

Appendices

(No. of pages excluding this page = 174)

- | | |
|------------|-----------------------------|
| Appendix A | Fauna Survey Results |
| Appendix B | Flora Survey Results |
| Appendix C | Threatened Species Profiles |
| Appendix D | Assessments of Significance |
| Appendix E | Tree Hollow Plot Data |

This page has intentionally been left blank

Appendix A

Fauna Survey Results

(No. of pages excluding this page = 13)

Table A1	Analysis of Likelihood of Threatened Fauna Occurring at the Project Site
Table A2.1	Fauna Survey Effort in the Study Area
Table A2.2	Fauna Trapping Grid Locations
Table A3	Mammals and Reptiles recorded in Project Site
Table A4	Bird Survey Results
Table A5	Frog Survey Results
Table A6	Freshwater Macroinvertebrates

Table A1 Analysis of Likelihood of Threatened Fauna Occurring at the Project Site

Page 1 of 5

	Scientific name	Common Name	Legal Status		Locality	Popran NP	Study Area	Project Site	Habitat	Habitat present in Project Site	Likelihood of Occurrence
			TSC	EPBC							
INSECTS											
	<i>Petalura gigantea</i>	Giant Dragonfly	E1						Permanent swamps, bogs - some free water, open vegetation.	Yes	Low
FISH											
	<i>Prototroctes maraena</i>	Australian Grayling		V					Mid-water species-clear, gravelly streams-moderate flow. Prefers deep, slow flowing pools.	No	Low
	<i>Macquaria australiacus</i>	Macquarie Perch	E1	E					River, lake habitats- upper reaches of rivers and tributaries.	No	Low
AMPHIBIANS	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V		Y			Small creeks, pools-sandstone ridgetop woodland, heath	Yes	Possible
	<i>Litoria aurea</i>	Green and Golden Bell Frog	E1	E					Open areas with non-permanent waterways and cover (e.g. Typha)	No	Low
	<i>Litoria brevipalmata</i>	Green-Thighed Frog	V						Rainforest to woodland, breeds in grassy semi-permanent ponds and flood-prone grassy areas	Yes	Possible
	<i>Mixophyes balbus</i>	Stuttering Frog	E1	V					Rainforest, wet, tall open forest	No	Low
	<i>Mixophyes iteratus</i>	Giant Barred Frog	E1	E					rainforests, moist eucalypt forest, nearby dry eucalypt forest, breed -shallow, flowing rocky streams	No	Low
	<i>Pseudophryne australis</i>	Red-Crowned Toadlet	V			Y		Y	Triassic sandstones-Sydney basin permanently moist soaks, ephemeral headwater stream beds.	Yes	Present

Table A1 Analysis of Likelihood of Threatened Fauna Occurring at the Project Site (Cont'd)

Page 2 of 5

	Scientific name	Common Name	Legal Status		Locality	Popran NP	Study Area	Project Site	Habitat	Habitat present in Project Site	Likelihood of Occurrence
			TSC	EPBC							
REPTILES	<i>Hoplocephalus stephensii</i>	Stephens' Banded Snake	V						Rainforest, eucalypt forests, rocky areas - to 950 m, shelters under bark	Yes	Possible
	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V				Y		Heath, open forest, woodland habitats. Termite mounds-critical-nesting. shelter-hollow logs, rock crevices, burrows	Yes	Probable
BIRDS											
	76 <i>Pterodroma nigripennis</i>	Black-winged Petrel	V						Marine, nests in burrows on the coast	No	Low
	103 <i>Puffinus assimilis</i>	Little Shearwater	V						Marine, breeds on islands	No	Low
	154 <i>Ixobrychus flavicollis</i>	Black Bittern	V						Terrestrial, estuarine wetlands-permanent water, dense vegetation	No	Low
	155 <i>Botaurus poiciloptilus</i>	Australasian Bittern	V						Permanent freshwater wetlands-tall, dense vegetation	No	Low
	163 <i>Pandion haliaetus</i>	Osprey	V						Clear, open water of large rivers, lagoons, lakes- coastal areas	No	Low
	264 <i>Burhinus grallarius</i>	Bush Stone-curlew	E1						Open forests and woodlands with sparse grassy groundlayer	Yes	Low
	266 <i>Haematopus longirostris</i>	Pied Oystercatcher	V						Intertidal flats, beaches	No	Low
	267 <i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V						Rock shelves, rocky headlands	No	Low
	313 <i>Sterna albifrons</i>	Little Tern	E1	MMB					Almost exclusively coastal, also inlets and rivers	No	Low
	316 <i>Sterna fuscata</i>	Sooty Tern	V						Marine, breeds on islands	No	Low
	324 <i>Gygis alba</i>	White Tern	V						Vagrant to coastal NSW	No	Low
	346 <i>Ptilinopus superbus</i>	Superb Fruit-dove	V						Rainforest, closed forest; forage high in the canopy	No	Low
	347 <i>Ptilinopus regina</i>	Rose-crowned Fruit-dove	V						Subtropical rainforest to swamp forest where fruit is plentiful	No	Low
	355 <i>Calyptorhynchus lathamii</i>	Glossy Black-cockatoo	V			Y	Y	Y	Dry forests- <i>Allocasuarina</i> , nest in tree hollows	Yes	Present
	390 <i>Lathamus discolor</i>	Swift Parrot	E1	E					Box-ironbark forests, woodlands	Yes	Possible

Table A1 Analysis of Likelihood of Threatened Fauna Occurring at the Project Site (Cont'd)

