flora & fauna assessment, proposed development

at 83 Booralie Road, Terrey Hills

2nd July 2013

prepared by

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OEH - Scientific Licence No. S L100777, DPI - Animal Research Authority 04-4786

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executive summary

This report has been prepared in conjunction with a proposed development application at the property known as 83 Booralie Road, Terrey Hills. The report identifies the flora species on the site and fauna species residing on or using the site as part of their foraging range. Specific assessment has been undertaken to identify habitats of threatened species, populations and ecological communities listed in the schedules of the *Threatened Species Conservation Act (NSW) 1995 & Environmental Protection Biodiversity Conservation Act (Cwlth) 1999*.

The subject site has an area of approximately 1.9ha and is largely cleared of native vegetation with the exception of a small area towards the Booralie Road frontage. Towards the southern portion of the allotment an open channel watercourse crosses the site and the riparian areas adjacent the watercourse and to the south are covered with dense thickets and a disturbed forest of noxious and environmental weeds.

The proposed development involves construction of a Seniors Housing Development with basement car parking (Rush, 2013) with associated landscaping (Dobson, 2013) and rehabilitation of the riparian area that crosses the southern portion of the site.

The subject site is considered in 4 main habitat units (refer Figure 2.1); being:

- the Riparian Forest in the southern parts of the site adjacent Neverfail Gully Creek
- the Booralie Road Woodland on the site
- the Paddock Hedgerows, and
- the Cleared Pasture Land,

Within the Laitoki Road reserve adjacent the site the vegetation has also been considered and is referred to as the:

- the Laitoki Road Woodland

A number of threatened species have been recorded as occurring within a 10km grid square centred on the site and a number of field survey techniques and habitat assessments have been carried out primarily targeting threatened species. Those threatened species that have been recorded on the site or have some habitat relationships with the habitats on site include;

- Caley's Grevillea (*Grevillea caleyi*);
- Barking Owl (*Ninox connivens*);
- Masked Owl (Tyto novaehollandiae);
- Powerful Owl (*Ninox strenua*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*), and
- Duffy's Forest Ecological Community.

Based upon the assessments carried out in accordance with section 5A of the *Environmental Planning and Assessment Act 1979 (NSW),* and Significant Impact Guidelines 1.1 (SEWPC, 2009), the proposed development would not result in a significant impact on threatened species and populations and ecological communities listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* nor on those listed in the schedules of the *Environment Protection and Biodiversity Conservation Act 1999 (Cwlth).*

1. introduction

1.1 Background

This report has been prepared in conjunction with a proposed development application at the property known as 83 Booralie Road, Terrey Hills. The report identifies the flora species on the site and fauna species residing on or using the site as part of their foraging range. Specific assessment has been undertaken to identify habitats of threatened species, populations and ecological communities listed in the schedules of the *Threatened Species Conservation Act (NSW) 1995* & *Environmental Protection Biodiversity Conservation Act (Cwlth) 1999*.

The report has been commissioned by the Bayview Links Pty Ltd and site instructions have been provided by Boston Blyth Fleming. Preliminary site inspections were conducted in November 2013 and detailed surveys and field work were conducted between April - June 2013.

For the purposes of this report the property known as 83 Booralie Road, Terrey Hills will be referred to as the subject site.

1.2 Existing site & proposed development

The site is located on the corner of Booralie Road and Laitoki Road, Terrey Hills has an area of approximately 1.9ha. The site currently consists of a large open paddock area that extends over the majority of the site with a band of remnant vegetation along the front portion of the site towards Booralie Road. Scattered indigenous and exotic trees also occur along the site's Laitoki Road frontage. Towards the southern portion of the allotment an open channel watercourse crosses the site and the riparian areas adjacent the watercourse and to the south are covered with dense thickets and a disturbed forest of noxious and environmental weeds.

The proposed development involves construction of a Seniors Housing Development with basement car parking (Rush, 2013) with associated landscaping (Dobson, 2013) and rehabilitation of the riparian area that crosses the southern portion of the site.

2. the site

2.1 General information

The site is situated on the southern side of Booralie Road, Terrey Hills with the surrounding landscape comprising of residential developments and rural allotments.

The general site characteristics are outlined in the table below.

Site Area	19,517 m2
Landform Morphology	Crest, Simple slope, Open Channel
Aspect	South
Geology	Hawkesbury Sandstone
Soil Landscape	Somersby Soil Landscape
Watercourse	Neverfail Gully Creek flowing to the south west
Catchment	Kierans Creek
Receiving Waters	Cowan Creek / Hawkesbury River
Vegetation	Riparian Forest and Cleared Lands containing Environmental Weeds & Exotic Species

2.2 Site habitats

The subject site is considered in 4 main habitat units (refer Figure 2.1); being:

- the Riparian Forest in the southern parts of the site adjacent Neverfail Gully Creek
- the Booralie Road Woodland on the site
- the Paddock Hedgerows, and
- the Cleared Pasture Land,

Within the Laitoki Road reserve adjacent the site the vegetation has also been considered and is referred to as the:

- the Laitoki Road Woodland

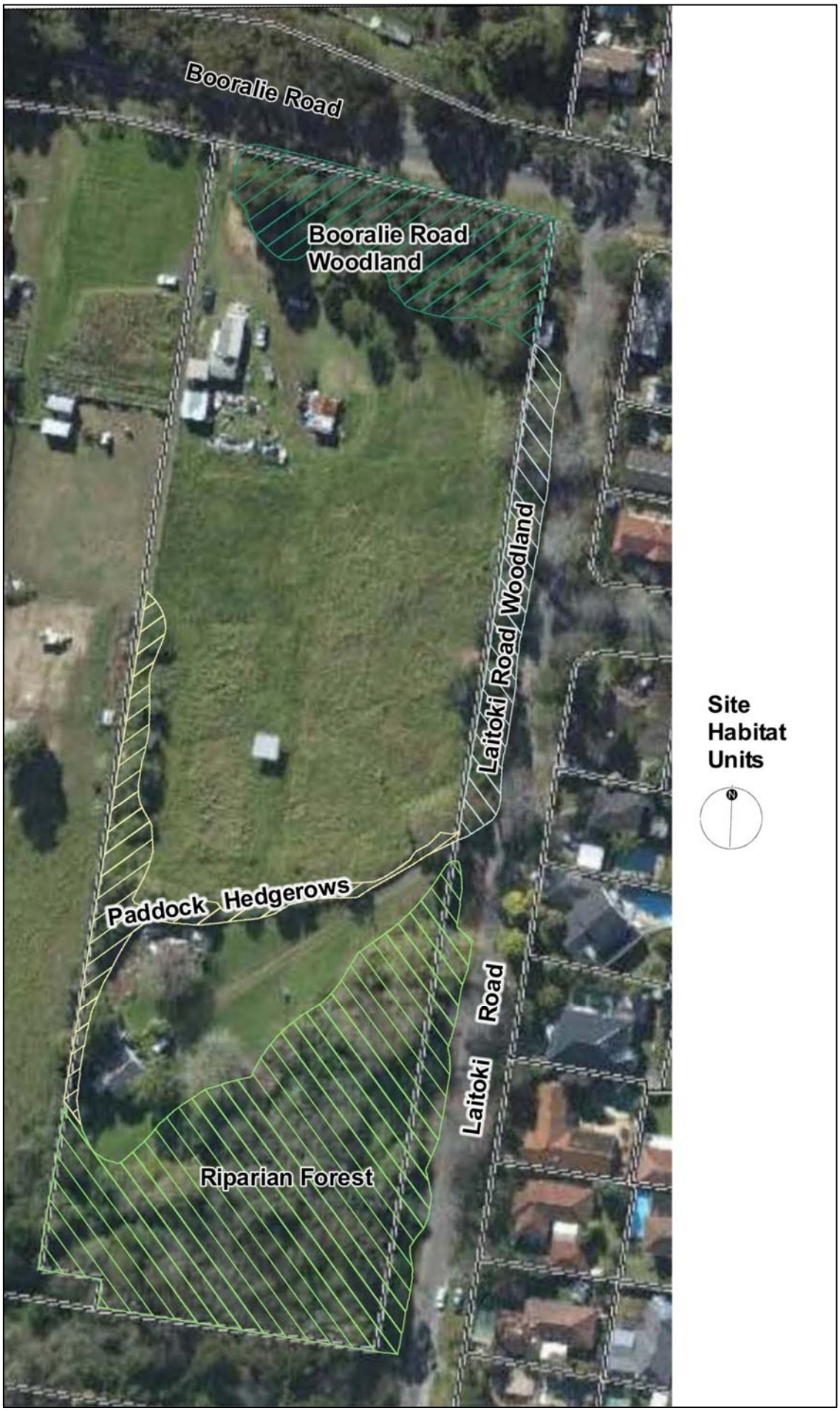

Figure 2.1–Aerial view of site habitats

3. flora & fauna survey

3.1 Flora species survey methods

3.1.1 Flora literature search

Flora records were obtained from the NSW Office of Environment & Heritage's (OEH, 2012) Wildlife Atlas searching a 10km grid square centred on the site (AMG co-ordinates E 323980 and N 6271900).

3.1.2 Flora field surveys

The flora survey covered an area of approximately 9,500m^2 using the Random Meander Method described by Cropper (1993) involving 15 person hours and was conducted on the 13/05/13 & 14/05/12.

Specific effort was undertaken to identify optimal and sub-optimal habitats of threatened species and communities and in these areas detailed searches were undertaken.

Species identifications are consistent with the nomenclature in Harden (1992, 1993, 2000 & 2002) with recent name changes as amended in the Royal Botanic Gardens Sydney publication *Cunninghamia*. Where some taxonomic uncertainty exists, samples were taken for verification using recognised floristic keys.

3.2 Fauna species survey methods

3.2.1 Fauna Literature search

Fauna records were obtained from the NSW Office of Environment & Heritage's (OEH, 2012) Wildlife Atlas searching a 10km grid square centred on the site (AMG co-ordinates E 323980 and N 6271900).

3.2.2 Fauna field surveys

The fauna surveys carried out have departed from those outlined in Threatened Biodiversity Survey & Assessment Guidelines for Developments & Activities Working Draft (OEH, 2004) because of the extent of site modifications, the simplified habitats on the site and the site's context, being surrounded by developed urban & rural areas,. Fauna investigations have been taken into account in:

- habitat assessments;
- herpetofauna diurnal survey;
- diurnal bird surveys;
- nocturnal surveys;
- hair tube trapping;
- remote camera surveys;
- ultrasonic bat detection, and
- opportunistic sightings conducted as part of other site surveys.
-

3.2.2.1 Herpetofauna diurnal survey

Two (2) 60 minute surveys were conducted during daylight hours during the afternoon of the 15/05/13 and 21/05/13. These were active surveys primarily in the habitats in the southern parts of the site and the Booralie Road vegetation.

Key microhabitats were searched using hand tools, lifting logs and debris and raking leaf litter.

3.2.2.2 Diurnal bird observations and call recognition

Four (4), 60 minute surveys were undertaken, of which 2 were conducted in the mornings on 16/05/13 & 17/05/13 and 2 were conducted in the afternoon of 15/05/13 & 16/05/13. The surveys were predominately transect surveys however records included those from other parts of the study area.

3.2.2.3 Nocturnal fauna sightings

Spotlighting was conducted to identify frogs, bats, mammals and nocturnal birds and reptiles and specifically targeted small ground mammals, possums, gliders, and owls. Two (2) 60-minute surveys were undertaken on and adjacent the site using a 100-watt hand held spotlight. These surveys were conducted shortly after dusk extending for 60 minutes into the early evening on the 15/05/13, 16/05/13.

3.2.2.4 Nocturnal Call playback

Call playback was undertaken during the night on 16/05/13 & 17/05/13 for threatened owl and amphibian species which have been recorded within 5km of the study area. Calls of Barking Owl (*Ninox connivens*), Powerful Owl (*Ninox strenua*) and Masked Owl (*Tyto novaehollandiae*) were broadcast using a loudhailer for 5 minutes followed by a 5 minute listening period for responses. Calls of Red-crowned Toadlet (*Pseudophryne australis)* and Giant Burrowing Frog (*Heleioporus australiacus)* were also broad cast over 30 second periods with a 30 second response period.

3.2.2.5 Hair tube traps

Ten (10) hair tube traps were used to identify mammals such as rodents, gliders, bandicoots and possums. Of the 10 hair tubes, 8 were larger tubes with 90mm diameter and 5 were smaller tubes with a 50mm diameter. The 8 large hair tubes were placed on the ground and the 2 smaller hair tubes were located in trees/shrubs at 1.5m -2m above ground level. Hair tubes were baited with a mixture consisting of peanut butter, rolled oats, honey, canola oil, almond essence, aniseed essence and left for 14 nights between the 15/05/13 and 30/05/13. Hair samples collected were identified using the method outlined by Brunner & Coleman (1974) and the analysis was undertaken by Barbara Triggs of 'Dead Finish' Genoa, Victoria.

3.2.2.6 Remote camera survey

Two (2) remote cameras were deployed within the southern part the site one being a Reconix PC800 and the other a UWay NT50. Both cameras were set up with an attractant bait canister laced with truffle oil. Remote cameras were set running over 14 nights between the 15/05/13 and 30/05/13.

3.2.2.7 Ultrasonic bat detection

Ultrasonic bat detection was undertaken over 2 nights commencing 15/05/13 & 16/05/13. Recording equipment was activated before dusk, running throughout the night until the following morning. Bat ultrasonic recordings were taken using an Anabat II detector with a digital ZCAIM storage unit and recordings were identified by Amy Rowles from Ecotone Environmental Consultants.

3.2.2.8 Opportunistic sighting, calls, scats and scratchings

During the course of individual surveys opportunistic observations, calls, scats, tracks and scratchings were also recorded both within the study area and locally off site.

3.3 Survey findings

3.3.1 Flora data

The following table identifies flora species:

- listed in the schedules of the *Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)* and recorded within a 10km grid square centered on the site in the Wildlife Atlas (OEH 2012);
- listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* and recorded within a 10km grid square centered on the site in the Wildlife Atlas (OEH 2012), and
- recorded on the site as part of field surveys.

OEH Wildlife Atlas (2012)	Riparian Forest (on site)	Booralie Woodland (on site)	Laitoki Road Reserve (adjacent site)	Paddock Hedgerows (on site)	Cleared Pasture Land (on site)	Family	Genus species	Common Name	Conservation Status	Autochthony
✔- Recorded, 🌲- Planted Native Specimen. **Unprotected** / **Protected** - Schedule 13 National Parks & Wildlife Act 1974 (NSW), Vulnerable **NSW** / **Endangered NSW / Critically Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Noxious** - Noxious Weeds Act 1993 (NSW), **Critically Endangered Cwlth** / **Endangered Cwlth** / Vulnerable **Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth).										
					✔	Apiaceae	*Foeniculum vulgare*	Fennel	Unprotected	Exotic
	✔					Araceae	*Colocasia esculenta*	Taro	Unprotected	Exotic
	✔				✔	Araceae	*Monstera deliciosa*	Fruit-salad Plant	Unprotected	Exotic
		✔				Araliaceae	*Schefflera actinophylla*	Umbrella Tree	Unprotected	Exotic
	✔					Arecaceae	*Livistona australis*	Cabbage Palm	Protected	Native
		✔				Arecaceae	*Phoenix canariensis*	Canary Island Date Palm	Unprotected	Exotic
		✔	✔	✔		Asclepiadaceae	*Araujia sericiflora*	Moth Vine	Noxious	Exotic
		✔	✔			Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	Noxious	Exotic
	✔	✔	✔		✔	Asteracae	*Bidens pilosa*	Cobbler's Peg	Unprotected	Exotic
	✔	✔		✔	✔	Asteraceae	*Ageratina adenophora*	Crofton Weed	Unprotected	Exotic
		✔		✔	✔	Asteraceae	*Conyza sp.*	Fleabane	Unprotected	Exotic
					✔	Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	Unprotected	Exotic
					✔	Asteraceae	*Hypochaeris radicata*	Catsear	Unprotected	Exotic
		✔			✔	Asteraceae	*Onopordum acanthium*	Scotch Thistle	Unprotected	Exotic
					✔	Asteraceae	*Senecio madagascariensis*	Fireweed	Unprotected	Exotic
				✔	✔	Asteraceae	*Sonchis oleraceus*	Common Sow Thistle	Unprotected	Exotic

