Chapter 3

Initial Assessment

This chapter covers the following Director General's Requirements:

DGR 3. INITIAL ASSESSMENT

> *A general description of the threatened species or populations known or likely to be present in the area that is the subject of the action and in any area that is likely to be affected by the action (Section 110(2)(a)).*
>
> *A general description of the ecological community present in the area that is the subject of the action and in any area that is likely to be affected by the action (Section 110(3)(a)).*

3.1 Identifying Subject Threatened Species, Populations and Ecological Communities

DGR 3.1 Identifying subject threatened species, populations and ecological communities ('subject species')

DGR 3.1.1 Assessment of available information

3.1.1 Critically Endangered and Endangered Ecological Communities

Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community, as listed under the TSC Act, has been identified in the Study Area, and on the Subject Site, as per the Sydney Metro Mapping (OEH, 2013a).

Littoral Rainforest and Coastal Vine Thickets of Eastern Australia is listed as Critically Endangered Ecological Community under the EPBC Act, and parts of the vegetation mapped in the Study area and Subject Site complies with the listing.

A detailed description of the vegetation present in the Study Area is provided in Section 4.4.1, and shown in **Figure 4.2**.

3.1.2 Threatened species and populations

Threatened flora and fauna species recorded in the locality by the Atlas of NSW Wildlife (OEH, 2015a) have been mapped in relation to the Study Area, as shown in **Figure 3.1** and **Figure 3.2**.

Table 3.1 provides a complete list of the threatened flora and fauna, assessed for the likelihood of occurrence. The threatened species and populations considered as 'subject species' for this SIS include:

i. *Threatened species*

a. Flora

- *Syzygium paniculatum*

b. Fauna

- Eastern Pygmy Possum (*Cercartetus nanus*);
- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis);*
- Large-eared Pied Bat (*Chalinolobus dwyeri);*
- Greater Broad-nosed Bat (*Scoteanax rueppellii);*
- Superb Fruit-dove (*Ptilinopus superbus);*
- Barking Owl (*Ninox connivens*);
- Powerful Owl (*Ninox strenua*);
- Eastern Osprey (*Pandion cristatus*);
- White-bellied Sea Eagle (*Haliaeetus leucogaster*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*); and
- Spotted-tail Quoll (*Dasyurus maculatus)*

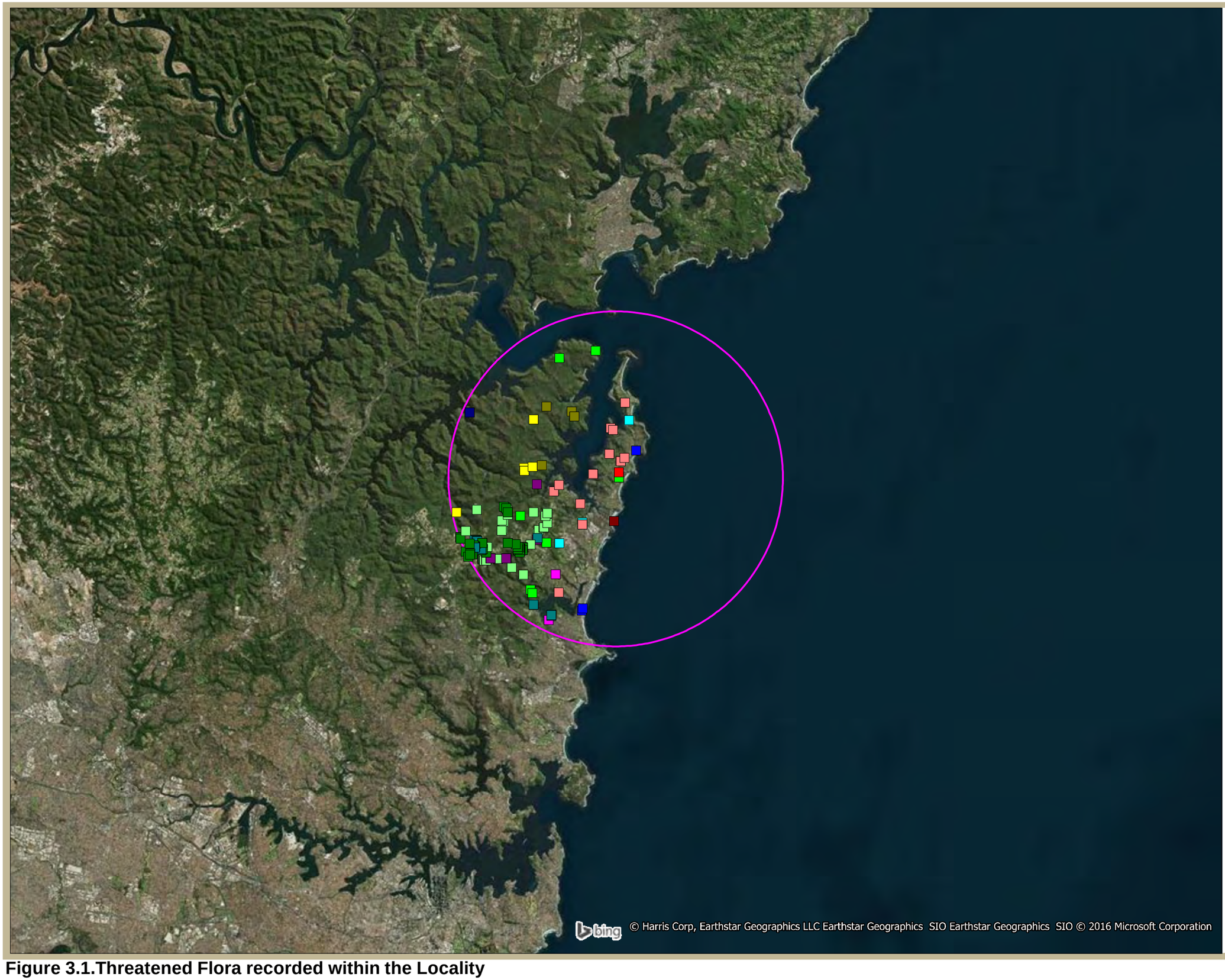
ii. *Threatened populations*

- Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill

iii. *Migratory species*

- Black-faced Monarch (*Monarcha melanopsis*);
- Spectacled Monarch (*Monarcha trivirgatus)*;
- Rainbow Bee-eater (*Merops ornatus);* and
- Rufous Fantail (*Rhipidura rufifrons)*

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject Site
- Locality (10km)

Threatened Flora

- *Asterolasia elegans*
- *Callistemon linearifolius*
- *Chamaesyce psammogeton*
- *Epacris purpurascens var. purpurascens*
- *Eucalyptus camfieldii*
- *Eucalyptus nicholii*
- *Genoplesium baueri*
- *Grevillea caleyi*
- *Kunzea rupestris*
- *Microtis angusii*
- *Persoonia hirsuta*
- *Pimelea curviflora var. curviflora*
- *Syzygium paniculatum*
- *Tetratheca glandulosa*

