and woodlands, utilising openings in the forest and corridors above creeks and small rivers, hawking back and forth looking for prey, taking small animals from the ground and foliage. They roost by day in tree hollows and the roof spaces of abandoned buildings.

Pregnant females congregate at maternity sites in suitable trees where they give birth and raise their young, apparently excluding males. Little is known about the reproductive biology of this species, however, it is known that a single young is produced in January and it suckles from a teat in the mother's armpit.

2. SEVEN-PART TEST

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Grey-headed Flying-fox

This species roosts in large colonies, none of which are located within the locality. Small numbers of individuals may occasionally visit the subject site when mature trees are flowering. Removal of some of these trees will not result in significantly limiting food resources for local populations of flying-foxes. Therefore, the proposed development of the subject site will not place local populations of this species at risk of extinction.

Eastern Bent-wing Bat

This species has been recorded foraging mostly above canopy vegetation around the man-made dams on Riverlands Golf Course (Ambrose 2008a), so is likely to forage for aerial insects above wetlands and tree canopies in Deepwater Park. The amount of vegetation to be removed from the subject site represents a negligible proportion of foraging habitat that is available for this species in the locality.

There are no tree hollows large enough for this species that could be used as roosting habitat on the subject site. There were no bats observed roosting in the culvert under Webster Street.

There are at least 13 other records of this species occurring in the locality. Eastern Bentwing Bats are highly mobile and are likely to fly between woodland and forest areas throughout the locality.

Given these factors, it is most unlikely that the proposed development will adversely affect the lifecycle of the Eastern Bentwing Bat to the extent that it will place a local population at risk of extinction.

Yellow-bellied Sheathtail Bat and Greater Broad-nosed Bat

Individuals of these two species roost in hollow-bearing trees. There are no hollow-bearing trees on the subject site that are suitable for roosting by bats.

Yellow-bellied Sheathtail Bats and Greater Broad-nosed Bats forage for insects in or above tree canopies. The trees that would be removed from the subject site represent a negligible amount of potential foraging habitat that is available in the locality for these species.

Therefore, removal of trees from the subject site is unlikely to significantly impact on local populations of these species to the extent that it will place a local populations at risk of extinction.

Large-eared Pied Bat and Large-footed Myotis

These species roost in caves, mines, tunnels and under bridges. No direct or indirect signs of bat roosts were detected under the M5 overpass or in the culvert under Webster Street.

The Large-footed Myotis forages for aerial insects over water bodies and may potentially forage along the Georges River and the wetlands within Deepwater Park. These water bodies would be protected from the impacts of the proposed development.

Large-eared Pied Bats forage for insects in or above tree canopies. The trees that would be removed from the subject site represent a negligible amount of potential foraging habitat that is available in the locality for this species.

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

Not applicable. Each bat species listed as a threatened species rather than as an endangered population.

(c) **In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(iv) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. Each bat species is listed as a threatened species rather than as an endangered or critically endangered ecological community.

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(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

(i) The proposed development would remove only negligible amounts of potential foraging habitat for threatened bat species. The trees proposed to be planted as part of the landscaping plan would provide additional foraging habitat for threatened bat species.

(ii) No area of habitat of threatened bat species will be fragmented or isolated as a result of the proposed development.

(iii) Potential foraging habitat of bat species that will be removed from Deepwater Park for the proposed development is a negligible proportion of the total habitat that is available for these species. Better quality habitat for these species occurs on the western bank of the Georges River. Removal of potential habitat from the subject site will not affect the long-term survival of either of these species in the locality.

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

No critical habitat for threatened bat species occurs in the locality.

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

The priority actions for the protection of microchiropteran bats in NSW are stated below:

1. Develop and promote State-wide bat awareness programs for schools, CMAs, landholders and industry groups etc.

2. Raise awareness of the effects of pesticides.

3. Prepare EIA guidelines which address the retention of hollow bearing trees maintaining diversity of age groups, species diversity, structural diversity. Give priority to largest hollow bearing trees.

