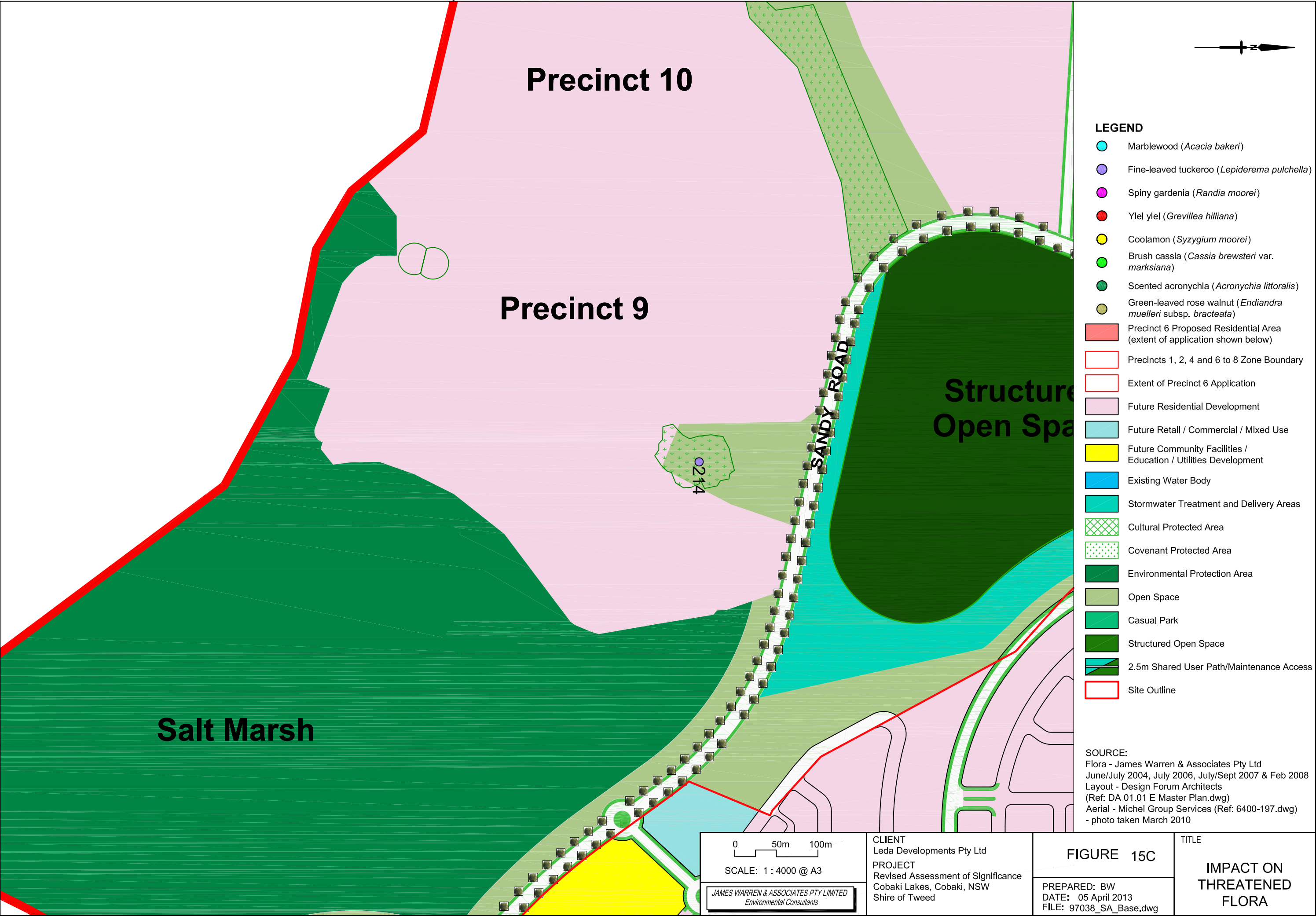




White yiel yiel occurs north of Brunswick Heads on the north coast of NSW and in Qld. The only populations currently known in NSW are in the Brunswick Heads and Tweed Heads areas, in small patches of remnant habitat (NPWS 2002a). Suitable habitat comprises sub-tropical rainforest, often on basalt derived soils.

NPWS have identified the following threats to the species:

- Risk of local extinction because populations are small and distribution is restricted;
- Loss of habitat through clearing for development;
- Habitat degradation through invasion by introduced weeds; and
- Seed collection for horticulture.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site.

The single stem of White yiel yiel on the Subject site occurs outside of the proposed development footprint and will not be affected by the proposed development (**FIGURE 15a**).

The proposed development will result in the removal or modification of a total of 0.11 hectares (1%) of rainforest communities that are considered to represent potential habitat for this species, all of which will occur from areas of the site with existing development approvals.

Scented acronychia

The NPWS database (June 2010) contains nine (9) records of this species within 10kms of the Subject site. Thirty-two (32) records occur within the Tweed LGA. A total of one (1) stem of Scented acronychia has been recorded from within a small isolated clump of vegetation in the central northern portion of the Subject site (**FIGURES 8 & 8a**).

Scented Acronychia grows in littoral rainforest on sand and is found between Fraser Island in Queensland and Port Macquarie on the north coast of NSW. NPWS have identified the following threats to this species:

- Destruction of habitat as a result of coastal development;
- Damage caused by inappropriate use of four-wheel drive vehicles;
- Invasion by introduced weeds, particularly Lantana, Bitou Bush and exotic vines; and
- Dieback caused by exposure to salt-laden winds.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site.

The Concept Plan has been amended to include this small patch of vegetation, including the single stem of Scented acronychia, within an area of Public Open Space (**FIGURE 15a**). Furthermore, it is proposed to protect this patch of vegetation under an Environmental Covenant.

The proposed development will result in the removal or modification of a total of 0.11 hectares (1%) of rainforest communities that are considered to represent potential habitat for this species, all of which will occur from areas of the site with existing development approvals.

Fine-leaved tuckeroo

The NPWS database (June 2010) contains one hundred and four (104) records of this species within 10kms of the Subject site. One hundred and fifty-five (155) records occur within the Tweed LGA. A total of thirty-six (36) stems of Fine-leaved tuckeroo have been recorded on the Subject site (**FIGURES 8, 8a, 8b & 8c**) the majority of which occur within the rainforest communities associated with Mt. Woodgee in the northern portion of the Subject site. One (1) stem occurs within a small isolated patch of rainforest in the central southern portion of the Subject site (i.e. Community 2b). This species has also been recorded in adjacent habitat to the east of the Subject site (EcoPro 2004) (**FIGURE 9**).

The Fine-leaved Tuckeroo inhabits lowland subtropical forest, particularly riverine areas, and in NSW is largely confined to infertile metasediments in the Tweed Valley (NPWS 2002). Sites in NSW include Middle Pocket, North Pumpenbil Creek, Hopkins Creek, Numinbah Gap, Stott's Island Nature Reserve, Tomewin, Piggabeen and Bilambil (Floyd, 1989).

NSW National Parks and Wildlife Service list the following threats to this species:

- Invasion of habitat by introduced weeds
- Clearing and fragmentation of habitat for development
- Collection of seed for horticulture

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site.

All stems of Fine-leaved tuckeroo occur outside of the proposed development footprint and will not be affected by the proposed development (**FIGURE 15a, 15b & 15c**). The small isolated patch of rainforest in the central southern portion of the Subject site (i.e. Community 2b) will be retained and protected by an Environmental covenant.

The proposed development will result in the removal or modification of a total of 0.11 hectares (1%) of rainforest communities that are considered to represent potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals. It is worth noting that this species is particularly common within the locality with several hundred having been recorded by JWA at Terranora and Bilambil.

Spiny gardenia

The NPWS database (June 2010) contains forty-two (42) records of this species within 10kms of the Subject site. Eighty-three (83) records occur within the Tweed LGA. A total of twelve (12) stems of Spiny gardenia have been recorded on the Subject site (**FIGURES 8 & 8a**) the majority of which occur within the rainforest communities associated with Mt. Woodgee and in a small riparian community (near Mt. Woodgee) in the northern portion of the Subject site. Six (6) additional stems of this species have been recorded within the border reserve to the north of the Subject site.

Spiny gardenia occurs from Lismore in north-east NSW north to the Logan River in south-east Qld. It is sparsely distributed, with most records in the Tweed and Brunswick areas (NPWS 2002). Spiny gardenia has been recorded from sub-tropical, riverine, littoral and dry rainforest habitats.

NSW National Parks and Wildlife Service list the following threats to this species:

- Clearing and fragmentation of habitat for development, agriculture and roadworks;
- Invasion of habitat by introduced weeds;
- Trampling by visitors; and
- Fire.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site. Six (6) stems of this species have been recorded within the border reserve to the north of the Subject site.

All Spiny gardenia stems occur outside of the proposed development footprint and will not be affected by the proposed development (**FIGURE 15a**).

The proposed development will result in the removal or modification of a total of 0.11hectares (1%) of rainforest communities that are considered to represent potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

Marblewood

The NPWS database (June 2010) contains thirty (30) records of this species within 10kms of the Subject site. One hundred and nineteen (119) records occur within the Tweed LGA. A total of eight (8) stems of Marblewood have been recorded on the Subject site (**FIGURES 8, 8a & 8b**) from within the rainforest communities associated with Mt. Woodgee in the northern portion of the Subject site, and within small isolated patches of vegetation in the central northern portion of the site. A number of specimens are also located within the steep-sided gullies near the dam on the western boundary of the Subject site. Fourteen (14) additional stems of this species have been recorded adjacent to the western boundary and three (3) additional stems within the border reserve to the north.

Marblewood has a restricted distribution from coastal south-east Queensland to north-east NSW (Mullumbimby). Suitable habitat consists of subtropical rainforest and adjacent eucalypt forest.

NSW National Parks and Wildlife Service list the following threats to this species:

- Loss of habitat from development and agriculture
- Invasion by weeds, particularly Lantana
- Fire
- Visitor impacts in high-use areas

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site. Fourteen (14) stems of this species have been recorded adjacent to the western boundary and three (3) stems within the border reserve to the north.

All stems of Marblewood occur outside of the proposed development footprint and will not be affected by the proposed development (**FIGURE 15a & 15b**).

The proposed development will result in the removal or modification of a total of 0.11 hectares (1%) of rainforest communities that provide potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

Brush cassia

The NPWS database (June 2010) contains twenty-six (26) records of this species within 10kms of the Subject site. One hundred and nine (109) records occur within the Tweed LGA. A total of two (2) stems of Brush cassia have been recorded on the Subject site (**FIGURES 8, 8a & 8b**) from within small isolated patches of vegetation and riparian areas in the central northern portion of the site.

Brush cassia occurs north from Brunswick Heads (NSW) to Beenleigh (south Queensland). The species occurs in littoral and riverine rainforest, and in regrowth on farmland, and along roadsides, preferring more fertile soil types (NPWS 2002).

NSW National Parks and Wildlife Service list the following threats to this species:

- Widening and maintenance of roads;
- Clearing and development of land;
- Browsing and trampling by stock;
- Invasion of habitat by introduced weeds; and
- Damage to trees and inhibition of regeneration by seed collectors.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site.

The Concept Plan has been amended to include these isolated patches of vegetation containing the Brush cassia within areas either designated as Environmental Protection Area or to be retained under Environmental covenant (**FIGURE 15a & 15b**).

The proposed development will result in the removal or modification of a total of 0.11 hectares (1%) of potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

Coolamon

The NPWS database (June 2010) contains forty-five (45) records of this species within 10kms of the Subject site. One hundred and ninety-five (195) records occur within the Tweed LGA. No specimens of Coolamon have been recorded on the Subject site, however, two (2) Coolamons have been recorded within the border reserve to the north of the Subject site (**FIGURES 8 & 8a**).

Coolamon is found in the Richmond, Tweed and Brunswick River valleys in north-east NSW, and has a limited occurrence in south-east Queensland. Suitable habitat consists of subtropical and riverine rainforest at low altitude (NPWS 2002). The species often occurs as isolated paddock trees.

NSW National Parks and Wildlife Service list the following threats to this species:

- Clearing and fragmentation of habitat for development, agriculture and road-works;
- Weed infestation and general degradation of rainforest habitat;
- Grazing and trampling by domestic stock; and
- Illegal collection for horticulture.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site.

The proposed development is considered unlikely to impact on the Coolamons, which occur adjacent to the Subject site (**FIGURE 15a**).

The proposed development will result in the removal or modification of a total of 0.11 hectares (1%) of rainforest communities considered to represent potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

Green-leaved rose walnut

The NPWS database (June 2010) contains six (6) records of this species within 10kms of the Subject site. Thirty-nine (39) records occur within the Tweed LGA. A total of five (5) stems of Green-leaved rose walnut have been recorded on the Subject site (**FIGURES 8a & 8b**) from within the steep-sided gullies near the dam on the western boundary of the Subject site. This species has also been recorded in adjacent habitat to the east of the Subject site (EcoPro 2004) (**FIGURE 9**).

This species occurs in Queensland and in north-east NSW south to Maclean and inhabits Subtropical rainforest or wet eucalypt forest, chiefly at lower altitudes. The NSW NPWS list the following threats to this species:

- Clearing and fragmentation of habitat for coastal development, agriculture and road-works;
- Infestation of habitat by weeds;
- Frequent fire; and
- Trampling by visitors.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site.