N
Grid North

Data Source:
BioNet Atlas of NSW Wildlife
© NSW Office of Environment and Heritage
dated 01/01/1980 -15/03/2016
Map Scale: 1:250,000.

cumberland ecology

2.5 0 2.5 5 7.5 10 km

I:\...115023\Figures\RP1_SIS\20160511\Figure 3.1. Threatened Flora Records_Locality

Figure 3.1.Threatened Flora recorded within the Locality

Coordinate System: MGA Zone 56 (GDA 94)

Grid North

Legend

Subject Site

Locality 10km

Threatened Fauna

- Australasian Bittern
- Australian Fur-seal
- Australian Painted Snipe
- Bar-tailed Godwit
- Barking Owl
- Black Bittern
- Black-browed Albatross
- Bush Stone-curlew
- Caspian Tern
- Cattle Egret
- Common Greenshank
- Common Noddy
- Dugong
- Eastern Bentwing-bat
- Eastern Curlew
- Eastern Freetail-bat
- Eastern Osprey
- Eastern Pygmy-possum
- Eastern Reef Egret
- Fork-tailed Swift
- Gang-gang Cockatoo
- Giant Burrowing Frog
- Gibson's Albatross
- Glossy Black-Cockatoo
- Greater Broad-nosed Bat
- Green and Golden Bell Frog
- Green Turtle
- Grey-headed Albatross
- Grey-headed Flying-fox
- Humpback Whale
- Koala
- Koala in the Pittwater Local Government Area
- Large-eared Pied Bat
- Lesser Frigatebird
- Little Bentwing-bat
- Little Eagle
- Little Lorikeet
- Loggerhead Turtle
- Masked Owl
- New Holland Mouse
- New Zealand Fur-seal
- Powerful Owl
- Red-crowned Toadlet
- Red-necked Stint
- Regent Honeyeater
- Rosenberg's Goanna
- Sharp-tailed Sandpiper
- Shy Albatross
- Sooty Oystercatcher
- Sooty Shearwater
- Sooty Tern
- Southern Brown Bandicoot (eastern)
- Southern Myotis
- Southern Right Whale
- Sperm Whale
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill
- Superb Fruit-Dove
- Swift Parrot
- Terek Sandpiper
- Turquoise Parrot
- Wandering Albatross
- Wedge-tailed Shearwater
- Whimbrel
- White-bellied Sea-Eagle
- White-throated Needletail
- Wompoo Fruit-Dove

Data Source:
BioNet Atlas of NSW Wildlife
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dated 01/01/1980 -05/11/2015
Map Scale: 1:250,000.

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I:\...\15023\Figures\RP1_SIS\20160511\Figure 3.2. Threatened Fauna recorded_Locality

Figure 3.2.Threatened Fauna recorded within the Locality

2.5 0 2.5 5 7.5 10 km

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Flora	Elaeocarpaceae	*Tetratheca glandulosa*		V,		12	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone. Occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Occurs in open woodland, woodland and open forest.	Unlikely to occur. No suitable habitat present.	No
Flora	Ericaceae	*Epacris purpurascens* var. *purpurascens*		V,		1	Found in a range of habitat types, most of which have a strong shale soil influence.	Unlikely to occur. No suitable habitat present.	No
Flora	Euphorbiaceae	*Chamaesyce psammogeton*	Sand Spurge	E1,		1	Found on the foredunes and headlands of the eastern coast from Jervis Bay to Queensland.	Unlikely to occur. No suitable habitat present.	No
Flora	Geraniaceae	*Pelargonium* sp. *Striatellum (G.W.Carr 10345)*	Omeo Stork's-bill	E1,	E	0	Found often above the high-water level of irregularly inundated or ephemeral lakes in the transition zone between surrounding grasslands or pasture and the wetland or aquatic	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
							communities.		
Flora	Haloragaceae	*Haloragodendron lucasii*		E1	E	0	Occurs in dry sclerophyll forest on moist sandy loam soils.	Unlikely to occur. No suitable habitat present.	No
Flora	Moraceae	*Streblus pendulinus*	Siah's Backbone		E	0	Grows in warm rainforest mainly along watercourses.	Unlikely to occur. No suitable habitat present.	No
Flora	Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V,3		2	Grows in dry sclerophyll forest on the coast and adjacent ranges.	Unlikely to occur. No suitable habitat present.	No
Flora	Myrtaceae	*Eucalyptus camfieldii*	Camfield's Stringybark	V,	V	5	Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges.	Unlikely to occur. No suitable habitat present.	No
Flora	Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V,	V	4	Occurs in dry, grassy woodland, on shallow and infertile soils, mainly on granite.	Unlikely to occur. No suitable habitat present.	No
Flora	Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	E1,	V	14	Occurs on gravels, sands, silts and clays in riverside gallery rainforest and	Potential to occur. Suitable habitat present.	Yes

