Sydney Turpentine-Ironbark Forest

TIF is an open forest community and the dominant canopy trees are Turpentine (*Syncarpia glomulifera*) and Grey Ironbark (*Eucalyptus paniculata*). Common understorey shrubs include Sweet Pittosporum (*Pittosporum undulatum*), Hop Bush (*Dodonaea triquetra*), Elderberry Panax (*Polyscias sambucifolia*) and Sickle Wattle (*Acacia falcata*). In open grassy areas, Kangaroo Grass (*Themeda australis*) and Blady Grass (*Imperata cylindrica*) are common.

STIF occurs on fertile soils in an area of moderate rainfall. It is transitional between Cumberland Plain Woodland in drier areas and Blue Gum High Forest on adjacent higher rainfall ridges. As a transitional community, the species composition varies according to the influence of sandstone and aspect. It is restricted to the inner western suburbs of Sydney on Wianamatta shale and the shale ridge caps on the Hornsby Plateau. STIF has been reduced to 0.9% of its original extent, surviving as small remnants in Baulkham Hills, Parramatta, Hornsby, Ku-ring-gai and Bankstown areas.

In the early years of European settlement, STIF was heavily cleared for farming and timber, followed by suburban development as Sydney expanded. The biggest threat remains clearing and other threats are damage from recreational activities, rubbish dumping, grazing, mowing and weeds (NPWS 2001).

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.

Not applicable. The Final Determination lists CPW and STIF as Endangered Ecological Communities. The Scientific Committee has subsequently released a Preliminary Determination that lists CPW as a Critically Endangered Ecological Community. Therefore, CPW and STIF are not threatened 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.

CPW and STIF are not endangered populations. See explanation under Part (a).

(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.

The subject site is located near the western edge of the distribution of Sydney Turpentine-Ironbark Forest (STIF) and only about one kilometre south-east of the eastern-most area of Cumberland Plain Woodland (CPW) (Figure 10 of present report). Therefore, it is within a geographical transition zone between these two endangered ecological communities. Both these communities grow on Wianamatta shale.

The location of remnant vegetation on the subject site is shown in Figure 10 of the present report. Remnant vegetation on the subject site has been mapped by NPWS (2002) as STIF. However, the remnant vegetation has 13 plant species that Tozer (2003) concludes is representative of STIF and nine species that are representative of CPW (Table 3.2 of present report). Therefore, remnant vegetation on the subject site is likely to be a transition between these two communities, rather than one or the other, although it is difficult to say definitively because so few shrub and groundcover species have been retained.

Ground-truthing of the subject site established that 1.318 ha of CPW/STIF occurs on the site. A total of 1.262 ha of this will be retained and an additional 1.290 ha (1.15 ha near the north-western corner of the subject site and 0.14 ha along the southern boundary) will be planted with CPW and STIF species. Therefore, the nett increase in CPW/STIF on the subject site after subdivision would be 1.234 ha.

A buffer of at least 10 metres will be maintained between the edge of each of the remnants labelled as Conservation Area A in Figure 8. Remnant vegetation retained elsewhere on the subject site may be impacted by stormwater runoff from residential areas. Polyweb fencing will be erected around the remnants during construction periods to prevent damage to CPW and STIF vegetation from trampling, vehicles and use of heavy machinery.

Therefore, 0.667 ha of remnant CPW/STIF and 1.290 ha of newly-created conservation areas (containing CPW and STIF species) (a total of 1.957 ha of native vegetation) will be adequately buffered against the impacts of the proposed urban development, whereas an additional 0.595 ha of remnant CPW/STIF is likely to be modified (e.g. increased weed invasion) as a result of stormwater runoff.

A Bushland Rehabilitation Management Plan (Ambrose 2009) proposes planting schedules for areas to be landscaped with CPW and STIF species and means by which weeds and other exotic plants can be controlled in both the short- and long-term in the remnant vegetation and landscape areas.

Therefore, the proposed development is unlikely to have an adverse effect on the extent of CPW or STIF or substantially and adversely modify CPW to the extent that their local or broader geographical occurrences are likely to be placed at risk of extinction.

(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.

1. A total of 0.667 ha of remnant CPW/STIF and 1.290 ha of newly-created conservation areas (containing CPW and STIF species) (a total of 1.957 ha of native vegetation) will be adequately buffered against the impacts of the proposed urban development, whereas an additional 0.595 ha of remnant CPW/STIF is likely to be modified (e.g. increased weed invasion) as a result of stormwater runoff.

2. The proposed development will not result in fragmentation or isolation of CPW or STIF habitat.

3. The CPW/STIF remnants on the subject site are highly degraded as a result of past clearance of most of the native understorey species and the replacement of much of the native groundcover with exotic grasses and herbs, including common weed species. However, the vegetation is at the eastern margin of the distribution of CPW and western margin of STIF and is considered to be an important example of vegetation that is transitional between these two communities. Pollen and seeds from native canopy trees, in particular, in the remnant vegetation on the subject site are likely to be important sources of genetic material for other STIF and CPW remnants within 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 CPW 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 Department of Environment and Climate Change (DECC) have identified the following priority actions to help in the recovery CPW and STIF in NSW:

1. Management of EECs is to be included in school environmental management plans where the school land contains EECs.

2. Management of EECs to be included in the conditions for Crown land trusts, lease and licence holders.

3. Prepare and implement community awareness, education and involvement strategy.

4. Support community conservation by providing nursery or other facilities, for regeneration activities.

5. Local Govt prepare plans of management in accordance with the Local Government Act for reserves containing EECs, which have conservation as a primary objective, or where conservation is compatible.

6. Promote best practice management guidelines.

7. Incorporate consideration of EEC protection in regional open space planning.

8. Encourage planning authorities to address EECs in development of environmental planning instruments and, where possible, seek biodiversity certification.

9. Manage, to best practice standards, areas of EECs which have conservation as a primary objective, or where conservation is compatible. Priorities are to be based on DEC conservation significance assessment.

10. Encourage and promote best-practice management of EECs on private land.

11. Ensure the consideration of impacts on EECs when enforcing noxious weed or pest species control in EECs.

12. Develop and implement Cumberland Plain Reservation Strategy and create a protected bushland network through targeted land acquisition as land becomes available.

13. Public authorities will promote management agreements to landholders through their ongoing land use planning activities.

14. Investigate the preparation of a recommendation for the declaration of critical habitat.

15. Investigate the development of a regular monitoring program to assess the change in extent of vegetation across the Cumberland Plain.

16. Finalise the multi-EEC recovery plan as a State priority in accordance with contractual obligations with DEH, by July 2007.

17. Liaise with institutions to facilitate research relevant to the recovery of Cumberland Plain EECs.

The proposed development is consistent with the priority actions for protecting CPW and STIF 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 will not constitute, or be part of, a key threatening process and will not likely result in the operation of, or increase the impact of, a key threatening process, to CPW or STIF provided that the proposed Bushland Rehabilitation Management Plan is implemented.

3. CONCLUSION

The proposed development will not have a significant impact on the status of CPW or STIF, or their habitats, at a local, regional or state level. Therefore, a Species Impact Statement is NOT required for these EECS in relation to the proposed development.

4. REFERENCES

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BIRD SPECIES

1. SPECIES PROFILES

Bush Stone-Curlew (*Burhinus grallarius*)

The Bush Stone-curlew has been recorded throughout mainland Australia except for the most arid parts (Blakers *et al.* 1984; Marchant & Higgins 1993). The current Australian population is estimated to be 15,000 individuals (Watkins 1993).

Bush Stone-curlews require sparsely grassed, lightly timbered, open forest or woodland. In southern Australia, they persist most often where there is a well-structured litter layer and fallen timber debris (Blakers *et al.* 1984, Marchant & Higgins 1993; Johnson & Baker-Gabb 1994), but in parts of northern Australia, they seem to persist where the ground cover is more open (A. Appleman in Garnett & Crowley 2000). They are thought to be sedentary, but abundance in central Australia appears to vary with rainfall. They lay one or two eggs on the ground in open areas, usually well away from trees (Johnson & Baker-Gabb 1994), and feed on a range of invertebrates and small vertebrates, as well as seeds and shoots (Marchant & Higgins 1993).

The rarity and continuing decline of Bush Stone-curlews in the southern part of the species' range has been attributed to predation by foxes, habitat clearance for agriculture, habitat degradation by pastoralism, and removal of leaf litter and fallen timber debris from habitat remnants (Johnson & Baker-Gabb 1994). The species was formerly hunted legally, and continues to be so illegally (Marchant & Higgins 1993).

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).

Allocasuarinas 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.

Swift Parrot (*Lathamus discolor*)

The Swift Parrot is a gregarious species that breeds in eucalypt forests in eastern and northern Tasmania and it over-winters in south-eastern mainland Australia. During the breeding season the species feeds on the nectar of the flowering Tasmanian Blue Gum (*Eucalyptus globulus*).

In late March almost the entire population moves to mainland Australia. Most over-winter in Victoria and central and eastern NSW, but each year a few are recorded from south-eastern Qld and occasionally from as far west in Tasmania (Blakers *et al.* 1984). Migrants return to Tasmania in September (Brown 1989).

Swift Parrots inhabit *Eucalyptus* forests, breeding in mature and senescent trees. They breed where Tasmanian Blue Gums are flowering well, and in poor flowering seasons the amount of breeding is reduced. On the mainland Swift Parrot movements are little understood. It congregates in areas where eucalypts are flowering profusely, often returning regularly to the same places. It is consequently dependent on winter-flowering species, particularly Red Ironbark (*Eucalyptus sideroxylon*), Yellow Gum (*E. leucoxylon*), White Box (*E. albens*) and Swamp Gum (*E. ovata*) (Brown 1989). It also feeds in Manna Gum (*E. viminalis*) in autumn. It often occurs in remnant patches of mature eucalypts of agricultural land and is also common in some Melbourne suburbs (Emison *et al. 1987*).

In Tasmania the abundance of Blue Gums has been greatly reduced by clearance of land for agriculture, saw log production and clear-felling for woodchips (Garnett 1993). Individual parkland trees are now often the most important food sources.

Similarly, on the mainland most of the best-quality stands of favoured food tree species have been cleared for agriculture and many of those remaining have been heavily cut-over to produce poles for firewood. The resulting immature stands may be poorer and less reliable sources of nectar (Brown 1989). In 1959 there were several reports of large concentrations of Swift Parrots from Victoria and NSW during winter (Hindwood and

Sharland 1964). However, in NSW, there appear to be few records from the period 1988-90 (Garnett 1993) and, apart from 100+ birds being observed in Temora in May 1990, all observations were of fewer than four birds (A. Morris in Garnett 1993).

Some Swift Parrots are also taken illegally for the commercial bird trade and, in recent years, a number of trappers have been prosecuted in NSW (J. Hardy in Garnett 1993).

Turquoise Parrot (*Neophema pulchella*)

The Turquoise Parrot is endemic to eastern Australia. The species range extends from north-eastern Vic., through NSW to the granite belt of south-east Qld. In NSW, the Turquoise Parrot is typically recorded west of the escarpment in the tablelands and on the western slopes, extending to coastal districts through the dry forest corridor of the Hunter Valley (Crome & Shields 1992). Once common near Sydney, this population crashed early in the 1900s and at one stage the Sydney population was thought to be extinct (Garnett 1992). Recent records indicate that the species now occurs in scattered populations near Sydney and throughout eastern and central NSW (Blakers *et al.* 1984).

The species is an inhabitant of the steep, rocky ridges and gullies, rolling hills, valleys and river-flats and nearby plains of the Great Dividing Range. It occurs in eucalypt woodlands and open forests with a ground cover of grasses and low understorey of shrubs (Jarman 1973; Morris 1980). It feeds on seed of grasses, herbaceous plants and shrubs and requires a reliable supply of drinking water (Higgins 1999). The species seldom forms large flocks and is commonly encountered as pairs or small parties of 6-8 birds (Higgins 1999).
Threats to this species include:

- Loss of habitat through clearing, intensive logging, burning and grazing;
- destruction of sites containing hollows which may be used for nesting; and
- inappropriate fire regimes which remove nesting and feeding resources.

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 availibilty 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).

Masked Owl (*Tyto novaehollandiae*)

The southern subspecies of the Masked Owl occupies a home range of 5 –10 km^2 within a diverse range of wooded habitats that provide large hollow-bearing trees for roosting and nesting and nearby open areas for foraging (Kavanagh & Murray 1996; Higgins 1999). This can include forests, remnants within agricultural land or almost treeless plains. Nests and roost sites are usually in hollows of large trees, often in riparian forest. Clutch size is usually 3 or 4 (Schodde & Mason 1980; Kavanagh 1996). Masked Owls also roost, and less commonly nest, in caves (Debus 1993; Peake et al. 1993; Debus & Rose 1994). Prey are principally terrestrial mammals, including rodents and marsupials (Debus 1993; Kavanagh 1996), although possums, gliders, bats, birds, lizards and rabbits may be taken opportunistically (Higgins 1999).