OEH Wildlife Atlas (2012)	Riparian Forest (on site)	Booralie Woodland (on site)	Laitoki Road Reserve (adjacent site)	Paddock Hedgerows (on site)	Cleared Pasture Land (on site)	Family	Genus species	Common Name	Conservation Status	Autochthony
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	✔					Basellaceae	*Anredera cordifolia*	Maderia Vine	Noxious	Exotic
		✔				Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda	Unprotected	Exotic
				✔		Bignoniaceae	*Tecomaria capensis*	Cape Honeysuckle	Unprotected	Exotic
			✔		✔	Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle	Unprotected	Exotic
	✔	✔	✔			Casuarinaceae	*Allocasuarina littoralis*	Black She-oak	Unprotected	Indigenous
		✔				Commelinacea	*Commelina cyanea*	Scurvy Weed	Unprotected	Indigenous
	✔		✔			Commelinaceae	*Tradescantia fluminernsis*	Wandering Jew	Noxious	Exotic
		✔				Convolvulaceae	*Dichondra repens*	Kidney Weed	Unprotected	Indigenous
	✔					Cunoniaceae	*Callicoma serratifolia*	Black Wattle	Unprotected	Indigenous
	✔	✔				Cunoniaceae	*Ceratopetalum gummiferum*	Christmas Bush	Protected	Indigenous
	✔🌲					Cyatheaceae	*Cyathea cooperi*	Straw Treefern	Protected	Native
		✔				Cyperaceae	*Cyathochaeta diandra*	-	Unprotected	Indigenous
	✔					Cyperaceae	*Cyperus papyrus*	-	Unprotected	Exotic
				✔	✔	Cyperaceae	*Cyperus rotundus*	Nutgrass	Unprotected	Exotic
	✔	✔	✔	✔		Davalliaceae	*Nephrolepis cordifolia*	Fishbone Fern	Unprotected	Exotic
	✔		✔	✔	✔	Dicksoniaceae	*Calochlaena dubia*	Common Ground Fern	Protected	Indigenous
		✔				Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower	Unprotected	Indigenous
		✔				Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash	Unprotected	Indigenous
✔						Elaeocarpaceae	*Tetratheca glandulosa*	Glandular Pink-bell	Vulnerable NSW, Cwth	Indigenous
✔						Epacridaceae	*Epacris purpurascens var. purpurascens*	-	Vulnerable NSW	Indigenous
	✔	✔			✔	Euphorbiaceae	*Euphorbia peplus*	Petty Spurge	Unprotected	Exotic
	✔	✔	✔			Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart	Unprotected	Indigenous
		✔				Euphorbiaceae	*Phyllanthus tenellus*	-	Unprotected	Exotic
		✔		✔	✔	Euphorbiaceae	*Ricinus communis*	Castor Oil Plant	Unprotected	Exotic
			✔🌲			Fabaceae	*Acacia baileyana*	Cootamundra Wattle	Unprotected	Native

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		✔				Fabaceae	*Acacia elata*	Mountain Cedar Wattle	Unprotected	Native
	✔		✔			Fabaceae	*Acacia parramattensis*	Parramatta Wattle	Unprotected	Indigenous
		✔				Fabaceae	*Cytisus scoparius*	Scotch Broom	Noxious	Exotic
	✔		✔			Fabaceae	*Erythrina X sykesii*	Coral tree	Unprotected	Exotic
	✔					Fabaceae	*Robinia pseudoacacia*	Black Locust	Unprotected	Exotic
		✔	✔	✔		Fabaceae	*Senna pendula*	Cassia	Unprotected	Exotic
		✔			✔	Fabaceae	*Vicia sativa*	Vetch	Unprotected	Exoitc
✔						Haloragaceae	*Haloragodendron lucasii*	Hal	Endangered NSW, Cwlth	Indigenous
			✔			Iridaceae	*Crocosmia x crocosmiiflora*	Montbretia	Unprotected	Exotic
	✔				✔	Juncaceae	*Juncus usitatus*	Common Rush	Unprotected	Indigenous
	✔		✔			Lauraceae	*Cinnamomum camphora*	Camphor Laurel	Noxious	Exotic
	✔	✔	✔			Liliaceae	*Dianella caerulea*	Blue Flax Lily	Unprotected	Indigenous
		✔				Liliaceae	*Lilium formosanum*	Formosan Lily	Unprotected	Exotic
					✔	Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	Unprotected	Exotic
				✔	✔	Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	Unprotected	Exotic
	✔					Myrtaceae	*Angophora costata*	Sydney Red Gum	Unprotected	Indigenous
✔						Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	Vulnerable NSW	Indigenous
	✔	✔	✔			Myrtaceae	*Corymbia gummifera*	Red Bloodwood	Protected	Indigenous
✔						Myrtaceae	*Darwinia biflora*	-	Vulnerable NSW, Cwth	Indigenous
✔						Myrtaceae	*Eucalyptus camfieldii*	Heart-Leaved Stringybark	Vulnerable NSW, Cwth	Indigenous
		✔				Myrtaceae	*Eucalyptus capitellata*	Brown Stringybark	Unprotected	Indigenous
		✔				Myrtaceae	*Eucalyptus haemastoma*	Scribbly Gum	Unprotected	Indigenous
✔						Myrtaceae	*Eucalyptus nicholii*	Narrow-Leaf Peppermint	Vulnerable NSW	Native
	✔		✔			Myrtaceae	*Eucalyptus pilularis*	Blackbutt	Unprotected	Indigenous

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✔						Myrtaceae	*Eucalyptus scoparia*	Wallangarra White Gum	Endangered NSW, Vulnerable Cwth	Native
			✔			Myrtaceae	*Eucalyptus sieberi*	Silver Top/Black Ash	Unprotected	Indigenous
✔						Myrtaceae	*Kunzea rupestris*	-	Vulnerable NSW	Indigenous
✔						Myrtaceae	*Leptospermum deanei*	-	Vulnerable NSW, Cwth	Indigenous
			✔			Myrtaceae	*Melaleuca armillaris*	Bracelet Honey-myrtle	Unprotected	Indigenous
✔						Myrtaceae	*Melaleuca deanei*	Deane's Melaleuca	Vulnerable NSW, Cwth	Indigenous
✔						Myrtaceae	*Syzygium paniculatum*	Magenta Lillypilly	Vulnerable NSW, Cwth	Indigenous
	✔		✔			Oleaceae	*Ligustrum lucidum*	Large Leaf Privet	Noxious	Exotic
	✔	✔	✔	✔	✔	Oleaceae	*Ligustrum sinense*	Small Leaf Privet	Noxious	Exotic
✔						Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue-orchid	Vulnerable NSW, Cwth	Indigenous
✔						Orchidaceae	*Diuris bracteata*	-	Endangered NSW, Extinct Cwlth	Indigernous
✔						Orchidaceae	*Genoplesium baueri*	Midge Orchids	Vulnerable NSW	Indigenous
✔						Orchidaceae	*Microtis angusii*	Angus's Onion Orchid	Endangered NSW, Cwlth	Indigenous
			✔		✔	Phytolaccaceae	*Phytolacca octandra*	Ink Weed	Unprotected	Exotic
	✔					Pinaceae	*Pinus radiata*	Monterey Pine / Radiata Pine	Unprotected	Exotic
	✔	✔	✔	✔		Pittosporaceae	*Pittosporum undulatum*	Native Daphne	Unprotected	Indigenous
				✔	✔	Plantaginaceae	*Plantago hispida*	Plantain	Unprotected	Exotic
	✔					Poaceae	*Arundo donax*	Giant Reed	Unprotected	Exotic
		✔			✔	Poaceae	*Cortaderia selloana*	Pampas Grass	Noxious	Exotic
					✔	Poaceae	*Cynodon dactylon*	Common Couch Grass	Unprotected	Exotic
					✔	Poaceae	*Digitaria sanguinalis*	Summer/ Crab Grass	Unprotected	Exotic
		✔				Poaceae	*Echinopogon caespitosus*	Tufted Hedgehog Grass	Unprotected	Indigenous
		✔	✔	✔		Poaceae	*Ehrharta erecta*	Panic Veldtgrass	Unprotected	Exotic

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		✔				Poaceae	*Entolasia stricta*	Wiry Panic	Unprotected	Indigenous
	✔	✔	✔			Poaceae	*Microlaena stipoides*	Weeping Grass	Unprotected	Indigenous
					✔	Poaceae	*Paspalum urvillei*	Vasey Grass	Unprotected	Exotic
	✔	✔	✔	✔	✔	Poaceae	*Pennisetum clandestinum*	Kikuyu Grass	Unprotected	Exotic
			✔			Poaceae	*Setaria gracilis*	Slender Pigeon Grass	Unprotected	Exotic
		✔				Poaceae	*Setaria spp.*	Pidgeon Grass	Unprotected	Exotic
					✔	Poaceae	*Sporobolus fertilis*	Parramatta Grass	Unprotected	Exotic
	✔					Polygonaceae	*Acetosa sagittata*	Potato Vine	Noxious	Exotic
				✔	✔	Polygonaceae	*Persicaria decipiens*	Slender Knotweed Herb	Unprotected	Indigenous
					✔	Polygonaceae	*Rumex crispus*	Curled Dock	Unprotected	Exotic
					✔	Polygonaceae	*Rumex spp.*	Dock	Unprotected	Exotic
		✔	✔			Proteaceae	*Banksia serrata*	Old Man Banksia	Unprotected	Indigenous
✔		✔	✔			Proteaceae	*Grevillea caleyi*	Caley's Grevillea	Endangered NSW, Cwlth	Indigenous
		✔				Proteaceae	*Grevillea sericea*	Pink Spider Flower	Unprotected	Indigenous
		✔				Proteaceae	*Lambertia formosa*	Mountain Devil	Unprotected	Indigenous
✔						Proteaceae	*Persoonia hirsuta*	Hairy Geebung	Endangered NSW, Cwlth	Indigenous
✔						Proteaceae	*Persoonia mollis subsp. maxima*	-	Endangered NSW, Cwlth	Indigenous
				✔	✔	Rosaceae	*Rubus fruticosus*	Blackberry	Unprotected	Exotic
		✔				Sapindaceae	*Dodonaea triquetra*	Hop Bush	Unprotected	Indigenous
		✔				Smilacaceae	*Smilax glyciphylla*	Sweet Sarsaparilla	Unprotected	Indigenous
	✔			✔	✔	Solanaceae	*Cestrum parqui*	Green Cestrum	Noxious	Exotic
		✔				Solanaceae	*Solanum aviculare*	Kangaroo Apple	Unprotected	Indigenous
	✔	✔	✔	✔	✔	Solanaceae	*Solanum mauritianum*	Wild Tobacco Tree	Unprotected	Exotic
	✔	✔			✔	Solanaceae	*Solanum nigrum*	Blackberry Nightshade	Unprotected	Exotic
		✔🌲				Sterculiaceae	*Brachychiton acerifolius*	Illawarra Flame Tree	Unprotected	Native

OEH Wildlife Atlas (2012)	Riparian Forest (on site)	Booralie Woodland (on site)	Laitoki Road Reserve (adjacent site)	Paddock Hedgerows (on site)	Cleared Pasture Land (on site)	Family	Genus species	Common Name	Conservation Status	Autochthony
✔- Recorded, - Planted Native Specimen. **Unprotected** / **Protected** - Schedule 13 National Parks & Wildlife Act 1974 (NSW), Vulnerable **NSW** / **Endangered NSW / Critically Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Noxious** - Noxious Weeds Act 1993 (NSW), **Critically Endangered Cwlth** / **Endangered Cwlth** / Vulnerable **Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth).										
✔						Sterculiaceae	*Lasiopetalum joyceae*	-	Vulnerable NSW, Cwth	Indigenous
✔						Thymelaeaceae	*Pimelea curviflora var. curviflora*	Curved Rice-flower	Vulnerable NSW, Cwth	Indigenous
			✔			Tropaeolaceae	*Tropaeolum majus*	Nasturtium	Unprotected	Exotic
	✔	✔	✔	✔	✔	Verbenaceae	*Lantana camara*	Lantana	Noxious	Exotic
				✔	✔	Verbenaceae	*Verbena bonariensis*	Purple Top	Unprotected	Exotic
	✔	✔	✔			Zingiberaceae	*Hedychium gardnerianum*	Ginger Lily	Unprotected	Exotic

3.3.2 Fauna data

The following table identifies fauna species:

- listed in the schedules of the *Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)* and recorded within a 10km grid square centered on the site in the Wildlife Atlas (OEH 2012);
- listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* and recorded within a 10km grid square centered on the site in the Wildlife Atlas (OEH 2012);
- recorded on the site as part of field surveys.

OEH Wildlife Atlas (2012)	Recorded on Site	Class	Genus species	Common Name	Conservation Status	Autochthony
✔ - Recorded / Identified, ✔ θ Record Highly Probable, ✔ Record Probable, ✔ Record Likely / Possible. **Unprotected** / **Protected** - National Parks & Wildlife Act 1974 (NSW), **Vulnerable NSW** / **Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Critically Endangered Cwlth** / **Endangered Cwlth** / **Vulnerable Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)						
✔		Amphibia	*Heleioporus australiacus*	Giant Burrowing Frog	Vulnerable NSW, Cwth	Native
	✔	Amphibia	*Limnodynastes peronii*	Striped Marsh Frog (Brown Striped)	Protected	Native
✔		Amphibia	*Litoria aurea*	Green and Golden Bell Frog	Endangered NSW, Vulnerable Cwth	Native
✔		Amphibia	*Pseudophryne australis*	Red-crowned Toadlet	Vulnerable NSW	Native

OEH Wildlife Atlas (2012)	Recorded on Site	Class	Genus species	Common Name	Conservation Status	Autochthony
✔ - Recorded / Identified, ✔ θ Record Highly Probable, ✔ Record Probable, ✔ Record Likely / Possible. **Unprotected** / **Protected** - National Parks & Wildlife Act 1974 (NSW), **Vulnerable NSW** / **Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Critically Endangered Cwlth** / **Endangered Cwlth** / **Vulnerable Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)						
	✔	Arachnida	*Ixodes holocyclus*	Paralysis Tick	Unprotected	Native
	✔	Arachnida	*Phonognatha graeffei*	Leaf-curling Spider	Unprotected	Native
	✔	Aves	*Acanthorhynchus tenuirostris*	Eastern Spinebill	Protected	Native
	✔	Aves	*Accipiter novaehollandiae*	Grey Goshawk	Protected	Native
	✔	Aves	*Anthochaera chrysoptera*	Little (Brush) Wattlebird	Protected	Native
✔		Aves	*Anthochaera phrygia*	Regent Honeyeater	Critically Endangered NSW, Endagered Cwlth	Native
	✔	Aves	*Ardea pacifica*	White-necked Heron	Protected	Native
	✔	Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	Protected	Native
✔		Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo	Vulnerable NSW	Native
✔		Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	Vulnerable NSW	Native
	✔	Aves	*Corvus coronoides*	Australian Raven	Protected	Native
	✔	Aves	*Cracticus nigrogularis*	Pied Butcherbird	Protected	Native
	✔	Aves	*Dacelo novaeguineae*	Laughing Kookaburra	Protected	Native
✔		Aves	*Glossopsitta pusilla*	Little Lorikeet	Vulnerable NSW	Native
	✔	Aves	*Gymnorhina tibicen*	Australian Magpie	Protected	Native
✔		Aves	*Hieraaetus morphnoides*	Little Eagle	Vulnerable NSW	Native
	✔	Aves	*Hirundo neoxena*	Welcome Swallow	Protected	Native
✔		Aves	*Ixobrychus flavicollis*	Black Bittern	Vulnerable NSW	Native
✔		Aves	*Lathamus discolor*	Swift Parrot	Endangered NSW, Cwlth	Native
	✔	Aves	*Lichenostomus chrysops*	Yellow-faced Honeyeater	Protected	Native
	✔	Aves	*Malurus cyaneus*	Superb Fairy-wren	Protected	Native
✔		Aves	*Melithreptus gularis*	Black-chinned Honeyeater	Vulnerable NSW	Native
✔		Aves	*Neophema pulchella*	Turquoise Parrot	Vulnerable NSW	Native
✔		Aves	*Ninox connivens*	Barking Owl	Vulnerable NSW	Native
✔		Aves	*Ninox strenua*	Powerful Owl	Vulnerable NSW	Native
	✔	Aves	*Psophodes olivaceus*	Eastern Whipbird	Protected	Native
	✔	Aves	*Pycnonotus jocosus*	Red-whiskered Bulbul	Unprotected	Introduced
	✔	Aves	*Rhipidura leucophrys*	Willie Wagtail	Protected	Native