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
							remnants of littoral rainforest.		
Flora	Myrtaceae	*Kunzea rupestris*		V,	V		Found in shrubland and heathland in shallow depressions on large flat sandstone rock outcrops.	Unlikely to occur. No suitable habitat present.	No
Flora	Myrtaceae	*Melaleuca biconvexa*	Biconvex Paperbark	V	V	0	Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Unlikely to occur. No suitable habitat present.	No
Flora	Myrtaceae	*Melaleuca deanei*	Deane's Melaleuca	V,	V	0	Often occurs in ridgetop woodland, with a small minority found in heath on sandstone.	Unlikely to occur. No suitable habitat present.	No
Flora	Orchidaceae	^^*Genoplesium baueri*	Bauer's Midge Orchid	E1,2	E	1	Found in dry sclerophyll forest and moss gardens over sandstone.	Unlikely to occur. No suitable habitat present.	No
Flora	Orchidaceae	^^*Microtis angusii*	Angus's Onion Orchid	E1,2	E	1	Known from one disturbed site at Ingleside on ridgetop lateritic soils that would have once supported the Duffys Forest EEC.	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Flora	Orchidaceae	*Caladenia tessellata*	Thick-lipped Spider-orchid	E1,2	V	0	Grows in grassy sclerophyll woodland on clay loam or sandy soils.	Unlikely to occur. No suitable habitat present.	No
Flora	Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue-orchid			0	Occurs in a variety of habitats including woodland and swamp-heath. Larger populations typically occur in *Eucalyptus sclerophylla*, *E. sieberi*, *Corymbia gummifera* and *Allocasuarina littoralis* dominated woodland.	Unlikely to occur. No suitable habitat present.	No
Flora	Proteaceae	*Grevillea caleyi*	Caley's Grevillea	E4A,3	E	22	Restricted to an 8 km square around Terrey Hills, occurring as far east as Ingleside. It is associated with ridgetop lateritic soils and the Duffys Forest EEC.	Unlikely to occur. No suitable habitat present.	No
Flora	Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E1,3	E	5	Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Unlikely to occur. No suitable habitat present.	No
Flora	Rutaceae	*Asterolasia*		E1,	E	1	Found on Hawkesbury	Unlikely to occur. No	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
		elegans					sandstone in sheltered forests on mid- to lower slopes and valleys.	suitable habitat present.	
Flora	Santalaceae	*Thesium australe*	Austral Toadflax	V,	V	0	Occurs in grassland or grassy woodland. Often found in damp sites in association with *Themeda australis* (Kangaroo Grass). A root parasite that takes water and some nutrient from other plants, especially *T. australis*.	Unlikely to occur. No suitable habitat present.	No
Flora	Thymelaeaceae	*Pimelea curviflora* var. *curviflora*		V,	V	1	Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	Unlikely to occur. No suitable habitat present.	No
Amphibia	Hylidae	*Litoria aurea*	Green and Golden Bell	E1	V	0	Permanent or ephemeral swamps, dams and slow	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
			Frog				flowing streams with emergent vegetation such as reeds, particularly those containing bulrushes (*Typha* spp.) and Spikerushes (*Eleocharis* spp.). Optimal habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and sheltering sites available. Can occur in highly disturbed areas. It inhabits a variety of forest types including coastal forest, open woodland and cleared areas.		
Amphibia	Hylidae	*Litoria littlejohni*	Littlejohn's Tree Frog	V	V	0	Occurs in heath based forests and woodlands. Breeding habitat occurs in upper reaches of permanent streams and in perched	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
							swamps.		
Amphibia	Myobatrachidae	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	10	Found in heath, woodland and open forest with sandy soils.	Unlikely to occur. No suitable habitat present. All records within Warriewood Escarpment and Ku-ring-gai Chase National Park.	No
Amphibia	Myobatrachidae	*Mixophyes balbus*	Stuttering Frog	E1,2	V	0	Permanent flowing rocky rivers and streams. It inhabits rainforest, wet sclerophyll forest and montane forests, it is rarely encountered far from a stream.	Unlikely to occur. No suitable habitat present.	No
Amphibia	Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V		20	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	Unlikely to occur. No suitable habitat present. Majority of records are within Ku-ring-gai Chase National Park, with outliers at Warriewood Escarpment and Church Point.	No
Reptilia	Elapidae	*Hoplocephalus bungaroides*	Broad-headed	E1,2	V	0	Found in sandstone habitats - during autumn, winter and	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
			Snake				spring shelters in rock crevices and under flat rocks on exposed cliff edges. In summer found in crevices/hollows in trees within 500 m of escarpments.		
Reptilia	Varanidae	*Varanus rosenbergi*	Rosenberg's Goanna	V		9	Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component.	Unlikely to occur. No suitable habitat present. All records are at least 3 km from Subject Site, with majority of records within Ku-ring-gai Chase National Park.	No
Aves	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle		C	0	Found in coastal habitats and around terrestrial wetlands in tropical and temperate regions. Often near large areas of open water.	Potential to occur. Roosting habitat present on the Subject Site, and foraging habitat nearby.	Yes
Aves	Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V		2	Occupies habitats rich in prey within open eucalypt forest, woodland, or open	Unlikely to occur. No suitable habitat present. The closest record is	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
							woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch.	approximately 3 km away, close to Ku-ring-gai Chase National Park.	
Aves	Accipitridae	*Pandion cristatus*	Eastern Osprey	V,3		6	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	Potential to occur. Found in coastal areas, and may pass through the Subject Site as part of its foraging range.	Yes
Aves	Apodidae	*Apus pacificus*	Fork-tailed Swift		C,J,K	0	Aerial species.	Potential to pass over the site but the Subject Site does not provide habitat.	No
Aves	Apodidae	*Hirundapus caudacutus*	White-throated Needletail		C,J,K	0	Aerial species.	Potential to pass over the site but the Subject Site does not provide habitat.	No
Aves	Ardeidae	*Ardea modesta*	Great Egret		M	0	Found in a range of wetland habitats including swamps, marshes, flooded grasslands, sewage treatment ponds and coastal lagoons.	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Aves	Ardeidae	*Ardea ibis*	Cattle Egret		C,J	0	Occurs in grasslands, woodlands and wetlands and also found in pastures and croplands.	Unlikely to occur. No suitable habitat present.	No
Aves	Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	E1	E	0	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes.	Unlikely to occur. No suitable habitat present.	No
Aves	Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E1		19	Occurs in woodlands and open forests with a sparse grassy ground layer and fallen timber.	Unlikely to occur. No suitable habitat present. Closest record is several hundred metres south-east of Subject Site from 2010. Records mostly located in Avalon.	No
Aves	Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V,3		1	Generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower	Possible. Marginal potential forage habitat available.	Yes

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
							altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas.		
Aves	Cacatuidae	^^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,2		27	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur.	Unlikely to occur. No suitable habitat present.	No
Aves	Columbidae	*Ptilinopus superbus*	Superb Fruit-Dove	V		1	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	Likely to occur. Suitable habitat present in the form of Littoral Rainforest. Forage and roost habitat available throughout the majority of the Subject Site.	Yes

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Aves	Dasyornithidae	*Dasyornis brachypterus*	Eastern Bristlebird	E	E	0	Inhabits dense, low vegetation in heath and open woodland. In northern NSW occurs in open forest with dense grass understorey and sparse mid-storey. Nests on or near ground in dense vegetation.	Unlikely to occur. No suitable habitat present.	No
Aves	Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher	V		2	Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries.	Unlikely to occur. No suitable habitat present. Latest record from 2011 at Mona Vale Beach and other record from 2006 in North Avalon.	No
Aves	Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	E4A	E	2	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak.	Unlikely to occur. No suitable habitat present. Records approximately 4 km south-west of the Subject Site, in Warriewood Wetlands and Terrey Hills.	No
Aves	Meropidae	*Merops ornatus*	Rainbow Bee-eater		M,J	0	Inhabits heathland, open forest and woodlands, shrublands and various	Potential to occur. Suitable habitat available.	Yes