Habitat clearance is the principle reason for the decline in the range of this species (Higgins 1999). The reason for the low density of Masked Owls, however, is unknown. Although food does not appear to be limiting on the east coast (Kavanagh 1996),the apparent decline in arid Australia may be linked to the decline in the abundance of small mammals (Burbidge & McKenzie 1989). Within forests on the east coast, the availability of nest trees could be declining (Peake *et al.* 1993; Kavanagh 1996), but the scarcity of Masked Owls in logged forests is more likely to be because the vigorous regrowth after logging makes the habitat less suitable for foraging (Kavanagh *et al.* 1995).

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.

Bush Stone-curlew

There is one record of the Bush Stone-Curlew occurring in the locality (within 5 km of subject site). There is no nesting habitat for this species on the subject site and very marginal foraging habitat occurs only in remnant vegetation near the north-western corner of the site. It is most unlikely to occur on the subject site because of the marginality of the foraging habitat and the high risk of predation if it did occur their (from foxes and feral cats).

Therefore, the proposed development will not have an adverse effect on the life cycle of the Bush Stone-curlew to the extent that a viable local population is likely to be placed at risk of extinction.

Glossy Black-Cockatoo

There are 37 records of the Glossy Black-Cockatoo within the locality. There is no potential nesting habitat on the subject site because the larger trees, which may have contained

suitable hollows, have been selectively logged in the past. There are no favoured food tree species of Glossy Black-Cockatoos (*Allocasurina* spp. and, to a lesser extent, *Casuarina* spp.) on the subject site. The occasional Glossy Black-Cockatoo individual may rest or seek shelter in mature native trees on the subject site, but most of these trees will be retained as part of the proposed development.

Therefore, the proposed development will not have an adverse effect on the life cycle of the Glossy Black-Cockatoo to the extent that a viable local population of this species is likely to be placed at risk of extinction.

Swift Parrot

There are 12 records of the Swift Parrot occurring within the locality. Swift Parrots do not breed in mainland Australia. Over-wintering birds feed on the nectar of flowering eucalypts while within the locality. Most eucalypts on the subject site will be retained and the proposed development will not significantly limit food resources for Swift Parrots in the locality. Therefore, the proposed development will not have an adverse effect on the life cycle of the Swift Parrot to the extent that a viable local population of this species is likely to be placed at risk of extinction.

Turquoise Parrot

There are four records of the Turquoise Parrot occurring in the locality. There are no tree hollows large for use by this species as nesting habitat. Turquoise Parrots may potentially forage on the ground for grass and weed seeds among treed areas of the subject site. These areas will be retained and improved as potential habitat for Turquoise Parrots.

Therefore, the proposed development will not have an adverse effect on the life cycle of the Turquoise Parrot to the extent that a viable local population of this species is likely to be placed at risk of extinction.

Forest Owls

There are three records of Barking Owls and seven records of Masked Owls within the locality. Potential foraging habitat for each of these species occurs within the undisturbed forested areas of the subject site. However, none of these species was observed on the subject site, despite intensive targeted searches for them.

There are no tree hollows large enough on the subject site for use by forest owls as nesting habitat.

The usual territory size of a pair of Barking Owls is 30-200 ha (Higgins 1999). Masked Owls are sedentary, usually occurring in pairs, and maintain a core home range of up to 155 ha in area (Kavanagh & Murray 1996). Mooney (1992, 1993) claims that Masked Owls forage over at least several square kilometres from the nest tree. However, at some sites it has been variously described as a scarce visitor (e.g. Hardy & Farrell 1990) vagrant (Parker 1977; Longmore 1978). Young birds are known to disperse at least 10 km from their natal territory (Higgins 1999). Therefore, the total subject site is less than the size of a single territory of either a Masked Owl or Barking Owl. The subject site is marginal foraging habitat for either of these species because of the past vegetation clearance and any owls visiting the site are likely to use only the treed areas, nearly all of which are being retained.

Therefore, the proposed development will not have an adverse effect on the life cycle of the Barking Owl or Masked Owl to the extent that viable local populations of these species are likely to be 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 forested and woodland birds considered here are threatened species and not endangered populations.

(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 forested and woodland birds considered here are threatened species and not endangered or critically endangered ecological communities.

(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) Threatened bird species that may very occasionally use the subject site are likely to use only the treed areas of the site. Only 0.1 ha of remnant canopy trees will be removed, which represents a negligible amount of habitat available for these species within the locality and broader geographical region.

(ii) The proposed development will not result in fragmentation or isolation of threatened bird habitat.

(iii) The area of bushland that will be cleared for the proposed development is a negligible proportion of total amount of bushland available to threatened bird species in the locality. Although the site contains potential habitat for threatened bird species, none were observed on the site, despite targeted surveys for them. Therefore, the development area is not considered to be important for the long-term survival of threatened bird species.

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

No critical habitat for threatened bird 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.

Bush Stone-curlew

The priority actions for the protection of the Bush Stone-curlew in NSW are stated below:

1. Establish and maintain robust and genetically-managed captive populations suitable for use in captive-breeding programs (Medium priority).

2. Establish and support community groups to undertake habitat management activities, monitoring and surveys, record sightings. High priority areas - Murray, Murrumbidgee, Central West, Hunter/Central Rivers, Northern Rivers CMAs (High priority).

3. Raise public awareness of the Bush Stone-curlew through publicity activities, such as public talks and publication of articles in popular magazines (Medium priority).

4. Maintain, develop and distribute Bush Stone-curlew promotional and community education materials, including habitat management brochure, posters, stickers, T-shirts, puppets and call CDs (Medium priority).

5. Hold a Bush Stone-curlew Summit to bring together people working on the species across NSW and interstate (Medium priority)

6. Assess status of the Bush Stone-curlew against the listing criteria of the Commonwealth EPBC Act and "critically endangered" category in TSC Act, and prepare a nomination if warranted (Medium priority).

7. Undertake integrated predator and pest control programs in Bush Stone-curlew habitat in high priority CMAs, with a particular emphasis around breeding sites and during the breeding season. Refer to recovery plan for information (High priority).

8. Apply for an off-label permit to undertake 1080 baiting on Pelican and Rileys Islands, and other areas where fox-baiting currently not permitted (Medium priority).

9. Ensure Threatened Species Hazard Reduction List is accurate and up-to-date regarding management of impacts to Bush Stone-curlews and their habitat (Medium priority).

10 Prepare environmental impact assessment (including survey) guidelines. Distribute to state and local government agencies and publish on DEC website. Update annually to ensure new information included (High priority).

11 Adequately consider Bush Stone-curlews and their habitat requirements during biodiversity certification of environmental planning instruments (High priority).

12. Enter records from surveys and assessments onto NSW Wildlife Atlas acurately and quickly, and obtain records held by other organisations for inclusion on the Wildlife Atlas (High priority).

13. Ensure up-to-date and accurate Bush Stone-curlew information is being used in the "Property Vegetation Plan Developer - Threatened Species Tool." (Medium priority)

14. Assess effectiveness of Property Vegetation Plans (both offset and incentive versions) in conserving Bush Stone-curlews and their habitat. If not happening, identify why not and provide formal feedback to those responsible within relevant agencies (Medium priority).

15. Assess implementation and effectiveness of Threatened Species Licence conditions under the Integrated Forestry Operations Approvals, and renegotiate conditions if appropriate (Medium priority).

16. Support the use of Metarhizium within a 2km radius around Bush Stone-curlew sites and habitat on non-DEC lands during locust control activities. Metarhizium to be used on DEC lands supporting Bush Stone-curlew habitat (High priority).

17. Manage Bush Stone-curlew habitat in high priority CMAs (see recovery plan) - predator control, fallen timber retention, ground cover length, weed control, stock access, application of insecticides, disturbance, regeneration, site security and viability (High priority).

18. Prepare and implement management plans for at least 1 local Bush Stone-curlew population in each high priority CMA (see recovery plan for details). Source funding to implement management plans. Prepare and implement additional plans if possible (priority).

19. Acquire Bush Stone-curlew habitat when land acquisition opportunities arise. Priority areas for habitat acquisition to be determined (High priority).

20. Support and encourage the management of Bush Stone-curlew habitat on private land, as per the habitat management guidelines in the recovery plan (Low priority).

21. Undertake annual monitoring programs in high priority CMAs to determine breeding success, juvenile recruitment and status of the population. Refer to recovery plan for information (Low priority).

22. Integrate Bush Stone-curlew recovery actions with threat abatement plans and recovery actions for other threatened species, populations or ecological communities (Low priority).

23. Establish recovery team and interstate working group to review plan and prioritise implementation of actions. Coordinate implementation of actions and support regional projects (Low priority).

24. Undertake studies examining the impact of habitat degradation and modification on Bush Stone-curlews, particularly examining processes which are associated with urban and agricultural development such as removal of fallen timber, weed invasions, clearing (High priority).

25. Undertake studies examining the impact of introduced species on Bush Stone-curlews, particularly foxes, cats, dogs and rabbits and the inter-relationships between them. Research which informs control programs and management activities is encouraged (High priority).

26. Undertake studies examining the impact of chemicals on Bush Stone-curlews, particularly examining direct and indirect impacts and whether population-level impacts are likely (Medium priority).

27 Undertake research into Bush Stone-curlew ecology, particularly examining micro and macro-habitat requirements, home range, dispersal characteristics and population dynamics. See recovery plan for further details (High priority).

28. Develop protocols to monitor Bush Stone-curlew populations and methods for assessing long-term population viability (High priority).

29. Examine the genetic variability between and within populations of Bush Stone-curlews, and develop protocols for collection and storage of genetic material (Medium priority).

30. Increase understanding of the biology of the Bush Stone-curlew, particularly factors affecting breeding success, juvenile recruitment, and survival of individuals (Medium priority).

31. Undertake community and field surveys within areas of habitat (breeding, foraging and roosting) in high priority CMAs to identify Bush Stone-curlew sites (High priority).

32. Identify and map Bush Stone-curlew habitat on council lands within high priority CMAs - foraging, breeding and roosting habitat should be identified (High priority).

33. Identify and map Bush Stone-curlew habitat on private land within high priority CMAs - foraging, breeding and roosting habitat should be identified (High priority).

34. Identify and map Bush Stone-curlew habitat on DEC estate and crown lands within high priority CMAs - foraging, breeding and roosting habitat should be identified (High priority).

35. Using Wildlife Atlas records as a guide, undertake community and field surveys for Bush Stone-curlews and manage their habitat on public land as per survey and habitat management guidelines in the recovery plan, wherever possible (Low priority).

36. Implement translocation proposal and maintain monitoring to assess success of translocation (Medium priority).

37. Identify priority sites for trial Bush Stone-curlew translocation into the wild (Medium priority).

38. Prepare translocation proposal, seek relevant approvals and licences, secure funding for post-release monitoring and habitat management (Medium priority).

The proposed development is consistent with the priority actions for the recovery of the Bush Stone-curlew in NSW.

Glossy Black-Cockatoo

The priority actions for the protection of the Glossy Black-Cockatoo in NSW are stated below:

1. Increase landholder and public awareness and interest in Glossy Black Cockatoo conservation and habitat management (Medium priority).

2. Utilise the Glossy Black Cockatoo as a flagship threatened species for woodland and forest conservation education and awareness programs (Low priority).

3. Develop/encourage strategic planning approach for Glossy Black Cockatoo at the local and regional level (High priority).

4. Prepare and distribute EIA guidelines to decision makers (Medium priority).

5. Provide incentives for landholders to fence and manage key sites (Medium priority)

6. Assist landholders who wish to enter into voluntary conservation agreements at key sites (Medium priority).

7. Encourage the restoration of foraging habitat that has been cleared or degraded by previous impacts (Medium priority).

8. Continue existing monitoring programs (e.g. Goonoo population) and encourage other community groups to develop a monitoring program of local populations (Low priority).

9. Identify and map key breeding and foraging habitat, similar to the mapping done by Robinson (2004) at St Georges Basin (High priority).

The proposed development is consistent with the priority actions for the recovery of the Glossy Black-Cockatoo in NSW.

Swift Parrot

The priority actions for the protection of the Swift Parrot in NSW are stated below:

1. Consult and involve Indigenous community through employment of community liason officer (Medium priority).

2. Reduce the incidence of Swift Parrot collisions by raising community awareness of the threat of man-made hazrds (including windows/glass panes and high wire-mesh fences) in the vicinity of suitable habitat (Medium priority).

3. Compile, produce and distribute the annual Swift Parrot volunteer newsletter "Swifts Across the Strait" (Low priority).

4. Develop and distribute EIA guidelines to decision makers (Medium priority).

5. Develop and distribute Swift Parrot habitat identification, management and enhancement guidelines (Medium priority).

6. Protect, manage and restore Swift Parrot habitat on private land through conservation agreements, management agreements and incentive payments (High priority).

7. Enhance habitat for Swift Parrots by planting suitable tree species to complement natural regeneration or to enhance remnants (Medium priority)

8. Employ community liason officer to coordinate conservation actions for the species, including the maintainance of community and volunteer networks through (High priority).

9. Manage the recovery process through the continued operation of the Swift Parrot Recovery Team (Medium priority).

10. Conduct Swift Parrot habitat research on both private and public land (Medium priority).

11. Coordinate volunteer surveys at known and potential Swift Parrot sites on private and public land (High priority).

12. Identify and map the extent and quality of Swift Parrot foraging and roosting habitat on private and public land (High priority).

The proposed development is consistent with the priority actions for the recovery of the Swift Parrot in NSW.