OEH Wildlife Atlas (2012)	Recorded on Site	Class	Genus species	Common Name	Conservation Status	Autochthony
✔ - Recorded / Identified, ✔θ Record Highly Probable, ✔ Record Probable, ✔ Record Likely / Possible. **Unprotected** / **Protected** - National Parks & Wildlife Act 1974 (NSW), **Vulnerable NSW** / **Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Critically Endangered Cwlth** / **Endangered Cwlth** / **Vulnerable Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)						
	✔	Aves	*Sericornis frontalis*	White-browed Scrubwren	Protected	Native
	✔	Aves	*Strepera graculina*	Pied Currawong	Protected	Native
	✔	Aves	*Trichoglossus haematodus*	Rainbow Lorikeet	Protected	Native
✔		Aves	*Tyto novaehollandiae*	Masked Owl	Vulnerable NSW	Native
	✔	Aves	*Vanellus miles*	Masked Lapwing	Protected	Native
	✔	Gastropoda	*unassessed GBL1 - Lymnaeidae Family*	Freshwater Snail	Unprotected	-
	✔	Hirudinea	*unassessed - Erpobdellidae Family*	Leech	Unprotected	-
	✔	Insecta	*Nasutitermes walkeri*	Niggerhead Termite	Unprotected	Native
✔		Mammalia	*Cercartetus nanus*	Eastern Pigmy-possum	Vulnerable NSW	Native
✔		Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	Vulnerable NSW, Endangered Cwth	Native
	✔	Mammalia	*Felis catus*	Cat	Unprotected	Introduced
✔		Mammalia	*Isoodon obesulus obesulus*	Southern Brown Bandicoot	Endangered NSW, Cwlth	Native
✔		Mammalia	*Miniopterus australis*	Little Bentwing-bat	Vulnerable NSW	Native
✔		Mammalia	*Miniopterus schreibersii*	Common (Eastern) Bent-wing Bat	Vulnerable NSW	Native
✔		Mammalia	*Mormopterus norfolkensis*	Eastern Freetail Bat	Vulnerable NSW	Native
✔		Mammalia	*Myotis macropus*	Southern Myotis	Vulnerable NSW	Native
	✔	Mammalia	*Oryctolagus cuniculus*	Rabbit	Unprotected	Introduced
	✔	Mammalia	*Perameles nasuta*	Long-nosed Bandicoot	Protected	Native
✔		Mammalia	*Phascolarctos cinereus*	Koala	Vulnerable NSW	Native
✔		Mammalia	*Pseudomys novaehollandiae*	New Holland Mouse	Protected NSW, Vulnerable Cwlth	Native
✔	✔	Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	Vulnerable NSW, Cwth	Native
	✔	Mammalia	*Rattus rattus*	Black Rat	Unprotected	Introduced
✔		Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	Vulnerable NSW	Native
	✔	Mammalia	*Trichosurus vulpecula*	Common Brushtail Possum	Protected	Native
	✔	Mammalia	*Wallabia bicolor*	Swamp Wallaby	Protected	Native
✔		Reptilia	*Chelonia mydas*	Green Turtle	Vulnerable NSW, Cwth	Native
✔		Reptilia	*Dermochelys coriacea*	Leatherback Turtle	Endangered NSW, Cwlth	Migratory

OEH Wildlife Atlas (2012)	Recorded on Site	Class	Genus species	Common Name	Conservation Status	Autochthony
✔ - Recorded / Identified, ✔ θ Record Highly Probable, ✔ Record Probable, ✔ Record Likely / Possible. **Unprotected** / **Protected** - National Parks & Wildlife Act 1974 (NSW), **Vulnerable NSW** / **Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Critically Endangered Cwlth** / **Endangered Cwlth** / **Vulnerable Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)						
	✔	Reptilia	*Lampropholis delicata*	Delicate Skink	Protected	Native
	✔	Reptilia	*Pseudechis porphyriacus*	Red-bellied Black Snake	Protected	Native
	✔	Reptilia	*Tiliqua scincoides*	Common / Eastern Blue-tongue	Protected	Native
	✔	Reptilia	*Nephrurus milii*	Thick-tailed Gecko	Protected	Native
✔		Reptilia	*Varanus rosenbergi*	Rosenberg's Goanna /Heath Monitor	Vulnerable NSW	Native

Figure 3.1 – Black Rat (Rattus rattus) investigating the HairTube Trap (left) captured by remote camera on the edge of the Riparian Forest

Figure 3.2 – Common Brushtail Possum (*Trichosurus vulpecula*) captured by remote

3.3.3 Ecological communities data

The following table identifies ecological communities based upon community descriptions in determinations by NSW Scientific Committee and those identified by Benson & Howell (1994) and include communities:

- listed in the schedules of the *Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)* and recorded in the vicinity of the site (OEH, 2012);
- listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* and recorded in the vicinity of the site (OEH, 2012);
- considered as possibly occurring within the region, and
- recorded on the site from field surveys.

OEH (2002) Mapping	Recorded On Site	Community name	Conservation Status
Vulnerable NSW / Endangered NSW - Threatened Species Conservation Act 1995 (NSW), **Critically Endangered Cwth** / **Endangered Cwth** / **Vulnerable Cwth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwth)			
✔	✔ Potential component species	Duffy's Forest	Endangered NSW
✔		Swamp Sclerophyll Forest on Coastal Floodplains	Endangered NSW
✔		Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered NSW

3.3.4 Population data

No threatened populations are recorded within a 10km grid square centered on the site in the Wildlife Atlas (OEH 2012).

4. habitat assessment

4.1 Local & regional habitat context

The site is located at the interface of the developed residential lots and the rural lands of Terrey Hills. Immediately to the east of the site the residential land is intensively developed whilst the land to the west and south of the site are larger rural allotments. The developed residential land is typically modified and consists of small lawn and garden areas with scattered exotic, non-indigenous and indigenous trees. The rural land to the west and south of the site consists of cleared open areas, small pockets of vegetation and bushland and scattered tree canopy cover which is predominately indigenous tree species.

At a more regional level the larger bushland areas of Ku-ring-gai Chase National Park are 250m north of the site and 1km to the south west of the site and the bushland areas of JJ Melbourne Hills Memorial Reserve and Garigal National Park are within 1km south east of the site.

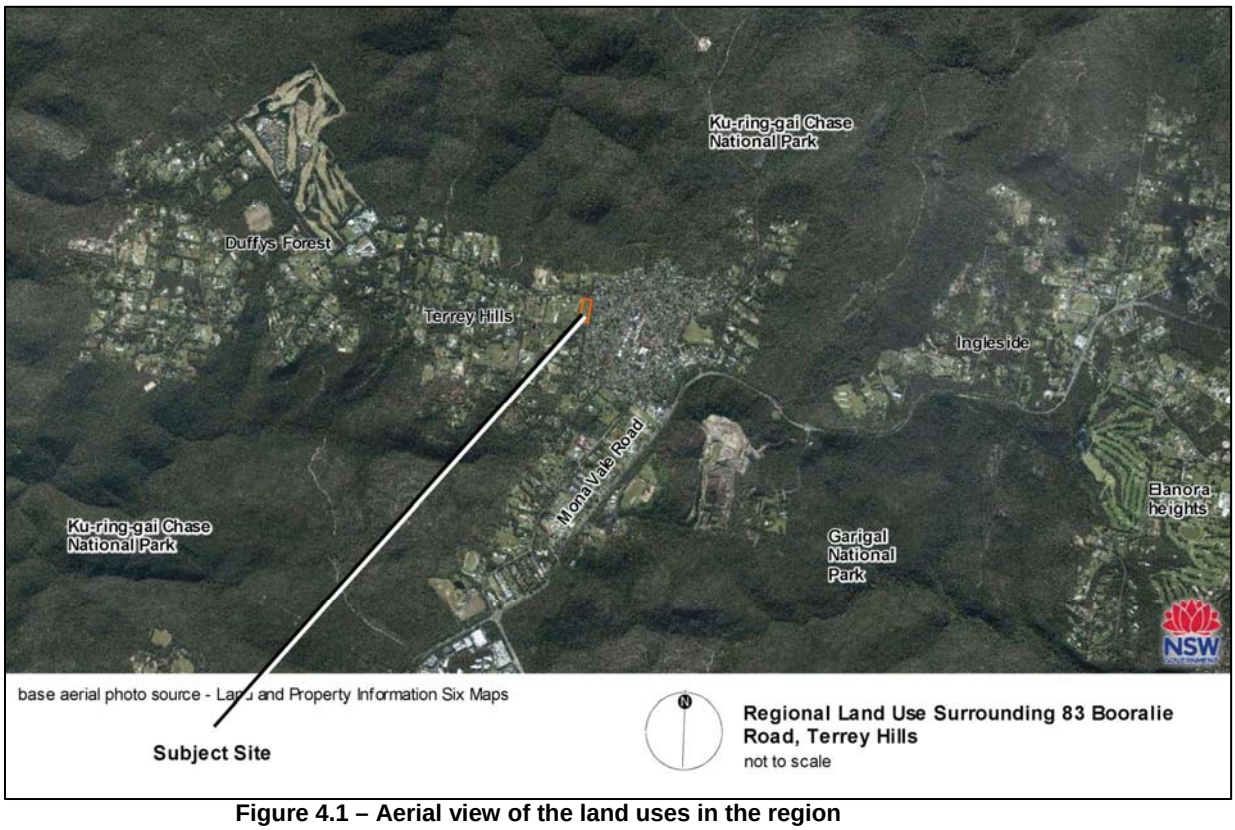

Figure 4.1 – Aerial view of the land uses in the region

Although the local area contains stands of trees and pockets of bushland, the site and the immediate area not considered to be breeding or foraging habitat for sensitive species such as Regent Bowerbird *(Sericulus chrysocephalus*) and Red-capped Robin (*Petroica goodenovii)* whose range does not usually extend outside larger bushland reserves.

With some tree cover and proximity to larger bushland reserves, the local environment can provide foraging and core habitat for other native fauna species such as, Southern Boobook (*Ninox boobook*) and Australian King-Parrot (*Alisterus scapularis*), many of which are not found in areas with more intense development.

Remnant trees and pockets of vegetation in urban and rural areas can also typically provide core refuge habitat for some small mammals such as Long-nosed Bandicoot (*Perameles nasuta*) and Ringtail Possum (*Pseudocheirus peregrinus*). Whilst these may be considered common species they are often the prey of threatened species such as Powerful Owl (*Ninox strenua*).

Fauna that do not reside locally and have broader foraging ranges are expected to be able to frequent the site. Some of these species such as the Grey-headed Flying-fox (*Pteropus poliocephalus*) and Powerful Owl (*Ninox strenua*) are listed in the schedules of the *Threatened Species Conservation Act (NSW) 1995.*

The developed rural/urban landscape is also considered core habitat for fauna species typically found in urban areas. The faunal composition on the site is also influenced by more typical urban native fauna including aggressive species such as Pied Currawong (*Strepera graculina*) and Noisy Miner (*Manorina melanocephala*) or resilient, adaptable species such as Grass/Delicate Skink (*Lampropholis delicata*) and Common Brushtail Possum (*Trichosurus vulpecula*).

4.2 Local habitat connectivity

Being in a developed rural/urban area with modified habitats, the remaining indigenous vegetation occurs as:

- scattered indigenous trees amongst residential properties, private and public schools, roads reserves, parklands and sports fields or
- small (< 0.5ha) pockets vegetation in the rural land.

Scattered indigenous trees are incorporated into the urban landscape and small pockets of vegetation occur in the local rural areas. There are no contiguous links of natural habitat between the site and the larger natural bushland habitats in Ku-ring-gai Chase National Park.

Fauna frequenting the site or moving through the site are typically those species capable of adapting or habituating to urban areas with fragmented habitats.

Although the site does not form part of a defined habitat link between local core habitat areas, the transfer of genetic material between the indigenous vegetation on and adjacent the site is expected to occur via pollinating species such as Grey-headed Flying-fox (*Pteropus poliocephalus*) and Rainbow Lorikeet (*Trichoglossus haematodus*) which frequently move across developed rural/urban areas.

4.3 Habitats on and adjoining the site

The subject site is considered in 4 main habitat units (refer Figure 2.1); being:

- the Riparian Forest in the southern parts of the site adjacent Neverfail Gully Creek
- the Booralie Road Woodland on the site
- the Paddock Hedgerows, and
- the Cleared Pasture Land,

Within the Laitoki Road reserve adjacent the site the vegetation has also been considered and is referred to as the:

- the Laitoki Road Woodland

4.4 Vegetation in the Riparian Forest

The vegetation in the Riparian Forest habitats is dominated by environmental weeds. Apart from some isolated emergent Sydney Red Gums (*Angophora costata*) the tree canopy is dominated by the exotic Black Locust (*Robinia pseudoacacia*) with patches of Coral Trees (*Erythrina X sykesii*). The understorey consists of Lantana (*Lantana camara*) and Small Leaf Privet (*Ligustrum sinense*) with the ground covers dominated by Wandering Jew (*Tradescantia fluminernsis*). Around the perimeter of this habitat unit are thickets of Lantana (*Lantana camara*) and Giant Reed (*Arundo donax*). Other problematic environmental and noxious weed species in this area include Madeira Vine (*Anredera cordifolia*) and Green Cestrum (*Cestrum parqui*). Several isolated indigenous species persist in this area including Native Daphne (*Pittosporum undulatum*) and Christmas Bush (*Ceratopetalum gummiferum*) however many of the Christmas Bush are in poor condition with fungal growths and termites in the trunks.

There are several large dead indigenous trees in this area along with old dead Radiata Pines that appear to have been planted on the southern boundary line. The lack of indigenous species in this area suggests that this habitat may have been cleared in the past.

Figure 4.2 – Typical view of the Riparian Forest dominated by exotic, environmental and noxious weeds

4.5 Vegetation in the Booralie Road Woodland

The extent of this habitat is primarily on the site with the exception of a narrow band on the western end where the existing wire mesh fence encroaches into road reserve. The vegetation in this habitat occurs in 4 main groups based upon the characteristic species, these being the Mountain Cedar Wattle at the western end, the Lantana along the southern boundary of the habitat, the Coral Trees at the eastern end and remnants of the Duffys Forest community in the mid and northern portion of the habit.

Within the Duffys Forest community there are 3 *Grevillea caleyi* plants that under threat by the encroaching weeds and the threat of being pruned to provide access for pedestrians and horses along the Booralie Road bridal trail and nature strip.

The vegetation within the Duffys Forest area is, to some degree, floristically simplified and is characterised by Old Man Banksia (*Banksia serrata*), Scribbly Gum (*Eucalyptus haemastoma*), Red Bloodwood(*Corymbia gummifera*) and Blueberry Ash (*Elaeocarpus reticulatus*). Several of the canopy Eucalypts are also dead.

Figure 4.3 – Typical view of the Booralie Road Woodland on the site

4.6 Vegetation in the Laitoki Road Woodland

These habitats are not on the site and are within the Laitoki Road reserve, managed by Warringah Council.

The vegetation is modified and consists of dense thickets of Lantana, stands of Coral Trees along with some indigenous species including Silver Top/Black Ash (*Eucalyptus sieberi*) and Blackbutt (*Eucalyptus pilularis*). Some of the scattered indigenous canopy trees are in poor condition and have been regularly pruned to accommodate overhead wire clearances; many are also dead. The understorey / sub-canopy is predominately a mix of Native Daphne (*Pittosporum undulatum*) and Lantana. The ground covers are predominately exotic species some of which have become established from dumping of garden waste.

Based upon the few indigenous species remaining the vegetation was once considered to be part of the Duffys Forest community however based upon the level of weed densities and disturbances to the habitat, the vegetation in the Laitoki Road reserve is no longer considered to be characteristic of the structure and floristics of the endangered community.

There is 1 *Grevillea caleyi* plant surviving within these modified habitats. Some attempt appears to have been made to reduce the level of weeds in the immediate area of the plant and the *Grevillea caleyi* is growing partially beneath an open canopy of a Bracelet Honey-myrtle (*Melaleuca armillaris*). The plant is growing on the edge of the road verge immediately adjacent the road drainage ditch and the lateral branches are spreading over the road pavement.

Figure 4.4 - Vegetation along the western side of Laitoki Road fronting the site.

4.7 Vegetation in the Paddock Hedgerows

The Paddock Hedgerows occur along part of the western boundary of the site and across the site between the 2 main cleared areas in the southern portion of the site.

This vegetation has established along old fence lines, is typically less than 2 metres in height and consist of thickets of Lantana, Small Leaf Privet, Blackberry (*Rubus fruticosus*), Green Cestrum, Wild Tobacco Tree (*Solanum mauritianum*). Some hardy indigenous species persist such as Slender Knotweed (*Persicaria decipiens*) in damp places and in other areas Bracken (*Pteridium esculentum*).