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
							cleared, semi-cleared habitats, including farmland and areas of human habitation. Often occur in open, cleared or lightly-timbered areas located in close proximity to permanent water.		
Aves	Monarchidae	*Monarcha melanopsis*	Black-faced Monarch		M	0	Mainly occurs in rainforest ecosystems, including semi deciduous vine-thickets, dry (monsoon) rainforest and cool temperate rainforest.	Potential to occur. Suitable habitat available in the form of Littoral Rainforest.	Yes
Aves	Monarchidae	*Monarcha trivirgatus*	Spectacled Monarch		M	0	Inhabits subtropical or tropical moist lowland forests, subtropical or tropical mangrove forests, and subtropical or tropical moist montane forests.	Potential to occur. Suitable habitat available in the form of Littoral Rainforest.	Yes
Aves	Monarchidae	*Myiagra cyanoleuca*	Satin Flycatcher		M	0	Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
							migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.		
Aves	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V		0	Found in eucalypt forests and woodlands containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Unlikely to occur. No suitable habitat present.	No
Aves	Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V		3	Mostly occurs in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their ranges, and in remnant woodland patches and roadside vegetation. Isolated flowering trees in open country, e.g. paddocks, roadside	Unlikely to occur. No suitable habitat present. Closest record is approximately 300 m north of Subject Site but is from 1995.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
							remnants and urban trees are also used.		
Aves	Psittacidae	*Lathamus discolor*	Swift Parrot	E1,3	E	6	Occurs in woodlands and forests in NSW where it feeds on flowering trees. Breeds in Tasmania.	Unlikely to occur. No suitable habitat present. Closest record is at least 3km south-west of the Subject Site. Most records dated at 2009. Latest record from 2015 in Ku-ring-gai Chase National Park.	No
Aves	Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail		M	0	In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies usually with a dense shrubby understorey often including ferns.	Potential to occur. Suitable habitat available in the form of Littoral Rainforest.	Yes
Aves	Rostratulidae	*Rostratula australis*	Australian Painted Snipe	E	E	0	Inhabits fringes of shallow inland wetlands, swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Aves	Scolopacidae	*Gallinago hardwickii*	Latham's Snipe		C,J,K	0	Occurs in freshwater wetlands on or near the coast among dense cover.	Unlikely to occur. No suitable habitat present.	No
Aves	Strigidae	*Ninox connivens*	Barking Owl	V,3		9	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Dense vegetation is used occasionally for roosting.	Likely to occur. Foraging habitat present as part of a large home range. Potential roosting habitat occurs on Subject Site.	Yes
Aves	Strigidae	*Ninox strenua*	Powerful Owl	V,3		103	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	Known from the Study Area. Suitable foraging and roosting habitat.	Yes
Mammalia	Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	V		24	Broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred.	Potential to occur. Suitable foraging habitat available. Marginal roosting habitat present in the form of thickets of vegetation and Common Ringtail Possum dreys, although the species prefers to nest in tree	Yes

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
								hollows which are absent from the Subject Site.	
Mammalia	Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	4	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Potential to occur. The Subject Site may be part of a broad home range for individual animals passing through the area. Suitable prey species such as gliders and possums occur on the Subject Site. Marginal potential den sites present in the form of small caves. However, not recorded from the locality since 1998, near North Avalon.	Yes
Mammalia	Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E1	V	0	Occupies rock outcrops, escarpments and cliffs with features such as caves, fissures and ledges. Browses on adjacent vegetation. Has a home range of about 15 ha and shelters in caves.	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Mammalia	Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V		1	Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	Likely to occur. Highly mobile species which may utilise the site as part of a larger foraging area.	Yes
Mammalia	Muridae	*Pseudomys novaehollandiae*	New Holland Mouse		V	1	Occurs in open heathland, woodland and forest with heathland understorey and vegetated sand dunes.	Unlikely to occur. No suitable habitat present. Recent record from 2015 within Ku-ring-gai Chase National Park.	No
Mammalia	Peramelidae	*Isoodon obesulus obesulus*	Southern Brown Bandicoot (eastern)	E1	E	10	Generally only found in heath or open forest with a heathy understorey on sandy or friable soils.	Unlikely to occur. No suitable habitat present. All records within Ku-ring-gai Chase National Park.	No
Mammalia	Petauridae	*Petaurus norfolcensis*	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	E2,V,		1	Occurs in a range of habitats in NSW from low scrubby eucalypt woodland, banksia thickets, to tall wet eucalypt forest bordering on rainforest. Dens in tree hollows.	Potential to occur. Marginal suitable forage habitat available. No nesting habitat present as hollow-bearing trees are absent from the Subject Site. Records are very sparse in the locality	Yes

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
								are centred on Avalon to the north, with the last record in 2002.	
Mammalia	Phascolarctidae	*Phascolarctos cinereus*	Koala in the Pittwater Local Government Area	E2,V	V	7	Inhabit eucalypt woodlands and forests.	Unlikely to occur. No suitable habitat present. Closest record is approximately 850 m north-west of Subject Site from 1986. Records centred on Angophora reserve, approx 1 km to the north, with latest record from 2006.	No
Mammalia	Potoroidae	*Potorous tridactylus tridactylus*	Long-nosed Potoroo	V	V	0	Occurs in coastal heaths and dry or wet sclerophyll forests, with dense understorey.	Unlikely to occur. No suitable habitat present.	No
Mammalia	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	32	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Likely to occur. Suitable foraging habitat available. Species may feed on the fruits of rainforest trees and vines. No roost camps present on or adjacent to the Subject Site.	Yes

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Mammalia	Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	0	Found in well-timbered areas containing gullies. Roosts in caves, crevices in cliffs and old mine workings frequenting low to mid-elevation dry open forest and woodland close to these features.	Likely to occur. Highly mobile species which may utilise the site as part of a larger foraging area. Potential roosting habitat present in the form of small caves on the Subject Site, and coastal cliffs within the locality.	Yes
Mammalia	Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	V		6	Occurs in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.	Known to occur. Highly mobile species which utilise the site as part of a larger foraging area. Recorded during targeted surveys by Cumberland Ecology in June 2015.	Yes
Mammalia	Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V		12	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Known to occur. Highly mobile species which utilise the site as part of a larger foraging area. Recorded during targeted surveys by Cumberland Ecology in	Yes

Table 3.1 Threatened Flora and Fauna Recorded in the Locality and Assessment of the Likelihood of Occurrence

	Family	Scientific Name	Common Name	TSC Act	EPBC Act	10km Search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
								June 2015.	
Mammalia	Vespertilionidae	*Myotis macropus*	Southern Myotis	V		2	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools.	Unlikely to occur. No permanent waterbodies present on the Subject Site. Records from Warriewood Escarpment, latest from 2013.	No
Mammalia	Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V		1	Most commonly found in tall, wet forest but also occurs in woodland, dry forest and rainforest. Roosts in tree hollows.	Likely to occur. Highly mobile species which may utilise the site as part of a larger foraging area. No suitable roosting habitat present.	Yes

Chapter 4

Survey

This chapter covers the following Director General's Requirements:

DGR 4. SURVEY

4.1 Requirement to Survey

DGR 4.1 Requirement to survey

Cumberland Ecology undertook flora and fauna surveys, including targeted threatened species surveys within the Subject Site from March 2015 to June 2015. Additionally, previous studies conducted within the locality provided a useful database of information which has supplemented the surveys undertaken within the Study Area.