None of the Green-leaved rose-walnuts occur within the proposed development footprint (**FIGURE 15b**). The proposed development will result in the removal or modification of a total of 0.11 hectares (1%) of rainforest communities considered to represent potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

White lace flower

The NPWS database (June 2010) contains sixteen (16) records of this species within 10kms of the Subject site. Twenty-seven (27) records occur within the Tweed LGA. This species has been recorded from rainforest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 9**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

White laceflower occurs in riverine, lowland subtropical rainforest, and littoral rainforest. The species is distributed from north Queensland south to the Richmond River in northern NSW, and is found on a variety of soils including coastal sands, and soils derived from basalt and metasediments (NPWS 2002a).

NPWS have identified the following threats to the species:

- Loss of habitat through clearing and fragmentation;
- Habitat degradation through weed invasion and disturbance; and
- Illegal collection of seeds for horticulture.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site.

Suitable habitat for the White lace flower is considered to be comprised of undisturbed riverine and lowland subtropical rainforest communities on and adjacent to the Subject site. The proposed development will result in the removal or modification a total of

0.11 hectares (1%) of potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

Stinking cryptocarya

The NPWS database (June 2010) contains forty-three (43) records of this species within 10kms of the Subject site. Seventy-two (72) records occur within the Tweed LGA. This species has been recorded from rainforest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 9**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

Stinking laurel occurs throughout coastal south-east Qld and north-eastern NSW south to Iluka. Though seedlings can be fairly numerous, few mature trees are known (NPWS 2002). Stinking laurel is found in littoral rainforest, usually on sandy soils, but mature trees have been found on basalt soils. The seeds are readily dispersed by fruit-eating birds, and seedlings and saplings have been recorded from other habitats where they are unlikely to develop to maturity (NPWS 2002).

NPWS have identified the following threats to the species:

- Risk of local extinction because populations are small
- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks
- Infestation of habitat by weeds
- Trampling by visitors
- Fire

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site.

Suitable habitat for this species is considered to be comprised of undisturbed riverine and lowland subtropical rainforest communities on and adjacent to the Subject site. The proposed development will result in the removal or modification a total of 0.11 hectares (1%) of potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

Pink nodding orchid

The NPWS database (June 2010) contains seven (7) records of this species within 10kms of the Subject site. Seventeen (17) records occur within the Tweed LGA. This species has been recorded from Swamp forest adjacent to the Subject site (EcoPro 2004) (**FIGURE 9**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

This species inhabits dry eucalypt forest and coastal swamp forest at lower altitudes, often on sand. There are thought to be less than 20 populations of Pink nodding orchid in NSW, all located north of Bundjalung National Park, and including Tweed Shire. The species also occurs in Queensland.

The NSW NPWS lists the following threats to this species:

- Clearing and fragmentation of habitat for urban development;
- Invasion of habitat by introduced weeds such as Bitou Bush;
- Trampling by bushwalkers and fishers; and
- Illegal collection of orchids.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining SEPP 14 Wetland to the east of the site.

Suitable habitat for this species is considered to be comprised of undisturbed dry eucalypt forest and coastal swamp forest at lower altitudes on and adjacent to the Subject site. The proposed development will result in the removal or modification a total of 3.8 hectares of potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

Rough-shelled bush nut

The NPWS database (June 2010) contains seventy-seven (77) records of this species within 10kms of the Subject site. One hundred and seventy (170) records occur within the Tweed LGA. This species has been recorded from rainforest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 9**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

This species is confined chiefly to the Richmond and Tweed Rivers in north-east NSW, extending just across the border into Queensland, and inhabits subtropical rainforest, usually near the coast.

The NSW NPWS list the following threats to this species:

- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks;
- Risk of local extinction due to low numbers;
- Grazing and trampling by domestic stock;
- Fire;
- Invasion of habitat by weeds; and
- Loss of local genetic strains through hybridisation with commercial varieties.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining Crown Reserves to the north and west of the site.

Suitable habitat for this species is considered to be comprised of undisturbed subtropical rainforest communities on and adjacent to the Subject site. The proposed development will result in the removal or modification a total of 0.11 hectares (1%) of potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

Swamp orchid

The NPWS database (June 2010) contains two (2) records of this species within 10kms of the Subject site. Four (4) records occur within the Tweed LGA. This species has been recorded from Swamp forest adjacent to the Subject site (EcoPro 2004) (FIGURE 9). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

The Southern swamp orchid inhabits *Melaleuca quinquenervia* swamps and sclerophyll forest, on the coast, at or near sea level. The species occurs from Coffs Harbour north to Qld (NPWS 2002a).

The NSW National Parks and Wildlife Service list the following threats to this species:

- Frequent fire;
- Illegal collection for horticulture or cut flowers;
- Clearing and fragmentation of habitat for development, agriculture and roadworks;
- Drainage of swamps, or pollution from nutrient run-off;
- Grazing and trampling by domestic stock and feral pigs; and
- Invasion of habitat by introduced weeds.

The local population for this species is considered to be comprised of all individuals recorded on the Cobaki Lakes site as well as any individuals within contiguous habitat that could reasonably be expected to be cross-pollinating with those on the site. Therefore, the local population is considered to include all individuals on the site as well as any individuals within the adjoining SEPP 14 Wetland to the east of the site.

Suitable habitat for the Swamp orchid is considered to be comprised of undisturbed swamp sclerophyll forest communities on and adjacent to the Subject site. The proposed development will result in the removal or modification a total of 3.8 hectares of potential habitat for this species, all of which occurs in areas of the site, which have existing development approvals.

Amelioration/Offsets for Threatened flora species

The major amelioration strategy for Threatened flora species on the Subject site is the retention and long-term protection of suitable habitat within Environmental Protection Areas (FIGURE 5).

All of the Threatened plants recorded on and adjacent to the Subject site, with the exception of the Swamp orchid and the Pink nodding orchid, are typical of lowland rainforest. Approximately 10.88 hectares (99%) of lowland rainforest communities occurring on the Subject site will be retained, and an additional 13.30 hectares of land is proposed to be rehabilitated as lowland rainforest in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a). This will ensure a net gain of 13.19ha of suitable habitat for the majority of Threatened flora species on the Subject site. Furthermore, these areas will ensure protection for retained Threatened flora species and also provide additional habitat for Threatened flora species occurring on and adjacent to the Subject site.

The Swamp orchid and the Pink nodding orchid have been recorded adjacent to the Subject site and are typical of swamp sclerophyll forest communities. The entire area of existing Swamp sclerophyll forest on coastal floodplain will be lost from the Subject site (**FIGURE 12**). It is worth noting that the conservation significance of this community has been severely compromised by past land-use activities including cattle grazing and periodic slashing which has resulted in the removal of the midstorey and the prevalence of introduced grasses and common agricultural weeds in the groundcover layer.

In total, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset the loss of 3.8 hectares (**FIGURE 14**). This will ensure a net gain of 2.97ha of suitable habitat for these Threatened flora species. Furthermore, these areas will ensure protection for retained Threatened flora species and also provide additional habitat for Threatened flora species occurring on and adjacent to the Subject site.

It is also recommended that propagation of Threatened flora species be undertaken as part of the rehabilitation works on the Subject site in an attempt to bolster local populations. The rationale and methodology of Threatened plant propagation will be detailed within individual regeneration and revegetation plans to be completed for each of the rehabilitation precincts (in accordance with the Revised Site Regeneration and Revegetation Plan - JWA 2013a) at the Operational Works stage.

An Overview Buffer Management Plan has also been prepared for the Cobaki Lakes development (JWA 2009a) and includes the principles and management procedures that will be fundamental in future detailed BMP's prepared for all relevant stages of the proposed development. The overall objectives of the ecological buffers and related provisions at the Cobaki Lakes development site include the protection of Threatened flora species and their habitats.

The removal of a small area of potential habitat from the Subject site is not considered to represent a significant impact in relation to the local distribution of habitat for any Threatened flora species. It is considered that the proposed development is highly unlikely to result in the local extinction of any of these species.

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

Not applicable for recorded Threatened flora species.

(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 for recorded Threatened flora species.

- (d) *In relation to the 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.*

A summary of impacts on the habitats of Threatened flora species recorded on and adjacent to the Cobaki Lakes site has been provided in **TABLE 3** above.

Proposed rehabilitation works on the Subject site will result in a net gain of habitat for all Threatened flora species recorded on the Subject site or considered a possible occurrence on the Subject site.

- (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*

Habitat for Threatened flora species is already highly fragmented and has had a history of disturbance from land clearing, grazing, farm maintenance and other activities on the Subject site. The Proposed development has been designed to utilise disturbed areas of the Subject site and is unlikely to contribute significantly to an increase in the fragmentation of native vegetation communities. The Revised Site Regeneration & Revegetation Plan (JWA 2013a) includes the retention and embellishment of fauna movement corridors throughout the Subject site. These habitat linkages will ensure suitable movement opportunities are maintained for all native flora and fauna species.

- (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.*

Most of the vegetation to be removed consists of highly disturbed vegetation. The importance of this vegetation is minor when compared to the areas of suitable habitat proposed to be retained, protected and rehabilitated. The assessment of the importance of the habitat to be removed has taken into consideration the stages of the Threatened floras' life cycles and how reproductive success may be affected. It is considered that, with the adoption of recommended amelioration and management measures, the proposed development will not affect the life cycle or reproductive success of any identified Threatened flora species.

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

Critical habitat areas listed under the *Threatened Species Conservation Act (1995)* currently consist of habitat for Mitchell's rainforest snail in Stott's Island Nature Reserve, and habitat for the Little penguin population in Sydney's North Harbour.

There will be no adverse effects on any critical habitat listed, in the Register of critical habitat in NSW, from the action proposed.

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

Approved Recovery Plans have been prepared for the Spiny Gardenia, Green-leaved rose walnut (as part of the Recovery Plan for the Green-leaved rose walnut & Rusty rose walnut).

Spiny gardenia

The Recovery Plan for the Spiny gardenia lists the following proposed recovery objectives:

- To co-ordinate the recovery of the Spiny gardenia
- To determine the size and extent of the Spiny gardenia population
- To conduct monitoring and research into the biology, ecology and genetics of the Spiny gardenia relevant to the management of the species
- To manage and protect the Spiny gardenia population and associated habitat
- To expand the population size of the Spiny gardenia
- Gain an understanding of the cultural importance of the Spiny gardenia to Local Aboriginal Land Councils, Elders and other groups representing indigenous people
- To develop and implement a contingency plan to assist the long-term survival of the Spiny gardenia

It is considered that the proposed development is consistent with the objectives of the Recovery Plan for the Spiny gardenia.

Green-leaved rose walnut

The Recovery Plan for the Green-leaved rose walnut lists the following proposed recovery objectives:

- To coordinate the recovery of the Green-leaved rose walnut and the Rusty rose walnut;
- To resolve taxonomic difficulties in the separation of the Green-leaved rose walnut and the Rusty rose walnut, and other closely related taxa and conduct field surveys where necessary to fill information gaps;
- To reassess background information for the newly resolved taxa;
- To improve the consideration of the Green-leaved rose walnut and the Rusty rose walnut in environmental impact assessments for developments and activities;
- To manage and protect the Green-leaved rose walnut and the Rusty rose walnut and associated habitat from threatening processes;
- Fire planning and management;
- To improve knowledge of distribution, regeneration and genetics;

- To integrate the recovery of the Green-leaved rose walnut and the Rusty rose walnut with the recovery of other biota; and
- To involve the community in the recovery of the Green-leaved rose walnut and the Rusty rose walnut.

It is considered that the proposed development is consistent with the objectives of the Recovery Plan for the Green-leaved rose walnut and the Rusty rose walnut.

A range of protection measures have been proposed with the objective of retaining and protecting areas of habitat on the site for Threatened flora species and reducing impacts on Threatened flora wherever possible. With the implementation of these measures, it is considered that Threatened flora species will continue to persist on the site following development.

In 2004, amendments were made to the TSC Act (1995) that removed the mandatory requirement to prepare recovery plans and threat abatement plans, and instead require the preparation of Threatened species Priority Action Statements (PAS). The PAS will set out the measures required to promote the recovery of Threatened flora species to a position of viability in nature and for managing each key threatening process. Any PAS will be addressed in relevant management plans prepared for each future stage of the development.

(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.

A “threatening process” means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the TSC Act (1995).

Key Threatening Processes (Schedule 3):

- Invasion and establishment of exotic vines and scramblers
- Invasion of native plant communities by Bitou bush & Boneseed
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of *Lantana camara*
- Competition and grazing by the feral European rabbit
- Competition and habitat degradation by feral goats
- Competition from feral honeybees
- Herbivory and environmental degradation caused by feral deer
- Importation of red imported fire ants into NSW
- Introduction of the large earth bumblebee (*Bombus terrestris*)
- Invasion and establishment of the Cane Toad
- Invasion of the yellow crazy ant (*Anoplolepis gracilipes*)
- Predation by feral cats
- Predation by the European Red Fox
- Predation by the Plague Minnow (*Gambusia holbrooki*)
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island
- Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)

- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands
- Bushrock Removal
- Clearing of native vegetation
- Alteration of habitat following subsidence due to longwall mining
- Ecological consequences of high frequency fires
- Human-caused Climate Change
- Loss and/or degradation of sites used for hill-topping by butterflies
- Loss of Hollow-bearing Trees
- Removal of dead wood and dead trees
- Infection by Psittacine circoviral (beak & feather) disease affecting endangered psittacine species
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*
- Death or injury to marine species following capture in shark control programs on ocean beaches
- Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments

The proposed development has the potential to result in an increase in the **‘Invasion and establishment of exotic vines and scramblers’**, **‘Invasion of native plant communities by exotic perennial grasses’** and **‘Invasion, establishment and spread of *Lantana camara*’**. The Revised Site Regeneration & Revegetation Plan (JWA 2013a) prepared for the Cobaki Lakes development will ensure that these key threatening processes are not exacerbated. The proposed conservation areas on the Subject site have been divided into thirteen (13) rehabilitation/management precincts (**FIGURE 13**). Detailed regeneration and revegetation plans are to be completed for each of the precincts at the Operational Works stage.