4.8 Vegetation in the Cleared Pasture Areas

This habitat extends over the majority of the site. The southern portion of this habitat is predominately mown grass of Kikuyu (*Pennisetum clandestinum*) and the northern paddocks consist of Kikuyu, Common Couch Grass (*Cynodon dactylon*), Parramatta Grass (*Sporobolus fertilis*), Vasey Grass (*Paspalum urvillei*), Paddy's Lucerne (*Sida rhombifolia*) amongst other exotic species.

Figure 4.5 - Typical view of the pasture areas with the hedgerows towards the rear of the photo

4.9 Fauna habitats

4.9.1 Terrestrial habitats

The main portion of the site is gently sloping to the south draining to an open channel watercourse crossing the southern portion of the site. There are no rock outcrops, surface boulders, escarpments or rock overhangs present. The watercourse is fed by a 1m diameter pipe located within the Laitoki Road reserve that discharges stormwater from the urbanised catchment upstream. The drainage pipe is not considered large enough to be refuge for the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) which can be found in larger stormwater pipes and culverts.

There are a number of dead trees within the Riparian Forest, Booralie Road Woodland and the Laitoki Road Woodland.

Within the Riparian Forest several dead trees have trunk diameters greater than 800mm in diameter and contain large hollows many of which have vertical openings and provide limited shelter. There are also several large logs on the ground within the Riparian Forest where mature trees have failed.

Within the Booralie Road Woodland and the Laitoki Road Woodland dead trees have trunks that are typically less than 500mm in trunk diameter some of which have smaller habitat hollows.

Smaller hollows typically provide breeding refuge for Rainbow Lorikeets (*Trichoglossus haematodus*) or may provide seasonal refuge for some microchiropteran bat species. There are a number of microchiropteran bat species that are known to occur within a 5km radius of the site and these include Gould's Wattled Bat (*Chalinolobus gouldii*), Chocolate Wattled Bat (*Chalinolobus morio*), Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) and Little Forest Bat (*Vespadelus vulturnus*).

Despite targeted surveys, over 2 nights in suitable weather and focussing on the large dead trees in the Riparian Forest, no microchiropteran bat species were recorded using these trees. The only fauna recorded using the large dead trees for refuge were Rainbow Lorikeets (*Trichoglossus haematodus*). Despite some refuge potential being provided by the large dead trees, an adult Brushtail Possum (*Trichosurus vulpecular*) and juvenile were observed during the daylight hours in a fork of a live Coral Tree.

There are no feeding scars on the Red Bloodwoods (*Corymbia gummifera*) trees typical of those left by Gliders (*Petaurus sp.)* and there are also very few *Acacia sp*. that provide foraging opportunities during winter for this species.

Ground dwelling mammals recorded on the site included Rabbits (*Oryctolagus cuniculus*), observed in the afternoon, a free roaming Cat (*Felis catus*) observed just before dusk and Common Brushtail Possum (*Trichosurus vulpecula*), Black Rat (*Rattus rattus*) and Long-nosed Bandicoot (*Perameles nasuta*) recorded during the night. A single Swamp Wallaby (*Wallabia bicolour*) was found in the Open Pasture area.

With the exception of the Riparian Forest habitats, the remainder of the site is open cleared land and narrow linear bands of vegetation and these habitats limit the site's potential habitat for many fauna species apart from resilient or adaptable species typically found in urban areas or peri-urban areas.

Noisy Miners (*Manorina melanocephala*), Sulphur-crested Cockatoos (*Cacatua galerita*) and Rainbow Lorikeets (*Trichoglossus haematodus*) were observed on and adjacent the site and smaller more sensitive bird species such as Superb Fairy-wren (*Malurus cyaneus*) and Eastern Spinebill (*Acanthorhynchus*

tenuirostris) occurred along the interface of the Riparian Forest and Cleared pasture habitats.

The faunal composition on the site is considered to be consistent with that found in the local urban and rural areas and in particular those areas where tree hollows occur locally and habitats are supported by tree canopy cover. The faunal compositions in these areas tend to be:

- aggressive or dominating species such as Rainbow Lorikeet (*Trichoglossus haematodus*) and Noisy Miner (*Manorina melanocephala*);
- resilient and adaptable species such as Common Brushtail Possum (*Trichosurus vulpecular);*
- some semi resilient species found in disturbed habitats where dense vegetation provides some refuge such as Superb Fairy-wren (*Malurus cyaneus*) and Eastern Spinebill (*Acanthorhynchus tenuirostris*);
- species that reside off site in larger bushland reserves and have broad foraging ranges such as Powerful Owl (*Ninox strenua*) and Grey-headed Flying-fox (*Pteropus poliocephalus),* and
- occasional species that seasonally migrate from other areas and take advantage of breeding and foraging opportunities such as Channel-billed Cuckoo (*Scythrops novaehollandiae)*.
-

4.9.2 Riparian habitats

The watercourse running through the site has an incised channel and in some areas the banks are vertical and over 2m in height. For a distance of approximately 50m below the stormwater outlet the bed of the creek is actively eroding leaving the steep vertical banks and the erosion has also undercut the concrete apron immediately below the stormwater outlet. Debris such as car tyres and prams can be found below the outlet.

Figure 4.6 Slumping of the banks of the channel in the upper mid portion of the creek on the site.

Some limited stream bed aggregate is present and consist of blue metal, bitumen, and ironstone laterite. Small temporary ponds were present at the time of the surveys however a film of oil was present in these areas. With slumping banks occurring these areas provide little opportunity for Spotted Pardalotes (*Pardalotus punctatus*) or Giant Burrowing Frog (*Heleioporus australiacus*) to breed.

Figure 4.7 Aggregate in the creek bed consisting of blue metal, bitumen material, concrete and laterite ironstones with an oil film covering the water surface.

Below this active bed erosion the riparian and stream bed vegetation is dominated by a dense stand of Giant Reed (*Arundo donax*).

In the lower south western portion of the site the bed of the watercourse has eroded to the sandstone bedrock. The sandstone bedrock was covered with algae and the banks have eroded to form 2m high steep sides. Mosquito larvae and aquatic snails were observed in a rock pool in the lower southern portion of the watercourse. No tadpoles were observed.

4.10 External influences affecting habitat potential

Being in close proximity to urban developments, the potential habitats on the boundaries of the site are influenced by the adjacent activities. These activities include vehicular movements, noise, modified habitats and the presence of domestic pets.

4.11 Ecological community prior to the original development

With very few indigenous flora species on the site it is difficult to positively classify the vegetation community that existed prior to the original development using published floristic models. Based upon the presence of several dead Brown Stringybark (*Eucalyptus capitellata*) and the published mapping (Smith & Smith, 2000) the original vegetation association that occurred on the site prior to its development was the endangered Duffys Forest ecological community,

4.12 Critical habitat

Critical habitat is declared under the provisions of the *Threatened Species Conservation Act 1995 (NSW)* and this site is not listed as being part of any gazetted critical habitat. Currently the critical habitats listed in the schedules of the Act are

- Gould's Petrel;
- Little Penguin habitat in Sydney's North Harbour;
- Mitchell's Rainforest Snail in Stott's Island Nature Reserve;
- *Wollemia nobilis* (The Wollemi Pine);
- *Bomaderry zieria* within the Bomaderry bushland - critical habitat recommendation, and
- Eastern Suburbs Banksia Scrub Endangered Ecological Community - critical habitat recommendation.

The site is not considered to be critical habitat for the purposes of the *Threatened Species Conservation Act 1995 (NSW)*.

5. Caley's Grevillea (*Grevillea caleyi*) on & adjacent the site

5.1 Locations on and adjacent the site

There are 4 Caley's Grevillea (*Grevillea caleyi*) plants on and adjacent the site.

Three (3) are 3 *Grevillea caleyi* within the Booralie Road Woodland and based upon the survey (Bee & Lethbridge, 2012) 2 of these plants are located on the site and 1 *Grevillea caleyi* is located on the boundary line between the site and the Booralie Road reserve.

One other *Grevillea caleyi* is located within the Laitoki Road reserve outside the site allotment boundary (refer figure 5.1).

5.2 Brief summary of the biology & ecology *Grevillea caleyi*

Caley's Grevillea (*Grevillea caleyi*) a spreading shrub and its distribution is restricted to the northern Sydney suburbs of Belrose, Terrey Hills, Duffys Forest and Ingleside. The species typically occurs within the Duffys Forest ecological community found on ridge tops with iron-rich laterite soils.

There are 4 *Grevillea caleyi* plants on and adjacent the subject site. The species is known to regenerate after fires from seed stored in the soil and the numbers of plants is not considered to be a good guide in estimating the significance of sites. A more accurate estimation of the area occupied by *Grevillea caleyi* is the areas of habitat (OEH, 2004).

The area of habitat of the Duffys Forest community and the habitat of the *Grevillea caleyi* is mapped as occurring in parts of the Booralie Road Woodland (refer Figure 111) and a small area in the Laitoki Road reserve.

The species predominately flowers in winter and spring but may produce flowers sporadically throughout the year. The flowers of *Grevillea caleyi* are pollinated by nectivorous birds and the species may be self-compatible (OEH, 2004). The percentage of flowers producing viable seed is considered to be less than 5% (OEH, 2004). Seed dispersal is limited with and typically falls to the ground directly below the parent plant. Seed predation on the ground is high, typically by Bush Rats and Swamp Wallabies and the replenishment of the seed bank may be severely limited.

Some seeds may germinate in the absence of fire however in habitats with thick leaf litter and ground covers there have been no successful seedlings observed (OEH 2004). After fires the seeds stored in the soil readily germinates and above ground plants are killed by fire. For sustaining populations the inter-fire period is critical and it is recommended that that minimum period of 8-12 years is optimal. Adult plants senesce from about 12-15 years and the threats to the species include weed invasion.

The *Grevillea caleyi* habitats on the site are proposed to be retained in conjunction with the development however currently there does not appear to be any active management of the *Grevillea caleyi* habitats. Without active management of the *Grevillea caleyi* habitats, the habitats are likely to further degrade.

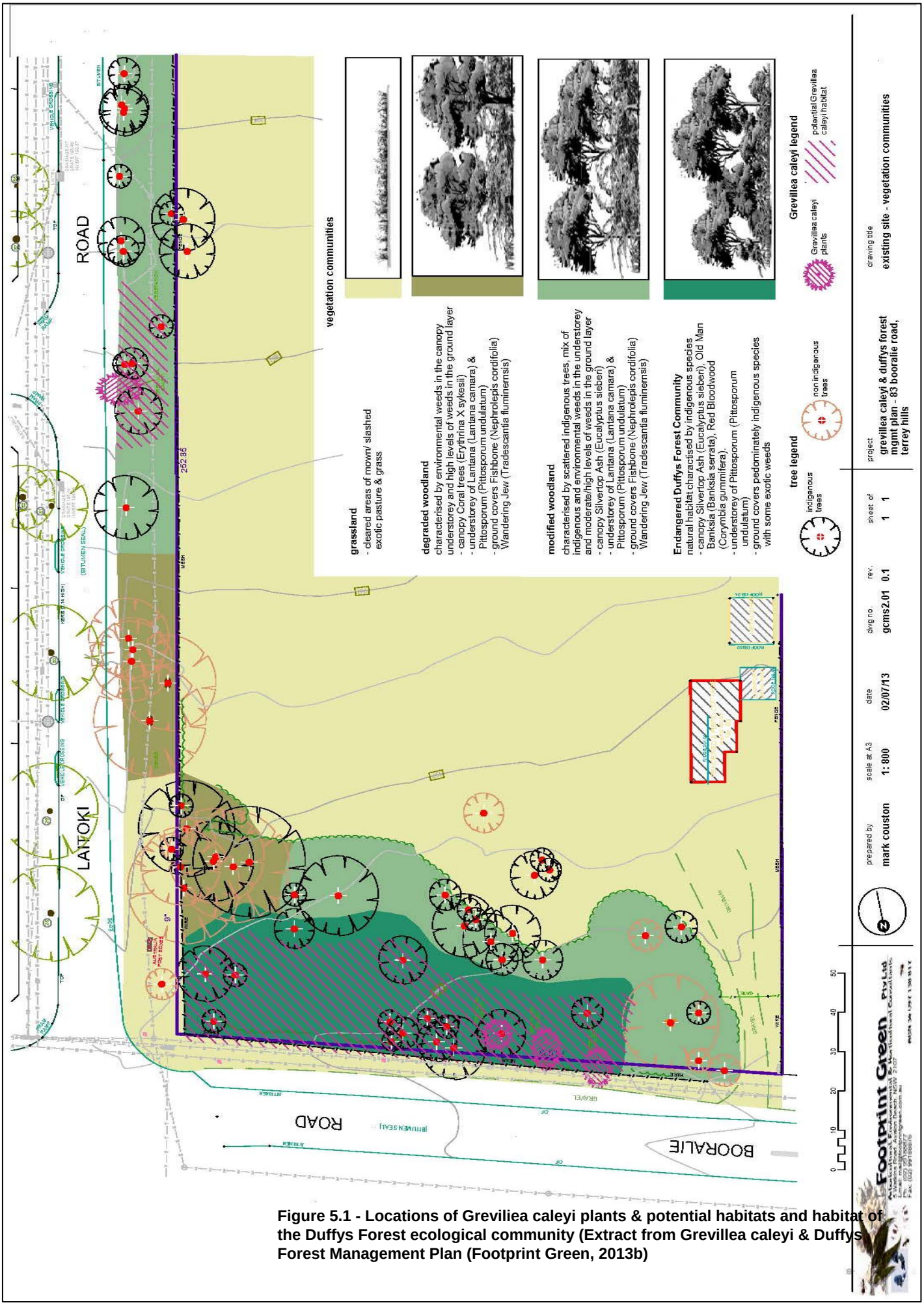

Figure 5.1 - Locations of Greviliea caleyi plants & potential habitats and habitat of the Duffys Forest ecological community (Extract from Grevillea caleyi & Duffys Forest Management Plan (Footprint Green, 2013b)

5.3 Site habitats of the *Grevillea caleyi*

The Booralie Road Woodland consists of the Duffys Forest community habitat in addition to disturbed & modified woodland habitats dominated by environmental weed species. The disturbed & modified woodland areas occur at the eastern end, southern boundary and at the western end of the Booralie Road Woodland. The eastern end is dominated by a dense stand of Coral Trees, on the southern boundary fill material and debris have been deposited and the vegetation consist of thicket of Lantana with some indigenous trees. The vegetation in the western end is dominated by the non-indigenous Mountain Cedar Wattle (*Acacia elata*). Whilst it is recognised that the seed of *Grevillea caleyi* stored in the soil can remain viable for some time the estimated half-life of the soil stored seed is is 7.6 years (OEH, 2004).

Figure 5.2 - View looking east along Booralie Road of the Booralie Road Woodland in June 2008.

Figure 5.3 - The same view looking east along Booralie Road of the Booralie Road Woodland in June 2013 showing the *Acacia elata* encroaching in the foreground and the Grevillea caleyi branching through the wire mesh fence.

The Laitoki Road habitat is considered to be more disturbed that the habitats in the Booralie Road Woodland. Dense thickets of lantana occur upslope and down slope of the *Grevillea caleyi* plant. The *Grevillea caleyi* is growing within 0.5m of the earthen drainage ditch and its lateral branches are spreading onto the road and appear to be tip pruned by passing traffic. There is very little branching on the western side away from the road. The road verge is slashed up slope and down slope of the plant. Seed from the plant is predominately falling on to organic matter which has collected under the plant and there is little opportunity for seed to fall on natural soils.

Figure 5.4 - View showing the western road verge of Laitoki Road and the *Grevillea caleyi* at road level in the left side of the photograph.

Figure 5.5 The Grevillea caleyi on Laitoki Road spreading out over the road pavement with a build up of organic matter beneath the canopy; the road drainage ditch is in the far right of the photo.

6. proposed development

6.1 Nature of development impacts

In terms of the ecology, biophysical changes to the site can have impacts that are:

- direct, affecting the site, or
- indirect, affecting the down stream or adjacent environment.

These impacts can also be considered as being:

- short term, during construction / demolition activities, or
- long term, extending over the life of the development and are influenced by the development design.

Impacts on the natural environment, whether direct or indirect, short term or long term are also considered generally in the context of having either a negative or positive effect.

6.2 Existing site & proposed developments

The existing site has an area of 19,960 m^2 and is described as consisting of:

- the Riparian Forest dominated by environmental and noxious weeds;
- the Booralie Road Woodland containing disturbed habitats and a small area isolated area of Duffys Forest ecological community;
- the Paddock Hedgerows and Cleared Pasture Land consisting of weed species and exotic grasses.

The vegetation within the Laitoki Road reserve fronting the site is described as

- the Laitoki Road Woodland consisting of disturbed habitats, environmental weeds and some isolated indigenous tree species.