Flora and fauna surveys were conducted, where appropriate, in accordance with guidelines provided in the OEH (then DEC) Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft) (DEC (NSW), 2004a). Each of the methods utilised by Cumberland Ecology is described in detail in **Sections 4.2** and **Section 4.3** below.

4.2 Survey Techniques

DGR 4.2 Documentation

DGR 4.2.1 Description of survey techniques and survey locations

4.2.1 Vegetation Mapping

Broad scale vegetation mapping (Whelans Insites (Gunninah Environmental Consultants), 2007; OEH, 2013a) has been undertaken across the majority of the Study Area and surrounds, and this has been modified to reflect site specific data from the recent surveys by Cumberland Ecology, and also previous detailed survey of parts of Attunga Reserve (Whelans Insites (Gunninah Environmental Consultants), 2007). The vegetation within the Subject Site was ground-truthed by Cumberland Ecology in 2015. The resultant information was synthesized using Geographical Information Systems (GIS) to create a vegetation map of the Study Area (refer to **Figure 4.2**). Mapping was completed using MapInfo Version 11.

4.2.2 Flora Survey

The Subject Site was surveyed by botanist Bryan Furchert and ecologist Vanessa Orsborn on the 19th of March 2015 and Bryan Furchet and Alexander Pursche on the 15th of June 2015. Two (2) survey plots using the BioBanking Assessment Methodology (BBAM) (DECC 2009) were conducted, as shown in **Figure 4.1**, and the following data was collected:

- Ground-truthing of existing vegetation maps and establishment of boundaries of the extent of Littoral Rainforest on the Subject Site;
- Native species richness recorded within each stratum of a 20 m x 20 m plot;
- Native over-storey projected foliage cover recorded at 10 points along a 50 m transect;
- Native mid-storey projected foliage cover recorded at 10 points along a 50 m transect;
- Native groundcover projected foliage cover recorded at 10 points along a 50 m transect for three life forms (shrubs, grasses and other);
- Weed species projective foliage cover expressed as a percentage of over-storey, mid-storey and ground cover along a 50 m transect;
- Number of trees with hollows where entrance width is over 5 cm and hollow is at least 1 m above ground within the 20 m x 50 m plot;
- The percentage of regenerating canopy species within the vegetation zone; and
- The total length in metres of fallen logs over 10 cm in diameter within the 20 m x 50 m plot.

In addition native plant species richness within a 20 m x 20 m plot and full floristic data was also collected to enable classification of each vegetation zone to the best-fit NSW plant community type. The floristic data is presented in a combined flora list in **Appendix B**.

4.2.3 Fauna Survey

All surveys were based on requirements found in the *Draft Threatened Species Survey and Assessment Guidelines* (DEC (NSW), 2004b).

i. Habitat assessment

The nature and extent of fauna habitats on the Subject Site were assessed and areas where threatened fauna species could reside or forage were identified. Site assessments for threatened and native fauna included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bushrock, caves and crevices, manmade structures, riparian areas, wetlands and waterbodies. The structural complexity of vegetation, the age structure of the woodland and

the nature and extent of human disturbance throughout the Study Area was also considered. Structural features considered included the extent and nature of the understorey and ground stratum, extent of canopy and flowering characteristics of flora. Indirect indicators of fauna use of the site such as droppings, diggings, footprints, scratches, nests, burrow paths and runways were recorded.

ii. Diurnal Bird Census

Two surveys were undertaken on different days for half an hour. Any bird species that were observed or heard calling were recorded and listed in the total species list for the Subject Site.

iii. Microbat survey

Two ANABAT detectors were set up for two nights in June 2015. Each unit was recording for 12 hours.

iv. Nocturnal Mammals

Spotlighting surveys were undertaken over five nights in June 2015, with one ecologist using a high power torch to search for evidence of nocturnal mammals. Call playback was undertaken for the Squirrel Glider.

Two Infra-Red (IR) cameras were set up near likely foraging areas over four nights in June 2015. These cameras were placed in Littoral Rainforest vegetation within the northern portion of the Subject Site.

v. Small mammals

A total of ten hair tubes were set up (five tubes in each of the two transects, spaced at approximately 5 m apart) over four nights in June 2015. These were baited with a mixture of peanut butter, oats and honey. These cameras were placed in Littoral Rainforest vegetation.

Two IR cameras were set up near likely foraging areas over four nights in June 2015. These cameras were placed in Littoral Rainforest vegetation within the northern portion of the Subject Site.

vi. Forest owls

Spotlighting surveys were undertaken over five nights in June 2015, with one ecologist using a high power torch to search for evidence of owls. Call playback for the Powerful Owl and Barking Owl was also undertaken.

vii. Amphibians

Spotlighting surveys were undertaken over five nights in June 2015, with one ecologist using a high power torch to search for evidence of the Red-crowned Toadlet.

viii. Incidental observations

Any incidental fauna species that were observed, heard calling, or otherwise detected on the basis of tracks or signs, were recorded and listed in the total species list for the Subject Site.

All fauna species recorded on the Subject Site are listed in **Appendix C**. A copy of the survey proformas used in the surveys is attached in **Appendix D**.

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Subject Site

Flora Survey Locations

- Quadrat

Fauna Survey Locations

- Hairtube Transect
- Hairtube
- ANABAT
- IR Camera
- Call Playback Point

Grid North

Image Source:
NearMap
(dated 30-12-2014)

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I:\...15023\Figures\RP1_S\S\20160511\Figure 4.1. Flora and Fauna Survey Locations

Figure 4.1. Flora and Fauna Survey Locations

10 0 10 20 30 40 m

4.3 Survey Effort

DGR 4.2 *Documentation*

DGR 4.2.1 *Documenting survey effort and results*

4.3.1 Flora Survey Effort

Recent flora surveys conducted by Cumberland Ecology in May and June 2015 within the Subject Site are summarised in **Table 4.1**.

Table 4.1 Recent flora surveys conducted by Cumberland Ecology in May and June 2015

Survey Type	Date	Number of Plots	Person Hours
20X50 Floristic BioBanking Plot	19/03/2015	1	6
20X50 Floristic BioBanking Plot	15/06/2015	1	6

Previous flora survey methods and survey effort for the study area are summarised in **Table 4.2**.