The proposed development has the potential to result in an increase in the **‘Invasion and establishment of the Cane Toad’**, **‘Predation by feral cats’** and **‘Predation by the European Red Fox’**. A Revised Fauna Management Plan (JWA 2013) has been prepared for the Cobaki Lakes development and provides measures to monitor and control pest animals to ensure that these key threatening processes are not exacerbated.

The proposed development has the potential to result in an increase in the **‘Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands’**. A detailed Stormwater Management Plan has been prepared for the proposed development and will ensure that this key threatening processes is not exacerbated.

The proposed development will contribute towards the **‘Clearing of native vegetation’**, a key threatening process listed on Schedule 3 of the *TSC Act (1995)*. The final determination of the NSW Scientific Committee notes that clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity, with impacts such as: destruction of habitat; fragmentation of habitat; riparian zone degradation; increased greenhouse gas emissions; increased habitat for invasive species; loss of leaf litter layer; loss or disruption of ecological function (e.g. loss of populations of pollinators or seed dispersers) and changes to soil biota.

Habitat loss is the main threatening process affecting all subject species. The Proposed development will make a minor contribution towards the loss of habitat in the region.

However, as previously discussed, the majority of vegetation to be lost has been highly disturbed by past landuse activities. The Revised Site Regeneration and Revegetation Plan (JWA 2013a) prepared for the site includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of native vegetation communities in the long-term.

The proposed development has the potential to result in an increase in the ‘**Ecological consequences of high frequency fires**’. A Bushfire Management Plan will be prepared by a suitably qualified firm at the detailed design stage to ensure that this key threatening processes is not exacerbated.

The proposed development has the potential to result in an increase in the ‘**Loss of Hollow-bearing Trees**’ and ‘**Removal of dead wood and dead trees**’. The vast majority of mature native vegetation on the Subject site will be retained. Therefore the majority of hollow-bearing trees will be retained within these forested areas. Any hollow-bearing trees to be removed are likely to occur as isolated paddock trees. The Revised Fauna Management Plan (JWA 2013) includes the following measures to ensure this key threatening process is not exacerbated:

- Any hollow-bearing trees within the urban zoned land should be retained where possible (or included within buffers, open space, etc.); and
- Installation of wildlife boxes for bats, birds & other mammals (where appropriate).

3.3.3 Results of Assessment of Significance

On the basis of this assessment, it is considered that the proposed development will not result in any significant impacts on Threatened flora species recorded on or adjacent to the Cobaki Lakes site.

3.4 Threatened fauna

3.4.1 Background

An Assessment of Significance will be completed for each Threatened flora species recorded on the Cobaki Lakes site, or considered a potential occurrence over time. The assessment has been completed in accordance with the *Threatened Species Assessment Guidelines: The Assessment of Significance* prepared by DECC (2007).

Twelve (12) Threatened⁶ fauna species have been recorded from the Subject site (JWA 2008) (**FIGURE 10**). An additional eighteen (18) Threatened species have been recorded during surveys on adjacent land (**FIGURE 11**). An Assessment of Significance (7-part test equivalence) has been completed for all of these species.

3.4.2 Factors for consideration

- (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.*

⁶ As listed within schedules of the TSC Act (1995) and EPBC Act (1999).

Impacts & Amelioration for Threatened Fauna and their habitats

Details of all fauna surveys completed on the Cobaki Lakes site are contained in the Ecological Assessment (JWA 2008). It is worth noting that suitable habitat for Threatened fauna to be removed from the Subject site occurs within existing 2(c) zoned land (i.e. Urban Expansion), land proposed to be rezoned as 2(c), or land that may otherwise be cleared in accordance with existing use rights.

A summary of impacts for each species recorded on and adjacent to the Subject site is provided in **TABLE 4**.

TABLE 4
POTENTIAL LOSS OF THREATENED FAUNA HABITAT

Species	Existing habitat (ha)	Habitat Loss (ha)	Habitat Loss (%)
Wallum froglet	79.12	66.47	84.01%
Black-necked stork	140.60	78.76	56.02%
Powerful owl	69.82	13.09	18.74%
Masked owl	69.82	13.09	18.74%
Osprey*	-	-	-
Koala	42.41	11.89	28.04%
Grey-headed flying-fox	72.26	12.96	17.94%
Little bent-wing bat ¹	72.26	12.96	17.94%
Common bent-wing bat ¹	72.26	12.96	17.94%
Eastern little mastiff bat ¹	72.26	12.96	17.94%
Yellow-bellied sheath-tail bat ¹	72.26	12.96	17.94%
Greater broad-nosed bat ¹	72.26	12.96	17.94%
Wallum sedge frog	35.39	24.12	68.15%
Bush hen	1.41	0.02	1.42%
Glossy black-cockatoo	48.61	5.42	11.15%
Brolga	140.60	78.76	56.02%
Black bittern	10.18	0.73	7.17%
Mangrove honeyeater	5.66	-	0%
White-eared monarch	10.99	0.11	1.00%
Wompoo fruit-dove	10.99	0.11	1.00%
Rose-crowned fruit-dove	10.99	0.11	1.00%
Superb fruit-dove	10.99	0.11	1.00%
Collared kingfisher	5.66	-	0%
Eastern grass owl	2.44	-	0%
Large-footed myotis	2.33	0.80	34.33%
Eastern long-eared bat	10.99	0.11	1.00%
Squirrel glider	52.81	9.55	18.08%
Common planigale	74.93	13.09	17.47%
Long-nosed potoroo [#]	-	-	-
Common blossom bat	3.80	3.80	100%

* Nesting habitat only

[#] Habitat adjacent to the Subject site only

¹ Forage habitat for these species has been calculated based on more suitable habitat (i.e. forested areas). Other areas of the site (i.e. open areas) may also be utilised for foraging purposes on occasions but have not been included in this calculation.

A discussion of potential impacts and amelioration measures to reduce potential impacts on Threatened fauna species is included below.

Wallum froglet

The NPWS database (June 2010) contains two hundred and eight (208) records of this species within 10kms of the Subject site. Two hundred and thirty-six (236) records occur within the Tweed LGA. Wallum froglets have been recorded within Paperbark areas, sedgelands and in the main drainage channel and adjacent sedgeland in the east of the property (**FIGURE 10**). This species has also been recorded in a numerous locations adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**) and is very widespread. The local population is estimated to comprise approximately 10,000 individuals (Hero *et al.* 2001).

Wallum Froglets are found only in acid paperbark swamps and sedge swamps of the coastal 'wallum' country. The species is a late winter breeder. Males call in choruses from within sedge tussocks or at the water edge.

NSW NPWS lists the following threats to this species:

- Destruction and degradation of coastal wetlands as a result of roadworks, coastal developments and sandmining;
- Reduction of water quality and modification to acidity in coastal wetlands; and
- Grazing and associated frequent burning of coastal wetlands.

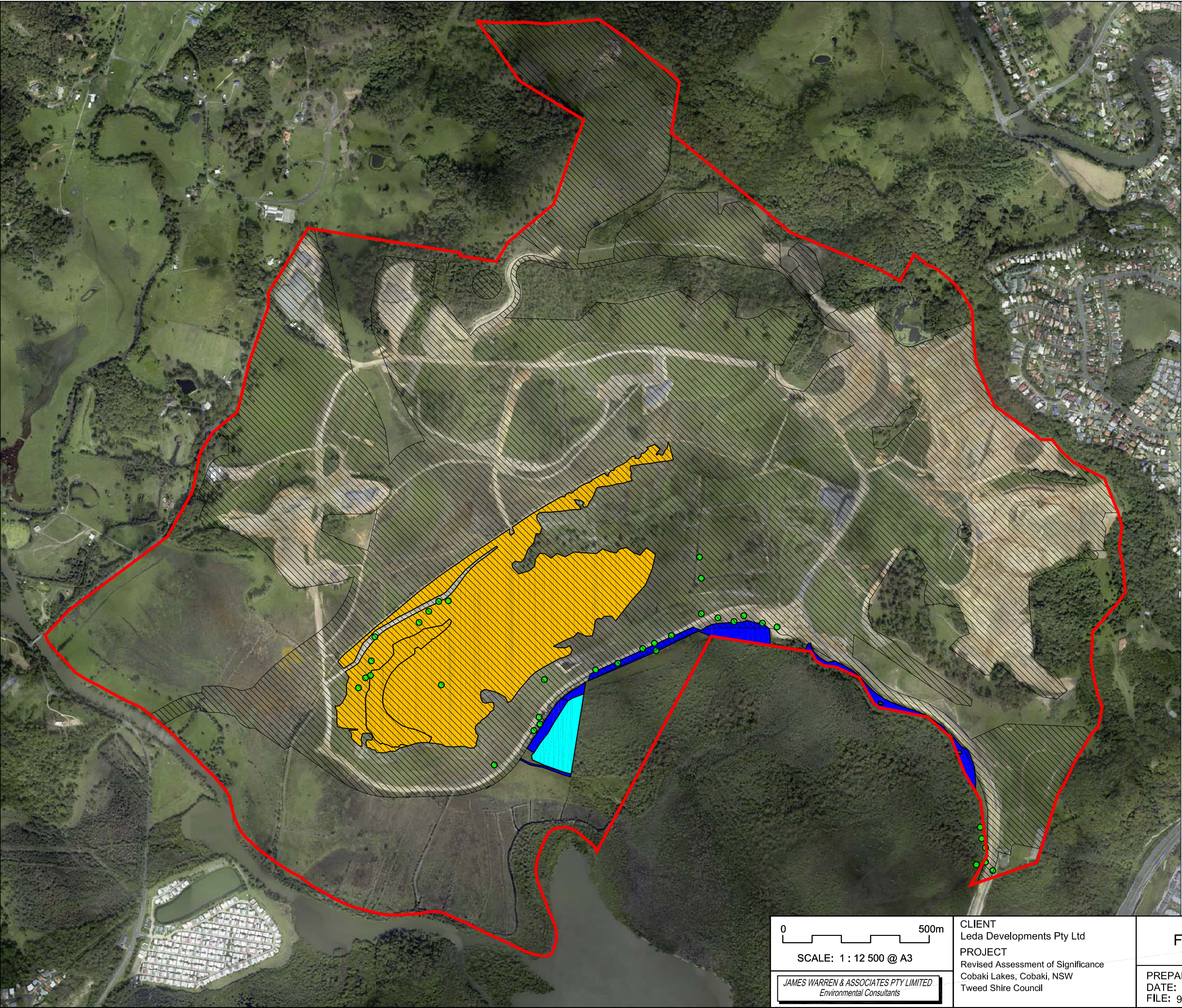
Core habitat for this species is considered to be comprised of undisturbed wet heathland and wetland communities adjacent to the Subject site whilst remaining habitats (i.e. adjoining areas of grassland and slashed areas) are considered to provide forage habitat when inundated during wet periods. Due to a history of disturbance to wetland communities on the Subject site, only 2.5ha of core habitat is considered to occur (**FIGURE 16**). However, approximately 79.12 hectares of forage habitat is considered likely to occur on the Subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

The proposed development may result in direct mortality to individuals of this species during construction due to habitat loss and/or being run over by machinery. However, the loss of some individuals and habitat of this widespread species during construction is unlikely to significant impact upon the local population of Wallum froglets. The proposed development will not remove or modify any area considered to provide core habitat for the Wallum froglet (i.e. breeding habitat, refuge habitat).

Approximately 66.47 hectares (84.01%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Additional impacts may include:

- Alteration of water quality in drainage lines due to soil runoff from the construction site;
- Alteration of hydrology of the drainage lines due to construction;
- Contamination or reduction of water quality in drainage lines due to runoff from chemicals or debris (fertilisers, etc);
- Introduction of weed species into core habitat areas; and



LEGEND

- Wallum froglet (*Crinia tinnula*) Locations
- Wallum froglet (*Crinia tinnula*) Core Habitat
- Identified Wallum froglet (*Crinia tinnula*) Forage Habitat
- Potential Wallum froglet (*Crinia tinnula*) Forage Habitat (see note)
- Proposed Development Areas
- Site Outline

Note: Drainage lines and low lying areas in this portion of the site are considered foraging habitat. The exact location and extent of foraging habitat in this area will be the subject of detailed assessment at the DA stage.

SOURCE:
Frogs - James Warren & Associates Pty Ltd
Impact area - Design Forum Architects
(Ref: DA 01.01 E Master Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m
SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd
PROJECT
Revised Assessment of Significance
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 16
PREPARED: BW
DATE: 05 April 2013
FILE: 97038_SA_Base.dwg

TITLE
IMPACT ON
WALLUM FROGLET
FORAGE HABITAT

- Increased competition from disturbance-adapted native, domestic and introduced fauna (such as Cane toads, Noisy miners, foxes, dogs, cats, rats, etc.).

Offsets for the removal of highly degraded Freshwater wetland vegetation from the Subject site will include the following:

1. Recreation of approximately 2ha of high quality wetland habitats. These compensatory Freshwater wetlands will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum froglet. Revegetation and management of Freshwater wetlands will occur in accordance with a Freshwater Wetland Compensatory Habitat Management Plan (SMEC 2012); and
2. Leda Manorstead Pty Ltd is currently in negotiations with OEH with a view to securing appropriate off-site offsets.

Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 14**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) and these areas are likely to provide suitable forage habitat for this species and partially offset any loss of forage habitat. In total, 8.77ha of rehabilitation works on the Subject site will result in the creation of suitable forage habitat for the Wallum froglet to partly offset the loss of 66.47ha. The remaining offset will be provided off-site.

A detailed Stormwater Management Plan has been prepared for the Subject site utilising current best-practice management techniques, which will ensure no adverse impacts on the hydrology of the current core habitat.

The construction of core habitat areas on the Subject site will be subject to a detailed Wallum froglet Compensatory Habitat Plan at the development application stage. With the implementation of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Black-necked Stork

The NPWS database (June 2010) contains forty-five (45) records of this species within 10kms of the Subject site. Eighty-six (86) records occur within the Tweed LGA. This species has been recorded foraging within the low-lying eastern and south-eastern portions of the Subject site (**FIGURE 10**).

The species is widespread across coastal northern and eastern Australia, becoming increasingly uncommon further south into NSW, and rarely south of Sydney. It inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands, and can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.

NSW NPWS list the following threats for this species:

- Loss of wetland habitat through clearing and draining for flood mitigation, agriculture and residential development;
- Degradation of wetland habitats through pollution and salinisation; and
- Modification of natural wetlands through changes in natural water flow regimes.

The proposed development will not result in significant disturbance to or the removal of habitat for this species within the wetland area located in the south-eastern portion of the site. It is estimated that approximately 140.60 hectares of forage habitat occurs on the Subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

Approximately 78.76 hectares (56.02%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Approximately 2.00 hectares of additional Freshwater wetland habitat will be created on the Subject site. Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 14**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a). In total, 8.77ha of rehabilitation works on the Subject site will result in the creation of suitable forage habitat for the Black-necked stork to partly offset the loss of 69.29ha.

Additionally, Leda Manorstead Pty Ltd is currently in negotiations with OEH with a view to securing appropriate off-site offsets for the removal of degraded Freshwater wetland vegetation from the Subject site.

Vegetation within the south-eastern portion of the Subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2013b). This area covers 54.63 hectares and currently provides suitable forage habitat for the Black-necked stork and will continue to do so in the long term.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Powerful Owl

The NPWS database (June 2010) contains no records of this species within 10kms of the Subject site. Twenty (20) records occur within the Tweed LGA. The Powerful owl was recorded in the north-eastern portion of the Subject site (**FIGURE 10**) in 1994 (Warren 1994). A survey completed by Debus (1994) did not confirm the presence of this species. However, Debus indicated that this absence following the breeding season is consistent with the seasonal shift in the use of different parts of the species' large home range.

These owls were again recorded during November 1997 in the Blackbutt Open Forest in the north-eastern portion of the site (Woodward-Clyde 1997). Further spotlighting and call playback surveys of the Subject site (JWA 2000 - 2009) have failed to record this species.

The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. Now uncommon throughout its range where it occurs at low densities. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.

NSW NPWS lists the following threats for this species:

- Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. This loss also affects the populations of arboreal prey species, particularly the Greater Glider which reduces food availability for the Powerful Owl;
- Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat;
- Can be extremely sensitive to disturbance around the nest site, particularly during pre-laying, laying and downy chick stages. Disturbance during the breeding period may affect breeding success;
- High frequency hazard reduction burning may also reduce the longevity of individuals by affecting prey availability;
- Road kills;
- Secondary poisoning; and
- Predation of fledglings by foxes, dogs and cats.

This species may potentially forage over the majority of the Subject site however it is estimated that approximately 69.82 hectares of better quality forage habitat (i.e. more mature forest and woodland communities) occurs on the Subject site. The development will result in the loss of approximately 13.09 hectares of potential habitat for the Powerful owl (approximately 18.74% of available habitat). The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. This species is able to live in disturbed coastal forest (Debus 1994). Loss of Sclerophyll forest and woodland may reduce the availability of arboreal and terrestrial mammalian prey for this species however loss of vegetation from the Subject site will approximate to only 2-3% of the estimated home range of a Powerful owl.

The proposed retention of large areas of intact forest is likely to result in the continued foraging of this species on the Subject site. Furthermore, approximately 61.82ha of revegetation/regeneration will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links across the site (**FIGURE 13**). These areas are all likely to provide suitable forage habitat for the Powerful owl in the long-term and offset the loss of 13.09ha of potential forage habitat.

Retention of old growth trees will also provide continued nesting opportunities for this species. Additionally, the installation of nest boxes of a suitable size for owls within retained vegetation (in accordance with the Revised Fauna Management Plan - JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Masked Owl

The NPWS database (June 2010) contains two (2) records of this species within 10kms of the Subject site. Twelve (12) records occur within the Tweed LGA. The Masked owl was recorded in the north-eastern portion of the Subject site (**FIGURE 10**) in 1994 (Debus 1994). Further spotlighting and call playback surveys of the Subject site (JWA 2000 - 2007) have failed to record this species. A number of unconfirmed records of this species occurred during survey of adjacent lands to the east (EcoPro 2004) (**FIGURE 11**). This species is typically recorded in dry sclerophyll forest and woodland, but also occasionally forages over open or partly cleared country.

The Masked owl extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. It inhabits dry eucalypt forests and woodlands from sea level to 1,100 metres.

NSW NPWS lists the following threats for this species:

- Loss of mature hollow-bearing trees and changes to forest and woodland structure, which leads to fewer such trees in the future;
- Clearing of habitat for grazing, agriculture, forestry or other development;
- A combination of grazing and regular burning is a threat, through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests;
- Secondary poisoning from rodenticides; and
- Being hit by vehicles.

This species may potentially forage over the majority of the Subject site however, it is estimated that approximately 69.82 hectares of better quality forage habitat occurs on the Subject site comprised of mature dry sclerophyll forests and woodlands. It is noted that this species will also forage over open areas (i.e. grasslands etc.) however these areas are not considered to form a significant component of the habitat for this species.

The development will result in the loss of approximately 13.09 hectares of potential forage habitat for the Masked owl (approximately 18.74% of available habitat). The majority of this vegetation removal will occur from portions of the site with existing development approvals. This species may also be susceptible to road-strike, as birds often forage along roadsides or use roads to move between foraging sites (Debus and Rose 1994).

Loss of Sclerophyll forest may reduce the availability of arboreal and terrestrial mammalian prey for this species however, loss of vegetation from the Subject site will approximate to only 2%-3% of the estimated home range of a Masked owl.

This species roosts and breeds primarily in wet sclerophyll forested gullies, favouring large roomy hollows for nesting. Nests have been located in both live and dead eucalypts. Roost sites are also typical in mature eucalypts bearing large hollows. It is considered that the proposed development will not remove any suitable nesting or roosting habitat.

Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. As with the Powerful owl this species is able to live in disturbed coastal forest (Debus 1994). The owls appear to favour a complex local mosaic of dense and sparse tree and ground cover and a high density of old hollow trees. This species will persist in

disturbed environments as long as existing and potential nest trees are retained, and suitable areas of forested or woodland areas are conserved so as to conserve prey species (Woodward-Clyde 1997).

The proposed retention of large areas of intact forest is likely to result in the continued foraging of this species on the Subject site. Furthermore, approximately 61.82ha of revegetation/regeneration will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links across the site (**FIGURE 13**). These areas are all likely to provide suitable forage habitat for the Masked owl in the long-term and offset the loss of 13.09ha of potential forage habitat.

Retention of old growth trees will also provide nesting opportunities for this species. Additionally, the installation of nest boxes of a suitable size for owls within retained vegetation (in accordance with the Revised Fauna Management Plan - JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Osprey

The NPWS database (June 2010) contains three hundred and sixty-nine (369) records of this species within 10kms of the Subject site. Four hundred and four (404) records occur within the Tweed LGA.

Ospreys are found right around the Australian coastline, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs.

NSW NPWS lists the following threats for this species:

- Removal of large trees near the coast that could be used as nest sites;
- Disturbances to water quality, such as from the disposal of treated effluent or stormwater runoff, that increases turbidity in feeding areas; and
- Ingestion of fish containing discarded fishing tackle.

It is expected that impacts of the proposed development will be restricted to human disturbance near any nest site. A nest site on a power pole was discovered in the south - east of the site (JWA 2006) away from any future development areas (**FIGURE 10**). Two (2) Ospreys have subsequently been observed in the nest on several separate occasions (2006 - 2008). A 100m buffer area has been designated around this nest (**FIGURE 17**) and it is considered that the proposed development will have little impact on this nest site. More recently this nest has been observed to deteriorate and it is considered that this nest site will not be suitable for use in the long-term.

The developer is therefore committed to erecting at least two (2) artificial nesting platforms on the site (**FIGURE 17**). It is well known that these platforms are highly successful.

It is considered that the proposed development is highly unlikely to result in the local extinction of this species.



LEGEND

- Osprey (*Pandion haliaetus*) - Old Nest
(Nest tree has recently collapsed)
- Osprey (*Pandion haliaetus*) - New Nest
(Nest no longer present)
- Proposed Nesting Platforms
- 100m Buffer
- Proposed Development Areas
- Site Outline

SOURCE:
Osprey Nests - James Warren & Associates Pty Ltd
Impact area - Design Forum Architects
(Ref: DA 01.01 E Master Plan.dwg)
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m
SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd
PROJECT
Revised Assessment of Significance
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 17
PREPARED: BW
DATE: 05 April 2013
FILE: 97038_SA_Base.dwg

TITLE
OSPREY
NESTS

Koala

The NPWS database (June 2010) contains ninety-eight (98) records of this species within 10kms of the Subject site. Five hundred and seventy-four (574) records occur within the Tweed LGA.

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the western region.

The site contains a number of tree species listed under Schedule 2 of SEPP 44 - Koala Habitat Protection as Koala feed tree species. These include:

- Tallowwood;
- Swamp mahogany;
- Grey gum;
- Forest red gum; and
- Scribbly gum.

Warren (1994) completed a targeted search on the Subject site for evidence of Koala activity (i.e. scratches and scats). A small number of faecal pellets were recorded and a low density of scratches on Grey gums and Tallowwoods were observed throughout the site.

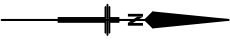
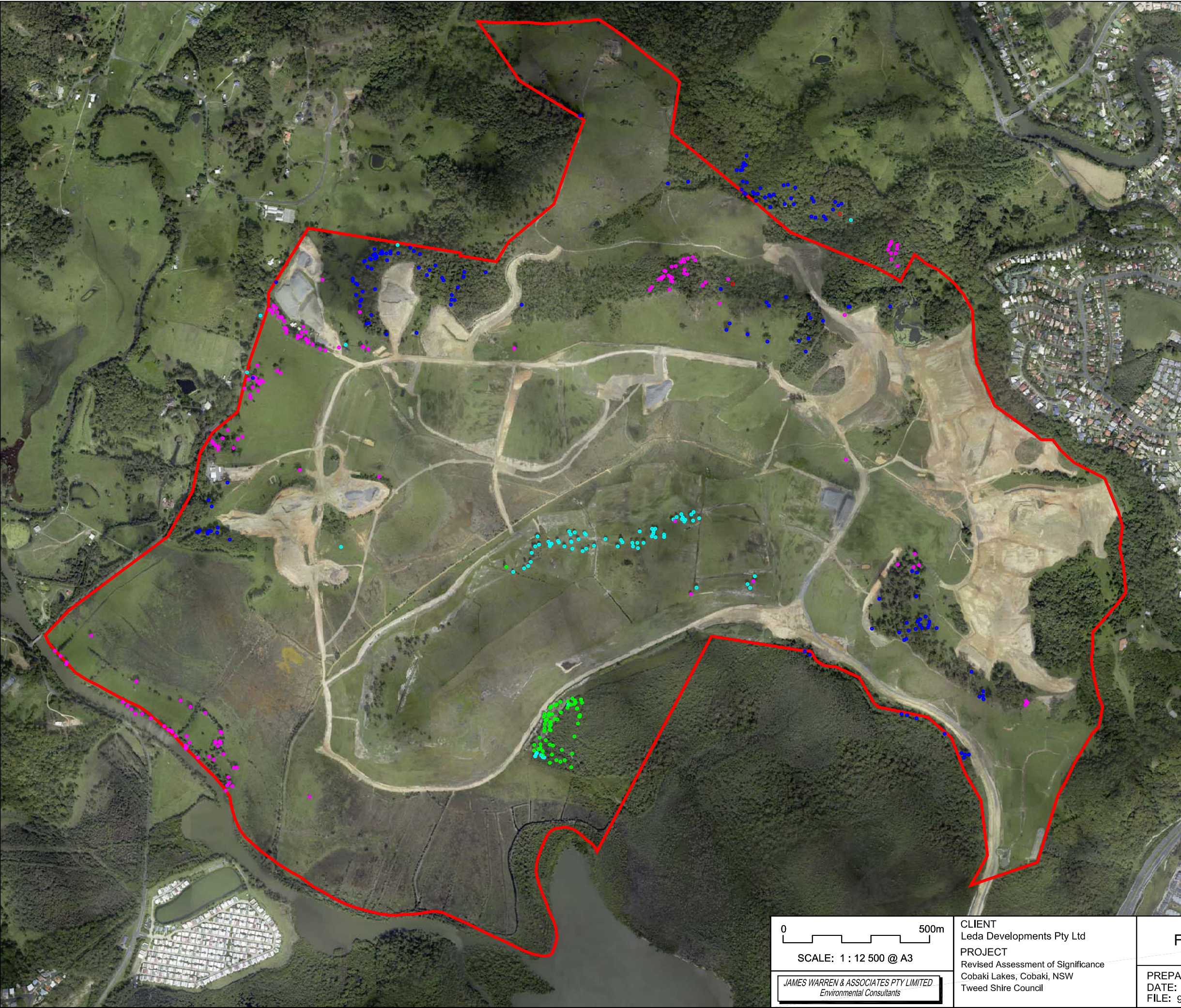
In December 2007, areas of the site containing preferred Koala food trees (i.e. Swamp mahogany, Forest red gum, Tallowwood, Grey gum) were searched for evidence of Koala activity. Two (2) scientists spent approximately twelve (12) hours on this component of the assessment. A nocturnal survey was also completed including spotlighting and call playback techniques. Approximately eight (8) hours was spent on this component of the assessment. No conclusive evidence of Koala activity (scats) was recorded from the site. Whilst a number of trees contained scratch marks, this is not considered a conclusive method of identifying Koala activity when not accompanied by scats and may be attributable to other more common arboreal species (i.e. Common brushtail possum). One (1) male Koala was heard calling approximately 200-300m north of the south-western corner of the Subject site (**FIGURE 10**).