The proposed development involves:

- demolition of the existing structures on the site;
- construction of a Seniors Housing Development with basement car parking (Rush, 2013);
- associated landscaping (Dobson, 2013)
- rehabilitation of the riparian area that crosses the southern portion of the site (Footprint Green, 2013a);
- protection and restoration of the Duffys Forest vegetation including the *Grevillea caleyi* habitat within the Booralie Road Woodland (Footprint Green, 2013b); and
- protection and management of the of the *Grevillea caleyi* habitat in the Laitoki Road reserve (Footprint Green, 2013b).

6.3 Scope of development impact

Although it is difficult, if not impossible, to consider ecological boundaries at such a small scale, for the purposes of assessing the scope of the impacts in the following information is provided in the table below.

Habitat	Existing (m2)	Retain & Rehabilitate (m2)	Modify & Landscape (m2)	Remove (m2)
Booralie Road Woodland	1,593	1,018		575 (environmental and noxious weeds only)
Laitoki Road Woodland	760	155 (Grevillea caleyi habitat)	400	205
Riparian Forest	4,656	3,076	1,580	
Paddock Hedgerows	817			817
Cleared Pasture	12,451			12,451

6.3.1 Direct long term negative impacts

From an ecological perspective the proposed development involves:

- modification of the habitats in the Riparian Forest;
- modification of the Laitoki Road reserve habitats and removal of some native vegetation;
- removal of 9 indigenous trees in the Laitoki Road reserve of which 2 are dead;
- removal of 19 indigenous trees on the southern edge of the Booralie Road Woodland on the site and in other parts of the site.

Within the degraded Riparian Forest some indigenous trees will be removed unless specifically noted for retention in the Arboricultural Impact Assessment (Footprint Green, 2013c).

6.3.2 Indirect long term negative impacts

6.3.2.1 Hydrological impacts

The proposed development will involve an increase in the built upon area. With the increase of impervious surface area there is the potential for increase in the peak flows in the watercourse during rain events. Taking into account the developed nature of the catchment and current land uses, the ecological impact in the down stream environments and in the receiving waters is considered to be negligible with adequate onsite detention controls.

6.3.2.2 Ecological impacts

The habitats on the site have been modified to varying degrees. Although modified the habitats provide a contribution to the local ecology by providing seasonal foraging opportunities and refuge for primarily bird species and potentially bat species. Taking into account the vegetation to be removed the proposed development is likely to displace some common fauna populations and remove some indigenous flora species. Detailed assessments on the impact on threatened species are considered in the following sections of this report.

6.3.3 Potential indirect short term negative impacts

Redevelopment of the site will have some short-term impacts associated with building activities including noise and soil disturbance.

6.3.3.1 Noise during construction

Taking into account the fauna found on site and within the surrounding areas, there may be some displacement of native fauna whilst works are in progress. The ecological impact of noise is considered to be low when considering the habitats on the site, the background noise levels and the ability of urban fauna to use habitats on site for foraging during the night. Whilst there may be some temporary displacement of more common native fauna as a result of construction noise a detailed assessment on the impact on threatened species is considered in the following sections.

6.3.3.2 Soil disturbance during construction

During construction soil disturbance will occur. To minimise the impact on the natural environment and the receiving waters down stream standard industry erosion & sediment controls will need to be in place and maintained. These are typically overcome and dealt with as conditions of consent and site management.

6.3.4 Direct long term positive impacts

The positive aspects of the proposed development includes works outlined in the Riparian Vegetation Management Plan (Footprint Green, 2012a) together with the restoration of the Duffys Forest vegetation including the *Grevillea caleyi* habitat within the Booralie Road Woodland and retention and management of the *Grevillea caleyi* habitat in the Laitoki Road reserve (Footprint Green, 2013b). Within the Riparian Forest and the Booralie Road Woodland a number of dead trees with habitat hollows are proposed to be retained.

7. relationship between threatened species and site habitats

7.1 Threatened species habitat assessment

The following assessment is made of the species, communities or populations identified in the previous data tables despite whether they were recorded as part of this survey or have been recorded previously in the vicinity of the site. The following habitat assessment takes into account the habitats on the site and the relationship between these habitats and those of threatened species, communities and populations.

In accordance with the Threatened Species Assessment Guidelines (OEH, 2007) if adequate surveys/studies have been carried out that clearly show that a species: does not occur within the study area; will not use the habitats on the site on occasion, or will not be influenced by off-site impacts, the species does not need further consideration.

7.2 Threatened flora habitat assessment

Conservation Status	Family	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Vulnerable NSW, Cwth	*Elaeocarpaceae*	*Tetratheca glandulosa*	Glandular Pink-bell	The species occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops typically associated with the Lucas Heights, Gymea, Lambert and Faulconbridge soil landscapes (OEH, 2000).	162	Potentially occurring in the Duffys Forest Habitat on the site which is to be retained.	✗
Vulnerable NSW	*Epacridaceae*	*Epacris purpurascens var. purpurascens*	-	*Epacris purpurascens var. purpurascens* is found at 30 locations in and around Sydney extending from Gosford in the north, Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the south. Its habitat consists of ridgetop drainage depressions supporting wet heath within or adjoining shale cap communities such as Stringybark and Ironbark woodlands and various shale/sandstone transition forest (OEH, 2002).	32	Habitat not present unlikely to occur	✗
Endangered NSW, Cwlth	*Haloragaceae*	*Haloragodendron lucasii*	Hal	Found in the upper reaches of Middle Harbour and Cowan Creek it is usually found growing in moist damp habitats adjacent creeks or adjacent soaks associated with sandstone benches.	1	Habitat not present unlikely to occur	✗
Vulnerable NSW	*Myrtaceae*	*Callistemon linearifolius*	Netted Bottle Brush	The species has been recorded growing in dry sclerophyll forest on the coast and adjacent ranges. Its known distribution occurs from the Georges River to Hawkesbury River in the Sydney area and north to Nelson Bay. Other records in 2000 have been from Coal Cliffs in the Southern Rivers CMA. Within the Sydney area, recent records are predominately limited to the Hornsby Plateau area near the Hawkesbury River and 4 records of the species also occur within Pittwater. Currently only 5-6 populations of the previous 22 populations remain. Three of these populations occur within Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve.	6	Habitat not present unlikely to occur	✗
Vulnerable NSW, Cwth	*Myrtaceae*	*Darwinia biflora*	-	Occurs on the edges of weathered shale capped ridges particularly at the interface with Hawkesbury sandstone. Most sites are on Lucas Heights Soil Landscape. The vegetation association often includes *Eucalyptus haemastoma, Corymbia gummifera* and or *E. squamosa* and the structure is usually woodland, open forest or scrub-heath (OEH, 2003).	1	Habitat not present unlikely to occur	✗

Conservation Status	Family	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Vulnerable NSW, Cwth	*Myrtaceae*	*Eucalyptus camfieldii*	Heart-Leaved Stringybark	This species is found on lateritic soils of the Mittagong formation and in Hawkesbury sandstone. Usually located on upper slopes and ridge tops its habitat is characterized by well drained soils and associated with dry sclerophyll woodlands and scrub.	31	Potentially occurring in the Duffys Forest Habitat on the site which is to be retained.	✗
Vulnerable NSW	*Myrtaceae*	*Eucalyptus nicholii*	Narrow-Leaf Peppermint	The species is endemic on the northern tablelands of NSW however it is widely planted as an urban street tree and in gardens It is quite rare in the wild and is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property. The species grows in dry grassy woodland, on shallow and infertile soils, mainly on growing on porphyry or granite soils (Brooker & Kleinig, 1999).	1	Outside the natural habitat range of the species unlikely to occur.	✗
Endangered NSW, Vulnerable Cwth	*Myrtaceae*	*Eucalyptus scoparia*	Wallangarra White Gum	Occurring mainly in Queensland, the species reaches its southern natural distribution limits in northern NSW. There are only 3 known natural locations where small populations occur. All 3 locations occur in the Tenterfield area none of which occur in conservation reserves (NSW Scientific Committee, 2002). The species has been used in the horticultural industry and has been planted widely as a street tree and as an ornamental species around Sydney.	1	Outside the natural habitat range of the species unlikely to occur.	✗
Vulnerable NSW	*Myrtaceae*	*Kunzea rupestris*	-	The species grows in shallow, sandy, low nutrient soil in depressions on sandstone rock platforms. It is typically found in short to tall scrubland or heath land at altitudes of 50–300 m (Wilson, 1991; Benson & McDougall, 1998).	2	Habitat not present unlikely to occur	✗
Vulnerable NSW, Cwth	*Myrtaceae*	*Leptospermum deanei*	-	The species is found in riparian shrubland, woodland and open forest on sandy alluvial soil or sand on lower hillsides and along permanent freshwater creeks in Hawkesbury Sandstone areas below 100 m above sea level (Benson 1990; Benson & McDougall 1998). The most substantial population is along Middle Harbour Creek within Garigal National Park (Benson & McDougall, 1998).	2	Habitat not present unlikely to occur	✗
Vulnerable NSW, Cwth	*Myrtaceae*	*Melaleuca deanei*	Deane's Melaleuca	Found in similar habitats to *Darwinia biflora*, it occurs on the edges of weathered shale capped ridges particularly at the intergrade with Hawkesbury sandstone. Most sites are on Lucas Heights Soil Landscape and prefers an open habitat.	6	Habitat not present unlikely to occur	✗

Conservation Status	Family	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Vulnerable NSW, Cwth	*Myrtaceae*	*Syzygium paniculatum*	Magenta Lillypilly	The species has been known to be associated with coastal dunes and Littoral Rainforest and is also found in riparian habitats (Payne 1997). The species has been commercially propagated and sold and is known to have been planted in a variety of urban habitats. The species been recorded growing on moist slopes on Narrabeen Group geology (Smith & Smith 2000).	1	Habitat not present unlikely to occur	✗
Endangered NSW, Extinct Cwlth	*Orchidaceae*	*Diuris bracteata*	-	Known only from the original collection near Gladesville, on the Parramatta R. before 1889 (Botanical Herbarium). The species was considered to be extinct but is now known from a few sites in dry sclerophyll woodland, and the total number of individuals is about 50. The known populations do not occur in conservation reserves. Several occurrences are on roadsides and are at risk from earthworks, herbicide spraying, slashing/mowing and illegal collection (NSW Scientific Committee, 2005) Known to occur at western end of Booralie Rd in Duffys Forest	1	Potentially occurring in the Duffys Forest Habitat on the site which is to be retained.	✗
Endangered NSW, Cwlth	*Orchidaceae*	*Microtis angusii*	Angus's Onion Orchid	The habitat is somewhat unclear as the species occurs at Ingleside in an old roadside soil dump stockpile area. The location of the species has been highly disturbed, however the natural soils are the ridgetop lateritic soils that occur in the Terrey Hills, Duffys Forest, Ingleside and Belrose areas.	4	Potentially occurring in the Duffys Forest Habitat on the site which is to be retained.	✗
Endangered NSW, Cwlth	*Proteaceae*	*Grevillea caleyi*	Caley's Grevillea	This species typically grows on Mittagong soil landscapes characterized by lateritic soils rich in iron and can be associated with the Duffys Forest vegetation association.	170	Occurs in the Duffys Forest Habitat on the site and Modified Woodland in the Laitoki Road reserve.	✔
Endangered NSW, Cwlth	*Proteaceae*	*Persoonia hirsuta*	Hairy Geebung	The species typically grows on sandstone amongst heath and low woodland. It has been recorded growing in the Duffy's Forest association on lateritic soils. It occurs in small numbers in woodlands and dry sclerophyll forest on sandstone and is known from a number of locations from Gosford and Hill Top to Glen Davis, at Putty and in the Royal National Park.	3	Potentially occurring in the Duffys Forest Habitat on the site which is to be retained.	✗

Conservation Status	Family	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Endangered NSW, Cwlth	*Proteaceae*	*Persoonia mollis subsp. maxima*	-	Has only been recorded in the area from Hornsby Heights to Mt Colah and its habitat is typically characterised by steep slopes with sandstone benches, scarps and rock outcrops. In these areas it is found in sheltered sites that are relatively moist receiving waters from drainage depressions and small intermittent creeks.	1	Habitat not present unlikely to occur	✗
Vulnerable NSW, Cwth	*Sterculiaceae*	*Lasiopetalum joyceae*	-	The species is typically occurs on ridgetops of the Hornsby Plateau and is known to occur from at 34 sites between Berrilee and Duffys Forest. It is an erect open shrub and is found growing on shale/sandstone transitional soils often associated with laterites. It can be found growing within a variety of communities ranging from open forests, woodlands & heathland.	2	Potentially occurring in the Duffys Forest Habitat on the site which is to be retained.	✗
Vulnerable NSW, Cwth	*Thymelaeaceae*	*Pimelea curviflora var. curviflora*	Curved Rice-flower	This species is confined to the coastal areas around Sydney found growing on Hawkesbury sandstone (Harden 2000) or on lateritic soils in similar habit to that occupied by the Duffys Forest association (Smith & Smith 2000).	30	Potentially occurring in the Duffys Forest Habitat on the site which is to be retained.	✗

7.3 Threatened fauna habitat assessment

Conservation Status	Class	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Vulnerable NSW, Cwth	Amphibia	*Heleioporus australiacus*	Giant Burrowing Frog	Sandy soil on sandstone ridges where sandy creek banks provide opportunities for burrowing. Tadpoles are typically found in rocky pools in the upper reaches of permanent and ephemeral creeks (Mahoney 1993)	18	Unlikely to occur in the disturbed Riparian Habitats on the site	✗
Endangered NSW, Vulnerable Cwth	Amphibia	*Litoria aurea*	Green and Golden Bell Frog	The species has a range extending at lower altitudes along eastern NSW and eastern Victoria. Its habitat includes in and at the edges of permanent slow moving or still, streams ponds, swamps and dams (Cogger 2000) and requires well-vegetated creeks, dams and swamps.	1	Habitat not present unlikely to occur.	✗
Vulnerable NSW	Amphibia	*Pseudophryne australis*	Red-crowned Toadlet	Red-crowned Toadlets do not usually live along permanent flowing water courses such as occur in gullies, instead preferring permanently moist soaks, areas of dense ground vegetation or litter along or near head-water stream beds. It is known to inhabit upper forested slopes and ridges on Hawkesbury sandstone or Narrabeen group preferring is moist sandstone habits with grass and debris near ephemeral watercourses. Red-crowned Toadlets have not been recorded breeding in permanently flowing streams or waters that are even mildly polluted (OEH, 2002).	46	Habitat not present unlikely to occur.	✗
Vulnerable NSW	Aves	*Ninox connivens*	Barking Owl	The species can be found inhabiting eucalypt forests, paperback and other woodlands, dense scrubs, foothills; river red gums and other large trees near watercourses. The species is dependant on large hollows of mature eucalypts for nests. The bird feeds on prey such as rabbits, rats, gliders and birds such as Rosella and starlings (Smith & Smith 2000).	4	Some limited potential nesting and refuge habitat in the Riparian Habitats on the site.	✔
Vulnerable NSW	Aves	*Ixobrychus flavicollis*	Black Bittern	Is known to inhabit mangroves and streamside vegetation including small creeks. Feeding is mostly undertaken at night where they stand and wait for small insects, crustaceans and small fish.	6	Habitat not present unlikely to occur.	✗

Conservation Status	Class	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✘ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Vulnerable NSW	Aves	*Melithreptus gularis*	Black-chinned Honeyeater	The eastern subspecies species is predominantly found west of the Great Dividing Range in a narrow belt through NSW into southern Queensland, and south into Victoria and South Australia where it occupies eucalypt woodlands within an approximate annual rainfall range of 400-700mm (Blakers et al. 1984) and is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond River district. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions and in western and south western Sydney at Wilberforce, Windsor, Penrith, Sandy Point and West Hoxton (Birddata 2006). The species is no longer found in many areas and population declines have been reported from the Cumberland Plain, Western Sydney (Hoskin 1991; Keast 1995) In NSW. The species is mainly found in woodlands containing box-ironbark associations and River Red Gum. Black-chinned Honeyeaters and occured in drier coastal woodlands of the Cumberland Plain, Western Sydney (NSW Scientific Committee, 2001). Black-chinned Honeyeaters are likely to experience high levels of competition from aggressive honeyeater species such as Noisy Miners and increased nest predation is expected from increasing populations of predators such as Pied Currawongs and Australian Ravens, particularly in small remnants (Major et al. 1998).	1	Habitat not present unlikely to occur. Likely to be displaced by more aggressive urban fauna, unlikely to occur.	✘
Vulnerable NSW	Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo	The Gang-gang Cockatoo can be across south eastern NSW and south eastern Victoria in a variety of forests and woodlands. It feeds on terminal leaves and seeds of Eucalypts, Acacia seeds and berries from hawthorn hedges. The species nests in deep hollows in eucalypts (Slater 1993) and the last known breeding population in metropolitan Sydney area is in the Hornsby/ Ku-ring-gai area. The species can also be found in urban areas in parks and gardens. This population is bounded by Beecroft – Cheltenham in the west, Epping – North Epping in the south, Turramurra – South Turramurra in the east, and Thornleigh – Wahroonga to the north. The population encompasses, but is not restricted to, Pennant Hills Park and parts of Lane Cove National Park. Individual birds are likely on occasion to move across the population boundary.	1	Not considered to be core breeding habitat, low foraging potential, unlikely to occur.	✘
Vulnerable NSW	Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	Considered rare in a national context, but moderately common in N.S.W. Because of its dependence on one type of food it is considered to be vulnerable. It nests in large hollows of dead trees and roosts in both wet and dry eucalypts, feeding in open Casuarina woodland, primarily where the Black She-oak (*Allocasuarina littoralis*) and Forest Oak (*Allocasuarina torulosa*) occurs.	40	Not considered to be core breeding habitat low foraging potential, unlikely to occur.	✘