	Scientific name	Common Name	Legal Status		Locality	Popran NP	Study Area	Project Site	Habitat	Habitat present in Project Site	Likelihood of Occurrence
			TSC	EPBC							
402	<i>Neophema pulchella</i>	Turquoise Parrot	V						Eucalypt woodlands, open forests- grasses and shrubs understorey	Yes	Possible
420	<i>Ninox strenua</i>	Powerful Owl	V			Y	Y		Woodland, open sclerophyll forest, tall open wet forest, rainforest	Yes	Probable
422	<i>Ninox connivens</i>	Barking owl	V						Swamp, eucalypt woodland, open forests.	Yes	Possible
426	<i>Tyto tenebricosa</i>	Sooty Owl	V			Y			Dry, subtropical, warm temperate rainforests, moist eucalypt forests; very large tree hollows-for nesting.	Yes	Possible
428	<i>Tyto novaehollandiae</i>	Masked Owl	V						Eucalypt forests, woodlands, nesting tree hollows, caves	Yes	Possible
511	<i>Climacteris picumnus</i>	Brown Treecreeper	V						Open grassy understorey-eucalypt woodlands, dry open forests and mallee;	Yes	Possible
556	<i>Pyrrholaemus sagittatus</i> (<i>Chthonicola sagittata</i>)	Speckled Warbler	V						Eucalyptus-dominated communities with grassy understorey	Yes	Possible
591	<i>Xanthomyza phrygia</i>	Regent Honeyeater	E1	E, MTS					Box-ironbark eucalypt associations, wet lowland coastal forests	Yes	Possible
621	<i>Melithreptus gularis</i> <i>gularis</i>	Black-chinned Honeyeater	V						Dry open forests and woodlands	Yes	Possible
443	<i>Apus pacificus</i>	Fork-tailed Swift		MMB					Species or species habitat may occur within area		
172	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		MTS					Estuaries, inlets, coastlines inland lakes.	No	Low
442	<i>Hirundapus caudacutus</i>	White-throated Needletail		MTS					Non-breeding migrant to eastern Australia	Yes	Low
455	<i>Merops ornatus</i>	Rainbow Bee-eater		MTS					Open forest, woodland, and farmland; nests excavated in creek banks, walls of quarries etc	Yes	Low

Table A1 Analysis of Likelihood of Threatened Fauna Occurring at the Project Site (Cont'd)

Page 4 of 5

	Scientific name	Common Name	Legal Status		Locality	Popran NP	Study Area	Project Site	Habitat	Habitat present in Project Site	Likelihood of Occurrence
			TSC	EPBC							
704	<i>Monarcha melanopsis</i>	Black-faced Monarch		MTS					Rainforests, moist eucalypt forests and gullies	Yes	Low
712	<i>Myiagra cyanoleuca</i>	Satin Flycatcher		MTS					Wet forests -.Great Dividing Range.	No	Low
716	<i>Rhipidura rufifrons</i>	Rufous Fantail		MTS					Undergrowth of forest gullies	Yes	Low
145	<i>Ardea alba</i>	Great Egret		MWS, MMB					Shallow water, including damp grasslands	No	Low
147	<i>Ardea ibis</i>	Cattle Egret		MWS, MMB					Follows feeding cattle	No	Low
219	<i>Gallinago hardwickii</i>	Latham's Snipe		MWS					Permanent and ephemeral wetlands	Yes	Low
260	<i>Rostrula benghalensis</i>	Painted Snipe		MWS					Temporary or infrequently filled freshwater wetlands	Yes	Low
MAMMALS											
Bats											
	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V					Roosts in caves or crevices in cliffs, frequents low to mid elevation dry open forest and woodland	Yes	Low
	<i>Falsistrellus tasmaniensis</i>	Great Pipistrelle	V						Moist habitats, trees taller than 20 m. roosts in hollows, under loose bark, or in buildings.	No	Low
	<i>Kerivoula papuensis</i>	Golden-tipped Bat	V						Rainforest and adjacent sclerophyll forest, roost in Yellow-throated Scrubwren or Brown Gerygone nests	Yes	Possible
	<i>Miniopterus australis</i>	Little Bent-wing Bat	V						Moist eucalypt forest, rainforest, dense coastal banksia scrub. roost in caves, sometimes tree hollows	Yes	Possible
	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	V			Y			Roost in caves; hunt above canopy in forested areas.	Yes	Possible
	<i>Mormopterus norfolkensis</i>	Eastern Little Mastiff-bat	V						Dry sclerophyll forest, woodland; roost in tree hollows or under bark.	Yes	Possible

Table A1 Analysis of Likelihood of Threatened Fauna Occurring at the Project Site (Cont'd)