More recently (September 2009), all trees listed under Schedule 2 which occur on the Subject site were located (**FIGURE 18**). Details of these trees are contained in **APPENDIX 1**. In total, four hundred and seventy-one (471) Koala food trees listed under Schedule 2 occur on the Subject site as follows:

- One hundred and fifty-six (156) Forest red gum (*Eucalyptus tereticornis*);
- One hundred and twenty-nine (129) Tallowwood (*Eucalyptus microcorys*);
- Seventy-three (73) Swamp mahogany (*Eucalyptus robusta*);
- One hundred and thirteen (113) Scribbly gum (*Eucalyptus signata*).

The majority of these trees will be retained within Environmental Protection Areas (**FIGURE 19**).

It is considered that Koalas may utilise the site occasionally as they disperse throughout the locality, however large areas of more suitable habitat is considered to occur throughout the locality (particularly within intact forested areas to the west) and are likely to be preferred by the local population of Koalas.



- LEGEND**
- *Eucalyptus microcorys*
 - *Eucalyptus signata*
 - *Eucalyptus robusta*
 - *Eucalyptus tereticornis*
 - Koala scats
 - Site Outline

SOURCE:
Habitat - James Warren & Associates Pty Ltd
Aerial - Michel Group Services (Ref: 6400-197.dwg)
- photo taken March 2010

0 500m
SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd
PROJECT
Revised Assessment of Significance
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 18
PREPARED: BW
DATE: 30 June 2010
FILE: 97038_SA_Base.dwg

TITLE
IDENTIFIED
KOALA HABITAT



- LEGEND**
- *Eucalyptus microcorys*
 - *Eucalyptus signata*
 - *Eucalyptus robusta*
 - *Eucalyptus tereticornis*
 - Koala scats
 - Precinct 6 Proposed Residential Area (extent of application shown below)
 - Precincts 1, 2, 4 and 6 to 8 Zone Boundary
 - Extent of Precinct 6 Application
 - Future Residential Development
 - Future Retail / Commercial / Mixed Use
 - Future Community Facilities / Education / Utilities Development
 - Existing Water Body
 - Stormwater Treatment and Delivery Areas
 - Cultural Protected Area
 - Covenant Protected Area
 - Environmental Protection Area
 - Open Space
 - Casual Park
 - Structured Open Space
 - 2.5m Shared User Path/Maintenance Access
 - Site Outline

SOURCE:
Habitat - James Warren & Associates Pty Ltd
Layout - Design Forum Architects
(Ref: DA 01.01 E Master Plan.dwg)

0 500m
SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd
PROJECT
Revised Assessment of Significance
Cobaki Lakes, Cobaki, NSW
Tweed Shire Council

FIGURE 19
PREPARED: BW
DATE: 05 April 2013
FILE: 97038_SA_Base.dwg

TITLE
IDENTIFIED
KOALA HABITAT
OVERLAID ON
PROPOSED LAYOUT

It is estimated that approximately 42.41 hectares of potential Koala habitat occurs on the Subject site. Approximately 11.89 hectares (28.04%) of potential forage habitat will be removed from the Subject site all of which will be removed from areas of the site with existing development approvals.

Additional impacts of the proposed development on Koalas include:

- Increased risk of death or injury from vehicle strike;
- Risk of harassment, death or injury from straying dogs;
- Risk of drowning in swimming pools; and
- Opportunities for Koala movement over the site may be restricted.

The majority of vegetation communities which provide suitable habitat for the Koala on the Subject site will be retained (**FIGURE 19**). Furthermore, approximately 61.82ha of revegetation/regeneration will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links across the site. These areas are likely to provide suitable forage habitat for the Koala in the long-term and provide vegetated linkages through the landscape (**FIGURE 13**). It is also worth noting that habitat for the Koala will be retained in perpetuity within the adjacent border reserve.

The Revised Fauna Management Plan (JWA 2013) includes additional relevant amelioration measures.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Grey-headed flying-fox

The NPWS database (June 2010) contains thirty-one (31) records of this species within 10kms of the Subject site. Two hundred and thirty-four (234) records occur within the Tweed LGA. The Grey-headed flying-fox has been recorded foraging in various locations on and adjacent to the Subject site (**FIGURES 10 & 11**). This species is known to roost in rainforest and swamp forest communities. A day-roost site for a small group (15 to 20 individuals) of this species has been recorded from Hidden Valley, to the north-east of the Subject site (**FIGURE 11**).

The Grey-headed flying-fox forages in rainforests, wet and dry sclerophyll forest, mangroves, fruit orchards and fruiting trees in parks and urban areas. The proposed development has the potential to result in the loss of foraging habitat for this species and reduce the foraging efficiency of any individuals foraging in the Study area.

NSW NPWS lists the following threats for this species:

- Loss of foraging habitat;
- Disturbance of roosting sites;
- Unregulated shooting; and
- Electrocution on powerlines.

It is estimated that approximately 72.26 hectares of forage habitat occurs on the Subject site for this species. Approximately 12.96 hectares (17.94%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Suitable roosting habitat for this species may occur in the rainforest community located on Mt. Woodgee which will be retained. Given the high mobility of this species, the loss of 12.96 hectares of known and potential foraging habitat is not considered significant in relation to the local distribution of potential foraging habitat for this species. The Grey-headed flying-fox is considered likely to continue foraging within retained areas of vegetation on the site.

Furthermore, 6.77ha of Swamp sclerophyll forest, 9.59ha of Lowland rainforest on floodplain, 3.71ha of Lowland rainforest and 12.06ha of Mixed sclerophyll will be regenerated/ revegetated on the Subject site (**FIGURE 14**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a). These areas are likely to provide suitable forage habitat for this species and offset the loss of 12.96ha.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Little bent-wing bat & Common bent-wing bat

The NPWS database (June 2010) contains thirteen (13) records of the Little bent-wing bat within 10kms of the Subject site. Sixty-one (61) records occur within the Tweed LGA. This species has also been recorded in a number of locations adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**).

The NPWS database (June 2010) contains no records of the Common bent-wing bat within 10kms of the Subject site or within the Tweed LGA.

The Little bent-wing bat and Common bent-wing bat forage on insects in forested habitats, and roost in caves, tunnels or similar structures located nearby. The proposed development will result in the loss of some foraging habitat for these species in the open woodland environments of the site, and reduce the foraging efficiency of any individuals foraging in the Study area.

NSW NPWS lists the following threats for these species:

- Disturbance of colonies, especially in nursery or hibernating caves may be catastrophic.
- Destruction of caves that provide seasonal or potential roosting sites.
- Changes to habitat, especially surrounding maternity caves.
- Use of pesticides.

It is estimated that approximately 72.26 hectares of forage habitat occurs on the Subject site for these species. Approximately 12.96 hectares (17.94%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. No roost habitat will be affected by the proposed development and it is considered that this species will continue to forage over the retained vegetation on the Subject site.

Furthermore, approximately 61.82ha of revegetation/regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links

across the site (**FIGURE 13**). These areas are likely to provide suitable forage habitat for these species in the long-term and offset the loss of 12.96ha.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Eastern free-tail bat, Yellow-bellied sheath-tail bat & Greater broad-nosed bat

The NPWS database (June 2010) contains one (1) record of the Eastern free-tail bat within 10kms of the Subject site. Four (4) records occur within the Tweed LGA.

The NPWS database (June 2010) contains four (4) records of the Yellow-bellied sheath-tail bat within 10kms of the Subject site. Five (5) records occur within the Tweed LGA.

The NPWS database (June 2010) contains no records of the Greater broad-nosed bat within 10kms of the Subject site. Two (2) records occur within the Tweed LGA.

The Eastern free-tail bat is found along the east coast from south Queensland to southern NSW. It inhabits dry sclerophyll forest and woodland east of the Great Dividing Range and roosts mainly in tree hollows but will also roost under bark or in man-made structures.

The NSW NPWS lists the following threats for this species:

- Loss of hollow-bearing trees.
- Loss of foraging habitat.
- Application of pesticides in or adjacent to foraging areas.

The Yellow-bellied sheath-tail-bat is a wide-ranging species found across northern and eastern Australia. It roosts singly or in groups of up to six, in tree hollows and buildings and in treeless areas they are known to utilise mammal burrows. It forages in most habitats across its very wide range, with and without trees.

The NSW NPWS lists the following threats for this species:

- Disturbance to roosting and summer breeding sites;
- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions;
- Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat; and
- Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.

The Greater broad-nosed bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. It utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.

The NSW NPWS lists the following threats for this species:

- Disturbance to roosting and summer breeding sites.

- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.
- Loss of hollow-bearing trees.
- Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.
- Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.

It is estimated that approximately 72.26 hectares of forage habitat occurs on the Subject site for these species. Approximately 12.96 hectares (17.94%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals.

Given the high mobility of these species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of suitable habitat. There will be a minor loss of potential roost sites (i.e. hollow-bearing trees) for these species however the installation of bat boxes within retained vegetation (in accordance with the Revised Fauna Management Plan - JWA 2013) will increase roosting opportunities for these species. It is considered that these species will continue to utilise retained vegetation for foraging and retained habitat trees for roosting.

Furthermore, approximately 61.82ha of revegetation/regeneration works will be completed in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) to offset any loss of remnant bushland and to provide vegetated links across the site (**FIGURE 13**). These areas are likely to provide suitable forage habitat for these species in the long-term and offset the loss of 12.96ha of potential habitat.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Wallum sedge-frog

The NPWS database (June 2010) contains twenty-two (22) records of this species within 10kms of the Subject site. Twenty-five (25) records occur within the Tweed LGA.

This species has been recorded from swamp forest communities adjacent to the Subject site on a number of occasions (Warren 1992, Woodward-Clyde 1997, EcoPro 2004) (**FIGURE 11**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

The Wallum sedge frog is dependent on low-nutrient wetlands with acidic waters, and often occurs in swamp forests dominated by Broad-leaved paperbark. It is also found along creeks or in marshy or swampy lowlands with emergent vegetation and reeds. The Wallum sedge frog is one of several species that breeds in water of low pH (3.4 to 4.5). Core habitat for this species is considered to be comprised of undisturbed wet heathland and wetland communities on and adjacent to the subject. The proposed development will not remove or modify any area considered to provide core habitat for the Wallum sedge frog.

The NSW NPWS lists the following threats for this species:

- Destruction and degradation of coastal wallum and coastal wetlands for roadworks, coastal developments and sand mining.
- Reduction of water quality and changes to acidity in coastal wetlands.
- Grazing and associated frequent burning of coastal wetlands.

Offsets for the removal of highly degraded Freshwater wetland vegetation from the Subject site will include the following:

1. Recreation of approximately 2ha of high quality wetland habitats. These compensatory Freshwater wetlands will be offline from the stormwater treatment train and will also be specifically designed to provide core (breeding) habitat for the Wallum sedge frog. Revegetation and management of Freshwater wetlands will occur in accordance with a Freshwater Wetland Compensatory Habitat Management Plan (SMEC 2012); and
2. Leda Manorstead Pty Ltd is currently in negotiations with OEH with a view to securing appropriate off-site offsets.

Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 14**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) and these areas are likely to provide suitable forage habitat for this species and partially offset any loss of forage habitat. In total, 8.77ha of rehabilitation works on the Subject site will result in the creation of suitable forage habitat for the Wallum sedge frog.

General mitigation measures aimed at minimising habitat loss and maintaining hydrological regimes of low-lying areas on and adjacent to the Subject site will minimise the impact to this species.

A detailed Stormwater Management Plan has been prepared for the Subject site utilising current best-practice management techniques, which will ensure no adverse impacts on the hydrology of the current core habitat and the proposed rehabilitated freshwater wetland. Furthermore, any stormwater treatment devices and sedimentation ponds will be designed so that they provide limited opportunities for the introduced Mosquito fish (*Gambusia* sp.) to breed and hence provide better habitat for native frogs.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Bush hen

The NPWS database (June 2010) contains sixteen (16) records of this species within 10kms of the Subject site. Twenty-seven (27) records occur within the Tweed LGA.