Conservation Status	Class	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✘ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Vulnerable NSW	Aves	*Hieraaetus morphnoides*	Little Eagle	The Little Eagle is distributed throughout the Australian mainland with the exception of the most densely forested parts of the Dividing Range escarpment and it occurs as a single population throughout NSW. The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland and sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. Nest sites require a tall living tree within a remnant patch, where the species build a large stick nest in winter and lay in early spring. The species feeds on birds, reptiles and mammals, occasionally adding large insects and carrion and was heavily dependent on rabbits prior to the release of the rabbit calicivirus (NSW Scientific Committee, 2010).	1	Not considered to be core breeding habitat low foraging potential unlikely to occur.	✘
Vulnerable NSW	Aves	*Glossopsitta pusilla*	Little Lorikeet	Little Lorikeet occur along the east coast of Australia from Cairns to Adelaide. In New South Wales their distribution extends from the coast to the western slopes of the Great Dividing Range to Albury, Parkes, Dubbo and Narrabri (Barrett et al. 2003).They are generally considered to be nomadic and individuals can at any time of year when nectar and pollen, particularly on profusely-flowering eucalypts, is available. The species also feed on flowering Melaleucas and Mistletoes. (NSW Scientific Committee, 2009). Little Lorikeets nest in small hollows usually in live trees and nest-hollows are used “traditionally”, with the same hollow known to be occupied for at least 29 years (not necessarily by the same individuals) (Courtney & Debus 2006). The breeding season extends from May to September (Higgins 1999).	1	Not considered to be core breeding habitat very low foraging potential unlikely to occur.	✘
Vulnerable NSW	Aves	*Tyto novaehollandiae*	Masked Owl	It is generally considered as a bird of forest margins recorded in wet and dry open forests and woodlands and urban areas (Debus & Rose 1994). The southern subspecies occupies a home range of 5 -10 km2 within a diverse range of habitats that provide large hollow-bearing trees for roosting and nesting (Kavanagh & Murray 1996) often in riparian forests. It has also been known to roost and nest in caves and preys on mammals typically less than 600g such as rats, mice, rabbits, sugar gliders and ringtail possums (Slater 1993, Debus & Rose 1996).	2	Some limited potential nesting and refuge habit in the Riparian Habitats on the site.	✔
Vulnerable NSW	Aves	*Ninox strenua*	Powerful Owl	The species has a range of 400 -1500ha (Davey 1993) and is known to nest in hollows in Eucalypts between 9-37m above ground usually in secluded well-vegetated gullies and usually occupying the largest emergent trees. Powerful Owls live alone or in pairs which occupy a permanent territory containing a number of roost sites and one or more nesting sites. The species feeds over a large range on small to medium sized mammals, including gliders, ringtail possum and immature brushtail possums.	28	Some limited potential nesting and refuge habit in the Riparian Habitats on the site.	✔

Conservation Status	Class	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✘ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Critically Endangered NSW, Endagered Cwlth	Aves	*Anthochaera phrygia*	Regent Honeyeater	Once considered abundant across south-eastern Australia its population is in decline (Garnett 1992), In New South Wales, the species are mostly recorded in forest associations of box/ironbark and they prefer the wetter sites within these associations. Riparian forests of *Casuarina cunninghamiana* (River Oak) with *Amyema ambagei*, (Needle-leaf Mistletoe) are also important for feeding and breeding. Nectar is the principal food, but sugary exudates from insects are also used, and insects are essential for breeding (Oliver, 1998, 2000). Important feed trees are *Eucalyptus sideroxylon* (Mugga Ironbark), *Eucalyptus albens* (White Box), *Eucalyptus melliodora* (Yellow Box) and Eucalyptus leucoxylon (Yellow Gum) however the species also use other woodland types and wet lowland coastal forest dominated by *Eucalyptus robusta* (Swamp Mahogany) or *Corymbia maculata* (Spotted Gum) when shortages of preferred food trees occur (Franklin et al., 1989, Ley and Williams, 1992, Webster and Menkhorst, 1992, Geering and French, 1998, Oliver et al., 1999). It is thought that aggressive species particularly Manorina melanocephala (Noisy Miner) may be displacing the Regent Honeyeater (Franklin et al., 1989, Grey et al., 1998).	1	Not considered to be core breeding habitat very low foraging potential, unlikely to occur.	✘
Endangered NSW, Cwlth	Aves	*Lathamus discolor*	Swift Parrot	The Swift Parrot inhabits eucalypt forests and breeds in hollows of mature and senescing trees in Tasmania. On the mainland it feeds off winter flowering Eucalypts although it will also feed on lerps, honeydew, Banksia nectar, fruits, seeds and other plant material as well as insects and their larvae (Forshaw & Cooper 1981, Garnett 1992). In New South Wales important foraging tree species include, *Eucalyptus macrocarpa* (Grey Box), *Eucalyptus sideroxylon* (Mugga Ironbark) on the western slopes and *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus fibrosa* (Red Iron Bark), *Corymbia maculata* (Spotted Gum), *Eucalyptus robusta* (Swamp Mahogany) and *Corymbia gummifera* (Red Bloodwood) (Swift Parrot Recovery Team, 2000). Since 1980 there have been some 60 sightings recorded in the Wildlife Atlas database (NSW National Parks & Wildlife Service 2003) within the Sydney Metropolitan Areas and locally small flocks were reported at Ingleside in 1986 (Cooper 1990). In 1938 hundreds of Swift Parrots were reported feeding in *Eucalyptus robusta* (Swamp Mahogany) in Warriewood (Hindwood 1939).	3	Site is not breeding habitat very low foraging potential, unlikely to occur.	✘

Conservation Status	Class	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✘ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Vulnerable NSW	Aves	*Neophema pulchella*	Turquoise Parrot	The Turquoise Parrot is an inhabitant of the steep, rocky ridges and gullies, rolling hills, valleys and river-flats and the nearby plains of the Great Dividing Range (Higgins 1999). Its preferred habitat is typically occurs as grasslands on the edge of open woodland or open forest where it can be seen in pairs or groups on the ground searching for seeds of grasses. Individuals generally breed from August to January laying 4-5 eggs in hollows, in trees, stumps or even fence posts, and it feeds on the seeds of native and introduced grasses and other herbs, including weeds (Quin, 1990, Quin and Baker-Gabb, 1993, Higgins, 1999). The species was once common near Sydney, however this population crashed in the early 1900s and at one stage the Sydney population was thought to be extinct (Garnett 1992). Recent records indicate that the species now occurs in scattered populations near Sydney and throughout eastern and central NSW (Blakers et al. 1984) with only 1 record occurring in Ku-ring-gai Chase National Park in 1983 within 10km of the site (OEH 2012).	1	The species was previously thought to be extinct in Sydney, very limited occurrence, unlikely to occur.	✘
Vulnerable NSW	Mammalia	*Miniopterus schreibersii*	Common (Eastern) Bent-wing Bat	The species has been recorded along the north coast of Australia from Qld to Vic and parts of northern WA and NT. Having been recorded in a variety of habitats it is typically found in well-timbered valleys. It roosts during the daylight hours in caves and has been recorded roosting in large storm water pipes. They fly quickly above tree tops in valleys, making fast dives to catch prey which are insects, mostly moths.	14	Core refuge and breeding habitat not present.	✘
Vulnerable NSW	Mammalia	*Mormopterus norfolkensis*	Eastern Freetail Bat	Has a range along the eastern coastal strip Australia extending from southern Queensland to southern NSW. Has been recorded roosting in tree hollows and feeds on flying insects. They forage above the tree canopy in forests or along the edges of forests. (Australian Museum 1999), (Allison & Hoye 1995). The habitat preference of this species is unclear. It has been predominantly recorded in dry eucalypt forest and woodland, but has been recorded in moist and edge environments. The wing morphology indicates that this species is adapted to the more open habitats.	1	Some limited refuge habitat in the Riparian Area and Duffys Forest habitats on the site.	✔
Vulnerable NSW	Mammalia	*Cercartetus nanus*	Eastern Pigmy-possum	Is found in a range of habitats from rainforest, sclerophyll forests to sclerophyll tree heath and the species range extends from south eastern Qld to south eastern SA and Tasmania (Australian Museum 2000). It feeds primarily on nectar and pollen from banksias, eucalypts and callistemon. It is generally nocturnal and whilst preferring to nest in small tree hollows it has been found in small constructed nests of shredded bark. It appears to be solitary with males having a range of about 0.68 ha and females having a range of 0.35 ha (Australian Museum 2000, Turner & Ward 2000).	29	Very limited foraging habitat present and limited refuge habitat in the Duffys Forest habitats unlikely to occur.	✘

Conservation Status	Class	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✘ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Vulnerable NSW	Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	The species occurs along the Australian east coast from the New South Wales / Victorian border to Cairns. It is found in a variety of habitats but its slow and direct flight favors habitats such as open woodlands, cleared lands and open creek corridors. It usually flies at a height of 3-6m and feeds off large slow flying insects such as beetles. It is thought that it may also prey on other bats. The species roosts in tree hollows and females congregate in suitable trees to give birth (Hoye & Richards ex Australian Museum 2000).	2	Not considered to be core breeding habitat however some limited refuge habitat in the Riparian Area and Duffys Forest habitats on the site.	✔
Vulnerable NSW, Cwth	Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	The species has 2 permanent maternal colonies in Sydney at Gordon and at Cabramatta. Other temporary colonies exist at the Botanical Gardens. The species predominately feeds on nectar and when blossoms are unavailable it feeds on fruit.	18	Not considered to be core breeding or refuge habitat low foraging potential, unlikely to occur	✘
Vulnerable NSW	Mammalia	*Phascolarctos cinereus*	Koala	The population occurs between Ingleside and Elanora heights to Palm Beach on the Barrenjoey Peninsula. Koalas feed on foliage from the genera Eucalyptus, Corymbia and Angophora. They appear to have a preference for feeding in *Eucalyptus punctata* (Grey Gum), however other species such as *E. haemastoma* (Scribbly Gum), E. robusta (Swamp Mahogany) and non endemic species such as E. nicholii (Narrow-leaved Black Peppermint). Other species that appear to be under-exploited include *Corymbia maculata* (Spotted Gum), *Corymbia gummifera* (Red Bloodwood) and to a lesser degree other species. (Smith & Smith 2001).	33	Not considered to be core breeding or refuge habitat low foraging potential, unlikely to occur.	✘
Vulnerable NSW	Mammalia	*Miniopterus australis*	Little Bentwing-bat	The distribution of the species is primarily along the eastern coast of Australia extending from Cape York to Taree in NSW. Incidental records have been recently in the Sydney and Hunter Region. There is some evidence that pregnant females from the Central Coast and Lower Hunter district migrate north every winter (Williams R. pers com.) The nearest known breeding colony is Willi Willi Caves near Kempsey. It appears that the southern most breeding population seem to depend upon the larger nursery colony of *Miniopterus schreibersii* (Eastern Bentwing-bat) to produce higher ambient temperatures to rear its young (Australian Museum 2000). The species roosts in caves or tunnels and feeds on insects flying beneath the tree canopy.	4	Not considered to be core breeding or refuge habitat low foraging potential, unlikely to occur.	✘

Conservation Status	Class	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Protected NSW, Vulnerable Cwlth	Mammalia	*Pseudomys novaehollandiae*	New Holland Mouse	The species is known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes and is a social animal, living predominantly in burrows shared with other individuals (Kemper, 1980; Lazenby et al., 2008). The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha (Lazenby et al., 2008) and populations appear to peak during early to mid stages of vegetation succession typically after fires (Fox and Mckay, 1981). The species is typically restricted to larger bushland areas in national parks.	4	Not considered to be core breeding or refuge habitat low foraging potential, unlikely to occur.	✗
Endangered NSW, Cwlth	Mammalia	*Isoodon obesulus obesulus*	Southern Brown Bandicoot	The species has a patchy distribution along the southeast coast in NSW and reaches its most northern limit at the Hawkesbury River and has been recorded in the larger tracts of bushland in Ku-ring-gai Chase, Garigal National Parks and in Nadgee Nature Reserve. This species prefers sandy soil with scrubby vegetation and /or areas of low ground cover that is periodically burnt (Braithwait 1995). The species displays a preference for regenerating sites following disturbance (OEH, 2006) The species is known to feed on ants, beetle larvae and plant material and some fungal species and whilst recorded in Ku-ring-gai Chase and Garigal National Parks, the species is not known to occur in small patches of bushland (Atkins, 1998)	94	Not considered to be preferred habitat, unlikely to occur in fragmented habitats.	✗
Vulnerable NSW	Mammalia	*Myotis macropus*	Southern Myotis	Has a range extending along the coastal areas of Australia from Victoria through NSW and Qld to NT and northern WA. The species is roosts in caves or overhangs never far from water bodies such as lakes streams and reservoirs. Their main diet is aquatic insects and is also is known to feed of flying insects (Richards 1995).	1	Not considered to be core breeding or refuge habitat low foraging potential, unlikely to occur.	✗
Vulnerable NSW, Endangered Cwth	Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	Found in a range of habitats and generally prey on medium size mammals and birds such as possums, small wallabies, rats, birds, domestic fowl, bandicoots, rabbits and also feed on insects and carrion. It is estimated that the range of the species is in the order of 750 ha (females) – 3500ha (males) using hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	2	Not considered to be core breeding or refuge habitat low foraging potential, unlikely to occur	✗

Conservation Status	Class	Genus species	Common Name	Habitat Requirements	No. of records within 10km grid search centred on the site (OEH, 2012)	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*							
Vulnerable NSW, Cwth	Reptilia	*Chelonia mydas*	Green Turtle	Green Turtles are found in tropical and subtropical waters throughout the world (Marquez 1990; Bowen et al. 1992) but normally remain within the northern and southern limits of the 20°C isotherms (Marquez 1990) although individuals have been known to stray into temperate waters (Cogger et al. 1993). There are 4 major breeding units are recognised in Australia and include the southern Great Barrier Reef, northern Great Barrier Reef, Wellesley Island in the Gulf of Carpentaria and the North West Shelf in Western Austalia. Although carnivorous when young (Cogger 2000), Green Turtles are primarily herbivorous, with a major diet of seagrass and algae (Read 1991; (Brand-Gardner et al. Cogger 2000). They also feed on a variety of other items including mangrove (Limpus & Limpus 2000), fish eggcases, jellyfish (Limpus et al. 1994).	1	Habitat not present	✗
Endangered NSW, Cwlth	Reptilia	*Dermochelys coriacea*	Leatherback Turtle	Leatherback Turtles are pelagic feeders, found in tropical, subtropical and temperate waters throughout the world (Marquez 1990). No major nesting has been recorded in Australia, although scattered isolated nesting occurs in southern Queensland and the Northern Territory. Some nesting has occurred in northern NSW near Ballina. However, no nesting has occurred in Queensland or NSW since 1996. The species has been reported from coastal waters from the Sunshine Coast in southern Queensland to central NSW; from Tasmania, Victoria and eastern South Australia and in south-western Western Australia. (SEWPC 2012).	2	Habitat not present	✗
Vulnerable NSW	Reptilia	*Varanus rosenbergi*	Rosenberg's Goanna /Heath Monitor	The species is typically found in woodland and heathland on sandy soils associated with ridge top plateaus (Smith & Smith 2000). It is diurnal scavenger and shelters in burrows logs and rock crevices (Cogger 2000). It breeds in spring and summer and lays eggs in termite mounds that are important habitat features. It feeds on a range of species, including invertebrates, small lizards, snakes and bird eggs. The species can be confused with the more common *Varanus varius* (Lace Monitor) which is more commonly occurs in gully forests.	50	Not considered to be core breeding habitat or preferred foraging habitat, unlikely to occur.	✗

7.4 Threatened ecological community habitat assessment

Conservation Status	Ecological Community	Habitat	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant habitat for the species, ✔ Potentially affected species requiring consideration and therefore likely to require assessment under s.5a of *Environmental Planning and Assessment Act 1979 (NSW)*				
Endangered, NSW	Duffy's Forest	The forest occurs on lateritic soils and deeply weathered shale soils typically found on lower ridges in Ku-ring-gai. Characteristic tree species include *Eucalyptus capitellata*, *Eucalyptus sieberi, Eucalyptus oblonga*, and *Angophora costata*. (NSW Scientific Committee 2002),	Habitat present along part of the Booralie Road frontage on the site.	✔
Endangered NSW	Swamp Sclerophyll Forest on Coastal Floodplains	The forest complex is found on the Cockle Bay, Tacoma Swamp and Warriewood Soil Landscapes and the vegetation structure ranges from forest to scrub to reedland and includes open-forest. Characteristic species include *Eucalyptus robusta, Eucalyptus botryoides, Livistona australis, Melaleuca linariifolia, Melaleuca styphelioides, Melaleuca ericifolia* and in some cases *Phragmites australis*.	Habitat not present	✗
Endangered NSW	Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions	The Forest Littoral Rainforest generally is a closed forest, the structure and composition of which is strongly influenced by proximity to the ocean. The plant species in this ecological community are predominantly rainforest species with evergreen mesic or coriaceous leaves. Several species have compound leaves, and vines may be a major component of the canopy. The community comprises the *Cupaniopsis anacardioides - Acmena spp*. alliance of Floyd (1990) which includes five sub-alliances which include *Syzygium leuhmannii, Acmena smithii, Ficus sp, Livistona sp, & Podocarpus sp*. (NSW Scientific Committee 2004).	Habitat not present	✗

8. threatened species assessment

8.1 Section 5a EP&A Act, 1979 (NSW) assessment

Assessment of Significance have been carried out (refer Appendix A) of this report addressing the threatened species, communities and populations identified as having some relationship to the site. Each assessment addresses the 7 points of consideration identified in section 5A of the *Environmental Planning and Assessment Act 1979 (NSW)*and is referred to as an Assessment of Significance.