Page 5 of 5

	Scientific name	Common Name	Legal Status		Locality	Popran NP	Study Area	Project Site	Habitat	Habitat present in Project Site	Likelihood of Occurrence
			TSC	EPBC							
	<i>Myotis macropus</i>	Large-footed Myotis	V			Y			Forage over streams and pools; roost in caves, hollow-bearing trees,	Yes	Possible
	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V		Y			Riparian rainforest, Paperbark, Casuarina forest-roosting .	Yes	Possible
	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V						Roosts in tree hollows	Yes	Possible
	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V						Woodland - moist and dry eucalypt forest, rainforest, roosts in tree hollows,	Yes	Possible
Terrestrial Mammals	<i>Cercartetus nanus</i>	Eastern Pigmy-possum	V						Heath, woodland, sclerophyll forest, rainforest habitats .	Yes	Possible
	<i>Dasyurus maculatus</i>	Tiger Quoll	V	E (SE mainland population)		Y			Rainforest, open forest, woodland, coastal heath, inland riparian forest roost: tree hollows, small caves,	Yes	Possible
	<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot	E1						Heathland, shrubland, dry sclerophyll forest -heathy understorey, sedgeland, woodland habitats;	Yes	Possible
	<i>Macropus parma</i>	Parma Wallaby	V						Moist eucalypt forest	Yes	Low
	<i>Petaurus australis</i>	Yellow-bellied Glider	V						Tall mature eucalypt forest coastal forests, dry escarpment forests, moist coastal gullies, creek flats	Yes	Low
	<i>Petaurus norfolcensis</i>	Squirrel Glider	V			Y			Blackbutt-Bloodwood forest-heath understorey-coastal areas/old growth Box, Box-Ironbark woodlands	Yes	Possible
	<i>Phascolarctos cinereus</i>	Koala	V						Eucalypt woodlands, forests.	Yes	Possible
	<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	V					Coastal heaths, dry, wet sclerophyll forests sandy loam soil.	Yes	Possible
	<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	V						Heathland, dense wet heath, swamps.	Yes	Low

Notes: E, E1 - endangered; V – vulnerable; MTB – migratory terrestrial species; MWS – migratory wetland species; MMB – migratory marine bird

Table A2.1 Fauna Survey Effort in the Study Area

Page 1 of 3

Survey Method	Target Threatened Species	Company	Site	Survey Effort	Summary	Date
Elliot A (ground)	Small mammals, Eastern Pygmy Possum	Cumberland Ecology	Project Site	4 grids x 10 traps x 4 nights		Jan/Feb 2006
Elliot A (ground)	Small mammals, Eastern Pygmy Possum	Cumberland Ecology	Project Site	1 line x 5 traps x 4 nights	180 trap nights	Jan/Feb 2006
Elliot A (ground)	Small mammals, Eastern Pygmy Possum	Countrywide Ecological Service	Study Area	5 lines x 10 traps x 4 nights	100 trap nights	Jan/Feb 2004
Elliot B (tree)	Squirrel Glider, Yellow-bellied Glider	Cumberland Ecology	Project Site	4 grids x 10 traps x 4 nights		Jan/Feb 2006
Elliot B (tree)	Squirrel Glider, Yellow-bellied Glider	Cumberland Ecology	Project Site	1 line x 5 traps x 4 nights	180 trap nights	Jan/Feb 2006
Elliot E (tree)	Eastern Pygmy Possum	Cumberland Ecology	Project Site	5 lines x 5 traps x 4 nights	100 trap nights	Jan/Feb 2006
Hair funnels (ground)	Southern Brown Bandicoot, Tiger Quoll	Cumberland Ecology	Project Site	5 grids x 5 traps x 4 nights	100 trap nights	Jan/Feb 2006
Hair tubes (ground)	Southern Brown Bandicoot,	Countrywide Ecological Service	Study Area	10 traps x unspecified nights (probably at least 4)	at least 40 trap nights	Jan/Feb 2004
Hair funnels (tree)	Squirrel Glider, Yellow-bellied Glider, Eastern Pygmy Possum	Cumberland Ecology	Project Site	5 grids x 5 traps x 4 nights	100 trap nights	Jan/Feb 2006
Hair tubes (tree)	Squirrel Glider, Yellow-bellied Glider, Eastern Pygmy Possum	Countrywide Ecological Service	Study Area	10 traps x unspecified nights (probably at least 4)	at least 40 trap nights	Jan/Feb 2004
Cage traps	Southern Brown Bandicoot, Tiger Quoll	Cumberland Ecology	Project Site	5 grids x 2 traps x 4 nights	40 trap nights	Jan/Feb 2006
Pitfall traps	Frogs, small mammals and reptiles	Countrywide Ecological Service	Study Area	4 lines x 2 10lt buckets x 4 nights	32 trap nights	Jan/Feb 2004
Pitfall traps	Frogs, small mammals and reptiles	Countrywide Ecological Services	Study Area	4 lines x 2 tube traps x 4 nights	32 trap nights	Jan/Feb 2004
Spotlighting	Gliders, Owls, Koala, Grey-headed Flying-fox, Stephen's Banded Snake	Cumberland Ecology	Project Site	2 hours x 2 people x 3 nights	12 person hours	Jan/Feb 2006

Table A2.1 Fauna Survey Effort in the Study Area (Cont'd)

Survey Method	Target Threatened Species	Company	Site	Survey Effort	Summary	Date
Spotlighting	Gliders, Owls, Koala, Grey-headed Flying-fox, Stephen's Banded Snake	Countrywide Ecological Service	Study Area	3 hours x 2 people x 4 nights	24 person hours	Jan/Feb 2004
Call playback	Forest Owls, Koala, Squirrel Glider, Yellow-bellied Glider	Cumberland Ecology	Project Site	2 hours x 2 people x 3 nights	12 person hours	Jan/Feb 2006
Call playback	Forest owls, Bush-stone Curlew, Koala, Squirrel Glider, Yellow-bellied Glider	Countrywide Ecological Service	Study Area	2 sites x unspecified nights (probably at least 2)	at least 4 sessions	Jan/Feb 2004
Anabat	Microbats	Cumberland Ecology	Project Site	1 anabat x 2 nights x 12 hours	24 hours	Jan/Feb 2006
Anabat	Microbats	Countrywide Ecological Service	Study Area	3 hours x 4 nights	12 hours	Jan/Feb 2004
Harp trap	Microbats	Countrywide Ecological Service	Study Area	1 trap x unspecified nights (probably at least 2)	at least 2 trap nights	Jan/Feb 2004
Frog habitat assessment	Red-crowned Toadlet, Great Burrowing Frog	Cumberland Ecology	Project Site	1 person x 6 hours	6 person hours	Dec 2005
Frog habitat assessment	Red-crowned Toadlet	Abel Ecology	Study Area	area traversed over 2 days	at least 8 person hours	Feb 2005
Call recognition	Red-crowned Toadlet, Great Burrowing Frog	Cumberland Ecology	Project Site	1 person x 6 hours	6 person hours	Dec 2005
Call recognition	Red-crowned Toadlet	Countrywide Ecological Service	Study Area	unspecified	unspecified	Jan/Feb 2004
Call recognition	Red-crowned Toadlet	Abel Ecology	Study Area	1 person x 2 nights	at least 8 person hours	Feb 2005
Opportunistic hand capture	Red-crowned Toadlet	Countrywide Ecological Service	Study Area	unspecified	unspecified	Jan/Feb 2004