Turquoise Parrot

The priority actions for the protection of the Turquoise Parrot in NSW are stated below:

1. Select targeted areas where large populations occur and liaise with landholders to protect hollow-bearing trees.
2. Develop an Expression of interest targeted towards private landowners to locate new sites and from this negotiate, develop and implement conservation management agreements for high priority sites.
3. Identify sites where the species is commonly observed and target for incentives and habitat management.
4. Control feral cats and foxes near high density populations (best practice: locally efficient and effective).
5. Control feral goats and pigs of known or potential habitat.
6. Encourage management of livestock grazing so as to improve understorey (foraging) habitat at priority sites.
7. Implement sympathetic habitat management in conservation reserves, council reserves and crown reserves where the species occurs.
8. Control weeds at priority sites.
9. Encourage bird observer groups to undertake spot monitoring surveys at previously recorded locations. Enter data collected into Wildlife Atlas.
10. Identify three targeted populations (per year over initial three years); focus recovery actions and adaptive management at these sites.

The proposed development is consistent with the priority actions for the recovery of the Turquoise Parrot in NSW.

Forest Owls

A draft recovery for large forest owls (including Sooty, Masked and Powerful Owls) was released by the Department of Environment & Conservation in May 2005. The objective or actions of this plan are:

1. Management and protection of habitat off reserves and State forests.
2. Mitigation of development-related threats.
3. Modelling and mapping of habitat and validation with surveys.
4. Monitoring owl population parameters.
5. Auditing of forestry prescriptions.
6. Encouragement of research.
7. Increasing community awareness and involvement in owl conservation.
8. Provision of organisational support and integration of the objectives and actions of the recovery plan.

The proposed development is consistent with the priority actions for the recovery of the Powerful, Sooty and Masked Owl 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.

Habitat clearance is considered a key threatening process to threatened forest and woodland bird species. However, only 0.1 ha of potential foraging habitat for each species will be cleared and 0.39 ha will be modified, which is considered a negligible proportion of potential habitat available to them in the locality and wider geographical area.

3. CONCLUSION

There are not likely to be any significant impacts on the status of the Bush Stone-curlew, Glossy Black-Cockatoo, Swift Parrot, Turquoise Parrot, Barking Owl or Masked Owl, or their habitats, resulting from the proposed development. Therefore, a Species Impact Statement is NOT required for these species.

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MAMMAL SPECIES

1. SPECIES PROFILES

Spotted-tailed Quoll (*Dasyurus maculatus*)

There are two Spotted-tailed (Tiger) Quoll subspecies: *Dasyurus maculatus gracilis* occurs in small isolated population in north Qld, while *D. m. maculatus* occurs along the remainder of the east coast from south-east Qld to Tasmania (NPWS 2000). This subspecies previously ranged over both sides of the Great Dividing Range from Qld to South Australia and Tasmania (Edgar & Belcher 1995). However, following a dramatic decline in range and numbers, it is now distributed over a restricted range in isolated areas that may be too small to support long-term viable populations (Edgar & Belcher 1995).

In NSW, the Tiger Quoll occurs on both sides of the Great Dividing Range. The north-east of NSW represents a stronghold for the species, because numbers in the south-east of the state have markedly declined (NPWS 2000). The western division of NSW has a number of scattered but unconfirmed records (Ayers *et al.* 1996).

The Tiger Quoll utilises a variety of habitats including sclerophyll forest and woodlands, coastal heathlands and rainforests (Dickman & Read 1992; Edgar & Belcher 1995; NPWS 2000). Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas.

The species' habitat requirements include suitable den sites (e.g. hollow logs, tree hollows, rock outcrops or caves) and an abundance of food (e.g. birds and small mammals) (Ayers *et al.* 1996). Individuals also require large areas of relatively intact vegetation through which to forage (NPWS 2000).

A single Tiger Quoll utilises numerous dens within its home range (NPWS 2000). The home range of this species is unknown, but estimates are between 800 ha and 20 km² (NPWS 2000). It is a highly mobile species and there are numerous records of overnight movements of several kilometres (Edgar & Belcher 1995).

Threats to the status of the Tiger Quoll include:

- loss, fragmentation and degradation of habitat through clearing of native vegetation through development, logging and fire (Edgar & Belcher 1995; Dickman & Read 1992);
- loss of large hollow logs and other potential den sites (Scotts 1992);
- competition for food and predation by foxes and cats (Edgar & Belcher 1995; Dickman & Read 1992);
- spread of epidemics, such as parasitic protozoa, by cats to Quolls (Edgar & Belcher 1995; Dickman & Read 1992);
- persecution by humans who perceive that Tiger Quolls prey on stock and poultry (Edgar & Belcher 1995; Dickman & Read 1992); and
- baiting of dingoes results in direct poisoning of Tiger Quolls and changes the composition of predators. Reduced dingo numbers favours foxes which compete with quolls (Edgar & Belcher 1995; Dickman & Read 1992).

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).

Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris)*

The Yellow-bellied Sheathtail Bat is probably the least understood of the NSW microchiropteran bats. Although the species is rare, records come from urban, agricultural, semi-arid and tall wet forest habitats; the diversity of habitats making it difficult to generalise about the species' requirements.

It is usually a solitary-roosting species, although small groups of 2-6 have been observed in northern Australia, especially in late winter and spring (Hall & Richards 1979). It normally roosts in tree spouts. Breeding appears to occur from early December to late March (Chimimba & Kitchener 1987).

Yellow-bellied Sheathtail Bats fly high and fast above the canopy (McKenzie & Rolfe 1986), although they also forage within 2 m of the ground in clearings. Known to eat grasshoppers, shield bugs and beetles.

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).

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.

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).

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.

Spotted-tailed Quoll

There is one record of the Spotted-tailed Quoll occurring in the locality (within 5 km of subject site). There is no denning habitat for this species on the subject site and very marginal foraging habitat occurs only in remnant vegetation near the north-western corner of the site. It is most unlikely to occur on the subject site because of the marginality of the foraging habitat and the high risk of predation if it did occur their (from foxes and feral cats).

Therefore, the proposed development will not have an adverse effect on the life cycle of the Spotted-tailed Quoll to the extent that a viable local population is likely to be placed at risk of extinction.

Grey-headed Flying-fox

There are three main Grey-headed Flying-fox roosting colonies (camps) in Sydney. These area located in the Royal Botanic Gardens on the Sydney Harbour, Edward Street, Gordon and in Cabramatta Creek, Cabramatta. There are no Grey-headed Flying-foxes camps on the subject site.

In the Sydney area, Grey-headed Flying-foxes tend to congregate in areas where there is a concentration of Swamp Mahoganies (*Eucalytpus robusta*) and Old Man Banksias (*Banksia serrata*), which are favoured food trees of the species. These plant species do not occur on the subject site, and so it is unlikely to be a favoured feeding area of Grey-headed flying-foxes. However, they will eat the pollen and nectar of other species of *Eucalyptus, Angophora* and *Corymbia* and so may potentially feed in small numbers within the woodland remnants at night. Potential food trees of Grey-headed Flying-foxes will be retained on the subject site.

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. The proposed development would not remove known breeding or roosting habitat, or other habitat that is critical to the survival of the Grey-headed Flying-fox.

Therefore, the proposed development is unlikely to will disrupt the lifecycle of Grey-headed Flying-fox to the extent that it will place local viable population at risk of extinction.

Microchiropteran Bats

There are no hollow-bearing trees, caves or other possible breeding structures (e.g. bridges or buildings) on the subject site. Therefore, there are no potential breeding or roosting trees for microchiropteran bats on site.

Microchiropteran bats may potentially use the canopy of the CPW/STIF remnant on the subject site as foraging habitat. This represents a negligible amount of foraging habitat that is available in the locality for these species. Better quality foraging habitat occurs in the bushland areas elsewhere in the locality. However, this remnant will be retained and will not be adversely impacted on by the proposed development/

Given these factors, it is most unlikely that the proposed development will disrupt the lifecycle of microchiropteran bat species to the extent that it will place local populations 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. Spotted-tailed Quolls, Grey-headed Flying-foxes and microchiropteran bats are threatened species rather than endangered populations.

(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. Spotted-tailed Quolls, and threatened bat species are not endangered or critically endangered ecological communities.

(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 CPW/SIF remnant on the subject site, which provides potential marginal foraging habitat for Spotted-tailed Quolls and bat species, will be retained. Therefore, there will be no further removal of habitat for threatened bat species in relation to the proposed development.

(ii) The proposed development will not result in fragmentation or isolation of threatened bat habitat.

(iii) Although the subject site contains potential marginal foraging habitat for quolls and threatened bat species, no bat roosts or quoll dens are likely to occur there. Therefore, the development area is not considered to be important for the long-term survival of threatened bat species.

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

No critical habitat for Spotted-tailed Quolls and 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.

<u>Spotted-tailed Quoll</u>

The priority actions for the protection of the Spotted-tailed Quoll in NSW are stated below:

1 Consult with Aboriginal land managers regarding intended conservation management efforts for Spotted-tailed Quolls on lands of interest to them.

2. Liaise with key aboriginal groups and document understanding of Spotted-tailed Quoll's local distribution, abundance, ecology and threats.

3. Assess potential risk Cane Toads pose to populations of quolls.

4. The threat of cane toads to be assessed as part of the DEC Cane Toad Action Plan.

5. Develop a licence agreement with managers of captive Spotted-tailed Quoll populations to enable recruitment to captive populations from wild populations.

6. Develop agreement with captive management institutions to facilitate use of captive animals for research when required.

7. Seminar on quoll biology and conservation.

8. Develop a communication strategy to raise public awareness of the Spotted-tailed Quoll, compile education resources and distribute to identified target audience. Support community participation in survey and monitoring programs.

9. Prepare brochure detailing designs of 'quoll-proof' poultry runs and aviaries and distribute within relevant locations.

10. Seek funding or sponsorship to subsidise landholder costs of modifying poultry runs and aviaries.

11. Establish and maintain regional working groups in southeast and northeast NSW to coordinate research and management.

12. Reserve Fire management Strategy(s) include operational guidelines that protect rocky outcrops and riparian zones within areas of known habitat.

13. Habitat requirements of Spotted-tailed Quolls to be adequately conserved within environmental planning instruments and through other legislative protection mechanisms, including property vegetation plans.

14. Renegotiate habitat retention prescriptions in IFOAs if they are found to be inadequate following research into disturbance thresholds and habitat requirements of breeding females.

15. Develop environmental impact assessment guidelines for the Spotted-tailed Quoll, which includes information on adequate survey methods, survey effort, inappropriate development proposals, impact mitigation measures.

16. At sections of roads where Spotted-tailed Quolls are frequently killed, incorporate methods to reduce the numbers of animals killed. Assess the effectiveness of different mitigation methods.

17. Erect signs in areas where road kills are common to alert drivers to the presence of Spotted-tailed Quolls.

18. Conduct systematic monitoring at key sites. Monitoring sites will be distributed across the NSW range of the Spotted-tailed Quoll and within different habitat types such as Kosciusko NP, Limeburner's Creek NR, northern tablelands and the Blue Mountains.

19. Develop a database and update it regularly to track population trends at monitoring sites, particularly with respect to density and survival of breeding females.

20. Identify study sites across the NSW range and within different habitat types at which long-term population monitoring can be undertaken.

21. Monitor survival of Spotted-tailed Quoll populations in habitat newly colonised by cane toads.

22. Based on research, develop and implement a protocol for use of poison baits that further reduces impacts on individual Spotted-tailed Quolls.

23. Research to investigate interactions between native and exotic predators and their prey to better understand the consequences of 1080 baiting at an ecosystem level.

24. Conduct and publish ecological research on relationship between prey density, den availability and density of females in different habitat types to determine measures of habitat quality.

25. Continue to undertake research on genetic diversity of populations to guide identification of appropriate genetic management units throughout range.

26. Develop standard data collection protocol to maximise information obtained from field surveys. Include procedure for monitoring disease status of wild animals and collecting and storing genetic samples.

27. Investigate the demographics of Spotted-tailed Quoll populations and use results to develop viability models for quoll populations.

28. Investigate the impact of fox and wild dog baiting on Spotted-tailed Quoll populations.

Research and publish findings to determine impact of wildfires and prescription burns on populations, with emphasis on prey resources, refugia, impacts of foxes, cats and wild dogs/dingoes.

29. Research disturbance thresholds and adequacy of existing prescriptions for retention of habitat of breeding females in timber production forests.

30. Collect genetic samples from all Spotted-tailed Quoll populations during field surveys and regular monitoring activities.

31. Conduct field and community surveys for the Spotted-tailed Quoll in areas where its distribution is poorly known. Areas identified for large-scale urban development (i.e. Far north coast, Hunter) and coastal reserves should be the highest priority.

32. Identify sections of roads where Spotted-tailed Quolls are frequently killed on roads.

33. Conduct a media campaign to ask for public records of road kills and use data held by the relevant government agencies.

34. Map Spotted-tailed Quoll distribution and update as additional data becomes available.

35. Review survey methods and assess effectiveness of different techniques to identify an optimal survey protocol. Undertake research into new methods, if necessary.

The proposed development is consistent with the priority actions for the recovery of the Spotted-tailed Quoll in NSW.