Table 4.2 Flora surveys conducted on the Subject Site and study area between 1999 and 2006

Conducted By	Date	Survey Type
Gunninah Environmental Consultants	September 1999, January 2000, June 2002	Random Meander
Abel Ecology	June 2006	Random Meander
Dominic Fanning (SLR)	1999	Random Meander
Ms Mia Dalby-Ball (Pittwater Council)	2006	Random Meander
Cumberland Ecology	2006	Random Meander, 20 mx20 m quadrats using modified Braun-Blanquet Scale

4.3.2 Fauna Survey Effort

Fauna survey methods and survey effort for the Subject Site are summarised in **Table 4.3** below.

Table 4.3 Fauna Survey Dates and Effort

Survey Technique	Survey Dates	Total Survey Effort
Diurnal Bird Census	22-23 June 2015	1 person hours (2 x 0.5 hours)
General Habitat Assessment	22 June 2015	1 person hours
Nocturnal Surveys and Call Playback	22-26 June 2015	2.5 person hours (5 x 0.5 hour surveys)
ANABAT	22-23 June 2015	48 person hours (2 units x 12 hours for 2 nights)
Hair Tubes	22-25 June 2015	960 person hours (10 units x 24 hours active for 4 nights)
IR Cameras	22-25 June 2015	192 person hours (2 units x 24 hours active for 4 nights)
Incidental Observations	Throughout survey periods	n/a

4.3.3 Weather Conditions

Weather conditions during flora and fauna surveys were generally appropriate for detection of a variety of flora and fauna. Surveys were undertaken in early winter (June 2015). A summary of weather conditions in the wider locality of the Study Area during the flora and fauna survey periods is provided in **Table 4.4** below.

Table 4.4 Weather conditions during surveys

Date	Temperature ºC (Min.)	Temperature ºC (Max.)	Last rain
19/03/2015	19.3	27.4	18/03/2015
15/06/2015	10.3	17.3	12/06/2015
22/06/2015	6.5	16.8	21/06/2015
23/06/2015	7.9	18.6	21/06/2015
24/06/2015	11.8	19.5	21/06/2015
25/06/2015	11.6	18.3	21/06/2015
26/06/2015	9.2	16.5	21/06/2015

Weather station data was obtained from two different active stations (Bureau of Meteorology, 2015):

- Station 66059 – Terrey Hills AWS for minimum and maximum daily temperatures; and

- Station 66079 - Avalon Beach (Avalon, Palmgrove Road) for rainfall.

4.3.4 Survey Personnel

The details of survey personnel are provided in **Table 4.5** below.

Table 4.5 Survey personnel

Survey Personnel	Role	Company	Contact Details
Vanesa Orsborn	Project Manager / Ecologist	Cumberland Ecology	(02) 9868 1933
Bryan Furchert	Botanist	Cumberland Ecology	(02) 9868 1933
Alex Pursche	Ecologist	Cumberland Ecology (at the time of survey)	(02) 9868 1933

4.3.5 Limitations

Adequate ecological data exists for the assessment of the ecological impacts for the proposed development. There are no significant limitations to the data available. The flora and fauna of the Subject Site have been subject to a series of surveys over several years. Consequently, the ecology of the Subject Site and indeed the flora and fauna of the locality is well known.

a. Flora

The weather conditions at the time of the flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs, grasses, herbs and creepers were readily identifiable in most instances. It is expected that not all flora species present would have been recorded during surveys. Despite this, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora, condition and viability of vegetation and likely impact on native vegetation.

b. Fauna

Targeted fauna surveys for the preparation of this SIS were undertaken in early winter (June 2015) which is not the optimal season for surveying the majority of fauna species. The winter surveys were particularly aimed at targeting Powerful Owl, which is known to occur in the Study Area. This data is supported by the findings of the habitat assessment, and incidental recordings during the March 2015 surveys. Nonetheless, there have been several studies of the Subject Site over several years which provide adequate data on fauna species that occur.

Limited time was spent on the Subject Site during surveys in March and June 2015. The most commonly occurring fauna species would have been recorded, but it is likely that additional common fauna species would be detected if further surveys were to take place.

However, vertebrate fauna of the locality is well known based upon a sizeable database of past records and various published reports on the Subject Site.

Accessibility of the Subject Site was partly limited in some areas due to ground conditions being very boggy in June 2015.

4.4 Survey Results

DGR 4.2 *Documentation*

DGR 4.2.2 *Documenting survey effort and results*

DGR 4.2.3 *Description and mapping of results of vegetation, flora and fauna surveys*

DGR 4.2.4 *Specific survey requirements (Powerful Owl and Littoral Rainforest)*

4.4.1 Vegetation Communities

i. Littoral Rainforest: Closed native canopy with native dominated understorey

This community occurs throughout the northern half of the site (**Photograph 4.1**) and as a band along the southern border of the site (**Photograph 4.2**), as shown in **Figure 4.2**. It conforms to the description in the final determination for the EEC Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions, listed under the *TSC Act*, and in the Commonwealth listing advice for the CEEC Littoral Rainforest and Coastal Vine Thickets of Eastern Australia, listed under the EPBC Act. The community also conforms to the description of the vegetation mapping unit Temperate Littoral Rainforest by Tozer *et al*. (2010). The community on site is associated with a south facing slope, and sandy soils amongst sandstone rocks.

The closed canopy is dominated by the tree species *Livistona australis* (Cabbage Tree Palm), *Acmena smithii* (Lilly Pilly), *Pittosporum undulatum* (Sweet Pittosporum), and *Glochidion ferdinandi* var. *ferdinandi* (Cheese Tree). Other species such as *Banksia integrifolia* (Coastal Banksia), *Ficus rubiginosa* (Port Jackson Fig), *Eucalyptus botryoides* (Bangalay), and *Allocasuarina littoralis* (Forest Oak) occur less frequently in the canopy, and as emergents. Underneath the canopy a small tree layer is present, comprised predominately of *Eupomatia laurina* (Native Guava), *Synoum glandulosum* (Scentless Rosewood), *Acmena smithii*, and *Pittosporum undulatum*. The exotic tree species *Erythrina x sykesii* is present in the canopy in the southern half of the site.

A dense shrub layer is present in most areas dominated by *Eupomatia laurina* and *Synoum glandulosum* and juveniles of the trees *Livistona australis* and *Pittosporum undulatum*. The exotic weed species *Lantana camara* is dominant in the understorey of some areas of the site, and other species such as *Ligustrum sinense* (Small-leaved Privet) occur more sporadically. Other shrubs species present with patchy occurrences include *Wilkiea huegeliana* (Veiny Wilkiea), *Notelaea longifolia*, *Pittosporum revolutum* (Rough-fruited

Pittosporum), and *Elaeocarpus reticulatus* (Blueberry Ash). Vines are common in the understorey and include the species *Morinda jasminoides* (Sweet Morinda), *Smilax australis* (Lawyer Vine), *Geitonoplesium cymosum* (Scrambling Lily).