Table A2.1 Fauna Survey Effort in the Study Area (Cont'd)

Page 3 of 3

Survey Method	Target Threatened Species	Company	Site	Survey Effort	Summary	Date
Diurnal bird sampling	General diurnal bird fauna	Cumberland Ecology	Project Site	1 person x two days (morning and afternoon/evening)	13.5 person hours	Dec 2005
Diurnal bird sampling	General diurnal bird fauna	Countrywide Ecological Service	Study Area	2 transects x 2 times in 2 days	8 transects	Jan/Feb 2004
Tracks, scats & traces	General terrestrial fauna	Cumberland Ecology	Project Site	3 hours x 2 people x 4 days	24 person hours	Jan/Feb 2006
Tracks, scats & traces	General terrestrial fauna	Countrywide Ecological Service	Study Area	unspecified	unspecified	Jan/Feb 2004
Fish	General	Cumberland Ecology	Project Site	2 people x 4 hours	8 person hours	38749
Macroinvertebrates	General	Cumberland Ecology	Project Site	2 people x 4 hours	8 person hours	38749

Table A2.2 Fauna Trapping Grid Locations

Site	AMGs - Easting	AMGs - Northing	Vegetation Community	Site	AMGs - Easting	AMGs - Northing	Vegetation Community
1a	333989	6300309	29	1f	333865	6300285	29
1b			29	1g			29a
1c			26	1h			29a
1d			26	1i			29a
1e	333903	6300236	29	1j	333974	6300343	29a
2a	334240	6300299	26	2f	334292	6300390	29
2b			26	2g			26
2c			26	2h			26
2d			29	2i			26
2e	334258	6300299	29	2j	334222	6300323	26
3a	334204	6300486	29	3f	334050	6300594	29a
3b			29a	3g			29a
3c			29a	3h			29a
3d			29a	3i			29a
3e	334214	6300503	29a	3j	334057	6300591	29a
4a	334168	6300814	25	4f	334011	6300956	25
4b			25	4g			25
4c			25	4h			25
4d			29	4i			29
4e	334104	6300778	29	4j	334999	6300965	29
5a	334289	6300881	29a	(Only 1 line for #5)			
5b			29a				
5c			29				
5d			26				
5e	334113	6300966	26				

Table A.3 Mammals and Reptiles Recorded in Project Site

Grid	Species	Name	Type
1	<i>Antechinus stuartii</i>	Brown Antechinus	Trap
1	<i>Antechinus swainsonii</i> (probable)	Dusky Antechinus	Hair
1	<i>Dasyurid</i>	Dasyurid	Hair
1	<i>Perameles nasuta</i>	Long-nosed Bandicoot	Trap
1	<i>Rattus fuscipes</i>	Bush Rat	Hair
1	<i>Rattus fuscipes</i>	Bush Rat	Trap
1	<i>Rattus fuscipes</i> (probable)	Bush Rat	Hair
1	<i>Rattus rattus</i>	Brown Rat	Hair
1	<i>Rattus sp.</i>	Rat	Hair
1	<i>Sminthopsis murina</i>	Common Planigale	Hair
1	<i>Sminthopsis murina</i> (probable)	Common Planigale	Hair
1	<i>Trichosurus sp.</i>	Brush-tailed Possum	Hair
1	<i>Wallabia bicolor</i>	Swamp Wallaby	Hair
2	<i>Antechinus sp.</i>	Antechinus	Hair
2	<i>Antechinus stuartii</i> (probable)	Brown Antechinus	Hair
2	<i>Perameles nasuta</i>	Long-nosed Bandicoot	Observed
2	<i>Peramelid</i>	Bandicoot	Hair
2	<i>Pseudocheirus peregrinus</i>	Ringtail Possum	Observed
2	<i>Rattus fuscipes</i>	Bush Rat	Hair
2	<i>Rattus fuscipes</i>	Bush Rat	Trap
2	<i>Rattus sp.</i>	Rat	Hair
2	<i>Sminthopsis murina</i>	Common Planigale	Hair
2	<i>Sminthopsis murina</i>	Common Planigale	Hair
2	<i>Varanus varius</i>	Lace Monitor	Trap
2	<i>Wallabia bicolor</i>	Swamp Wallaby	Observed
3	<i>Antechinus sp.</i>	Antechinus	Hair
3	<i>Antechinus stuartii</i>	Brown Antechinus	Trap
3	<i>Peramelid</i>	Bandicoot	Hair
3	<i>Rattus fuscipes</i>	Bush Rat	Trap
3	<i>Rattus fuscipes</i> (probable)	Bush Rat	Hair
3	<i>Rattus rattus</i>	Brown Rat	Hair
3	<i>Rattus sp.</i>	Rat	Hair
3	<i>Sminthopsis murina</i>	Common Planigale	Hair
4	<i>Antechinus stuartii</i>	Brown Antechinus	Trap
4	<i>Eulamprus quoyii</i>	Eastern Water Skink	Trap
4	<i>Mus domesticus</i>	House Mouse	Hair
4	<i>Petaurus breviceps</i>	Sugar Glider	Call
4	<i>Rattus fuscipes</i>	Bush Rat	Hair
4	<i>Rattus fuscipes</i>	Bush Rat	Trap
4	<i>Sminthopsis murina</i>	Common Planigale	Hair
4	<i>Sminthopsis murina</i>	Common Planigale	Hair
4	<i>Trichosurus caninus</i> (possible)	Mountain Brushtail Possum	Hair
4	<i>Vulpes vulpes</i>	Fox	Hair
5	<i>Pseudocheirus peregrinus</i>	Ringtail Possum	Observed
5	<i>Trichosurus vulpecula</i>	Common Brush-tailed Possum	Hair
5	<i>Trichosurus vulpecula</i>	Common Brush-tailed Possum	Hair
-	<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	AnaBat
-	<i>Chalinolobus gouldii</i> (probable)	Gould's Wattled Bat	AnaBat
-	<i>Vespadelus sp.</i>	Forest Bat	AnaBat