Grey-headed Flying-fox

The priority actions for the protection of the Grey-headed Flying-fox in NSW are stated below:

1. Assess the impacts Grey-headed Flying-fox camps have on water quality, and publish results in a peer-reviewed journal (Low priority).

2. Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts (Low priority).

3. Complete national recovery plan in 2006 (Medium priority).

4. Conduct range-wide assessments of the population size of Grey-headed Flying-foxes at least once during the 5-year recovery plan to monitor population trends (Low priority).

5. Describe the species, age structure & demographics of flying-foxes killed in fruit crops to improve the understanding of the impact by assessing trends in the species, sex, age & reproductive status of animals killed on crops (Medium priority).

6. Determine characteristics of optimal roosting habitat for Grey-headed Flying-foxes, exploring the roles of floristic composition, vegetation structure, microclimate and landscape features, and assess the status of camps (Medium priority).

7. Develop & provide to land managers & local community groups working with controversial flying-fox camps the resources needed for public education, highlighting species status, reasons for being in urban areas, reasons for decline etc (Medium priority).

8. Develop and implement a grower-based program to monitor trends in damage to commercial fruit crops by flying-foxes, and use the results to monitor the performance of actions to reduce crop damage (Medium priority).

9. Develop and promote mechanisms for widespread adoption of publicly subsidised incentives to reduce killing of flying-foxes in commercial fruit crops (High priority).

10. Develop guidelines to assist land managers dealing with controversial flying-fox camps (Medium priority).

11. Develop methods for rapid estimates of flying-fox damage on commercial crops, allowing the long-term monitoring of industry-wide levels and patterns of flying-fox damage (Medium priority).

12. Develop methods to monitor landscape scale nectar availability trends, to explain/potentially predict crop damage trends where crop protection is absent, & promote importance of foraging habitat productive in seasons critical to the horticulture industry (Low priority).

13. Document the levels of flying-fox damage to the horticulture industry within the range of the Grey-headed Flying-fox (Medium priority).

14. Establish & maintain a range-wide database of Grey-headed Flying-fox camps, including information on location, tenure, zoning & history of use, for distribution to land management/planning authorities, researchers & interested public (Medium priority).

15. Establish and maintain a Grey-headed Flying-fox recovery plan website to promote the recovery plan and to circulate other information on flying-foxes and their conservation (Low priority).

16. Identify the commercial fruit industries that are impacted by Grey-headed Flying-foxes, to provide an information base for use by the various stakeholders (Medium priority).

17. Implement appropriate vegetation management actions at camps critical to the survival of Grey-headed Flying-foxes (Medium priority).

18. Improve knowledge of Grey-headed Flying-fox camp locations, targeting regional areas and seasons where information is notably incomplete, such as inland areas during spring and summer (Medium priority).

19. Increase the extent and viability of foraging habitat for Grey-headed Flying-foxes that is productive during winter and spring (generally times of food shortage), including habitat restoration/rehabilitation works (High priority).

20. Investigate between-year fidelity of Grey-headed Flying-fox individuals to seasonal camps (Low priority).

21. Investigate the age structure and longevity of Grey-headed Flying-foxes (Medium priority).

22. Investigate the differences in genetic relatedness, sex, age etc. between sedentary and transient Grey-headed Flying-foxes (Low priority).

23. Investigate the genetic structure within Grey-headed Flying-fox camps, including levels of relatedness within and between members of adult groups, occupants of individual trees etc (Low priority).

24. Investigate the patterns of juvenile Grey-headed Flying-fox dispersal and mortality, allowing identification of the specific habitat requirements of juveniles (Low priority).

25. Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes (Medium priority).

26. Protect and enhance priority foraging habitat for Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land (High priority).

27. Protect roosting habitat critical to the survival of Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land (Medium priority).

28. Publish Grey-headed Flying-fox recovery plan newsletters to inform the public of the recovery plan, its progress, opportunities for participation in actions and lists of educational material and where to find them (Low priority).

29. Review & evaluate campsite management activities, summarising outcomes of past experiences at controversial camps. Noise impacts on neighbours of camps to be considered. For use in managing future conflicts with humans at flying-fox camps (Medium priority).

30. Review and improve methods used to assess population size of Grey-headed Flying-foxes (Low priority).

31. Set priorities for protecting foraging habitat critical to the survival of Grey-headed Flying-foxes and generate maps of priority foraging habitat (High priority).

The proposed development is consistent with the priority actions for the recovery of the Grey-headed Flying-fox in NSW.

Microchiropteran Bats

There are currently no NSW recovery or threat abatement plans for microchiropteran bat species.

(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 is not part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process on the Spotted-tailed Quoll or threatened bat species provided that the CPW remnant on the subject site is retained.

3. CONCLUSION

No known breeding habitat of threatened bat species and an insignificant proportion of potential foraging and dispersal habitat will be cleared or indirectly and adversely impacted upon. Therefore, a Species Impact Statement is NOT required for the Spotted-tailed Quoll or threatened bats as part of the proposed development.

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Bushland Rehabilitation Management Plan

Proposed Residential Subdivision
Convent of St Joseph Site,
Barina Downs Road,
Baulkham Hills Local Government Area

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Report No. 200823r3(b)

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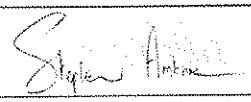
Signature:	
Date:	9 March 2011

1

INTRODUCTION

1. PURPOSE OF REPORT

1.1 Overview

The Applicant proposes to subdivide the majority of the Convent of St Josephs site at Barina Downs Road, Castle Hill (the "subject site": Figure 1) In the Baulkham Hills Local Government Area for residential development. The existing conference centre, gate-keepers cottage, areas of remnant vegetation and planted trees along the existing driveway will be retained.

The primary objectives of the Bushland Rehabilitation Management Plan (BRMP) are to prescribe:

- vegetation and fauna habitat management strategies and methods to help protect the long-term viability of Cumberland Plain Woodland (CPW) and Sydney Turpentine-Ironbark Forest (STIF) in the Baulkham Hills LGA;

- bushland restoration strategies and methods to enhance vegetation and fauna habitats in degraded bushland areas of the subject site by proposing a list of native plant species that can be planted in proposed conservation areas on the subject site;

- a BRMP costing and implementation schedule; and

- a monitoring program to assess the effectiveness of the implemented BRMP in the enhancement of flora and fauna habitats on the subject site.

1.2 SITE DESCRIPTION

1.2.1 Overview

The subject site is approximately rectangular in shape, about 18.5 ha in area, and is bounded to the:

- north by Barina Downs Road and further north by residential development;
- south and west by residential development; and
- east by Mackillop Drive and further east by residential development (Figures 1 and 2).

The subject site is currently used as a function centre and residential accommodation for the Sisters of St Joseph. The majority of the buildings are located near the south-western corner of the subject site and a small cottage is located at the eastern end. The majority of the native vegetation has been cleared from the subject site for use by grazing livestock, but areas

along the access road from Barina Downs Road (that is, the driveway) and around the heritage-listed buildings have been landscaped with exotic plants (Figure 2).

Ambrose (2009) recorded 115 species and varieties of plants in landscaped and remnant vegetation areas on the subject site, comprising 52 exotic species (45.2% of total plant species/varieties), 30 locally native species (26.1%), 17 non locally-native species (14.8%) and 16 cultivars (13.9%).

The subject site slopes gently to the south and moderately to the north from the centrally-located driveway. There are no drainage lines on the subject site.

The subject site is located on an elevated Hawkesbury sandstone ridge top, surrounded by a Luddenham soil landscape. The dark podzolic soils or massive earthy clays are underlain by Ashfield and Bringelly Shales of the Wianamatta Group (Hazelton *et al.* 1989).

1.2.2 Remnant Vegetation

Small remnants of native vegetation occur on the subject site, which NPWS (2002) maps as Sydney Turpentine Ironbark Forest (STIF). This vegetation type is currently listed as a Critically Endangered Ecological Community under the EPBC Act and as an Endangered Ecological Community under the TSC Act. According to NPWS (2002), small remnants of this community still occur on the subject site (Figure 3).

However, Baulkham Hills Council has mapped remnant vegetation on the subject site as Cumberland Plain Woodland (CPW) (Figure 4). This vegetation type is currently listed as an Endangered Ecological Community under the schedules of both the TSC and EPBC Acts. However, the NSW Scientific Committee has produced a Preliminary Determination to list CPW as a Critically Endangered Ecological Community under the TSC Act.

The true extent of the distribution of remnant vegetation on the subject site, determined from on-ground flora and fauna surveys (Ambrose 2009) is shown in Figure 5.

The native canopy of Area A (Figure 5) is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*) with the occasional Flooded Gum (*Eucalyptus grandis*) (Plate 1).

Native canopy trees in Areas B and C (Plates 2 and 3) include Flooded Gums, Rough-barked Apples (*Angophora floribunda*), White Stringybarks (*Eucalyptus globoidea*) and Black She-oaks (*Allocasuarina littoralis*).

Native shrub and groundcover species in these remnants are scarce because of grazing by livestock and replacement with exotic grasses and some weed species. Native species that occur there include Wallaby Grass (*Austrodanthonia racemosa*), Kangaroo Grass (Themeda australis), Kidney-weed (*Dichondra repens*) and Weeping Meadow Grass (*Microlaena stipoides*). Exotic grass species include Sweet Vernal Grass (*Anthoxanthum odoratum*), Prairie Grass (*Bromus catharticus*), Cocksfoot Grass (*Dactylus glomerata*), Yorkshire Fog (*Holcus lanatus*) and Perennial Ryegrass (*Lolium perenne*) and common exotic herb species include Catsear (*Hypochaeris radicata*) and Plantain (*Plantago lanceolata*).

It is probable that the 28 Forest Red Gums (*Eucalyptus tereticornis*) that occur on the northern side of the driveway (Plate 4, Area D) are also remnant trees, rather than occurring there as part of a landscaping program.

The remnant vegetation on the subject site has 13 plant species that Tozer (2003) lists as representative of STIF and nine species that are representative of CPW (Table 1.1). Therefore, Ambrose (2009) concluded that the site's remnant vegetation is likely to be a transition between these two communities, rather than one or the other, although it is difficult to say definitively because so few shrub and groundcover species have been retained.

Table 1.1 **PLANT SPECIES ON THE SUBJECT SITE THAT ARE REPRESENTATIVE OF STIF AND CPW (ACCORDING TO TOZER 2003)**

Characteristic STIF Species in Remnants	Characteristic CPW Species in Remnants
Canopy Species	
Angophora costata	*Angophora floribunda*
Angophora floribunda	*Eucalyptus crebra*
Eucalyptus eugenoides	*Eucalyptus eugenoides*
Eucalyptus globoidea	*Eucalyptus globoidea*
Eucalyptus punctata	*Eucalyptus punctata*
Eucalyptus tereticornis	*Eucalyptus tereticornis*
Understorey Species	
Pittosporum undulatum	None
Acacia parramattensis	
Groundcover Species	
Dichondra repens	*Austrodanthonia racemosa*
Entolasia stricta	*Themeda australis*
Lomandra longifolia	*Microlaena stipoides*
Microlaena stipoides	
Oplismenus aemulus	

1.2.3 *Landcaped Areas*

Areas along the subject site's driveway, memorial gardens north of the driveway, landscaped gardens around the building and the boundary areas of the subject site, have been landscaped with a mix of exotic and non-locally native plant species (Plates 5 to 7). Trees that commonly occur in these areas include Jacaranda (*Jacaranda mimosifolia*), Deodar Cedar (*Cedrus deodora*), Fiddlewood Tree (*Citharexylum spinosum*), Liquidamber (*Liquidamber styraciflua*), Coral Tree (*Erythrina x sykesii*), Chinese Banyan (*Ficus microcarpa*), Japanese Maple (*Acer palmatum*), Cotoneaster (*Cotoneaster* sp.), Pin Oak (*Quercus palustris*), Monterey Pine (*Pinus radiata*), Green Ash (*Fraxinus pennsylvanica*) and Griffith's Ash (*Fraxinus griffithsii*). Non-locally native trees that have been planted include Brush Box (*Lophostemon confertus*), Crows Ash (*Flindersia australis*), Lemon-scented Gum (*Corymbia citriodora*), Queensland Firewheel Tree (*Stenocarpus sinuatus*), White Cedar (*Melia azederach*) and Norfolk Island Pine (*Araucaria heterophylla*).

The memorial garden (John Webber Park) to the north of the function centre and driveway contains a broad range of planted mostly exotic and non-locally native trees and shrubs, including Weeping Lilly Pilly (*Syzigium 'cascade'*), Dwarf Brush Cherry (*Syzigium australe*), several horticultural varieties of *Grevillea* and *Callistemon*, Banksia 'Giant Candles (*Banksia*

ericifolia x spinulosa), Golden Honey Locust (*Gleditsia sunburst*), Jacaranda, Liquidamber, Grass-leaved Hakea (*Hakea multilineata*), Willow Leaf Hakea (*Hakea salicifolia*), Weeping Boobialla (*Myoporum floribundum*), Black Locust (*Robinia pseudoacacia frisia*), Wisteria (*Wisteria* sp.), Brisbane Golden Wattle (*Acacia fimbriata*), Orchard Tree (*Bauhinia variegata*), Lemon-scented Tea-tree (*Leptospermum petersonii*), Rubber Tree (*Hevea brasiliensis*), Australian Christmas Bush (*Prostanthera lasianthos*), Weeping Fig (*Ficus benjamina*), Red Cedar (*Toona australis*), Pin Oak, Tibouchina (*Tibouchina* sp.), Olive Tree (*Olea europaea*), Waratah (*Telopea speciossisima*), Rose (*Rosa multiflora*), Yellow Gum (*Eucalyptus leucoxylon*), Spotted Gum (*Eucalyptus maculata*), Red Ironbark (*Eucalyptus sideroxylon*), Argyle Apple (*Eucalyptus cinerea*), Impatiens (*Impatiens* sp.), Firewheel Tree (*Stenocarpus sinuatus*) and Claret Ash (*Fraxinus* 'Raywood').