The ground layer is dominated by ferns in most areas, the dominant species on site being *Doodia aspera* (Rasp Fern) and *Blechnum cartilagineum* (Gristle Fern), with others such as *Adiantum aethiopicum* (Maidenhair fern), *Adiantum hispidulum* (Rough Maidenhair Fern), and *Calochlaena dubia* (False Bracken Fern) occurring less frequently. Other herbaceous species such as *Pseuderanthemum variabile* (Pastel Flower), *Lepidosperma elatius* (Tall Sword-sedge), *Schelhammera undulata* (Lilac Lily), and the grasses *Entolasia marginata* (Margined Panic) and *Oplismenus imbecillis* (Creeping Beard Grass) have a scattered distribution in the ground layer. Exotic weed species are common in areas that have undergone disturbance, or are close to current and former residential properties, such as the interface between the rainforest and backyards in the north of the site, and below old fibro buildings in the south of the site. These species include *Ehrharta erecta* (Panic Veldtgrass), *Asparagus aethiopicus* (Sprenger's Asparagus), and *Tradescantia fluminensis* (Fluminensis).

Photograph 4.1 Littoral Rainforest in the northern half of the site

Photograph 4.2 Littoral rainforest in the southern half of the site

ii. Littoral Rainforest - Closed native canopy with exotic dominated understorey

This community occurs in the southern half of the site, and is associated with areas of the site that have undergone disturbance, and with areas along a drainage depression that are likely to have nutrient enriched soils from residential runoff. The canopy in these areas is predominately comprised of *Livistona australis*, *Glochidion ferdinandi* var. *ferdinandi* and *Pittosporum undulatum*, and to a lesser extent *Acmena smithii*. Exotic shrubs such as *Lantana camara*, *Ligustrum sinense*, and *Ochna serrulata* (Mickey Mouse) are common in the understorey, and the ground layer is dominated by exotic weed species such as *Nephrolepis cordifolia* (Fishbone Fern), *Ageratina adenophora* (Crofton Weed), *Tradescantia fluminensis,* (Wandering Jew), *Ehrharta erecta* and *Hedychium gardnerianum* (Ginger Lily). Other exotic species such as *Solanum nigrum* (Blackberry) occur less frequently (**Photograph 4.3**).

As the TSC Act does not list condition thresholds for the listed community, this vegetation technically conforms to the community under that Act. However, as over seventy percent of the ground and shrub layers comprise exotic weed species, including “transformer” weed species such as *Lantana camara* and *Tradescantia fluminensis*, these areas do not meet the condition threshold for the listed community under the *EPBC Act*.

Photograph 4.3 Littoral Rainforest with exotic understorey

iii. Littoral Rainforest: Open native canopy with exotic dominated understorey

This area conforms to the TSC Act listing for the community, however does not conform to the *EPBC* listing due to the lack of canopy (**Photograph 4.4**). At the time of the site survey in 2015 this area appeared to be regrowing Littoral Rainforest, with a recently cleared canopy. The canopy at the time of the site survey consisted of several scattered *Livistona australis* individuals, and the shrub layer consisted of juvenile *Livistona australis* individuals. Vegetation for the most part was less than 1 m in height. The ground layer was dominated by regrowth individuals of native species including *Lomandra longifolia* (Spiny Mat-rush), *Commelina cyanea* (Scurvy Weed), *Oplismenus aemulus* (Basket Grass), *Calochlaena dubia*, and the vine *Cissus hypoglauca* (Water Vine), however was depauperate in native species in comparison to adjacent, upslope intact areas.

Exotic weed species were extremely common in the ground layer and consisted of juvenile individuals of the shrubs *Lantana camara* and *Ligustrum sinense,* and herbs including *Solanum nigrum* (Blackberry Nightshade), *Nephrolepis cordifolia* (Fishbone Fern), and *Ageratina adenophora*.

Photograph 4.4 Littoral Rainforest with Open Canopy (east)

iv. Urban Native/Exotic Vegetation (Not Listed)

This vegetation community occurs surrounding and downslope of old fibro residential dwellings on the property (**Photograph 4.5**). The community consists of old garden shrubs, uncontrolled lawn grasses, and exotic herb species. The western extent of this community has a canopy of several large *Erythrina x sykesii*, and garden shrubs including the species *Citrus x limon* (Lemon), and *Murraya paniculata* (Orange Jessamine). Also in the shrub layer are several non-endemic tree fern *Cyathea cooperi* (Straw Treefern), and exotic weeds such as *Senna pendula* var. *glabrata* (Cassia) and *Ligustrum sinense*, and the prostrate *Asparagus aethiopicus*.

The ground layer is dominated by exotic weed species with native species limited to scattered individuals of common species such as the grasses *Microlaena stipoides* (Weeping Grass) and *Oplismenus aemulus* (Basket Grass), the forbs *Hydrocotyle peduncularis* (Native Pennywort) and *Cotula australis* (Common Cotula), and the ferns *Calochlaena dubia* and *Asplenium australasicum* (Bird's Nest Fern), with the latter planted in a former garden bed. Weeds include the forbs *Conyza sumatrensis* (Tall Fleabane), *Acetosa sagittata* (Turkey Rhubarb), *Ageratina adenophora*, and *Crassocephalum crepidioides* (Thickhead), and the grasses *Ehrharta erecta* and *Stenotaphrum secundatum* (Buffalo Grass).

Photograph 4.5 Urban Native/Exotic vegetation surrounding dilapidated buildings

Coordinate System: MGA Zone 56 (GDA 94)

ATTUNGA RESERVE

Legend

- Subject Site
- Study Area
- Approved Driveway (DA N0274/09)
- Managed APZ (DA N0730/10)

Vegetation Community (CE, 2015)

- Littoral Rainforest: Closed native canopy with native dominated understorey (TSC Act & EPBC Act)
- Littoral Rainforest: Closed native canopy with exotic dominated understorey (TSC Act)
- Littoral Rainforest: Open/ cleared native canopy with exotic dominated understorey (TCS Act)
- Urban Native/ Exotic Vegetation (not listed)

Vegetation Community (Modified from OEH, 2013)

- Coastal Escarpment Littoral Rainforest
- Central Coast Escarpment Moist Forest
- Coastal Sandstone Foreshores Forest
- Coastal Headland Clay Heath

Vegetation Community (Gunninah, 2007)

- Littoral Rainforest
- Poor Quality Littoral Rainforest

Image Source:
Nearmap
(dated 30-12-2014)

Data Source:
OEH (2013). The Native Vegetation of the Sydney Metropolitan Area. Office of Environment and Heritage NSW.