Table A.4 Bird Survey Results

Page 1 of 2

TON	Common Name	Scientific Name	Abundance	Heath	Woodland Forest	Riparian	Cleared Grass
32	Bar-shouldered Dove	<i>Geopelia humeralis</i>	A		X		
221	Brown Goshawk	<i>Accipiter fasciatus</i>	A		X		
254	Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	A		X		
265	Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	3		X	X	
282	Crimson Rosella	<i>Platycercus elegans</i>	B		X		X
322	Laughing Kookaburra	<i>Dacelo novaeguineae</i>	A		X	X	
326	Sacred Kingfisher	<i>Todiramphus sanctus</i>	A		X		
334	White-throated Needletail	<i>Hirundapus caudacutus</i>	C	X	X	X	X
347	Common Koel	<i>Eudynamis scolopacea</i>	A		X		
349	Pheasant Coucal	<i>Centropus phasianinus</i>	A		X		X
357	Welcome Swallow	<i>Hirundo neoxena</i>	A				X
361	Grey Fantail	<i>Rhipidura fuliginosa</i>	B	X	X	X	
392	Eastern Yellow Robin	<i>Eopsaltria australis</i>	B	X	X	X	
398	Golden Whistler	<i>Pachycephala pectoralis</i>	A	X		X	
401	Rufous Whistler	<i>Pachycephala rufiventris</i>	B	X	X		
408	Grey Shrike-thrush	<i>Colluricincla harmonica</i>	A	X	X	X	
415	Magpie-lark	<i>Grallina cyanoleuca</i>	A				X
421	Eastern Whipbird	<i>Psophodes olivaceus</i>	A	X		X	
424	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	A		X	X	
429	Cicadabird	<i>Coracina tenuirostris</i>	A		X		
470	Striated Thornbill	<i>Acanthiza lineata</i>	B		X	X	
475	Brown Thornbill	<i>Acanthiza pusilla</i>	B	X	X	X	
488	White-browed Scrubwren	<i>Sericornis frontalis</i>	B	X	X	X	X
494	Large-billed Scrubwren	<i>Sericornis magnirostris</i>	A			X	
498	Chestnut-rumped Heathwren	<i>Hylacola pyrrhopygia</i>	A	X			
525	Golden-headed Cisticola	<i>Cisticola exilis</i>	A				X
529	Superb Fairy-wren	<i>Malurus cyaneus</i>	B		X		X
536	Variegated Fairy-wren	<i>Malurus lamberti</i>	B	X	X	X	
549	Varied Sittella	<i>Daphoenositta chrysoptera</i>	A		X	X	
558	White-throated Treecreeper	<i>Cormobates leucophaeus</i>	A		X		
564	Mistletoebird	<i>Dicaeum hirundinaceum</i>	A		X	X	
565	Spotted Pardalote	<i>Pardalotus punctatus</i>	A		X		
574	Silvereye	<i>Zosterops lateralis</i>	B	X	X	X	
583	Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	A		X	X	
591	Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	B	X	X	X	
605	Lewin's Honeyeater	<i>Meliphaga lewinii</i>	A			X	
614	Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	A	X	X	X	
617	White-eared Honeyeater	<i>Lichenostomus leucotis</i>	A	X			
631	New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	C	X	X	X	

Table A.4 Bird Survey Results

Page 2 of 2

TON	Common Name	Scientific Name	Abundance	Heath	Woodland Forest	Riparian	Cleared Grass
632	White-cheeked Honeyeater	<i>Phylidonyris nigra</i>	A		X		
634	Noisy Miner	<i>Manorina melanocephala</i>	A		X		
637	Little Wattlebird	<i>Anthochaera chrysoptera</i>	B	X	X	X	
645	Noisy Friarbird	<i>Philemon corniculatus</i>	A		X	X	
662	Red-browed Finch	<i>Neochmia temporalis</i>	A	X		X	
671	Olive-backed Oriole	<i>Oriolus sagittatus</i>	A		X		
679	Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>	A			X	
694	Pied Currawong	<i>Strepera graculina</i>	A		X	X	
702	Grey Butcherbird	<i>Cracticus torquatus</i>	A		X		X
705	Australian Magpie	<i>Gymnorhina tibicen</i>	A			X	X
930	Australian Raven	<i>Corvus coronoides</i>	A		X		X
990	Red-whiskered Bulbul	<i>Pynonotus jocosus</i>	A		X		