1.3 PROPOSED DEVELOPMENT

The Applicant proposes to subdivide the majority of the subject site for residential development, while retaining both the existing natural and cultural heritage values of the site. This means that the existing conference centre, areas of remnant vegetation and planted trees along the existing driveway will be retained (Figure 6).

Residential development will be a mix of two-storey medium-sized dwellings, two-storey townhouses and a low rise apartment building (Figure 6). The proposed subdivision and tree-planting plan is shown in Figure 7. Proposed conservation areas, where native vegetation will be retained and enhanced through the implementation of a Bushland Rehabilitation Management Plan is shown in Figure 8.

1.4 STRUCTURE OF REPORT

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

Chapter 2 provides an overview of the vegetation management issues relating to the subject site, including potential impacts that may arise as a result of the establishment of the proposed works program.

Chapter 3 proposes short- and long-term management actions as part of the BRMP, including the identification of proposed conservation outcomes and indicators of success.

Chapter 4 summarises the timing for implementation of the BRMP strategies, determines who is responsible for implementing them and discusses monitoring and evaluation requirements.

Appendix A defines the noxious weed categories. *Appendix B* lists the noxious weeds for the Baulkham Hills Local Government Area.

Figure 1 **LOCATION OF SUBJECT SITE**

Figure 2 **AERIAL VIEW OF SUBJECT SITE**

Figure 3 **NPWS (2002) MAPPING OF VEGETATION COMMUNITIES IN AND AROUND THE SUBJECT SITE**

Map Units:
15: Sydney Turpentine-Ironbark Forest. 43: Sydney Turpentine-Ironbark Margin Forest.
Solid Colour: Canopy > 10% cover. Hatched Colour: Canopy < 10% cover