4. Ensure largest hollow bearing trees, inc. dead trees and paddock trees are given highest priority for retention in PVP assessments (offsets should include remnants in high productivity) and/or other land assessment tools.

5. Ensure the Code of Practice for private native forestry includes adequate measures to protect large, hollow-bearing trees and viable numbers of recruit trees.

6. Promote the conservation of these HCV private land areas using measures such as incentive funding to landholders, off-setting and biobanking, acquisition for reserve establishment or other means.

7. Identify the effects of fragmentation on the species in a range of fragmented landscapes, such as cleared coastal river valleys. For example movement and persistence across a range of fragment sizes.

8. Investigate the effectiveness of logging prescriptions.

9. Research the degree of long-term fidelity to roost trees and roosting areas in order to assess their importance and the effects of their removal.

10. Research the roosting ecology of tree-roosting bats, e.g. identifying the attributes of key roosts.

11. Study the ecology, habitat requirements and susceptibility to logging and other forestry practices of this little-known species

12. Identify important foraging range and key habitat components for this species.

13. Research the effect of different burning regimes.

14. Research the effectiveness of rehabilitation measures intended to increase bat populations in degraded landscapes, such as revegetating riparian zones.

15. Study the susceptibility of this species to pesticide accumulation.

16. Undertake long-term monitoring of populations cross tenure in conjunction with other bat species to document changes.

17. Quantify any benefits of local bat populations to reducing the impact of insect pests on commercial crops.

18. Identify areas of private land that contain high densities of large, hollow-bearing trees as areas of high conservation value in planning instruments and land management negotiations e.g. LEP, CAPs, PVPs.

19. Undertake a systematic survey of productive coastal river valleys to quantify the importance of private land relative to public lands.

The proposed development is consistent with the priority actions for the recovery of microchiropteran bats in NSW.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed development would result in the loss of potential foraging habitat of threatened bat species, which is a key threatening process. However, the proposed development would not remove more than a negligible amount of potential foraging habitat for these species in the locality, and no known roosting habitat. Therefore, the proposed development is not likely to result in the operation of, or increase the impact of, a key threatening process for threatened bird species.

3. CONCLUSION

No known roosting habitat of threatened bat species occurs on the subject site or in bushland areas alongside Webster Street. Marginal foraging habitat for these species occurs within the treed areas of the subject site. Therefore, a Species Impact Statement is NOT required for any of the threatened bats as part of this proposed development.

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CUMBERLAND PLAIN LAND SNAIL (*Meridolum corneovirens*)

1. SPECIES PROFILE

Conservation Status

The Cumberland Plain Land Snail is listed as an endangered species on Schedule 1 of the *TSC Act 1995.*

Description

Meridolum corneovirens is a native snail species with a typical adult shell diameter ranging between 15-30 mm. The colour is generally tan to dark brown with a green or yellow tinge. The underside of the shell, especially in living individuals, tends to have a glossy appearance and is semi-transparent. The upper side of the shell has a coarse wrinkly appearance. In adult shells the edge of the aperture is reflected, forming a slight lip. This is typically white in colour. However, the feature is absent in both juvenile and sub-adult individuals. The juveniles have a more angular shell and tend to have an open area in the central part of the underside of the shell, known as the umbilicus. Generally, in adults the umbilicus is closed or partially covered. Sometimes there is a reddish brown patch around the umbilical area.

Distribution and Habitat

Meridolem corneovirens occurs within the Cumberland Plain region of western Sydney. It is currently known from over 100 locations. However, most of these locations are scatterd throughout the region and are often small and isolated. Populations are known from Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Penrith and Wollondilly local government areas.

Meridolem corneovirens is restricted to the Cumberland Plain and Castlereagh Woodlands, and also along the fringes of River Flat Forest, especially where it meets Cumberland Plain Woodland. The species typically occurs under logs and other debris, among leaf and bark accumulations around bases of trees and sometimes underneath grass clumps. Where possible, it will burrow into loose soil.