The Assessment of Significance is not a "pass or fail" test and the purpose of the assessment is to allow proponents to undertake a qualitative assessment analysis of the likely impacts and whether further detailed assessment is necessary in the form of a Species Impact Statement (OEH 2007).

The Threatened Species Assessment Guidelines - The Assessment of Significance (OEH, 2007) outline that mitigating, ameliorative or compensatory measures proposed as part of the development should not normally be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been proven successful for that species in a similar situation. Where complex mitigating, ameliorative or compensatory measures are required, such as translocation, bush restoration, purchase of land, further assessment through the Species Impact Statement process is likely to be required.

8.2 EPBC Act, 1979 (Commonwealth) assessment

Part 13 Division 1 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* (EPBC) lists flora, fauna and ecological communities that are considered to be "matters of national environmental significance". Under the Act consideration must be given as to whether the proposed actions will, or is likely to have a "significant impact" on "matters of national environmental significance".

To minimise duplication in the environmental assessment procedures, a bilateral agreement was made in January 2007 between the Commonwealth & NSW Governments giving accreditation of New South Wales assessment processes in relation to threatened species, populations and ecological communities.

The agreement provides for "Controlled actions" as defined in the *Environment Protection & Biodiversity Act 1999 (Cwlth)* relating to threatened species, to no longer require assessment under Part 8 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* where they are assessed under Part 3A, 4 or 5 of the *Environmental Planning and Assessment Act 1979 (NSW)*.

Notwithstanding the above, the significant impact criteria in the Matters of National Environmental Significance Significant Impact Guidelines (SEWPC, 2009) typically need to be addresses in relation to matters of national environmental significance

8.3 Findings of Section 5a EP&A Act, 1979 (NSW) assessments

Through field surveys, habitat assessments and literature/database searches a number of the threatened species, populations and communities listed in the *Threatened Species Conservation Act (NSW)* have been identified as having some habitat relationships with the habitats on site. These being;

- Caley's Grevillea (*Grevillea caleyi*);
- Barking Owl (*Ninox connivens*);
- Masked Owl (Tyto novaehollandiae);
- Powerful Owl (*Ninox strenua*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*), and
- Duffy's Forest Ecological Community.

These species, populations and ecological communities have been considered in context with the Assessment of Significance outlined in section 5A of the *Environmental Planning and Assessment Act 1979 (NSW)* (refer Appendix A) Based upon these assessment the proposed development is unlikely to have a significant impact on threatened species and populations listed in the *Threatened Species Conservation Act (NSW)*.

8.4 Findings of EPBC Act, 1999 (Cwlth) assessments

Through field surveys, habitat assessments and literature/database searches 1 endangered species listed in the *Environmental Protection Biodiversity Conservation Act (Cwlth) 1999* has been identified as having some habitat relationships with the habitats on site. These being;

- Caley's Grevillea (*Grevillea caleyi*);

This species has been considered in context with the Significance Significant Impact Guidelines (SEWPC, 2009) (refer Appendix B). Based upon this assessment the proposed development is unlikely to have a significant impact on threatened species listed in the *Environmental Protection Biodiversity Conservation Act (Cwlth) 1999*.

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appendix A –assessment of significance, (*EP&A Act 1979, NSW)*

Background & definitions

The habitat assessments and the following impact assessments made in this report have focused on identifying the relationship of threatened species, populations and communities to the habitats on the site as well as determining the suitability of these to support resident populations of threatened species.

Definitions for the terms “Composition”, “Extent”, “Habitat”, “Life cycle”, ”Local occurrence”, “Local population”, “Risk of extinction”, “Study area”, “Subject site”, “Viable”, used in this assessment are consistent with the Threatened Species Assessment Guidelines (OEH 2007) being:

- “Composition” refers to both the assemblage of flora and fauna species, and the physical structure of the ecological community;
- “Extent” refers to the physical area removed and/or to the compositional components of the habitat and the degree to which each is affected;
- “Habitat” is the area occupied or periodically or occasionally occupied, by any threatened species, population or ecological community and includes all the different aspects (both biotic and abiotic) used by the different stages of their life cycles;
- “Life cycle” is the series or stages of reproduction, growth, development, aging and death of an organism;
- ”Local occurrence” is the community that occurs within the study area;
- “Local population” is the local population that occurs in the study area. In cases where multiple populations occur in the study area, each population should be assessed separately.
- “Risk of extinction” is the likelihood that the local population will become extinct either in the short- term or in the long term as a result of direct or indirect impacts on the viability of that population.
- “Study area” means the subject site and any other areas which are likely to be affected by the proposal, either directly or indirectly.
- “Subject site” means the area directly affected by the proposal.
- “Viable”, is the capacity to successfully complete each stage of the life cycle under normal conditions.

Species – *Caley's Grevillea (Grevillea caleyi)*

(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 viable local population of the species is likely to be placed at risk of extinction. "
Caley's Grevillea (*Grevillea caleyi*) a spreading shrub and its distribution is restricted to the northern Sydney suburbs of Belrose, Terrey Hills, Duffys Forest and Ingleside. The species typically occurs within the Duffys Forest ecological community found on ridge tops with iron-rich laterite soils.

There are 4 *Grevillea caleyi* plants on and adjacent the subject site. The species is known to regenerate after fires from seed stored in the soil and the numbers of plants is not considered to be a good guide in estimating the significance of sites. A more accurate estimation of the area occupied by *Grevillea caleyi* is the areas of habitat (OEH, 2004).

The area of habitat of the Duffys Forest community and the habitat of the *Grevillea caleyi* is mapped as occurring in parts of the Booralie Road Woodland (refer Figure 5.1) and a small area in the Laitoki Road reserve.

The species predominately flowers in winter and spring but may produce flowers sporadically throughout the year. The flowers of *Grevillea caleyi* are pollinated by nectivorous birds and the species may be self-compatible (OEH, 2004). The percentage of flowers producing viable seed is considered to be less than 5% (OEH, 2004). Seed dispersal is limited with and typically falls to the ground directly below the parent plant. Seed predation on the ground is high, typically by Bush Rats and Swamp Wallabies and the replenishment of the seed bank may be severely limited.

Some seeds may germinate in the absence of fire however in habitats with thick leaf litter and ground covers there have been no successful seedlings observed (OEH 2004). After fires the seeds stored in the soil readily germinate and above ground plants are killed by fire. For sustaining populations the inter-fire period is critical and it is recommended that that minimum period of 8-12 years is optimal. Adult plants senesce from about 12-15 years and the threats to the species include weed invasion.

The *Grevillea caleyi* habitats on the site are proposed to be retained in conjunction with the development however currently there does not appear to be any active management of the *Grevillea caleyi* habitats. Without active management of the *Grevillea caleyi* habitats, the habitats are likely to further degrade.

Taking into account the nature and scope of the proposed development (refer section 6); it is unlikely that the development will further adversely effect the lifecycle of the species in this location.

(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 viable local population of the species is likely to be placed at risk of extinction. "
Endangered populations are listed in Schedule 1 Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

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

Endangered ecological communities are listed in Schedule 1 Part 3 of the Threatened Species Conservation Act 1995 and critically endangered ecological communities are listed in Schedule 1a Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

(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 and,

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

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

The proposed development would not remove or modify the habitats of *Grevillea caleyi* on and adjacent the site.

Currently the Booralie Road Woodland and Laitoki Road habitats are isolated from other known habitats such as those on Mona Vale Road. The removal of predominately weed vegetation within the Laitoki Road reserve may slightly increase the isolation of the single *Grevillea caleyi* plant in the Laitoki Road reserve.

Whilst the Laitoki Road *Grevillea caleyi* habitats are to be retained, the long term survival of the species is questionable when considering the current level of management.

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

The area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995. There is no critical habitat within the site or in close proximity to the proposed development.

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

Recovery plans are prepared under the provisions of Part 4, Division 1 of the Threatened Species Conservation Act 1995.

The *Grevillea caleyi* Recovery Plan (DEC, 2004) has been prepared and there are published reviews of the plan since 2004. The *Grevillea caleyi* habitats on and adjacent the subject site are referred to in the Recovery Plan as Site No. 23.

The site specific management action in the Recovery Plan for Site 23 is "*weed management is needed in remnant bushland*".

The proposed development and the Grevillea caleyi & Duffys Forest Management Plan (Footprint Green, 2013b) is consistent with the objectives of the *Grevillea caleyi* Recovery Plan (DEC, 2004)

Threat Abatement Plans are prepared under the provisions of Part 5, Division 1 of the Threatened Species Conservation Act 1995 for Key Threatening processes.

(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."
Currently there are 36 Key Threatening Processes listed in the Threatened Species Conservation Act 1995. Key Threatening Processes relevant for the species include:

- Clearing of Native Vegetation

Although the Clearing of Native Vegetation is listed as a threatening process, it is considered that the proposed development will not increase these threats in relation to this species in these circumstances.

Summary: Species - *Caley's Grevillea (*Grevillea caleyi*)*
The species occurs on and adjacent the site. The habitats of the *Grevillea caleyi* are to be retained and protected and rehabilitated, therefore the proposed development is unlikely to have a significant impact on the species.

Species - *Ninox connivens* (Barking Owl)

(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 viable local population of the species is likely to be placed at risk of extinction. "
The Barking Owl (*Ninox connivens*) breeds in late winter / spring and nest in hollows, typically in live Eucalypts, 20-35 m above ground. Hollow entrances of 20-46 cm in diameter and hollow depths of 200-300cm are typically used by the species.

Barking Owl (*Ninox connivens*) typically roost in or under dense foliage in large trees including rainforest species of streamside gallery forests often near watercourses or wetlands (OEH, 2003)

The species occupies traditional permanent territories, and forage opportunistically for terrestrial, arboreal and aerial prey between dusk and dawn and occasionally in daylight (Higgins 1999). The species prey on a variety of birds, mammals and large insects including common native and introduced birds such as rosellas and starlings (Kavanagh 1995) (Debus 1997), (Debus et al. 1998, 1999) (Higgins,1999). During the late spring and summer months, post breeding, the diet of the species includes many insects. Vertebrates seem to be important in its diet during winter and breeding seasons.

The species was not recorded on the site during field surveys and the site is not considered to be core breeding habitat. The site may provide some limited foraging opportunities and marginal roosting habitat in the Riparian Forest.

Taking into account the nature and scope of the proposed development (refer section 6), and the foraging range of the species, it is unlikely that a viable local population of the species is to be placed at risk of extinction.

(b) " in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction. "
Endangered populations are listed in Schedule 1 Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

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

Endangered ecological communities are listed in Schedule 1 Part 3 of the Threatened Species Conservation Act 1995 and critically endangered ecological communities are listed in Schedule 1a Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

(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 and,

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

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

The site is not considered to be core roosting or breeding habitat but may provide some seasonal foraging potential and marginal roosting habitat in the Riparian Forest. The extent of habitats to be removed or modified as a result of the development are summarised in section 6 of this report.

Taking into account the mobility of the species and their foraging range, the proposed development would not isolate foraging habitat of the species and the habitats to be removed are not considered to be significant to the long term survival of the species in this locality.

(e) " whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly."
The area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995. There is no critical habitat within the site or in close proximity to the proposed development.

(f) " whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan".
The draft Recovery Plan for Barking Owl (*Ninox connivens*) (OEH, 2003) has been prepared and although the site is not considered to be core breeding habitat, the proposed development is not inconsistent with the objectives and actions of the recovery plan.

(g) " whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process."
Currently there are 36 Key Threatening Processes listed in the Threatened Species Conservation Act 1995. Key Threatening Processes relevant for the species include:

- Clearing of Native Vegetation
- Loss of Hollow-bearing Trees

Whilst the Clearing of Native Vegetation is listed as a key threatening process, based upon the nature and scope of the proposed development (refer section 6) the proposed development will not significantly increase threatening processes in relation to this species.

Whilst some larger dead trees within the Riparian Forest are proposed to be removed the species was not recorded on the site and proposed development is unlikely to directly contribute to the Loss of Hollow-bearing Trees in relation to this species.

Summary Species – Barking Owl (*Ninox connivens*)

Based upon the nature and scope of the proposed development (refer section 6) and this assessment, it is considered that the proposed development is unlikely to have a significant impact on the species – Barking Owl (*Ninox connivens*).

Species - Masked Owl (*Tyto novaehollandiae*)

(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 viable local population of the species is likely to be placed at risk of extinction. "
Masked Owl (*Tyto novaehollandiae*) lives in eucalypt forests and woodlands from the coast, where it is most abundant, to the western plains (Kavanagh 2002).

The species has been recorded nesting in hollows in both dead and live Eucalypts with hollows being at least 400mm wide and 1m deep. Hollow entrances are at least 3 m above ground, in trees of at least 900mm diameter at breast height (OEH, 2006). The species typically uses the same hollow for breeding but may use alternate hollows within its range.

During the day the species roosts in hollows in live or occasionally dead eucalypts; dense foliage in gullies; and caves or recesses in cliffs (OEH, 2006).

Masked Owl (*Tyto novaehollandiae*) preys on ground dwelling mammals in particular native and introduced rodents, rabbits, bandicoots, arboreal mammals and some cases bird species. Their range is estimated to be between 400-1,000ha depending upon the productivity of the habitats.

The species was not recorded on the site during field surveys and the site is not considered to be core breeding habitat. The site may provide some limited foraging opportunities and marginal roosting habitat in the Riparian Forest.

Taking into account the nature and scope of the proposed development (refer section 6), and the foraging range of the species, it is unlikely that a viable local population of the species is to be placed at risk of extinction.

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

Endangered populations are listed in Schedule 1 Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

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

Endangered ecological communities are listed in Schedule 1 Part 3 of the Threatened Species Conservation Act 1995 and critically endangered ecological communities are listed in Schedule 1a Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

(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 and,

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

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

The site is not considered to be core roosting or breeding habitat but may provide some seasonal foraging potential and marginal roosting habitat in the Riparian Forest. The extent of habitats to be removed or modified as a result of the development are summarised in section 6 of this report.

Taking into account the mobility of the species and their foraging range, the proposed development would not isolate foraging habitat of the species and the habitats to be removed are not considered to be significant to the long term survival of the species in this locality.

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

The area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995. There is no critical habitat within the site or in close proximity to the proposed development.

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

The Recovery Plan for Large Forest Owls (OEH, 2006) has been prepared and although the site is not considered to be core breeding habitat, the proposed development is not inconsistent with the objectives and actions of the recovery plan.