Figure 4 **BAULKHAM HILLS COUNCIL MAP OF VEGETATION COMMUNITIES ON AND AROUND THE SUBJECT SITE**

Orange shading: Cumberland Plain Woodland

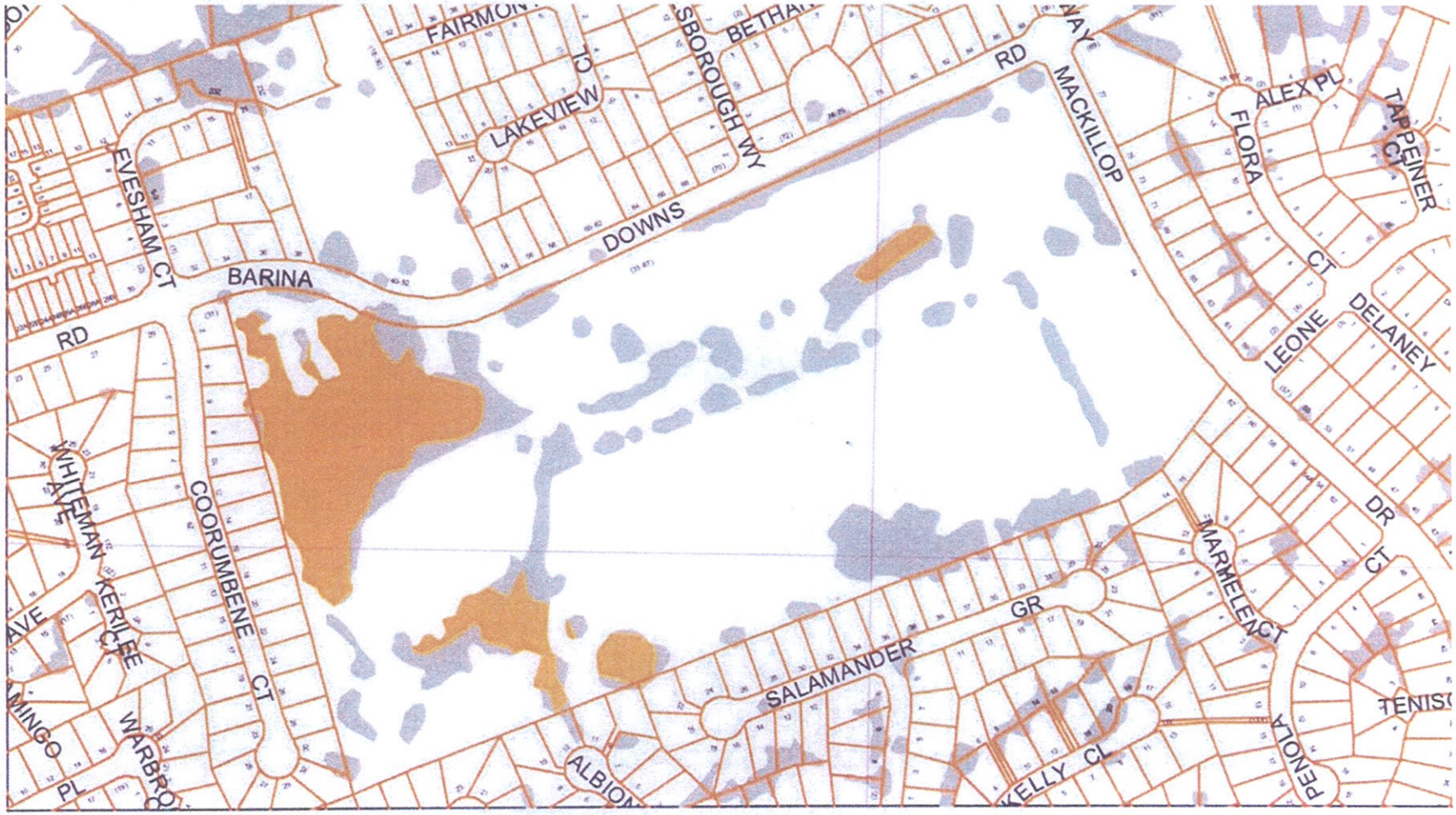


Figure 5 **REMNANT VEGETATION AREAS ON SUBJECT SITE**

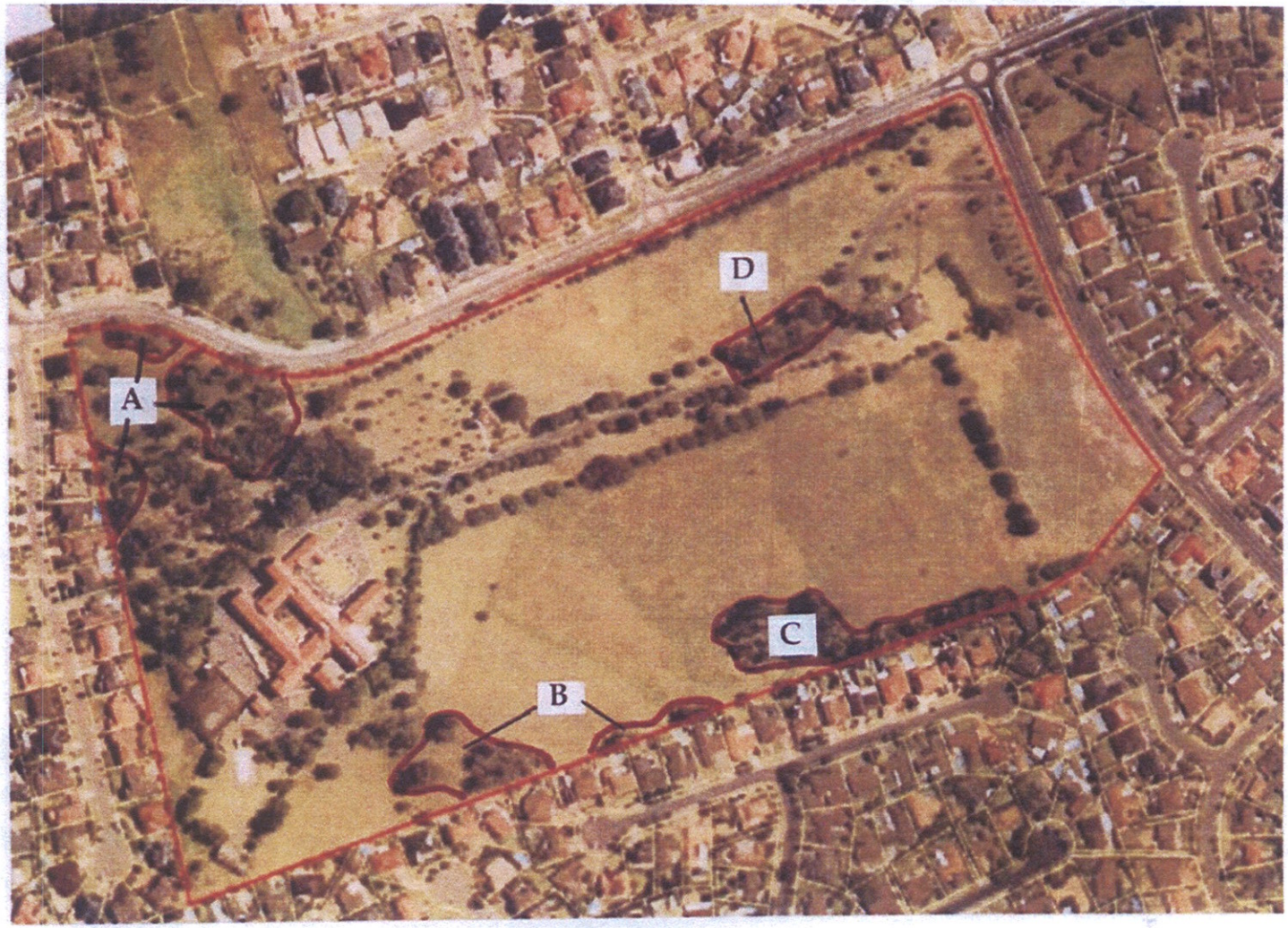


Figure 6 **PROPOSED DEVELOPMENT CONCEPT**

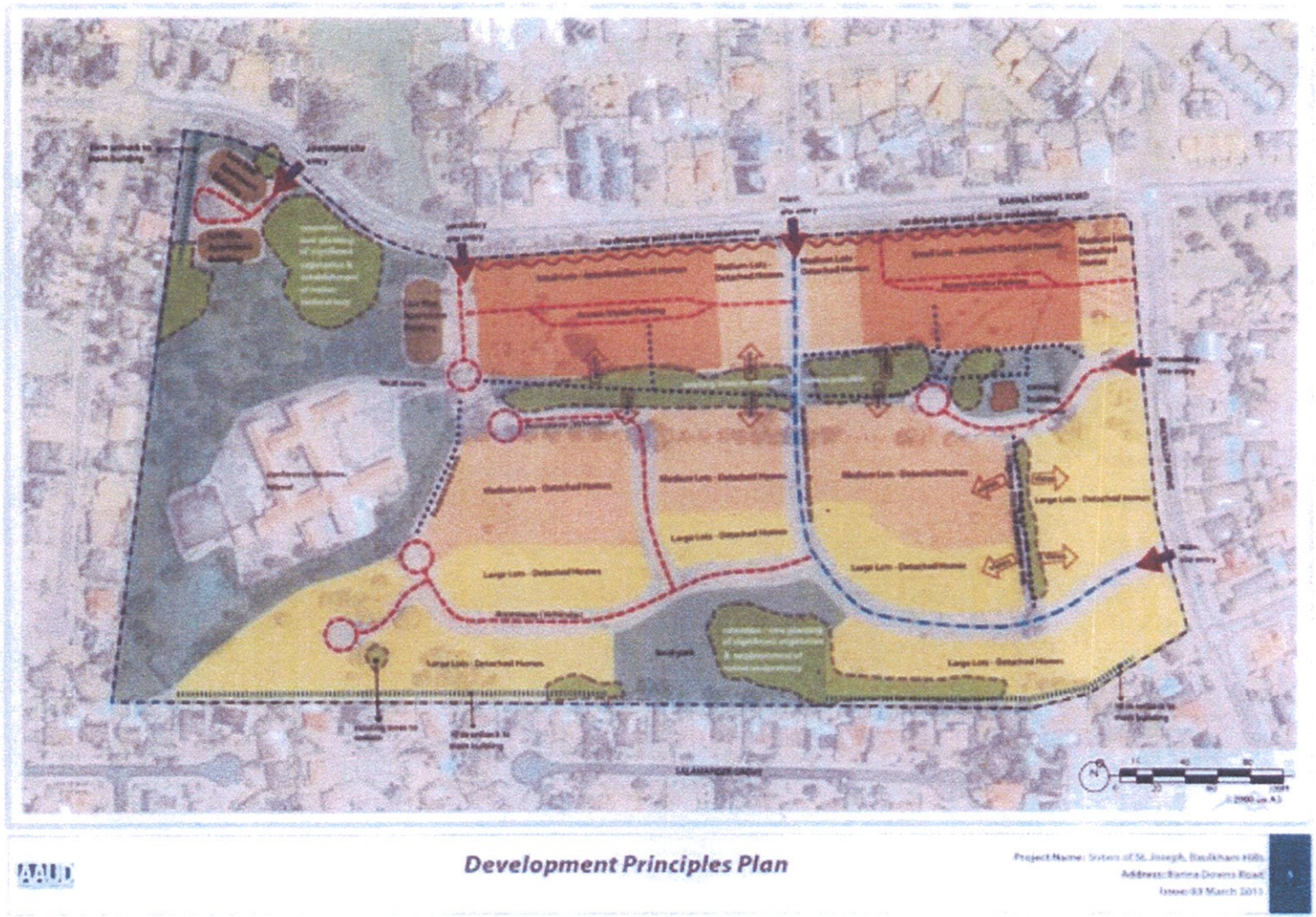


Figure 7 **PROPOSED RESIDENTIAL SUBDIVISION AND ROAD PLAN**

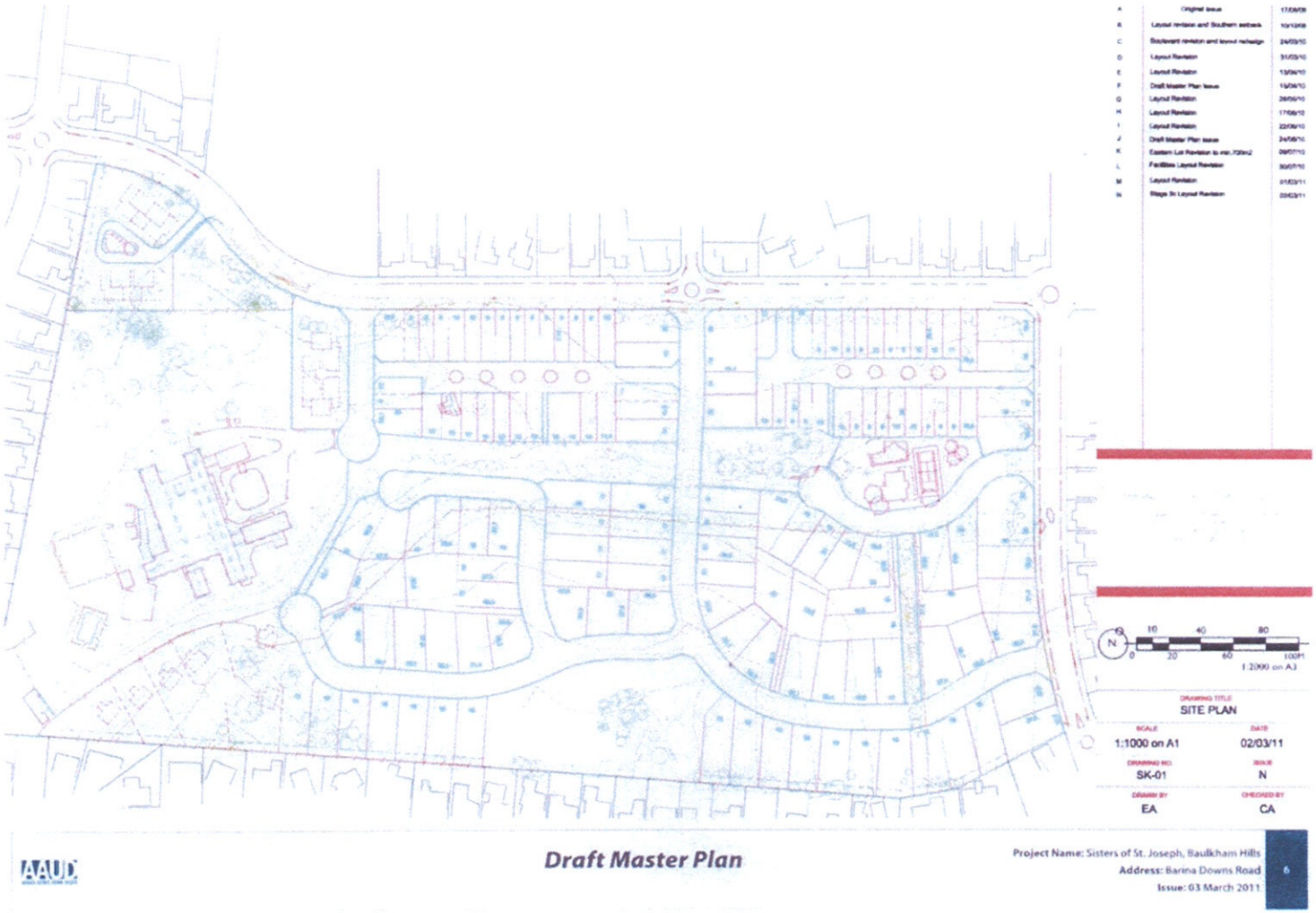


Figure 8 **PROPOSED VEGETATION RETENTION (CONSERVATION) AREAS**

Plate 1 **Remnant Vegetation North-west Corner of Subject Site (Area A) Dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*).**

Plate 2 **Remnant Vegetation Along the Southern Boundary of the Subject Site (Area B), dominated by White Stringybark (*Eucalyptus globoidea*) and Flooded Gum (*E. grandis*).**

Plate 3 **Remnant Vegetation Along the Southern Boundary of the Subject Site (Area C), dominated by White Stringybark (*Eucalyptus globoidea*) and Flooded Gum (*E. grandis*).**

Plate 4 **Forest Red Gums (*Eucalyptus tereticornis*) on Northern side of Driveway.**

Plate 5 Row of Planted Brush Box Along Eastern Boundary of Paddock

Plate 6 Crows Ash (*Flindersia australis*) Along the Northern Side of Driveway

Plate 7 Coral Trees (*Erythrina x sykesii*) on Southern Side of Driveway.

2

ISSUES AND IMPACTS

2.1 INTRODUCTION

This chapter provides an overview of the vegetation management issues relating to the subject site and neighbouring areas, including potential impacts that may arise as a result of the proposed industrial subdivision.

2.2 LOSS AND MODIFICATION OF NATIVE VEGETATION COMMUNITIES

About 1.318 ha of CPW/STIF occurs on the site (Figure 8). A total of 1.262 ha of this will be retained and an additional 1.290 ha (1.15 ha near the north-western corner of the subject site and 0.14 ha along the southern boundary) will be planted with CPW and STIF species. Therefore, the nett increase in CPW/STIF on the subject site after subdivision would be 1.234 ha.

A buffer of at least 10 metres will be maintained between the edge of each of the remnants labelled as Conservation Area A in Figure 8. Remnant vegetation retained elsewhere on the subject site may be impacted by stormwater runoff from residential areas. Polyweb fencing will be erected around the remnants during construction periods to prevent damage to CPW and STIF vegetation from trampling, vehicles and use of heavy machinery.

Therefore, 0.667 ha of remnant CPW/STIF and 1.290 ha of newly-created conservation areas (containing CPW and STIF species) (a total of 1.957 ha of native vegetation) will be adequately buffered against the impacts of the proposed urban development, whereas an additional 0.595 ha of remnant CPW/STIF is likely to be modified (e.g. increased weed invasion) as a result of stormwater runoff.

The present report proposes the means by which the retained remnant vegetation areas can be protected from the impacts of urban development, planting schedules for areas to be landscaped with CPW and STIF species and means by which weeds and other exotic plants can be controlled in both the short- and long-term in the remnant vegetation and landscape areas.

2.3 WEEDS

Weeds and exotic grasses that occur on the subject site include Rhodes Grass (*Chloris gayana*), Paspalum (*Paspalum dilatatum*), Paddys Lucerne (*Sida rhombifolia*), Kikuyu (*Pennisetum clandestinum*), Wild Oats (*Avena sativa*), Prairie Grass (*Bromus catharticus*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Asaparagus Fern (*Protasparagus aethiopicus*), Lantana (*Lantana camara*), Curley Dock (*Rumex crispus*), Mickey Mouse Plant (*Ochna serrulata*), Morning Glory (*Ipomoea indica*), Large-leaved Privet (*Ligistrum lucidum*), Small-leaved Privet (*Ligustrum sinense*), Camphor Laurel (*Cinnamomum camphora*), Crofton Weed (*Ageratina*

adenophora), Cobbler's Pegs (*Bidens pilosa*), Catsears (*Hypochaeris radicata*) and Milk-thistle (*Sonchus oleraceus*).

Given the extent of weed infestation in remnant bushland on the subject site, considerable weed control is required as part of the BRMP. Ongoing work is required in the future to remove or significantly reduce infestation and manage weeds in the long-term so that they do not continue to spread from the neighbouring residential areas.

2.4 EARTHWORKS AND CONSTRUCTION IMPACTS

Earth-moving and construction works associated with the establishment of residential allotments and establishment of roads, and subsequent building of dwellings and other buildings, have the potential to cause sediment runoff into retained bushland and landscaped areas if proper sediment controls are not put in place.

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

3

VEGETATION MANAGEMENT

3.1 MANAGEMENT APPROACH

The approach of the BRMP is to align short- and long-term management actions with the proposed conservation outcomes and indicators. In this way the implementation of management actions can be monitored and reviewed to ensure consistency with the future desired character and conservation outcomes of the site.

The aims for bushland management of the site include:

- maintenance of existing ecological values of bushland outside the proposed development area;
- enhancement of native vegetation and natural habitats in areas already degraded;
- creation and maintenance of vegetation and habitat connectivity; and
- successful integration of the built and natural environment.

3.2 CONSERVATION OUTCOMES.

3.2.1 *Overview*

The five main conservation objectives for vegetation management on site are:

- Protection of the CPW/STIF remnants and the existing landscaped areas on the subject site that are to be retained, and landscape areas to be created, from the direct and indirect impacts of earthworks associated with residential subdivision and construction works associated with residential development.
- weed management;
- bush regeneration;
- fire protection; and
- maintenance of open areas elsewhere on the subject site (that is, within individual subdivision lots).

3.2.2 *Protection of Remnant Vegetation and Landscape Areas*

(a) Procedures

Protection of vegetation areas that will be retained or created on the subject site is required during construction and landscaping phases on the subject site.

The proposed measures are outlined in the present section and Section 3.2.4 of the BRMP. Specific measures to be undertaken include:

- Erosion and sediment control measures will be installed prior to the commencement of works on the site and maintained in accordance with approved erosion and sediment control plan for the development and the Landcom's "Soils and construction", 4th Edition, March 2004. These measures will be certified by way of a Compliance Certificate, which will be issued a minimum of two days before works are to commence on site.

- These measures will ensure that there were will no sediment flow and excessive water flow from the subject site into retained bushland and landscaped areas.

- Proposed construction footprints will be surveyed and marked using poly-web fencing or other such measures, prior to the commencement of earthworks and construction. Vegetation clearing will be limited to within the surveyed construction areas. No access to construction equipment or personnel will occur outside the surveyed area. Fencing (or other alternative measures) will remain in place until the risk of accidental clearing from construction activity is removed.

- No trees, including saplings, on the subject site will be removed, ringbarked, cut, topped or lopped or wilfully destroyed without the prior consent of Baulkham Hills Council and in accordance with Council's Tree Preservation Order and Policy.

- The health of trees that are close to works will be monitored at regular intervals during the construction period by an appropriately qualified and experienced arborist. The frequency of these inspections will be at least once a month, unless there is an immediate concern about the health of a tree upon which the services of the arborist will be required at that time. If the arborist observes any damage to trees during this period, then he/she will report this finding to the construction engineer, landowner and Baulkham Hills Council.

- If, during the course of construction (including vegetation clearing), the construction engineer becomes aware of the presence of any threatened flora and fauna species that are likely to be significantly affected, he/she will immediately cease those construction activities that are likely to affect the threatened species and consult with landowner, Baulkham Hills Council and the NSW Department of Environment and Climate Change (DECC). Following this consultation, the construction engineer will meet all the requirements as directed by Baulkham Hills Council prior to recommencement of any works likely to affect threatened species.

(b) Specific Tree Protection Measures

The following additional measures will be implemented in vegetated areas that are adjacent to earthworks and construction areas:

WORKS NEAR TREES

Tree trunks will be protected by 2 metre lengths of 75 mm x 25 mm hardwood timbers spaced at 80 mm that are secured with galvanised wire (not fixed or nailed to the tree in any way).

All works within 5 metres of any trees required to be retained (whether on the subject site or on adjoining land) will be carried out under the supervision of an 'AQF Level 5 Arborist'

and a certificate submitted to the principal certifying authority, detailing the methods(s) used to preserve the trees.

There will be no excavation, filling or stockpiling of building materials, parking of vehicles or plant, disposal of cement slurry, waste water or other contaminants within 4 metres of any trees, unless authorised in writing by Ryde Council.

TREE PRUNING

All tree removal and tree pruning will be undertaken in accordance with the Australian Standard AS4373-2007 (Pruning of Amenity Trees) and will be carried out in a manner that does not adversely affect retained native trees.