Threats

The bulk of the known populations are small, isolated and vulnerable to impacts from clearing and habitat modification such as weed invasion, inappropriate fire management and removal of ground cover. These forms of modification remove shelter, breeding habitat and sources of food.

2. SEVEN-PART TEST

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

There are 47 records of the Cumberland Plain Land Snail occurring in the locality. No Cumberland Plain land Snails were recorded on the subject site or in surveyed areas alongside Webster Street. The nearest known population consists of 10 individuals, located approximately 400 m north-west of the subject site, in a bushland rehabilitation area within Deepwater Park along the boundary with Riverland Golf Course. This habitat area would not be impacted on by the proposed development. It is also unlikely that this snail population would disperse to the subject site or suitable habitat areas alongside Webster Street.

There is no suitable habitat for this species within the subject site because the area is mown regularly and there is no fallen bark or leaf litter accumulated around the base of individual trees.

Potential habitat for the Cumberland Plain Land Snail occurs in Cooks River (Castlereagh) Ironbark Forest alongside Webster Street. However, no snails were detected there, despite targeted searches for them. This habitat area would be protected from the potential impacts of the road upgrade provided that:

- **silt fences and sediment ponds are appropriately placed around road construction areas on the subject site** to prevent runoff of sediment and nutrient-enriched waters into nearby bushland areas and drainage lines. The effectiveness of these traps should be closely monitored during construction, ensuring that treated site run-off meets EPA guidelines.

- **an ongoing weed removal program along the edges of the access road is implemented,** with priority given to the removal of noxious weeds and detaching climbers, in accordance with the general recommendation of weed control in the Deepwater Plan of Management.

Therefore, it is considered unlikely that the approved development would adversely affect the life cycle of Cumberland Plain Land Snails to the extent that it would place a viable local population of each species at risk of extinction.

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

Not applicable. The Cumberland Plain Land Snail listed as a threatened species rather than as an endangered population.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. The Cumberland Plain Land Snail is listed as a threatened species rather than as an endangered or critically endangered ecological community.

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(d) In relation to a habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

(i) Potential habitat for the Cumberland Plain Land Snail occurs in Cooks River (Castlereagh) Ironbark Forest alongside Webster Street. However, no snails were detected there, despite targeted searches for them. This habitat area would be protected from the potential impacts of the road upgrade provided that the mitigation measures described in Point (a) are implemented.

(ii) No area of habitat for the Cumberland Plain Land Snail will become fragmented or isolated from other habitat areas as a result of the proposed development.

(iii) No Cumberland Plain Land Snails were found on the subject site. The area of potential habitat alongside Webster Street a negligible amount of habitat that is available for this species within the locality and the Sydney Basin Bioregion. Potential habitat for the Cumberland Land Snail in this latter area is considered to be marginal habitat because of the extent of infestation by weeds and other exotic plants. Weed invasion is a recognised key threatening processes that impacts on the status of the Cumberland Land Snail.

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

No critical habitat for the Cumberland Plain Land Snail occurs in the locality.

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

There are currently no recovery plans or threat abatement plans for the Cumberland Plain Land Snail in NSW.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Weed infestation of habitat is a key threatening process to the status of the Cumberland Plain Land Snail. Increased vehicular traffic flow along Webster Street may result in increased weed infestation of potential habitat areas for the snail on the sides of the road. However, this habitat is already significantly infested with weeds. Weed control along the sides of Webster Street has been recommended as a mitigation measure for the proposed development. Effective implementation of this measure would improve the existing condition of potential habitat in this part of Deepwater Park for Cumberland Plain Land Snails.

3. CONCLUSION

The proposed development of the subject site will not significantly impact on the status of the Cumberland Plain Land Snail or its habitat. Therefore, a Species Impact Statement is NOT required for this species in relation to the proposed development.

4. REFERENCE

Ambrose, S.J. (2008). Proposed New Access Road to Riverlands Golf Course & Adjoining Land, Milperra, Bankstown Local Government Area: Fauna Survey and Assessment. Report Prepared for Demian Developments Pty Ltd by Ambrose Ecological Services Pty Ltd (dated 3 November 2008).