This species has been recorded within Swamp mahogany forest at the northern end of the Cobaki Broadwater (EcoPro 2004) (**FIGURE 11**). Critical habitat features for this species appear to be dense vegetation and proximity to water, although it has been recorded some distance from permanent streams on occasions. Extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

The NSW NPWS lists the following threats for this species:

- Clearing, filling and draining of wetlands for agricultural, residential and industrial development;
- Pollution of wetlands from agricultural, urban and industrial run-off;
- Changes to wetlands caused by weed invasions, often associated with sedimentation or grazing;
- Predation by introduced, feral and domestic predators, particularly the foxes and feral cats; and
- Use of herbicides and pesticides in agriculture and residential areas.

Potential habitat for this species is considered to be comprised of lowland rainforest and swamp forest communities with a dense midstorey/groundcover and standing water. It is estimated that approximately 1.41 hectares of potential habitat occurs on the Subject site for this species, comprised of isolated patches of lowland rainforest. The proposed development will result in the removal or modification a total of 0.02 hectares (1.42%) of potential habitat for this species, all of which occurs within portions of the site with existing development approvals. Due to their crepuscular and nocturnal nature, this species is most likely to be active around dusk or during the night. This may place any birds at risk of disturbance by street lighting and night-time traffic. Other impacts may include predation by domestic cats.

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 6.77 hectares of Swamp sclerophyll forest, 9.59 hectares of Lowland rainforest on floodplain, 3.71 hectares of Lowland rainforest and 2.00 hectares of Freshwater wetland (**FIGURE 14**). These areas may provide suitable habitat for this species in the long-term and will offset the loss of 0.02ha of habitat.

The following additional amelioration measures should be considered in accordance with the Revised Fauna Management Plan (JWA 2013):

- Traffic movement controls on local roads and awareness signage are to be incorporated into detailed site design
- Landowners should control cats. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.
- Street lights adjacent to retained habitat areas should be capped. Vegetated buffers and/or dense planted screens will also reduce the impacts of lighting.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Glossy black-cockatoo

The NPWS database (June 2010) contains one (1) record of this species within 10kms of the Subject site. Fifty-seven (57) records occur within the Tweed LGA.

This species has been recorded from suitable habitat adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species, or evidence of its occurrence (i.e. chewed *Allocasuarina* cones).

The Glossy black-cockatoo is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW. It

inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000m in which stands of she-oak species, particularly Black she-oak (*Allocasuarina littoralis*), Forest she-oak (*A. torulosa*) or Drooping she-oak (*A. verticillata*) occur.

Suitable habitat for this species is considered to be comprised of dry and moist sclerophyll forests with an abundance of *Allocasuarina* species. It is estimated that approximately 48.61 hectares of potential forage habitat occurs on the Subject site for this species, however few areas of dense mature *Allocasuarina* occur on the site.

The proposed development will result in the removal or modification a total of 5.42 hectares (11.15%) of potential habitat for this species. The majority of this vegetation removal will occur from portions of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

The proposed development will retain large areas of intact forest that will provide continued foraging resources for this species on the Subject site. Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the revegetation/regeneration of 61.82ha to offset any loss of vegetation and to provide vegetated links across the site (**FIGURE 14**). These works will utilise *Allocasuarina* species where appropriate to provide suitable forage resources for this species.

Additionally, the installation of nest boxes of a suitable size for cockatoos within retained vegetation (in accordance with the Revised Fauna Management Plan - JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for nesting purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Brolga

The NPWS database (June 2010) contains no records of this species within 10kms of the Subject site or within the Tweed LGA. This species has been recorded from wetlands adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

The Brolga was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It is still abundant in the northern tropics, but very sparse across the southern part of its range. Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps.

The NSW NPWS lists the following threats for this species:

- At least in former times, Brolgas were poisoned and shot because of their feeding incursions into crops, following drainage of swamps; and
- Loss of wetland habitat through clearing and draining for flood mitigation and agriculture.

Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the Subject site. The proposed development will not result in disturbance to

or the removal of potential habitat for this species within the wetland area located in the south-eastern portion of the site. It is estimated that approximately 140.60 hectares of forage habitat occurs on the Subject site during suitable conditions (i.e. localised flooding after periods of heavy rainfall).

Approximately 78.76 hectares (56.02%) of potential forage habitat will be removed from the Subject site. The majority of this vegetation removal will occur from portions of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

The creation of approximately 2 hectares of Freshwater wetland will provide additional suitable habitat for the Brolga on the Subject site. Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 14**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a). These areas and additional off-site offsets will provide suitable habitat for this species in the long-term and offset the loss of habitat.

Additionally, 54.63 hectares of vegetation within the south-eastern portion of the Subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2013b) (**FIGURE 14**). This area currently provides suitable forage habitat for the Brolga and will continue to do so in the long term.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Black bittern

The NPWS database (June 2010) contains two (2) records of this species within 10kms of the Subject site. Ten (10) records occur within the Tweed LGA.

An unconfirmed sighting of this species occurred near the Cobaki Broadwater adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. The species also occurs in the south-west of Western Australia. In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. It inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.

The NSW NPWS lists the following threats for this species:

- Clearing of riparian vegetation.
- Predation by foxes and feral cats on eggs and juveniles.
- Grazing and trampling of riparian vegetation by stock.

Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the Subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the Subject site. The proposed development will not result in disturbance to

or the removal of potential habitat for this species. Overall, impacts on this species are considered to be relatively low.

The recreation of approximately 2 hectares of Freshwater wetland will provide additional suitable habitat for the Black bittern on the Subject site in the long-term. Furthermore, 6.77 hectares of Swamp sclerophyll forest will be regenerated/revegetated on the Subject site (**FIGURE 14**) in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a). These areas and additional off-site offsets may also provide suitable habitat for this species and represent a net gain in available habitat in the long-term.

It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Mangrove honeyeater

The NPWS database (June 2010) contains twenty-two (22) records of this species within 10kms of the Subject site. Twenty-three (23) records occur within the Tweed LGA.

This species has been recorded from mangrove and swamp forest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

The Mangrove honeyeater is confined to the coastal fringe and offshore islands of eastern Australia from the Townsville area, Queensland south to the NSW north coast. It is common in Queensland but rare in NSW, where a few colonies exist at scattered localities, including the Tweed, Richmond and Clarence River estuaries and Stuarts Point south of Macksville. Its primary habitat is mangrove forest but the species also occurs in other near-coastal forests and woodlands, including casuarina and paperbark swamp forests.

The NSW NPWS lists the following threats for this species:

- Clearing of old mangrove stands and adjoining forest and woodland vegetation for tourist, residential and infrastructure development;
- Use of herbicides and pesticides in agriculture and to protect tourist and residential areas; and
- Pollution of estuarine areas.

Suitable habitat for this species is considered to be comprised of undisturbed mangrove and wetland communities on and adjacent to the Subject site. Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the Subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the Subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species. Overall, impacts on this species are considered to be relatively low.

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 6.77 hectares of Swamp sclerophyll forest (**FIGURE 14**). These areas may also provide suitable habitat for this species and represent a net gain in available habitat in the long-term.

Additionally, 54.63 hectares of vegetation within the south-eastern portion of the Subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2013b) (**FIGURE 14**). This area currently provides stands of mangrove vegetation suitable as forage habitat for the Mangrove honeyeater and will continue to do so in the long term. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

White-eared monarch

The NPWS database (June 2010) contains six (6) records of this species within 10kms of the Subject site. Eighty-five (85) records occur within the Tweed LGA.

This species has been recorded from rainforest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

The White-eared monarch is restricted to eastern Queensland and the NSW north coast from Cape York south to Iluka at the mouth of the Clarence River and occur west only as far as the Richmond Range. Occasionally found further south in the vicinity of Coffs Harbour and Port Macquarie. In NSW this species occurs primarily in coastal rainforest, swamp forest and wet eucalypt forest.

The NSW NPWS lists the following threats for this species:

- Clearing and isolation of low elevation subtropical rainforest, coastal rainforest and wet and swamp forest resulting from agricultural, tourist and residential development;
- Conversion of multi-aged wet forests to young, even-aged stands through forest management; and
- Weed invasions completely dominating habitats.

Suitable habitat for this species is considered to be comprised of undisturbed rainforest communities associated with Mt Woodgee on and adjacent to the Subject site. It is estimated that approximately 10.99 hectares of potential forage habitat occurs on the Subject site for the White-eared monarch. Approximately 0.11 hectares (1%) of potential forage habitat will be removed from the Subject site all of which will be removed from areas of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 9.59 hectares of Lowland rainforest on floodplain and 3.71 hectares of Lowland rainforest (**FIGURE 14**). These areas may provide suitable habitat for this species in the long-term and offset the loss of 0.11ha of potential habitat.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Wompoo fruit-dove, Rose-crowned fruit-dove & Superb fruit-dove

The NPWS database (June 2010) contains one (1) record of the Wompoo fruit-dove within 10kms of the Subject site. One hundred and fifteen (115) records occur within the Tweed LGA.

The NPWS database (June 2010) contains eight (8) records of the Rose-crowned fruit-dove within 10kms of the Subject site. One hundred and eight (108) records occur within the Tweed LGA.

The NPWS database (June 2010) contains no records of the Superb fruit-dove within 10kms of the Subject site. Two (2) records occur within the Tweed LGA.

The Wompoo fruit-dove and Rose-crowned fruit-dove have been recorded from rainforest and swamp forest communities adjacent to the Subject site, and an unconfirmed sighting of the Superb fruit-dove also occurred (EcoPro 2004) (**FIGURE 11**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record these species.

The Wompoo fruit-dove occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. It is rare south of Coffs Harbour. It occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests.

The NSW NPWS lists the following threats for this species:

- Clearing, fragmentation and weed invasion of low to mid-elevation rainforest due to coastal development and grazing;
- Logging and roading in moist eucalypt forest with well-developed rainforest understorey; and
- Burning which reduces remnant rainforest habitat patches.

The Rose-crowned fruit-dove occurs along the coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. It occurs mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.

The NSW NPWS lists the following threats for this species:

- Clearing and fragmentation of low to mid-elevation rainforest;
- Logging and roading in moist eucalypt forest with well-developed rainforest understorey;
- Burning of remnant rainforest habitat;
- Invasion of habitat by introduced weed species; and
- Removal of Camphor Laurel food source without appropriate mitigation measures.

The Superb fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. It inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.

The NSW NPWS lists the following threat for this species:

- Clearing and degradation of rainforest remnants.

Suitable habitat for the fruit-doves is considered to be comprised of undisturbed rainforest communities associated with Mt Woodgee on and adjacent to the Subject site. It is estimated that approximately 10.99 hectares of potential forage habitat occurs on the Subject site for these species. Approximately 0.11 hectares (1%) of potential forage habitat will be removed from the Subject site all of which will be removed from areas of the site with existing development approvals. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 9.59 hectares of Lowland rainforest on floodplain and 3.71 hectares of Lowland rainforest and 6.77 hectares of Swamp sclerophyll forest (**FIGURE 14**). These areas may provide suitable habitat for the fruit-doves in the long-term and offset the loss of 0.14ha of potential habitat.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Collared kingfisher

The NPWS database (June 2010) contains fifty-nine (59) records of the Collared kingfisher within 10kms of the Subject site. Sixty-one (61) records occur within the Tweed LGA.

This species has been recorded from the Cobaki Broadwater adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

The Collared kingfisher occurs around the northern Australian coastline from Shark Bay in Western Australia to the mouth of the Clarence River, NSW. In NSW it is most commonly observed in the Tweed River estuary, where it breeds. This species is virtually restricted to mangroves and other estuarine habitats and mainly occurs about the mouths of the larger coastal rivers.

The NSW NPWS lists the following threats for this species:

- Clearing of old mangrove stands for tourist, residential and infrastructure development;
- Loss of large coastal trees containing hollows or termite nests;
- Pollution of estuaries and accumulation of agricultural herbicide and pesticide residues; and
- Use of pesticides to protect tourist and residential developments.

Suitable habitat for this species is considered to be comprised of undisturbed mangrove communities on and adjacent to the Subject site. Potential habitat for this species occurs within the low-lying eastern and south-eastern portions of the Subject site, particularly in association with the Cobaki Broadwater. It is estimated that approximately 5.66 hectares of potential habitat for this species occurs on the Subject site. The proposed development will not result in disturbance to or the removal of potential habitat for this species.

Overall, impacts on this species are considered to be relatively low. Approximately 54.63 hectares of vegetation within the south-eastern portion of the Subject site will be retained and rehabilitated in accordance with the Revised Saltmarsh Rehabilitation Plan (JWA 2013b) (**FIGURE 14**). This area currently provides stands of mangrove vegetation suitable as forage habitat for the Collared kingfisher and will continue to do so in the long term. It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Eastern grass owl

The NPWS database (June 2010) contains three (3) records of this species within 10kms of the Subject site. Twenty-four (24) records occur within the Tweed LGA.

An individual Eastern grass owl was recorded in sedgeland at the southern end of the airport runway, approximately 1.75km to the east of Subject site (EcoPro 2004) (**FIGURE 11**). However, extensive searches on the Subject site (JWA 2000 - 2007) have failed to record this species.

This species has been recorded inhabiting coastal and inland grasslands, coastal heath, agricultural crops and swamp margins (NSW State Forests 1995; Shields 1995). Primary breeding habitat appears to be dense, secluded grass tussock swards, sometimes near water (NSW State Forests 1995). It hunts nocturnally, feeding mainly on rodents. However, birds, insects, frogs and reptiles are also consumed (Shields 1995). Nesting occurs in trodden-down grass under bushes or tussocks.