Table A.5 Frog Survey Results

Page 1 of 2

Site	Easting	Northing	Description	Species Present	Threatened Species Habitat
A	333614	6300809	Small boggy area, near end of northern track. Area dominated by <i>Glychenia</i> and <i>Gahnia</i> .		
B	333945	6300783	Wet sandstone outcrop. Northern track. Dominated by ferns, <i>Glychenia</i>		Red-crowned Toadlet
C	333992	6300648	Northern track crossing of Creek A, above waterfall.		Red-crowned Toadlet
D	333887	6300634	Creek A below waterfall.	Red-crowned Toadlets <i>Pseudophryne australis</i>	Red-crowned Toadlet
E	334012	6300655	Creek A above road crossing	Red-crowned Toadlets <i>Pseudophryne australis</i>	Red-crowned Toadlet
F	334235	6300792	<i>Eleocharis</i> Pond, Northern bore track	Eastern Dwarf Tree Frog <i>Litoria fallax</i>	
G	334259	6300747	<i>Gahnia</i> wetland, top of Creek A.	Perons Tree Frog <i>Litoria peronii</i> , Bleating Tree Frog <i>Litoria dentata</i>	Giant Burrowing Frog
H	334108	6300509	Northern side of Tea Tree Swamp		Giant Burrowing Frog
I	334132	6300413	Southern side of Tea Tree Swamp		Giant Burrowing Frog
J	334119	6300401	<i>Glychenia</i> ditch off Creek B		Red-crowned Toadlet
K	334129	6300345	Top end of Creek B		
L	333946	6300454	Lower tea Tree Swamp		Giant Burrowing Frog
M	334512	6300848	Creek A, under power lines	Bleating Tree Frog <i>Litoria dentata</i> , Striped Marsh Frog <i>Limnodynastes peronii</i>	

Table A.5 Frog Survey Results

Page 2 of 2

Site	Easting	Northing	Description	Species Present	Threatened Species Habitat
N	334287	6300255	Creek B , under power lines		
O	334645	6300603	Abandoned Quarry Pond and Sedge area	Perons Tree Frog <i>Litoria peronii</i> , Broad-palmed Frog <i>Litoria latopalmata</i> , Eastern Dwarf Tree Frog <i>Litoria fallax</i> , Striped Marsh Frog <i>Limnodynastes peronii</i>	
P	333768	6300541	Creek C below junction of Creeks A and B	Leaf Green Tree Frog <i>Litoria phyllochroa</i>	

Table A.6 Freshwater Macroinvertebrates

Order	Family	Abundance	SIGNAL Grades
Diptera	Chironomidae:		
	- Tanypodinae (sub-family)	3	4
	- Chironominae (sub family)	6	3
	- Orthoclaadiinae (sub family)	1	4
Hemiptera	Notonectidae	12	1
	Hydrometridae	3	3
	Mesoveliidae	2	2
	Veliidae	1	3
Tricoptera	Odontoceridae	1	7
	Leptoceridae	2	6
Odonata	Sylestidae	4	7
Megaloptera	Corydalidae	1	7
Aphipoda	-	1	3
Arachnida	-	5	-
Summary	Taxa Totals	Total Abundance	Average SIGNAL Grading
7 Orders	9 Families	42	4.16667*

* Moderate Pollution (Chessman, 1995)

Appendix B

Flora Survey Results

(No. of pages excluding this page = 6)

Table B.1 Plants Recorded by Cumberland Ecology

Page 1 of 4

Group	Species	Community:	E26	E26	E26	E29	E25	E29	E25	E29	E26
			Quadrat:	1	2	3	4	5	6	7	8
Trees											
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-oak			1	1					
	<i>A. torulosa</i>	Forest Oak					adj				
Cunoniaceae	<i>Callicoma serratifolia</i>	Callicoma					adj		3		
	<i>Ceratopetalum gummiferum</i>	Christmas Bush						2	3	2	
Epacridaceae	<i>Trochocarpa laurina</i>	Tree Heath					adj				
Myrtaceae	<i>Angophora costata</i>	Smooth-barked Apple	2	5	1		1	5	5	5	
	<i>Corymbia gummifera</i>	Red Bloodwood	5	2	2	1		2		1	
	<i>Eucalyptus haemastoma</i>	Scribbly Gum			5	1	3			5	
	<i>E. piperita</i>	Sydney Peppermint					6	5	5	5	
	<i>E. punctata</i>	Grey Gum	1	5	1					1	
	<i>E. sparsifolia</i>	a stringybark	1	1	1	1				1	
	<i>Syncarpia glomulifera</i>	Turpentine							adj		
Proteaceae	<i>Banksia serrata</i>	Old Man Banksia		2				2	2	2	
Shrubs											
Apiaceae	<i>Platysace lanceolata</i>								1		
	<i>P. linearis</i>			2	1	1	1		1	1	
Araliaceae	<i>Polyscias sambucifolius</i>	Elderberry Panax					2				
Dilleniaceae	<i>Hibbertia bracteata</i>		3		1			2	3	1	
	<i>H. . empetrifolia</i>					1					
	<i>H. linearis</i>		3	3							
	<i>H. procumbens</i>					1					
Elaeocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash							1		
Epacridaceae	<i>Brachyloma daphnoides</i>		2	2							
	<i>Drachophyllum secundum</i>							1			
	<i>Epacris longiflora</i>							2			
	<i>E. obtusa</i>										2
	<i>E. pulchella</i>				2						
	<i>Leucopogon esquamatus</i>				1						
	<i>L. microphyllus</i>			1	2						
	<i>Woolfsia pungens</i>							2			
Euphorbiaceae	<i>Amperea xiphoclada</i>							2			
	<i>Glochidion ferdinandi</i>	Cheese Tree					2				
	<i>Phyllanthus hirtellus</i>		1								
	<i>Micrantheum ericoides</i>			1							
	<i>Ricinocarpus pinifolius</i>	Wedding Bush						3		2	
Fabaceae	<i>Bossiaea heterophylla</i>		1		2					2	
	<i>B. scolopendria</i>		2	2		1				2	
	<i>Dillwynia floribunda</i>		3	3	1			3			