Whelans Insites (Gunninah Environmental Consultants) (2007). Littoral Rainforest and Offest Issues - Ref. D184EV.

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Grid North

I:\...15023\Figures\RP1_SIS\20160622\Figure 4.2. Vegetation_Study Area

Figure 4.2. Vegetation Communities within the Study Area

25 0 25 50 75 100 m

4.4.2 Flora

i. General species

The majority of the Subject Site consists of rainforest associated species, including Cabbage palms (*Livistona australis*), mesic tree species such as Lilly Pillys (*Acmena smithii*) and *Pittosporum* sp., ferns; such as the Rough tree fern (*Cyathea australis*), vines and twiners such as *Cissus* sp. and sparse tussock grasses such as *Lomandra* sp. A total of 73 native species and 68 exotic species were recorded on the Subject Site and parts of the Study Area. The overall abundance of native and exotic species varies across the Subject Site, however, in general, native species predominate.

ii. Threatened species

No threatened flora species were identified within the Subject Site or Study Area.

4.4.3 Fauna

i. Fauna habitat

Fauna habitat on the Subject Site generally consists of Littoral Rainforest vegetation with some cleared and landscaped areas surrounding an existing dwelling, derelict cottage, shed and driveway located towards the centre of the Subject Site. These areas provide potential habitat for microchiropteran bats, birds and mammals. There is extensive sandstone outcropping and boulders on the upper slopes, suitable for reptiles and potential roost sites for microchiropteran bats. A minor watercourse is present on the south-western section of the Subject Site, providing habitat for amphibians.

a. Rainforest habitat

The dense canopy within this habitat provides suitable foraging and roosting habitat for passerine birds, as well as potential Powerful Owl roosting habitat (see **Photograph 4.6**). Adequate understorey provides foraging and nesting habitat for small mammals, such as the Common Ringtail Possum (*Pseudocheirus peregrinus*). Various microchiropteran bats would likely forage beneath the canopy of the rainforest.

Photograph 4.6 Dense rainforest habitat

b. Open rainforest habitat

A section of open rainforest vegetation north of the existing dwelling provides potential foraging habitat for forest owls as well as microchiropteran bats (see **Photograph 4.7**).

Photograph 4.7 Open rainforest habitat

c. Waterbodies

An unnamed drainage line is present within the Subject Site, and was seen to be dry in March and flowing during the June survey period. This waterway begins at the western portion of the Subject Site and flows south-east. This drainage line provides potential foraging and breeding habitat for some amphibian species. No permanent waterbodies exist on the Subject Site, and due to the steepness of the site, the drainage line is not likely to retain water for long periods after rainfall.

d. Caves and boulder piles on site

Extensive sandstone outcropping and boulders on the upper slopes of the Subject Site provide suitable habitat for reptiles, and potential roost sites for microchiropteran bats (see **Photograph 4.8**).

Photograph 4.8 Cave at the Subject Site

e. Leaf litter and ground stratum habitat

The Littoral Rainforest vegetation provides ample ground cover for amphibians, reptiles, and small mammals (see **Photograph 4.9**). There is also small scattered sandstone boulders present among the leaf litter.

Photograph 4.9 Littoral Rainforest habitat at the Subject Site

f. Anthropomorphic habitat

The old existing shed provides potential roosting habitat for microchiropteran bats under the roof (**Photograph 4.10**).

Photograph 4.10 Old shed on the Subject Site

ii. Diurnal Bird Census

A total of ten bird species were recorded during diurnal surveys. These species were common for the area and habitat type. It is likely that additional common species utilise the Subject Site and surrounds as part of a larger foraging habitat and so this list is not exhaustive. A species list for the Subject Site based on 2015 surveys is provided in **Table 4.6** below. A comprehensive fauna list, for all surveys conducted on the Subject Site between 1999 and 2015, is provided in **Appendix C**.

No threatened bird species were recorded during diurnal bird surveys.

Table 4.6 Diurnal bird species recorded in the Subject Site

Family	Scientific Name	Common Name
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren
Acanthizidae	*Acanthiza pusilla*	Brown Thornbill
Cacatuidae	*Cacatua sanguinea*	Little Corella

Table 4.6 Diurnal bird species recorded in the Subject Site

Family	Scientific Name	Common Name
Meliphagidae	*Phylidonyris niger*	White-cheeked Honeyeater
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater
Podargidae	*Podargus strigoides*	Tawny Frogmouth
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet
Psittacidae	*Platycercus elegans*	Crimson Rosella
Psophodidae	*Psophodes olivaceus*	Eastern Whipbird
Psophodidae	*Cinclosoma punctatum*	Spotted Quail-thrush

iii. Microbat survey

Two threatened microchiropteran bat species were recorded during the targeted survey in 2015 based on the ANABAT detectors:

- Eastern Bentwing-bat (*Miniopterus schreibersii oceansis*) (Vulnerable under TSC Act); and
- Little Bentwing-bat (*Miniopterus australis*) (Vulnerable under TSC Act).

iv. Nocturnal Mammals

During nocturnal spotlighting surveys, a Common Ringtail Possum was seen within the Subject Site within Littoral Rainforest vegetation.

No fauna was recorded on either of the two IR cameras.

v. Small mammals

Hair tubes recorded only a single sample, which was analysed and determined to be Common Brushtail Possum (*Trichosurus vulpecula*). This species was also recorded during spotlighting.

No fauna were recorded on either of the two IR cameras.

vi. Forest Owls

One Tawny Frogmouth (*Podargus strigoides*) was encountered during nocturnal surveys. No other nocturnal birds, such as the Powerful Owl or Barking Owl were recorded.

vii. Amphibians

The Common Eastern Froglet (*Crinia signifera*) was heard within the drainage depression during surveys.

viii. Incidental observations

No other fauna species were encountered.

ix. Threatened and Migratory species

The Eastern Bentwing-bat and Little Bentwing-bat, both listed as Vulnerable under the TSC Act were recorded within the Subject Site during targeted surveys.

Potentially occurring threatened fauna species that are likely to occur within the Subject Site and surrounds consist largely of avifauna and bats. Additional to those species confirmed as present on the Subject Site, potentially occurring threatened fauna species include:

- Superb Fruit-Dove;
- Powerful Owl;
- Barking Owl;
- Eastern Bentwing-bat;
- Little Bentwing-bat;
- Greater Broadnosed Bat;
- Large-eared Pied Bat; and
- Grey-headed Flying-fox;

The occurrence of the majority of threatened fauna species is considered to be limited to occasional passage through the Subject Site as part of a wider foraging range, although some roosting habitat occurs on site for threatened microbats in the form of small caves and crevices and the existing shed.

Coordinate System: MGA Zone 56 (GDA 94)

Figure 4.3. Threatened Flora and Fauna Recorded in the Study Area