The NSW NPWS lists the following threats for this species:

- Loss of suitable habitat due to grazing, agriculture and development;
- Disturbance and habitat degradation by stock;
- Use of pesticides in agriculture to control rodent populations thereby reducing seasonal food sources for owls, and potentially poisoning owls; and
- Frequent burning, which reduces ground cover.

This species may forage over the low-lying eastern portions of the Subject site. Potential nesting/roost habitat for this species also occurs within the low-lying eastern and south-eastern portions of the Subject site. It is estimated that approximately 2.44 hectares of potential nesting/roost habitat for this species occurs on the Subject site. The proposed development will not result in disturbance to or the removal of potential nesting/roost habitat for this species.

Given the high mobility of this species, the loss of potential foraging habitat on the Subject site is not considered significant in relation to the local distribution of potential foraging habitat for this species.

Increased vehicular traffic on the Subject site may result in the increased risk of vehicular strike. In the vicinity of Ballina in northern NSW birds are often recorded as road kills along the edge of the Pacific Highway, suggesting that they may use the road verge for foraging (Maciejewski 1996).

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 6.77 hectares of Swamp sclerophyll forest (**FIGURE 14**). These areas may provide suitable habitat for this species and will result in a net gain of suitable habitat in the long-term.

It is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Large-footed myotis

The NPWS database (June 2010) contains four (4) records of this species within 10kms of the Subject site. Nineteen (19) records occur within the Tweed LGA.

This species has been recorded during surveys adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, numerous surveys on the Subject site (JWA 2000 - 2007) have failed to record this species.

Large-footed myotis generally roost close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish.

The NSW NPWS lists the following threats for this species:

- Reduction in stream water quality affecting food resources;
- Loss or disturbance of roosting sites;
- Clearing adjacent to foraging areas; and
- Application of pesticides in or adjacent to foraging areas.

Potential forage habitat for this species is generally restricted to the adjacent Cobaki Broadwater and the large farm dam in the south-western portion of the site. The proposed development will result in the removal of a small area (0.8ha or 34.33%) of potential forage habitat for this species. However, this will be offset by the construction of drainage channels and revegetation across the site. Overall, impacts on this species are considered to be relatively low.

The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites. Additionally, the installation of bat boxes within retained vegetation (in accordance with the Revised Fauna Management Plan - JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for roosting purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of this species.

Eastern long-eared bat

The NPWS database (June 2010) contains four (4) records of this species within 10kms of the Subject site. Thirty (30) records occur within the Tweed LGA.

This species has been recorded from rainforest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, numerous surveys on the Subject site (JWA 2000 - 2007) have failed to record this species.

The Eastern long-eared bat is found from Cape York through eastern Queensland to the far north-east corner of NSW. In NSW they appear to be confined to the coastal plain and nearby coastal ranges, extending south to the Clarence River area, with a few records further south around Coffs Harbour. The species can be locally common within

its restricted range. It inhabits Lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest.

The NSW NPWS lists the following threats for this species:

- Clearing, fragmentation and isolation of lowland subtropical rainforest, wet and swamp eucalypt forest and coastal scrub, particularly forest and scrub close to the coast, for agricultural, residential and other development;
- Loss of hollow-bearing trees and stands of palms and rainforest trees used for roosting and maternity sites;
- Invasion of habitat by weeds, particularly by Bitou Bush on the coast; and
- Use of pesticides.

Suitable habitat for the Eastern long-eared bat is considered to be comprised of lowland subtropical rainforest and swamp sclerophyll forest. This species roosts in hollows in trees and also in the hanging foliage of palms, in dense clumps of foliage of rainforest trees and under bark. It forages within structurally complex forests. It is estimated that approximately 10.99 hectares of potential forage habitat occurs on the Subject site for this species, comprised of the intact rainforest community associated with Mt Woodgee, and smaller isolated rainforest patches.

Approximately 0.11 hectares (1%) of potential forage habitat will be removed from the Subject site, all of which will be removed from areas of the site with existing development approvals. Given the high mobility of this species, the loss of a small area of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species. The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites.

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 9.59 hectares of Lowland rainforest on floodplain, 3.71 hectares of Lowland rainforest, 6.77 hectares of Swamp sclerophyll forest (**FIGURE 14**). These areas may provide additional suitable habitat for this species in the long-term and offset the loss of 0.11ha of potential habitat.

The installation of bat boxes within retained vegetation (in accordance with the Revised Fauna Management Plan - JWA 2013) may also improve the habitat values of the site for this species and encourage the use of site habitats for roosting purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Squirrel glider

The NPWS database (June 2010) contains no records of this species within 10kms of the Subject site. Three (3) records occur within the Tweed LGA.

This species has been recorded from forest communities adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, numerous surveys on the Subject site (JWA 2000 - 2007) have failed to record this species.

The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. It inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas, and prefers mixed species stands with a shrub or Acacia midstorey.

The NSW NPWS lists the following threats for this species:

- Loss and fragmentation of habitat;
- Loss of hollow-bearing trees;
- Loss of flowering understorey and midstorey shrubs in forests; and
- Individuals can get caught in barbed wire fences while gliding.

Suitable habitat for the Squirrel glider is considered to be comprised of mature dry sclerophyll and wet sclerophyll forests with abundant hollows for refuge and den sites. It is estimated that approximately 52.81 hectares of potential forage habitat occurs on the Subject site for this species.

In total, 9.55 hectares (18.08%) of potential habitat (i.e. remnant bushland with hollow-bearing trees) will be lost from the Subject site. The majority of habitat to be removed occurs within portions of the site with existing development approvals. The loss of potential habitat on the Subject site is not considered significant in relation to the local distribution of habitat for this species.

The Revised Site Regeneration and Revegetation Plan (JWA 2013a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 61.82ha of revegetation/regeneration works will be completed in accordance with this plan (**FIGURE 14**) to offset the loss of 9.55ha of potential habitat and to provide vegetated links across the site.

The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential roost sites. Additionally, the installation of nest boxes within retained vegetation (in accordance with the Revised Fauna Management Plan - JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for denning purposes.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Common planigale

The NPWS database (June 2010) contains nine (9) records of this species within 10kms of the Subject site. Thirty-two (32) records occur within the Tweed LGA.

This species has been recorded from a very small area (i.e. about 1 hectare) consisting of Swamp Mahogany-Brushbox Forest adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, numerous surveys on the Subject site (JWA 2000 - 2007) have failed to record this species.

This species occurs in coastal north-eastern NSW, coastal east Queensland and Arnhem Land. The species reaches its southern distribution limit on the NSW lower north coast.

Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water.

The NSW NPWS lists the following threats for this species:

- Predation by foxes, cats and cane toads;
- Loss and fragmentation of habitat through clearing for agriculture and development in coastal areas;
- Frequent burning and grazing that reduces ground cover such as hollow logs and bark; and
- Disturbance of vegetation surrounding water bodies.

Suitable habitat for the Common planigale is considered to be comprised of mature rainforest, eucalypt forest and heathland on and adjacent to the Subject site. It is estimated that approximately 74.93 hectares of potential forage habitat occurs on the Subject site for these species.

In total, 13.09 hectares (17.47%) of potential habitat will be lost from the Subject site. The majority of habitat to be removed occurs from portions of the site with existing development approval. The loss of potential habitat is not considered significant in relation to the local distribution of habitat for this species.

This species, if present, would be particularly susceptible to predation by cats and dogs. Habitat disturbance associated with construction, especially noise and vibration, may also have a significant impact on this species.

The Revised Site Regeneration and Revegetation Plan (JWA 2013a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 61.82ha of revegetation/regeneration works will be completed in accordance with this plan (**FIGURE 14**) to offset the loss of 13.09ha of habitat and to provide vegetated links across the site.

The retention of large areas of intact forest communities, including a number of old growth trees, will continue to provide potential habitat for this species. Additionally, the installation of nest boxes within retained vegetation (in accordance with the Revised Fauna Management Plan - JWA 2013) will improve the habitat values of the site for this species and encourage the use of site habitats for denning purposes.

Landowners should control cats and dogs. All animals should reside within fenced enclosures and be on a leash when outside of the enclosure.

With the adoption of the above amelioration measures, it is considered that the proposed development is highly unlikely to result in the local extinction of these species.

Long-nosed potoroo

The NPWS database (June 2010) contains three (3) records of this species within 10kms of the Subject site. Twelve (12) records occur within the Tweed LGA. It is also worth noting that the Long-nosed potoroo population adjacent to the Subject site has been listed as an Endangered Population.

A small disjunct population of Long-nosed potoroos has been recorded adjacent to the north-eastern corner of the Subject site (Warren 1992, Woodward-Clyde 1997, EcoPro 2004) (**FIGURE 11**). However, numerous surveys on the Subject site (Warren 1992, 1993, Woodward-Clyde 1997, Parker 1999, JWA 2000 - 2007) and within the border reserve to the north and north-west of the Subject site (JWA 2000 - 2007), have failed to record this species.

Suitable habitat for the Long-nosed potoroo is considered to be comprised of heathland and dry and wet sclerophyll forests with a dense understorey adjacent to the north-eastern boundary of the Subject site. A sandy loam soil is also a common feature. The proposed development will not result in disturbance to or the removal of potential habitat for this species. This species has historically been recorded from the north and south of the existing site access road, which has essentially formed two small sub-populations. Without mitigation, road kills may significantly affect these populations. Predation by domestic cats and dogs is also a potential impact of the development.

The NSW NPWS lists the following threats for this species:

- Habitat loss and fragmentation from land clearing for residential and agricultural development;
- Predation from foxes, dogs and cats;
- Too frequent fires or grazing by stock that reduce the density and floristic diversity of understorey vegetation; and
- Logging regimes or other disturbances that reduce the availability and abundance food resources, particularly hypogenous fungi, and ground cover.

The Revised Site Regeneration and Revegetation Plan (JWA 2013a) outlines the various measures to ensure that the retained remnant vegetation is adequately managed. Approximately 61.82ha of revegetation/regeneration will be completed in accordance with this plan (**FIGURE 14**) to offset any loss of vegetation and to provide vegetated links across the site.

Furthermore, a Management Plan has been prepared for the Long-nosed potoroo population at Cobaki Lakes (Warren 1994) as is to be adopted as part of the proposed Cobaki Lakes development. The following is a summary of the management strategies to be implemented:

- Ensure that the potoroo population in Cobaki Crown Reserve remains viable;
- To maximise Potoroo population in available and potential habitat;
- Monitoring of predator presence, use of the culverts for fauna access should be carried out by the NPWS and Cobaki Lakes;
- All domestic stock will be removed from known and potential Potoroo habitat;
- All domestic stock will be removed from Potoroo habitat rehabilitation areas;
- Feral animals be monitored and controlled for several years after completion of construction of the road;
- All known and potential Long-nosed potoroo habitat in the Cobaki Crown Reserve will be conserved where possible;
- Selected portions of land occurring on contiguous freehold property will be rehabilitated to eventually form Potoroo habitat;
- All fire be excluded for approximately 15 years;
- In the long term, strategic burning will be necessary. A long term Management Plan (including the use of fire) be established by the future managers (presumably NSW NPWS) for the Crown Wetland and Border Reserve which:

- accommodates rejuvenation/revitalisation of plant communities, and
- provides food and suitable habitat for the fauna
- Fauna underpasses should be constructed as an integral part of the Boyd Street access roadworks. Wing fences, steel grates and dense habitat rehabilitation are all strategies which will be utilised in conjunction with the underpasses;
- Other management features will include minimal habitat disturbance, minimal faunal underpass lengths, road signage and vehicle speed reduction; and
- Biennial reports on Potoroo and feral animal monitoring activities will be prepared.

With the adoption of these amelioration measures, it is unlikely that the proposed development will result in the extinction of this Endangered Population.

Common blossom bat

The NPWS database (June 2010) contains five (5) records of this species within 10kms of the Subject site. Twenty-five (25) records occur within the Tweed LGA.

This species has been recorded during surveys of land adjacent to the Subject site (EcoPro 2004) (**FIGURE 11**). However, numerous surveys on the Subject site (JWA 2000 - 2007) have failed to record this species.

Common blossom bats occur in coastal areas of north-east NSW and eastern Queensland. They often roost in littoral rainforest and feed on flowers in adjacent heathland and paperbark swamps.

The NSW NPWS lists the following threats for this species:

- Clearing of coastal habitat for urban development or sandmining; and
- Weeds, such as Bitou Bush, that suppresses the regeneration of key food trees, such as Coastal Banksia.

Potential forage habitat for this species occurs in the low-lying eastern portion of the Subject site. The proposed development will result in the removal or modification a total of 3.8 hectares of Swamp sclerophyll forest on floodplain. Given the high mobility of this species, the loss of potential foraging habitat is not considered significant in relation to the local distribution of habitat for this species.

Rehabilitation works in accordance with the Revised Site Regeneration and Revegetation Plan (JWA 2013a) will result in the regeneration/revegetation of 6.77 hectares of Swamp sclerophyll forest (**FIGURE 14**). These areas and additional off-site offsets may provide additional suitable forage habitat for this species in the long-term and offset the loss of 3.8ha of potential habitat.

It is considered that the proposed development is highly unlikely to result in the local extinction of these species.

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

Not applicable for recorded Threatened fauna species.

(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 for recorded Threatened fauna species.

(d) *In relation to the 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.***

A summary of impacts on the habitats of Threatened fauna species recorded on and adjacent to the Cobaki Lakes site has been provided in **TABLE 4** above.