Table B.1 Plants Recorded by Cumberland Ecology (Cont'd)

Page 2 of 4

Group	Species	Community: Quadrat:	E26	E26	E26	E29	E25	E29	E25	E29	E26
			1	2	3	4	5	6	7	8	9
	<i>Gompholobium latifolia</i>							1			
	<i>G. virgata</i>		2		1						1
	<i>Hovea linearis</i>		1								1
	<i>Phyllota philicoides</i>		2		1			3			
	<i>Pultenaea daphnoides</i>								3		
	<i>P. elliptica</i>		3	2	2						2
	<i>P. ?polifolia</i>				1						
	<i>P. rosmarinifolius</i>		1			1					
	<i>Aotus ericoides</i>										2
	<i>Acacia linifolia</i>	Flax Wattle		2			2	2			2
	<i>A. myrtifolia</i>	Myrtle-leaved Wattle			1						1
	<i>A. oxycedrus</i>		2	4		1	2	2			2
	<i>A. suaveolens</i>	Sweet-scented Wattle	1	3	1	2	2	2			2
	<i>A. terminalis</i>	Sunshine Wattle					1	1	1		
	<i>A. ulicifolia</i>	Prickly Moses	1				2	1			1
Lamiaceae	<i>Prostanthera linearis</i>							1	3		
Myrtaceae	<i>Angophora hispida</i>	Dwarf Apple			adj	2					
	<i>Baeckea brevifolia</i>		1		2?						
	<i>Callistemon pinifolius</i>		1	2							
	<i>Darwinia glaucophylla</i>		2			2					
	<i>Kunzea capitata</i>		3	3	3	4					
	<i>Leptospermum juniperinum</i>	Prickly-leaved Tea Tree									2
	<i>Leptospermum polygalifolium</i>	Yellow Tea Tree		3	2	2	6	2	5		
	<i>L. . trinervium</i>	Paperbark Tea Tree	5	5	3	2		2			
Proteaceae	<i>Banksia ericifolia</i>	Heath Banksia	2	2	1	7	2	2	2		3
	<i>B. oblonga</i>			1	1	1					
	<i>B. robur</i>	Swamp Banksia									3
	<i>B. spinulosa</i>	Hairpin Banksia			1			2			
	<i>Conospermum longifolium</i>				3			2			3
	<i>Grevillea buxifolia</i>	Grey Spiderflower	2	2							
	<i>G. diffusa</i>			1	3	2	2				
	<i>G. mucronulata</i>		1								
	<i>G. sericea</i>	Pink Spiderflower									
	<i>Hakea dactyloides</i>					1	1				
	<i>Hakea laurina</i>										1
	<i>H. . teretifolia</i>	Dagger Hakea	2	3	3	2		1	1		3
	<i>Isopogon anemonifolius</i>	Drumsticks	2								
	<i>Lambertia formosa</i>	Mountain Devil	2		3	2	1	2			3
	<i>Persoonia levis</i>	Broad-leaved Geebung			1	1		1			1
	<i>P. linearis</i>	Narrow-leaved Geebung					2				

Table B.1 Plants Recorded by Cumberland Ecology (Cont'd)

Page 3 of 4

Group	Species	Community: Quadrat:	E26	E26	E26	E29	E25	E29	E25	E29	E26
			1	2	3	4	5	6	7	8	9
	<i>Petrophile pulchella</i>	Conesticks	2	2	5	3					
	<i>P. ?sessilis</i>							1		2	
	<i>Xylomelum pyriforme</i>	Woody Pear								1	
Rhamnaceae	<i>Pomaderris intermedia</i>						adj				
Rutaceae	<i>Eriostemon australasius</i>										
	<i>E. buxifolia</i> ssp <i>obovatus</i>		1					1			
	<i>Boronia floribunda</i>		1			1		2		2	
	<i>B. ledifolia</i>		2	2							
Santalaceae	<i>Leptomeria acida</i>									1	
Sapindaceae	<i>Dodonaea multijuga</i>			2							
Thymeliaceae	<i>Pimelea linifolia</i>	Common Riceflower			1						
Tremandraceae	<i>Tetradlea ericifolia</i>				1						
	<i>T. thymifolia</i>									1	
Xanthorrhoeaceae	<i>Xanthorrhoea</i> sp.	a grasstree	2	2	2	2	1		2		
Herbs - Ferns											
Adiantaceae	<i>Adiantum aethiopicum</i>	Common Maidenhair Fern						2			
Blechnaceae	<i>Blechnum nudum</i>						adj				
Dennstaedtiaceae	<i>Hypolepis muelleri</i>	Harsh Ground Fern						2			
	<i>Pteridium esculentum</i>	Bracken Fern		1				4	3	2	2
Gleicheniaceae	<i>Gleichenia dicarpa</i>	Pouched Coral Fern								2	6
	<i>G. microphylla</i>										adj
	<i>Sticherus flabellatus</i>	Umbrella Fern								3	
Lindsaeaceae	<i>Lindsaea linearis</i>	Screw Fern				2					
Osmundaceae	<i>Todea barbara</i>	King Fern							1		
Selaginellaceae	<i>Sellaginella uliginosa</i>					2		2		3	
Herbs - Dicots											
Apiaceae	<i>Actinotus minor</i>	Lesser Flannel Flower	2	2	4	3		2		3	
	<i>Xanthosia pilosa</i>							1	2	1	
	<i>X. tridentata</i>								1		
Goodeniaceae	<i>Dampiera stricta</i>			2		1		1			
	<i>Goodenia bellidifolius</i>		2								
	<i>Scaevola ramosissima</i>							1			
Loganiaceae	<i>Mitrasacme polymorpha</i>							2			
Rutaceae	<i>Pomax umbellata</i>							1			
Stackhousiaceae	<i>Stackhousia viminea</i>					1					
Stylidiaceae	<i>Stylidium gramineum</i>	a Trigger Plant						2			
	<i>S. lineare</i>	a Trigger Plant			3	3					