EXCAVATION NEAR TREE ROOTS

All works within 4 metres of native trees will be undertaken in a sensitive manner with minimal disturbance to native flora. The excavation or filling of soil or placing of building materials will not occur within 4 metres of native trees, unless written approval is obtained from Ryde Council. Any approved excavation works within 4 metres of the retained native trees will be undertaken by hand excavation methods under supervision of a qualified arborist in such a manner that is non-injurious to any tree roots revealed. Tree roots between 10 mm and 50 mm in diameter, revealed during excavation, will be cut cleanly by a sharp hand saw. There will be no severance of tree roots that are greater than 50 mm in diameter. On completion of construction works, all disturbed areas on the subject site will be restored to a natural state in accordance with the approved tree-planting schedule, including the replacement of topsoil, removal of weeds and building materials.

(c) Performance Outcomes

- Minimised disturbance to habitats surrounding the worksite areas;
- Reuse of mulched native plant material from worksites in subsequent landscaping and rehabilitation areas;
- No harm to native fauna as a result of worksite activities.

3.2.3 *Weed Management*

Overview

A weed is a plant that is not native (i.e. it is exotic) to the area and causes commercial or environmental damage to economically viable cropping, native bushland or threatened species. Weed management involves controlling and potentially eradicating the population of a weed, deterring the introduction and/or further spread of the species. Effective weed control is achieved by employing techniques such as integrated pest management methods of biological, chemical, cultural, mechanical and physical practices.

Noxious Weeds

Under the NSW *Noxious Weeds Act, 1993* and associated regulations, landowners are required to follow different actions depending on the weed category the weed species falls under, outlined in the Act. These categories are listed in Appendix A.

Noxious weeds that occur within the Baulkham Hills Local Government Area are listed in Appendix B. There are three noxious weed species occurring on the subject site:

- Crofton Weed (*Ageratina adenophora*);
- Large-leaved Privet (*Ligustrum lucidum*) and
- Small-leaved Privet (*Ligustrum sinense*);

Other noxious weed species, as well as other general weed and exotic plant species that occur within the Baulkham Hills Local Government Area have the potential of invading the subject site from neighbouring blocks of land in the future. Therefore, weed control on the subject site needs to be ongoing and over the long-term.

Woody weeds on the subject site will require treatment with undiluted Roundup Bioactive herbicide, or the equivalent, using the:

- *cut-and-paint method*: cutting the plant down as close to the ground as possible, followed by the manual application of dyed, undiluted herbicide to the sapwood of the stump: or
- *scrape-and-paint method*. the removal of a vertical strip of the outer bark and the manual application of dyed, undiluted herbicide onto the exposed sapwood.

These methods reduce the likelihood of soil erosion because the whole plant is not removed. However, they require regular follow-up work because treated weeds tend to sucker. Any flowering, fruiting or seeding bodies should be removed from the plants before they are treated with either of these methods.

Weedy grasses and herbs can usually be physically removed from the soil. However these are numerous and cover a large area of the subject site - bushland interface, and thus their removal is likely to be a fiddly and time-consuming process. Where weeds are growing among native plants, especially native herbs and grasses, the main root mass of the weed may need to be cut out of the ground with a knife to avoid disturbing the roots of nearby native plants.

It is important to minimize the risk of herbicides entering drainage lines and wetlands in the locality. Therefore, undiluted herbicides should be used sparingly and carefully. It is essential to use only *Roundup Bioactive* when applying herbicides to the subject site, to reduce the impact on aquatic wildlife, especially frogs, just in case this is seepage of herbicides into aquatic environments. All herbicide should be applied surfactant-free.

All Lantana and Bridal Creeper material should be removed off site and disposed of appropriately because it is capable of spreading vegetatively.

No removed weed material should be left within the subject site or in adjoining bushland areas, especially if they are seeding. Seeding weeds that have been removed may be temporarily piled under black plastic elsewhere on the site because it is unlikely that the seeds will germinate. If the some seeds do germinate, then they will be localized (under the

plastic) and easy to remove. This material must ultimately be appropriately disposed of off-site.

Secondary weed control follows the primary weed control and involves physical weed removal and/or careful spot spraying of weed regrowth.

Maintenance of landscaped areas for bushfire hazard reduction purposes must be ongoing. The landholders will be responsible for the maintenance of these areas and will also bear the cost of the maintenance and monitoring.

Maintenance is required to include sediment and erosion control, weed control, replacement of plant losses and any other requirements for achieving successful vegetation establishment.

It is proposed to have a staged removal of weeds and landscaping of the subject site so that the area of bare soil within the subject site at any one time is minimized. If the construction activities prevent the staged weed removal/planting, then it is recommended that the commonly accepted practice of spraying bare earth areas with a sterile grass crop be implemented until such time as the landscaping can commence. A recommended temporary cover crop mix for soil stabilisation (including seed concentrations) is shown below:

Type	Spring/Summer Sowing	Autumn/Winter Sowing
Japanese Millet	20 kg/ha	-
Ryecorn/Barley/Oats	-	30 kg/ha
Red Clover	4 kg/ha	4 kg/ha
White Clover	4 kg/ha	4 kg/ha
Wimmera Rye	10 kg/ha	-
Kangaroo Valley Rye	-	10 kg/ha

N.B. Kikuyu is not to be used because it is a vigorous choking perennial that will out-compete native groundcover and shrub species.

Additional Weed Control Measures

- No fill material will be imported to the subject site without prior approval of Baulkham Hills Council. No recycling of material for use as fill material on the site will be carried out without the prior approval of the Council.

- No fill material will be imported to the site for landscaping purposes until such time as a Validation Certificate (with a copy of any report forming the basis for the validation) for the fill material has been submitted to Council. The Validation Certificate will:

  (a) be prepared by an appropriately qualified person (to be defined by Baulkham Hills Council) with consideration of all guidelines (e.g. EPA, ANZECC, NH&MRC), standards, planning instruments and legislation.

  (b) Clearly indicate the legal property description of the fill material source site;

  (c) provide details of the volume of fill material to be imported to the site in accordance with the EPA's "Environmental Guidelines: Assessment, Classification & Management of Non-liquid Wastes" 1997; and

(d) (based on fill classification) determine whether the fill material is suitable for its intended purpose and land use and whether the fill material will or will not pose an unacceptable risk to human health or the environment.

- An appropriately qualified person, defined by Baulkham Hills Council, will:
- supervise the filling works;
- on completion of filling works, carry out an independent review of all documentation relating to the filling of the site, and will submit a review findings report to Council and any Principal Certifying Authority;
- certify by way of a Compliance Certificate or other written documentation that fill materials have been placed on the site in accordance with all conditions of this consent and that the site will not pose an unacceptable risk to human health or the environment. A copy of the Compliance Certificate or other documentation will be submitted to Council and any Principal Certifying Authority.
- All construction litter and waste materials stored on site (including cigarette butts) must be contained in a designated area, such as a waste bay or bin, to ensure that no waste material enters the stormwater system or neighbouring properties, and the establishment and spread of weeds within the waste piles. The designated waste storage area will provide at least two waste bins to allow for the sorting of different waste materials. The waste bays will be fully enclosed when the site is unattended, particularly at night and over the weekend.
- All excavated material or waste generated as a result of the development that cannot be re-used or recycled will be disposed at a Council-approved site or waste facility. Details of the proposed disposal location of all the excavated material from the development site will be provided to the Principal Certifying Authority prior to construction works commencing.
- If mulch is used during landscaping of the subject site it is to be of native species in origin or non-nutrient rich decomposable material.

3.2.4 *Landscaping the Subject Site*

Overview

Landscaping/revegetation works are best suited for implementation when all civil works have been completed and Soil and Water management strategies and devices are in operation.

All bushland rehabilitation works are to meet industry best practice by following relevant Australian Standards:

- AS 4419 Soils for Landscaping and Garden Use.
  This sets requirements for bulk density, organic matter, weed content, large particle content, wettability, pH, electrical conductivity, ammonium toxicity, phosphorous content, dispersibility, toxicity, nitorogen drawdown, permeability and texture of soils.

- AS 4454 Composts, Soil Conditioners and Mulches.
  Requirements included in this Australian Standard that are relevant to the present BRMP to ensure efficient water use and healthy plant growth include:
  (a) Application of 75-100 mm of organic mulch over the ground surface where there are mass plantings. Top up annually. Keep the mulch at least 150 mm away from trunks and stems to prevent rot.
  (b) Mulch is to have a mixture of textures to allow water to pass through. A combination of chipped bark and leaves decomposes at different rates and supplies a variety of minerals and nutrients.
  (c) Avoidance of the introduction of pests and diseases from mulch imported to the site.
  (d) Fresh organic products (e.g. sawdust, woodchips and pine park) must not be applied directly to the soil. These materials extract nitrogen from the soil (nitrogen drawdown), completing with plant uptake and causing sickly plants.
  (e) If using an irrigation system, and underground or surface drip system should be used to make sure that the water reaches the soil below the mulch.
  (f) Avoidance of the use of mulch in areas where it is likely to be washed away by surface flow during heavy rain.

- AS 4373 Pruning of Amenity Trees.
  This sets the requirements that are necessary for shaping, crown-lifting or the removal of dead or diseased limbs on trees. Disease-free pruning of native vegetation should be put back into the landscape as mulch so as to return stored nutrients to the soil.

Bushland regeneration techniques described in Buchanan (1989), The National Trust of Australia (1991) and the Florabank website (www.florabank.org.au) meet these Australian Standards and will act as benchmarks to which the landscaping works on the subject site will be attained.

Landscape/Rehabilitation Strategies

Strategies for landscaping the subject site include:

- Planting of tube stock to minimise opportunities for the re-establishment of weed species. The planting of this stock will help the vegetated areas return to their original vegetation community structures.

- Staged revegetation will be used to utilise positive characteristics of invaded areas to increase chances of successful revegetation;

- A follow-up weed removal will be undertaken to ensure that weeds do not re-establish in areas of soil disturbance and to minimise competition with native plant species.

- No fill or imported surface material of indeterminate origin will be used in landscaping the subject site. This will help minimise the risk of further contaminating the site and the neighbouring areas with weeds or their seeds.

Composition of Plant Species

The main principal behind planting native species in community-title areas of the subject site is to have fully structured landscaped areas that have a mix of native tree, shrub and groundcover and grass species local to the area. All plantings will be of local provenance only. Plant species that are suitable for planting in the community title areas of the subject site include:

Tree Canopy Species

Forest Red Gum (*Eucalyptus tereticornis*)
Grey Box (*Eucalyptus moluccana*)
Narrow-leaved Ironbark (*Eucalyptus crebra*)
Narrow-leaved Stringybark (*Eucalyptus eugenoides*)
Red Ironbark (*Eucalyptus fibrosa*).
Blackbutt (*Eucalyptus pilularis*)
Turpentine (*Syncarpia glomulifera*)

Understorey/Shrub Species

Blackthorn (*Bursaria spinosa*)
Sweet Pittosporum (*Pittosporum undulatum*)
Downy Wattle (*Acacia pubescens*)
Sally Wattle (*Acacia falcata*)
Sydney Green Wattle (*Acacia parramattensis*)
Gorse Bitter Pea (*Daviesia ulicifolia*)
Egg and Bacon Pea (*Dillwynia tenuifolia*)
Thread-leaf Hopbush (*Dodonaea falcata*)
Prickly Spider Flower (*Grevillea juniperina* ssp *juniperina*)

Ground Stratum Species (Herbs and Grasses)

Poison Rock Fern (*Cheilanthes sieberi* ssp *seiberi*)
Blue Flax Lily (*Dianella revoluta* var. *revoluta*)
White Root (*Pratia purpurascens*)
Variable Sword-sedge (*Lepidosperma laterale*)
Caustic Weed (*Chamaesyce drummondii*)
Twining Glycine (*Glycine clandestina*)
Purple Twining-pea (*Hardenbergia violacea*)

Ivy Goodenia (*Goodenia hederacea*)
Austral Bugle (*Ajuga australis*)
Spiny-headed Mat-rush (*Lomandra longifolia*)
Many-flowered Mat-rush (*Lomandra multiflora*)
Kangaroo Grass (*Themeda australis*)
Wire Grass spp. (*Aristida* spp)
Weeping Grass (*Microlaena stipoides*)

Protective bags (milk cartons, bamboo rods or plastic bags) will be placed around planted tubestock because of the chance of grazing by feral or native animals and strong competition from weeds. The bags will be removed once the plants are established and are growing vigorously. The protective bags will be present for at least 6 months.

3.2 ESTIMATED COSTS

The estimated maximum area of land that could be rehabilitated or landscaped on the subject site, based on the current development proposal (Figure 8) is 26,200 m². A cost estimate for the proposed works is shown in Table 3.1. For the bush regeneration work a six-month primary weed removal is suggested followed by a 2-year bush regeneration program.