Proposed rehabilitation works on the Subject site, in conjunction with the provision of off-site offsets, will result in a net gain of habitat for all Threatened fauna species recorded on the Subject site or considered a possible occurrence on the Subject site.

- (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***

Habitat for Threatened fauna species is already highly fragmented and has had a history of disturbance from land clearing, grazing, farm maintenance and other activities on the Subject site. The Proposed development has been designed to utilise disturbed areas of the Subject site and is unlikely to contribute significantly to an increase in the fragmentation of native vegetation communities. The Revised Site Regeneration & Revegetation Plan (JWA 2013a) includes the retention and embellishment of fauna movement corridors throughout the Subject site. These habitat linkages will ensure suitable movement opportunities are maintained for all native flora and fauna species.

- (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.***

Most of the vegetation to be removed consists of highly disturbed vegetation. The importance of this vegetation is minor when compared to the areas of suitable habitat proposed to be retained, protected and rehabilitated. The assessment of the importance of the habitat to be removed has taken into consideration the stages of the Threatened floras' life cycles and how reproductive success may be affected. It is

considered that, with the adoption of recommended amelioration and management measures, the proposed development will not affect the life cycle or reproductive success of any identified Threatened flora species.

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

Critical habitat areas listed under the *Threatened Species Conservation Act (1995)* currently consist of habitat for Mitchell's rainforest snail in Stott's Island Nature Reserve, and habitat for the Little penguin population in Sydney's North Harbour.

There will be no adverse effects on any critical habitat listed, in the Register of critical habitat in NSW, from the action proposed.

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

Approved Recovery Plans have been prepared for the Powerful owl and Masked owl (as part of the 'Recovery Plan for the Large Forest Owls') and the Koala.

Large forest owls

The Recovery Plan for the Large Forest Owls lists the following proposed recovery objectives:

- Assess the distribution and amount of high quality habitat for the Masked owl across public and private lands to get an estimate of the number and proportion of occupied territories that are/are not protected;
- To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the species and across different land tenures and disturbance histories;
- To assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber-harvesting operations on the species and, (if necessary), to use this information to refine the prescriptions so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success;
- Ensure the impacts on the species and its habitat are adequately assessed during planning and environmental assessment processes;
- Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites);
- To improve the recovery and management of the species based on an improved understanding of key areas of its biology and ecology;
- To raise awareness of the conservation requirements of the species amongst the broader community, to involve the community in owl conservation efforts and in doing so increase the information base about owl habitats and biology; and
- To co-ordinate the implementation of the recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives.

It is considered that the proposed development is consistent with the objectives of the Recovery Plan for the Large Forest Owls.

Koala

The Recovery Plan for the Koala lists the following specific recovery objectives:

- To conserve Koalas in their existing habitat;
- To rehabilitate and restore Koala habitat and populations;
- To develop a better understanding of the conservation biology of Koalas;
- To ensure that the community has access to factual information about the distribution, conservation and management of Koalas at a national, state and local scale;
- To manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care;
- To manage over-browsing to prevent both Koala starvation and ecosystem damage in discrete patches of habitat; and
- To co-ordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

It is considered that the proposed development is consistent with the objectives and actions of the Recovery Plan for the Koala.

A range of protection measures have been proposed with the objective of retaining and protecting areas of habitat on the site for Threatened fauna species and reducing impacts on Threatened fauna wherever possible. With the implementation of these measures it is considered that Threatened fauna species will continue to persist on the site following development.

In 2004, amendments were made to the TSC Act (1995) that removed the mandatory requirement to prepare recovery plans and threat abatement plans, and instead require the preparation of Threatened species Priority Action Statements (PAS). The PAS will set out the measures required to promote the recovery of Threatened fauna species to a position of viability in nature and for managing each key threatening process. Any PAS will be addressed in relevant management plans prepared for each future stage of the development.

(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.

A “threatening process” means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the TSC Act (1995).

Key Threatening Processes (Schedule 3):

- Invasion and establishment of exotic vines and scramblers
- Invasion of native plant communities by Bitou bush & Boneseed
- Invasion of native plant communities by exotic perennial grasses

- Invasion, establishment and spread of *Lantana camara*
- Competition and grazing by the feral European rabbit
- Competition and habitat degradation by feral goats
- Competition from feral honeybees
- Herbivory and environmental degradation caused by feral deer
- Importation of red imported fire ants into NSW
- Introduction of the large earth bumblebee (*Bombus terrestris*)
- Invasion and establishment of the Cane Toad
- Invasion of the yellow crazy ant (*Anoplolepis gracilipes*)
- Predation by feral cats
- Predation by the European Red Fox
- Predation by the Plague Minnow (*Gambusia holbrooki*)
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island
- Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands
- Bushrock Removal
- Clearing of native vegetation
- Alteration of habitat following subsidence due to longwall mining
- Ecological consequences of high frequency fires
- Human-caused Climate Change
- Loss and/or degradation of sites used for hill-topping by butterflies
- Loss of Hollow-bearing Trees
- Removal of dead wood and dead trees
- Infection by Psittacine circoviral (beak & feather) disease affecting endangered psittacine species
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*
- Death or injury to marine species following capture in shark control programs on ocean beaches
- Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments

The proposed development has the potential to result in an increase in the ‘**Invasion and establishment of exotic vines and scramblers**’, ‘**Invasion of native plant communities by exotic perennial grasses**’ and ‘**Invasion, establishment and spread of *Lantana camara***’. The Revised Site Regeneration & Revegetation Plan (JWA 2013a) prepared for the Cobaki Lakes development will ensure that these key threatening processes are not exacerbated. The proposed conservation areas on the Subject site have been divided into thirteen (13) rehabilitation/management precincts (**FIGURE 13**). Detailed regeneration and revegetation plans are to be completed for each of the precincts at the Operational Works stage.

The proposed development has the potential to result in an increase in the ‘**Invasion and establishment of the Cane Toad**’, ‘**Predation by feral cats**’ and ‘**Predation by the European Red Fox**’. A Revised Fauna Management Plan (JWA 2013) has been prepared for the Cobaki Lakes development and provides measures to monitor and control pest animals to ensure that these key threatening processes are not exacerbated.

The proposed development has the potential to result in an increase in the **‘Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands’**. A detailed Stormwater Management Plan has been prepared for the proposed development and will ensure that this key threatening processes is not exacerbated.

The proposed development will contribute towards the **‘Clearing of native vegetation’**, a key threatening process listed on Schedule 3 of the *TSC Act (1995)*. The final determination of the NSW Scientific Committee notes that clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity, with impacts such as: destruction of habitat; fragmentation of habitat; riparian zone degradation; increased greenhouse gas emissions; increased habitat for invasive species; loss of leaf litter layer; loss or disruption of ecological function (e.g. loss of populations of pollinators or seed dispersers) and changes to soil biota.

Habitat loss is the main threatening process affecting all subject species. The Proposed development will make a minor contribution towards the loss of habitat in the region. However, as previously discussed, the majority of vegetation to be lost has been highly disturbed by past landuse activities. The Revised Site Regeneration and Revegetation Plan (JWA 2013a) prepared for the site includes specific performance criteria as well as a detailed maintenance and monitoring program to ensure the persistence of native vegetation communities in the long-term.

The proposed development has the potential to result in an increase in the **‘Ecological consequences of high frequency fires’**. A Bushfire Management Plan will be prepared by a suitably qualified firm at the detailed design stage to ensure that this key threatening processes is not exacerbated.

The proposed development has the potential to result in an increase in the **‘Loss of Hollow-bearing Trees’** and **‘Removal of dead wood and dead trees’**. The vast majority of mature native vegetation on the Subject site will be retained. Therefore the majority of hollow-bearing trees will be retained within these forested areas. Any hollow-bearing trees to be removed are likely to occur as isolated paddock trees. The Revised Fauna Management Plan (JWA 2013) includes the following measures to ensure this key threatening process is not exacerbated:

- Any hollow-bearing trees within the urban zoned land should be retained where possible (or included within buffers, open space, etc.);
- Installation of wildlife boxes for bats, birds & other mammals (where appropriate).

3.4.3 Results of Assessment of Significance

On the basis of this assessment, it is considered that the proposed development will not result in any significant impacts on Threatened fauna species recorded on or adjacent to the Cobaki Lakes site.

REFERENCES

- Barry D.H. (1981) A preliminary survey of the terrestrial vertebrates of the Proposed Cobaki Village Shire, Tweed Shire, NSW.
- Briggs J.D. and Leigh, J.H. (1995) Rare or Threatened Australian Plants. CSIRO Division of Plant Industry.
- CSIRO - Division of Wildlife and Ecology (1995). Murwillumbah Management Area-Fauna Survey.
- Debus, S.J.S. (1993) The mainland Masked Owl *Tyto novaehollandiae*. A Review. Aust. Bird Watcher 15, 168-191.
- Debus S.J.S and Rose A.B. (1994) The Masked Owl *Tyto novaehollandiae* in New South Wales, *Australian Birds*, 8: 40-65.
- Debus S.J.S. & Chafer C.J. (1994) The Powerful Owl *Ninox strenua* in NSW. Aust Birds, 28: 40-64.
- Department of Environment & Conservation (2005). Draft Recovery Plan for the Large Forest Owls. DEC, Sydney.
- Frith, H.J. (1952) Notes on the pigeons of the Richmond River, NSW. Emu, 52: 88-99.
- Hero J-M, Phillips S. and Shoo L. (2001) Survey for Reptiles, Amphibians and Mammals Inhabiting the Northern Section of the Proposed Tugun Bypass, prepared for PPK Environment & Infrastructure, Brisbane.
- James Warren & Associates (JWA) (2008) Response to the Director General's Environmental Assessment Requirements - Cobaki Lakes. Volume 1 - Ecological Assessment. A report prepared for Leda Manorstead Pty Ltd.
- James Warren & Associates (JWA) (2009a) Overview Buffer Management Plan. Cobaki Lakes - Preferred Project Report. A report prepared for Leda Manorstead Pty Ltd.
- James Warren & Associates (JWA) (2009b) Vegetation Management Plan. Cobaki Lakes - Preferred Project Report. A report prepared for Leda Manorstead Pty Ltd.
- James Warren & Associates (JWA) (2010) Revised Freshwater Wetland Rehabilitation Plan. Cobaki Lakes - Preferred Project Report. A report prepared for Leda Manorstead Pty Ltd.
- JWA (2013a) Revised Site Regeneration & Revegetation Plan. Cobaki Lakes. A report prepared for Leda Manorstead Pty Ltd.
- JWA (2013b) Revised Saltmarsh Rehabilitation Plan. Cobaki Lakes. A report prepared for Leda Manorstead Pty Ltd.
- JWA (2013) Revised Fauna Management Plan. Cobaki Lakes. A report prepared for Leda Manorstead Pty Ltd.

Kavanagh, R.P. and Murray, M. (1996). Home range, Habitat and Behaviour of the Masked Owl *Tyto novaehollandiae* near Newcastle, New South Wales. *Emu*, 96. Pp250-257.

Lindsey, R.L. (1992) Encyclopaedia of Australian Animals: Birds The Australian Museum, Sydney.

Maciejewski S.E. (1996) The Grass Owl *Tyto Capensis* in North-eastern New South Wales, pp 54-70, in: *Australian Raptor Studies II, Birds Australia Monograph 3*, (Eds) Szechura and Debus S., Birds Australia, Melbourne.

Marchant, S & Higgins, P.J. (coordinators) (1990) Handbook of Australian, New Zealand and Antarctic Birds. Vol. 1 Ratites to Ducks. Oxford University Press, Melbourne.

Marchant, S & Higgins, P. J. (eds) (1993) Handbook of Australian, New Zealand and Antarctic Birds. Vol. 2. Raptors to Lapwings. Oxford University Press, Melbourne.

National Parks and Wildlife (2003) Voluntary Conservation on Private and Public Land - Protecting Remnant Bush. Note 11 - 2003 located at nationalparks.nsw.gov.au/PDFs/Factsheet11_Protecting_remnants.pdf

NSW State Forests (1995) Dorrigo Management Area. Proposed Forestry Operations, Interim (3 years) Environmental Impact Statement: Volume C - Fauna Species Profiles, State Forests of NSW, Sydney.

Recher H.F. and Date E.M. (1988) Distribution and abundance of rainforest pigeons in NSW. Report to the NSW NPWS.

Shields J.M. (1995) Wildlife Management Prescriptions for Logging in Even-aged and Multi-aged Regrowth Forests, North of Narooma Management Area, unpublished report by State Forests of NSW and NSW National Parks and Wildlife Service.

Sherringham and Westaway (1995). Significant vascular plants of northern NSW. A report to the NSW NPWS and Northern Region Audit Council.

SMEC (2012) Freshwater Wetland Compensatory Habitat Management Plan. Report for LEDA Manorstead Pty Ltd. SMEC Australia Pty Ltd.

State Forests of NSW. (1995) Coffs Harbour Urunga Management Area - Environmental Impact Statement. Vol C, Proposed forestry operations - Schedule 12 Fauna. SFNSW, Northern Region.

Warren J, Holloway G & Scotts D (1994) "Draft Management Plan for the Long-nosed Potoroo (*Potorous tridactylus*)". Report prepared for Cobaki Lakes (Calsonic Management Services Pty Ltd).

White, A.W., (1995). Frog Survey of Taree and Coopernook Management Areas and Marsh State Forest. Unpublished Report. State Forests of New South Wales.

Wright A.E. (2001) "Cobaki Lakes Development, Anglican School: Mosquito Management Options". Report prepared for Cobaki Lakes (Leda Development Pty Ltd).