Threat Abatement Plans are prepared under the provisions of Part 5, Division 1 of the Threatened Species Conservation Act 1995 for Key Threatening processes.

(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."
Currently there are 36 Key Threatening Processes listed in the Threatened Species Conservation Act 1995. Key Threatening Processes relevant for the species include:

- Clearing of Native Vegetation
- Loss of Hollow-bearing Trees

Whilst the Clearing of Native Vegetation is listed as a key threatening process, based upon the nature and scope of the proposed development (refer section 6) the proposed development will not significantly increase threatening processes in relation to this species.

Whilst some larger dead trees within the Riparian Forest are proposed to be removed the species was not recorded on the site and proposed development is unlikely to directly contribute to the Loss of Hollow-bearing Trees in relation to this species.

Summary Species – Masked Owl (*Tyto novaehollandiae*)

Based upon the nature and scope of the proposed development (refer section 6) and this assessment, it is considered that the proposed development is unlikely to have a significant impact on the species – Masked Owl (*Tyto novaehollandiae*).

Species - *Ninox strenua* (Powerful Owl)

(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 viable local population of the species is likely to be placed at risk of extinction. "
The Powerful Owl (*Ninox strenua*) breeds in late autumn / mid winter and nest in large hollows in Eucalypts with trunk diameters of at least 0.8-2.4m. Male owls are known to roost within trees within 100-200m of the nest tree during the breeding season. *Ninox strenua* has a foraging range of 400 -1500ha (Davey 1993) and feed on medium sized mammals such as gliders, possums, flying-foxes and rabbits.

The species was not recorded on the site during field surveys and the site is not considered to be core breeding habitat. The site may provide some limited foraging opportunities and marginal roosting habitat in the gully area that is proposed to be retained.

The species is highly mobile and forages over a wide area. The vegetation being retained will provide some limited habitat for its prey such as Common Ringtail Possum (*Pseudocheirus peregrinus)*, Pied Currawongs (*Strepera graculina*) and Rainbow Lorikeet (*Trichoglossus haematodus)*.

The species was not recorded on the site during field surveys and the site is not considered to be core breeding habitat. The site may provide some limited foraging opportunities and marginal roosting habitat in the Riparian Forest.

Taking into account the nature and scope of the proposed development (refer section 6), and the foraging range of the species, it is unlikely that a viable local population of the species is to be placed at risk of extinction.

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

Endangered populations are listed in Schedule 1 Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

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

Endangered ecological communities are listed in Schedule 1 Part 3 of the Threatened Species Conservation Act 1995 and critically endangered ecological communities are listed in Schedule 1a Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

(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 and,

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

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

The site is not considered to be core roosting or breeding habitat but may provide some seasonal foraging potential and marginal roosting habitat in the Riparian Forest. The extent of habitats to be removed or modified as a result of the development are summarised in section 6 of this report.

Taking into account the mobility of the species and their foraging range, the proposed development will not isolate foraging habitat of the species and the habitats to be removed are not considered to be significant to the long term survival of the species in this locality.

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

The area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995. There is no critical habitat within the site or in close proximity to the proposed development.

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

The Recovery Plan for Large Forest Owls (OEH, 2006) has been prepared and although the site is not considered to be core breeding habitat, the proposed

development is not inconsistent with the objectives and actions of the recovery plan.

Threat Abatement Plans are prepared under the provisions of Part 5, Division 1 of the Threatened Species Conservation Act 1995 for Key Threatening processes.

(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."
Currently there are 36 Key Threatening Processes listed in the Threatened Species Conservation Act 1995. Key Threatening Processes relevant for the species include:

- Clearing of Native Vegetation
- Loss of Hollow-bearing Trees

Whilst the Clearing of Native Vegetation is listed as a key threatening process, based upon the nature and scope of the proposed development (refer section 6) the proposed development will not significantly increase threatening processes in relation to this species.

Whilst some larger dead trees within the Riparian Forest are proposed to be removed the species was not recorded on the site and proposed development is unlikely to directly contribute to the Loss of Hollow-bearing Trees in relation to this species.

Summary Species – Powerful Owl (*Ninox strenua*)

Based upon the nature and scope of the proposed development (refer section 6) and this assessment, it is considered that the proposed development is unlikely to have a significant impact on the species – Powerful Owl (*Ninox strenua*).

Species – Eastern Freetail-bat (*Mormopterus norfolkensis*)

(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 viable local population of the species is likely to be placed at risk of extinction. "
The East Coast Freetail-bat (*Mormopterus norfolkensis*) occurs east of the Great Dividing Range from south of Sydney to south eastern Queensland (Churchill, 1989).

East Coast Freetail-bat (*Mormopterus norfolkensis*) have generally been recorded as solitary animals (Allison & Hoye, 1995). There are 19 records of the species occurring in the Sydney area with: 2 record of the species occurring in Warringah, 1 record in Pittwater, 6 record in Ku-ring-gai and 4 in Hornsby (OEH 2013). East Coast Freetail-bats (*Mormopterus norfolkensis*) are also known to occur in maternal colonies in mangroves in the Hunter Estuary where they have been recorded in their hundreds (McConville, 2010).

East Coast Freetail-bat (*Mormopterus norfolkensis*) is known to occur in a variety of habitats including sclerophyll forest, woodland and mangroves. The species has a life span of approximately 5-7 years (Richards & Pennay, 2008).

The species has a greater forearm length than other Australian species of *Mormopterus* (Allison & Hoye 1995) and its morphology indicates that the species is a fast flyer adapted to foraging for insects in open areas. They are known to forage above the tops of forest trees, along the edges of forests, along tracks and trails and along more open riparian areas and have been recorded as regularly travelling up to 8km to forage (McConville, 2010).

The species roosts in tree hollows and or under the loose bark of trees and has been recorded roosting in the roof of a hut with several Gould's Wattle Bats (*Chalinolobus gouldii*) (Allison, & Hoye 1995) and the species was also found roosting in the roof of Picton Primary School again with a colony of Gould's Wattle Bats (*Chalinolobus gouldii*) (Robinson 1985). The species is also known to utilise artificial nest boxes.

The species was not recorded on the site and the site is not considered to be core breeding habitat however bark sheaths and tree hollows on trees on the site could provide diurnal roosting habitat.

Taking into account the nature and scope of the proposed development (refer section 6), and the foraging range of the species, it is unlikely that a viable local population of the species is to be placed at risk of extinction.

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

Endangered populations are listed in Schedule 1 Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

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

Endangered ecological communities are listed in Schedule 1 Part 3 of the Threatened Species Conservation Act 1995 and critically endangered ecological communities are listed in Schedule 1a Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

(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 and,

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

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

The site is not considered to be core breeding habitat but may provide some seasonal or temporary roosting habitat under tree bark sheaths and tree hollows and some foraging potential. The extent of habitats to be removed or modified as a result of the development are summarised in section 6 of this report.

Taking into account the mobility of the species and their foraging range, the proposed development would not isolate foraging habitat of the species and the suitable foraging and roosting habitat will remain on site and within the local area.

(e) " whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly."
The area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995. There is no critical habitat within the site or in close proximity to the proposed development.

(f) " whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan".
Recovery plans are prepared under the provisions of Part 4, Division 1 of the Threatened Species Conservation Act 1995. There is no recovery or draft recovery plan prepared for the species.

Threat Abatement Plans are prepared under the provisions of Part 5, Division 1 of the Threatened Species Conservation Act 1995 for Key Threatening processes.

(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."
Currently there are 36 Key Threatening Processes listed in the Threatened Species Conservation Act 1995. Key Threatening Processes relevant for the species include:

- Clearing of Native Vegetation
- Loss of Hollow-bearing Trees

Whilst the Clearing of Native Vegetation is listed as a key threatening process, based upon the nature and scope of the proposed development (refer section 5) the proposed development will not significantly increase threatening processes in relation to this species.

Whilst some dead trees within the Riparian Forest and Laitoki Road Woodland are proposed to be removed the species was not recorded on the site and proposed development is unlikely to directly contribute to the Loss of Hollow-bearing Trees in relation to this species.

Summary Species – Eastern Freetail-bat (*Mormopterus norfolkensis*)

Based upon the nature and scope of the proposed development (refer section 6) and this assessment, it is considered that the proposed development is unlikely to have a significant impact on the species – Eastern Freetail-bat (*Mormopterus norfolkensis*).

Species – Greater Broad-nosed Bat (*Scoteanax rueppellii*)

(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 viable local population of the species is likely to be placed at risk of extinction. "

The Greater Broad-nosed Bat (*Scoteanax rueppellii)* occurs east of the Great Dividing Range from north eastern Victoria to northern Queensland and although widespread the species distribution is sparse and patchy in coastal and near coastal eastern Australia.

The Greater Broad-nosed Bat (*Scoteanax rueppellii)* 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. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m. (OEH, 2005).

The Greater Broad-nosed Bat (*Scoteanax rueppellii)* is a powerful bat, up to 95mm long and has a direct flight pattern typically between 3-6m above ground. (Hoye & Richards, 1995) and the open nature of eucalypt forests and woodlands suit its direct flight path.

The species has been recorded roosting in tree hollows, cracks and fissures in the trunk and boughs of stags, and under exfoliating bark (SEWPC, 1999) and in roof spaces of old buildings (Hoye & Richards,1995). The species has also been recorded roosting in isolated patches of paddock trees (Law et al, 2000).

The species feeds primarily on beetles and other large flying insects and has been observed to kill and eat 8 other species of bats (Hoye & Richards, 1995). The females of the species are known to congregate at maternal sites and give birth in January. During this period the maternal colonies appear to exclude males during the birth and raising of the young.

The species was not recorded on the site and the site is not considered to be core breeding habitat however bark sheaths and tree hollows on trees on the site could provide diurnal roosting habitat.

Taking into account the nature and scope of the proposed development (refer section 6), and the foraging range of the species, it is unlikely that a viable local population of the species is to be placed at risk of extinction.

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

Endangered populations are listed in Schedule 1 Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

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

Endangered ecological communities are listed in Schedule 1 Part 3 of the Threatened Species Conservation Act 1995 and critically endangered ecological communities are listed in Schedule 1a Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

(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 and,

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

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

The site is not considered to be core breeding habitat but may provide some seasonal or temporary roosting habitat under tree bark sheaths and tree hollows and some foraging potential. The extent of habitats to be removed or modified as a result of the development are summarised in section 6 of this report.

Taking into account the mobility of the species and their foraging range, the proposed development would not isolate foraging habitat of the species and the suitable foraging and roosting habitat will remain on site and within the local area.

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

The area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995. There is no critical habitat within the site or in close proximity to the proposed development.

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

Recovery plans are prepared under the provisions of Part 4, Division 1 of the Threatened Species Conservation Act 1995. There is no recovery or draft recovery plan prepared for the species.

Threat Abatement Plans are prepared under the provisions of Part 5, Division 1 of the Threatened Species Conservation Act 1995 for Key Threatening processes.

(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."

Currently there are 36 Key Threatening Processes listed in the Threatened Species Conservation Act 1995. Key Threatening Processes relevant for the species include:

- Clearing of Native Vegetation
- Loss of Hollow-bearing Trees

Whilst the Clearing of Native Vegetation is listed as a key threatening process, based upon the nature and scope of the proposed development (refer section 5) the proposed development will not significantly increase threatening processes in relation to this species.

Whilst some dead trees within the Riparian Forest and Laitoki Road Woodland are proposed to be removed the species was not recorded on the site and proposed development is unlikely to directly contribute to the Loss of Hollow-bearing Trees in relation to this species.

Summary Species – Greater Broad-nosed Bat (*Scoteanax rueppellii*)
Based upon the nature and scope of the proposed development (refer section 6) and this assessment, it is considered that the proposed development is unlikely to have a significant impact on the species – Greater Broad-nosed Bat (*Scoteanax rueppellii)*.

8.5 Ecological Community – Duffys Forest

(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 viable local population of the species is likely to be placed at risk of extinction. "
Threatened species are listed in Schedule 1, Part 1 and Schedule 2 of the Threatened Species Conservation Act 1995. - Not applicable.

(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. "
Endangered populations are listed in Schedule 1 Part 2 of the Threatened Species Conservation Act 1995. - Not applicable.

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

Prior to European settlement, the Duffys Forest community is estimated to have covered an area of approximately 1,500 ha (Smith & Smith 2000). The current extent of the community is approximately 240ha, of which 117 ha (49%) is in National Parks and Wildlife Service reserves, 36 ha (15%) is in reserves managed by local councils or trusts, and 87ha (36%) is unreserved.

The majority of the community (87%) occurs in the Warringah Local Government Area and the community also remains in Pittwater, Ku-ring-gai and Hornsby Local Government areas.

The Duffys Forest ecological community exists within part of the Booralie Road Woodland on the site. Whilst some individual indigenous trees occur within the Laitoki Road reserve and the Riparian Forest, these habitats have been disturbed and modified and are no longer considered to be habitats of the community.

The Duffys Forest community is to be retained, protected and rehabilitated and taking into account the nature and scope of the proposed development (refer section 6), it is unlikely that the development will adversely effect or modify the extent of the ecological community.

(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 and,

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

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

The Duffys Forest community currently covers part of the Booralie Road Woodland. This area is to be retained, protected and rehabilitated.

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

The area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995. There is no critical habitat within the site or in close proximity to the proposed development.

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

Recovery plans are prepared under the provisions of Part 4, Division 1 of the Threatened Species Conservation Act 1995. There is no recovery or draft recovery plan prepared for the community.

(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."

Currently there are 36 Key Threatening Processes listed in the Threatened Species Conservation Act 1995. Key Threatening Processes relevant for the species include:

- Clearing of Native Vegetation

Whilst the Clearing of Native Vegetation is listed as a key threatening process, based upon the nature and scope of the proposed development (refer section 6) the proposed development will not significantly increase threatening processes in relation to this species ecological community. .

8.5.1 Summary: Duffys Forest ecological community

Based upon the nature and scope of the proposed development (refer section 6) and this assessment, it is considered that the proposed development is unlikely to have a significant impact on the endangered ecological community – Duffys Forest.

appendix B –assessment of significance, (EPBC *Act 1999, Cwlth)*

Background & definitions of the Commonwealth assessment process

Part 13 Division 1 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* (EPBC) lists flora, fauna and ecological communities that are considered to be "matters of national environmental significance". Under the Act consideration must be given as to whether the proposed actions will, or is likely to have a "significant impact" on "matters of national environmental significance".

To minimise duplication in the environmental assessment procedures, a bilateral agreement was made in January 2007 between the Commonwealth & NSW Governments giving accreditation of New South Wales assessment processes in relation to threatened species, populations and ecological communities.

The agreement provides for "Controlled Actions" as defined in the *Environment Protection & Biodiversity Act 1999 (Cwlth)* relating to threatened species, to no longer require assessment under Part 8 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* where they are assessed under Part 3A, 4 or 5 of the *Environmental Planning and Assessment Act 1979 (NSW)*.

Whilst the NSW assessment process, in particular Part 1 section 5A (2) of the *Environmental Planning and Assessment Act 1979 (NSW),* is acknowledged in the bilateral agreement to satisfies the requirements for assessments of "Controlled Actions" it is logical to assume that the NSW assessment process equally satisfies the assessment requirements for actions that are not considered to be controlled actions. Not withstanding this, the following assessments have been considered in accordance with the criteria in Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (SEWPC, 2009)

Definitions

Definitions for the terms "Habitat", "Important Population", "Population", used in this assessment are consistent with the Significant Impact Guidelines 1.1 (SEWPC, 2009) being:

"Habitat critical to the survival of a species or ecological community" refers to areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community such as pollinators);
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/ or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

"*Important Population*" in reference to Vulnerable Species is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or populations that are near the limit of the species range.

"Important Population" in reference to a Migratory Species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or habitat within an area where the species is declining.

"*Population*" in relation to Critically Endangered or Endangered Species refers to an occurrence of the species in a particular area. Occurrences include but are not limited to:

- a geographically distinct regional population or collection of local populations; or a population, or
- a collection of local populations, that occurs within a particular bioregion.

'*Population*', in relation to Migratory Species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.

Significant impact assessment based upon Significant Impact Guidelines

Based upon consideration of the site habitats and habitats of threatened species (refer section 7), the threatened species, populations and communities that are considered to have relevant habitat relationships with the site and are listed in the *Environment Protection & Biodiversity Act 1999 (Cwlth)* are;

- Caley's Grevillea (*Grevillea caleyi*).

Significant impact criteria in relation to *Grevillea caley*

Based upon the nature and scope of the proposed development (refer section 6) the proposed development will retain habitats of the species and will not:

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