Table 3.1 **ESTIMATED COSTS OF BUSHLAND RESTORATION WORKS**

Task	Quantity	Unit	Rate ($)	Amount ($)
Weeding, clearing and appropriate disposal of material from the subject site.	20,200	sq. m	1.50	30,300.00
Soilworks and cultivation in landscape areas of the subject site to a depth of 75 mm.	13,300	sq. m	1.00	13,300.00
Supply and installation of fencing for bushland protection	N/A	Total length: 1,200 m	5.00	6,000.00
Supply and installation of grasses and groundcovers for landscape areas: Virotubes.	26,600	Each	0.75	19,950.00
Supply and installation of shrubs for landscape areas: Hiko Tubes	13,200	Each	2.50	33,000.00
Supply and installation of saplings of native canopy trees	532	Each	6.50	3,458.00
Supply and installation of shrub guards (optional)	13,200	Each	0.50	6,600.00
Maintenance through to end of Year 1 (replanting, weeding, watering)	26,200 m²	Item	1.50	39,300.00
Maintenance through to end of Year 2: (replanting, weeding, watering)	26,200 m²	Item	1.50	39,300.00
Regular monitoring and reporting (establishment report, then once every 6 months for two years)	5	Each	1,000.00	5,000.00
TOTAL COST (including GST)				**$ 196,208.00**

4

IMPLEMENTATION AND MONITORING

4.1 INTRODUCTION

This chapter summarises the timing for implementation of the BRMP strategies, determines who is responsible for implementing them and discusses monitoring and evaluation requirements.

4.2 IMPLEMENTATION SCHEDULE

The bushland management strategies identified in Chapter 3 can be divided into four broad timeframes for implementation:

- ongoing;
- pre-construction;
- during construction;
- post-construction.

Table 4.1 summarises these strategies according to these time periods. The frequency and duration of each activity is also indicated.

4.3 IMPLEMENTATION RESPONSIBILITIES

- The landowners will be responsible for implementing the vegetation management procedures outlined in Chapter 3 and Table 4.1 of the present report.

- Where appropriate, these responsibilities will be delegated to contractors (incorporated into relevant contracts). Many of the strategies that have been outlined in Chapter 3 and Table 4.1 will be implemented by a suitably qualified and experienced Bushland Regenerator who has a Level 2 TAFE qualification in Bushland Management or by other suitably qualified and experienced person(s) that have been approved by Baulkham Hills Council

4.4 MONITORING

4.4.1 Overview

The overall objective of monitoring is to measure the effectiveness of the proposed strategies in achieving the desired outcomes. Detailed monitoring will help to identify and address non-conformance and implement corrective actions within an appropriate time frame.

The time-scale and frequency of each management procedure that is outlined in the BRMP is shown in Table 4.1

Table 4.1 MAINTENANCE SCHEDULE

Management area	Management guidelines	Approximate frequency
Weed Control		
Whole of site	Identify and map noxious and other weeds	Once every six months
Whole of site	Follow weed control instructions as per noxious weed category	As detected
Whole of site	Direct removal or suppression of weed infestation	Ongoing
Whole of site	Monitor and re-apply weed control strategy (as required)	Every month or as necessary under noxious weed control programs available from the local control authority
Bush regeneration		
Selected areas to be revegetated	Determine the priority order for which selected sites to be revegetated	Start of operations
As above	Fence off areas to be revegetated to indicate no stockpiling or construction	Start of operations
As above	Staged removal of weeds	Staged, as per bush regeneration strategy. Long term/ongoing.
As above	Revegetation	As weed species are removed. Preferable to plant native plants in the period September to November.
As above	Monitor the survivability of planted species in the revegetated areas. Replace trees and shrubs that have died.	Once every 6 months for 2 years.
Fire Protection		
Vegetated areas on the subject site that are not part of the revegetated riparian zone.	Monitor fuel load	Once a year, every September
Vegetated areas on subject site that are not part of the revegetated riparian zone.	Manual removal of excess fuel	When fuel loads exceed maximum level
Areas within 3 m buildings	Prune vegetation that has grown too closely to on-site buildings or heavy machinery.	The first week in October and the first week in February
Maintenance of open areas		
	Mowing and/or clearing around fences, shrubs, trees and other structures	November to March - once every fortnight. April to October - once a month.

4.4.2 During Construction

During the construction of buildings and associated infrastructures within individual allotments and bushland rehabilitation of the subject site, frequent monitoring will be undertaken to ensure that the conservation outcomes outlined in *Section 3.2* are being achieved. Monitoring will be undertaken where there is the greatest potential for direct or indirect impacts as a result of construction and fire management activities. Specific monitoring activities and their frequency of implementation are detailed in Table 4.1

Once the landscaping of designated conservation areas on the subject site has been completed, the Bushland Regenerator needs to produce an initial Vegetation Monitoring/Establishment Report. This report will include details of the completed planting schedule, and the health and condition of the plants at the time of planting.

Any adverse impacts on the bushland and common landscape areas the subject site that may have resulted from construction activities will be reported immediately in writing to Baulkham Hills Council and the landowners. No work will be permitted that further exacerbates any issues of non-compliance with the conservation objectives of the BRMP until contingency measures are prescribed and implemented.

4.4.3 Ongoing/Post-Construction

Long-term monitoring will target the vegetation zones identified in Figure 8, in particular, the remnant CPW/STIF vegetation areas and the proposed common landscape areas.

The aim of the bushland regeneration is to achieve at least a 90% survival rate of planted vegetation after 2 years. The bushland regenerator will return to the subject site every 6 months up to the end of the 2 years after the planting, to ensure that this survival rate has been achieved and to give advice to the landowners about future site maintenance. The reports will contain information about:

- the presence/abundance of weed species;
- planting survival rates; and
- other disturbances and physical damage (such as erosion).

Photographs will also be undertaken of the landscaped areas of the subject site to provide a long-term record of changes in vegetation and fauna habitats.

If plant survival rate is less than 90% after 2 years, then dead or dying plants should be replaced with healthy ones to the extent that the densities and types of plants, and abundance ratios between individual plant species, as outlined in any future landscape plan, are maintained.

The results and recommendations of the monitoring, including any impacts that are detected, are to be reported in writing, together with a photographic record of the condition of the vegetation, to Baulkham Hills Council and the current landowners. Contingency measures will be prescribed and implemented immediately upon identification of non-compliance with this BRMP.

Reporting of the condition of the vegetation will be conducted once every six months during the establishment and maintenance of the landscaped area.

4.5 PROPOSED TIMETABLE FOR THE IMPLEMENTATION OF THE BRMP

The timetable for the implementation of the BRMP is presented as Table 4.2.

Table 4.3 itemizes the main actions over the two-year vegetation maintenance period within the bushland and proposed landscape areas of the subject site, including the timing of reporting of the condition of the these areas.

Table 4.2 **PROPOSED TIMETABLE FOR THE IMPLEMENTATION OF THE BRMP UP TO AND INCLUDING THE LANDSCAPING PERIOD**

N.B.: Periods (months/years) refer to time lapse from the time of development consent for subsequent detailed development applications for those parts of the subject site impacting the remnant vegetation area.

Activity	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7				Month 8				Month 9			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Set up photographic monitoring																																				
Removal of weeds, other vegetative waste and garbage from the subject site.																																				
Temporary works (pre-construction), e.g. placement of hay bales, silt curtains, etc. to prevent soil runoff from subject site, especially weeded areas.																																				
Removal of native vegetation that have been identified for removal from the subject site.																																				
The removal of fill from the subject site that has been cleared from the construction footprint and parts of the subject site that have been designated for landscaping.																																				

Activity	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7				Month 8				Month 9			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Lay erosion control matting over soil, or spray-grass areas of soil, around the construction footprints that have been made bare as a result of weed or other vegetation removal.																																				
Pruning of branches that overhang the construction footprint or contravene the conditions necessary for the creation of an industrial site																																				
Installation of tree guards around the base of trees on the subject site or on neighbouring land, especially those along the common boundary between the subject site and the riparian zone of Second Pond Creek, to protect them from accidental physical damage from construction activities.																																				
Installation of fencing around the perimeter of the construction footprints within which construction activities (including the movement of vehicles and heavy machinery) will be restricted.																																				

Activity	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7				Month 8				Month 9			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Commence and complete civil construction activities (establishment of residential lots and associated urban infrastructure).																																				

	Month 10				Month 11				Month 12				Month 13				Month 14				Month 15			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Commence and complete civil construction activities (building of light industrial facilities).																								
Soil works associated with initial landscaping.																								
Install plant stock associated with landscaping																								

Table 4.3 PROPOSED TIMETABLE FOR 2-YEAR LANDSCAPING MAINTENANCE PERIOD

Year	Year 2												Year 3											
Month	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
Carry out maintenance including weeding, watering and replacement planting for 2 years.																								
Initial Landscaping Compliance Report (1st week of month)																								
2nd Landscape Monitoring Report (1st week of month)																								
3rd Landscape Monitoring Report (1st week of month)																								
4th Landscape Monitoring Report (1st week of month)																								
5th Landscape Monitoring Report (1st week of month)																								

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APPENDIX A

NOXIOUS WEED CATEGORIES

W1 - the presence of the weed on land must be notified to the local control authority and the weed must be fully and continuously suppressed and destroyed.

W2 - the weed must be fully and continuously suppressed and destroyed.

W3 - the weed must be prevented from spreading and its numbers and distribution reduced.

W4a - the weed must not be sold, propagated or knowingly distributed and any part of the weed must be prevented from growing within 3 metres of the boundary of a property.

W4b - the weed must not be sold, propagated or knowingly distributed and any existing weed must be prevented from flowering and fruiting.

W4c - the weed must not be sold, propagated or knowingly distributed and the weed must be prevented from spreading to an adjoining property.

W4d - the weed must not be sold, propagated or knowingly distributed and the weed must be removed if it is:

- 3 metres in height or less; or
- within half a kilometre of remnant bushland, as defined by SEPP 19, and is not deemed by a council as having historical or heritage significance.

W4e - the weed must be fully and continuously suppressed and destroyed. All reasonable precautions must be taken to ensure produce, soil, livestock, equipment and vehicles are free of the weed before sale or movement from an infested area of the property.

W4f - the weed must not be sold, propagated or knowingly distributed. Any biological control or other control program directed by a local control authority must be implemented.

W4g - the weed must not be sold, propagated or knowingly distributed.

APPENDIX B

NOXIOUS WEEDS OF THE BAULKHAM HILLS LOCAL GOVERNMENT AREA

HAWKESBURY RIVER COUNTY COUNCIL

The following weeds are declared noxious in the Hawkesbury River County Council control area **(including Baulkham Hills, Blacktown, Hawkesbury and Penrith council areas)**. The 'details' link on each listing provides further information on the legal requirements of the weed's listing and any variation in status within the local control area. A complete list of all weeds in all control areas is also available as a PDF document.

Common name	Scientific name	Category
African boxthorn	*Lycium ferocissimum*	W2
Alligator weed	*Alternanthera philoxeroides*	W1
Bathurst Noogoora Californian Cockle burrs	*Xanthium spp.*	W3
Black knapweed	*Centaurea nigra*	W1
Blackberry	*Rubus fruticosus (agg. spp.)*	W3
Broomrape	*Orobanche spp.*	W1
Cabomba	*Cabomba spp.*	W4g
Columbus grass	*Sorghum x almum*	W2
Crofton weed	*Ageratina adenophora*	W2
Dodder	*Cuscuta campestris*	W2
Giant Parramatta grass	*Sporobolus fertilis syn. Sporobolus indicus var. m*	W2
Green cestrum	*Cestrum parqui*	W2
Harrisia cactus	*Harrisia spp.*	W4f
Hawkweed	*Hieracium spp.*	W1
Horsetail	*Equisetum spp.*	W1
Johnson grass	*Sorghum halepense*	W2
Karroo thorn	*Acacia karroo*	W1
Kochia	*Kochia scoparia*	W1
Lagarosiphon	*Lagarosiphon major*	W1
Ludwigia	*Ludwigia peruviana*	W2
Mexican feather grass	*Nassella tenuissima syn Stipa tenuissima*	W1

Miconia	*Miconia spp.*	W1
Mother-of-millions	*Bryophyllum delagoense*	W2
Pampas grass	*Cortaderia spp.*	W2
Parthenium weed	*Parthenium hysterophorus*	W1
Paterson's curse,Vipers Italian bugloss	*Echium spp.*	W3
Pellitory	*Parietaria judaica*	W3
Prickly pears	*Opuntia spp.*	W4f
Privet - broadleaf	*Ligustrum lucidum*	W4b
Privet - narrowleaf	*Ligustrum sinense*	W4b
Rhus tree	*Toxicodendron succedaneum*	W2
Salvinia	*Salvinia molesta*	W2
Senegal tea plant	*Gymnocoronis spilanthoides*	W1
Siam weed	*Chromolaena odorata*	W1
Spiny burrgrass	*Cenchrus incertus*	W2
Spiny burrgrass	*Cenchrus longispinus*	W2
Spotted knapweed	*Centaurea maculosa*	W1
St John's wort	*Hypericum perforatum*	W2
Water hyacinth	*Eichhornia crassipes*	W2
Water lettuce	*Pistia stratiotes*	W1
Willows	*Salix spp.*	W4g

The information contained in this web page is based on knowledge and understanding of Order(s) under the Noxious Weeds Act 1993 at the time of writing or at the time of last review . However, because:

- there may be changes to the Order(s) users are reminded of the need to ensure that information on which they rely is up to date, and
- some weed declarations of particular weeds have explanatory or qualifying notes and users should check the accuracy, completeness and currency of information by:
    - reading the Order(s),
    - inquiring with the appropriate officer of the Local Government Authority for the user's locality, and/or
    - consulting with an independant advisor.