Table B.1 Plants Recorded by Cumberland Ecology (Cont'd)

Page 4 of 4

Group	Species	Community: Quadrat:	E26	E26	E26	E29	E25	E29	E25	E29	E26
			1	2	3	4	5	6	7	8	9
Herbs - Monocots											
Agavaceae	<i>Doryanthes excelsa</i>	Gynea Lily		2				3	2		
Anthericaceae	<i>Caesia parviflora</i>		1								
Cyperaceae	<i>Caustis flexuosa</i>	Curly Sedge	1		1						
	<i>C. recurvata</i>							3			
	<i>Cyathochaeta diandra</i>		2	2	2	2	2	3		2	
	<i>Gahnia clarkei</i>						2				6
	<i>G. sieberiana</i>								3		
	<i>Lepidosperma concavum</i>		3								
	<i>L. laterale</i>	Broad Sword-sedge				2					
	<i>L. . sp</i>			1	1						
	<i>Ptilothrix deusta</i>					2					
	<i>Schoenus imberbis</i>		3	3							
Iridaceae	<i>Patersonia glabrata</i>	a Purple Flag						2			
	<i>P. sericea</i>	a Purple Flag	3		4	2					
Lomandraceae	<i>Lomandra glauca</i>		4	3							
	<i>L. longifolia</i>	Spiny-headed Mat-rush		2					2		
	<i>L. obliqua</i>	Fishbone Mat-rush	1					2		2	
Orchidaceae	<i>orchid sp</i>					1					
Phormiaceae	<i>Dianella prunina</i>		2	1	1	1		1		1	
Poaceae	<i>Anisopogon avenaceous</i>		3	1	2	2		3		3	
	<i>Entolasia stricta</i>	Wiry Panic	2	4	2	2	3			4	
	<i>Imperata cylindrica var major</i>	Blady Grass					4				
	<i>Poa sp.</i>				2						
	<i>Themeda australis</i>	Kangaroo Grass			1						
	<i>poaceae</i>			2							
Restionaceae	<i>Empodisma minor</i>						3		2		
	<i>Lepyrodia scariosa</i>	Scale Rush	1	4		5					
	<i>Restio ?fimbriatus</i>						2				
Xyridaceae	<i>Xyris gracilis ssp gracilis</i>					2					
Vines											
Asclepiadaceae	<i>Marsdenia suaveolens</i>								1		
Fabaceae	<i>Hardenbergia violcea</i>	Purple Coral Pea					1	1			
Lauraceae	<i>Cassytha pubescens</i>	Devils Twine	2		2	2		1		1	
Pittosporaceae	<i>Billardiera scandens</i>	Common Appleberry							1	1	
Vitaceae	<i>Cissus hypoglauca</i>	Five-leaved Water Vine				1					
Smilacaceae	<i>Smilax glycyphylla</i>	Sarsaparilla						1	1		

Key:

1 = rare 2 = occasional 3 = common 4 = very common but less than 5% 5 = 5-25% 6 = 26-50%
7 = 51-75% adj = recorded adjacent to quadrat

This page has intentionally been left blank

Table B.2 Likelihood of Threatened Species Recorded (TSC Act-listed) or Predicted to Occur (EPBC Act-listed) within the Gosford LGA Occurring on the Project Site

Page 1 of 2

Scientific Name	Common Name	TSC Status	EPBC Status	Popran NP	Study Area	Project Site	Locality	Habitat	Habitat present in Project Site	Likelihood of occurrence
<i>Olearia cordata</i>		V	V	N	N	N	N	Grows in dry open sclerophyll forest and open shrubland, on sandstone ridges.	Yes	Low
<i>Astrotricha crassifolia</i>	Thick-leaf Star-hair	V	V	N	N	N	N	Occurs on sandstone in dry sclerophyll woodlands near Patonga and the Woronora Plateau, with an outlying record near Glen Davis	Yes	Low
<i>Senecio spathulatus</i>	Coast Groundsel	E1		N	N	N	N	Grows on primary dunes.	No	Low
<i>Hibbertia procumbens</i>	Spreading Guinea Flower	E1		Y	Y	Y	Y	Usually occurs within <i>Banksia ericifolia</i> - <i>Angophora hispida</i> - <i>Allocasuarina distyla</i> scrub/heath on skeletal soils.	Yes	Known
<i>Tetradlea glandulosa</i>		V	V	Y	Y	N	Y	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.	Yes	Probable
<i>Tetradlea juncea</i>	Black-eyed Susan	V	V	N	N	N	N	Usually occurs in low open forest/woodland with mixed scrub and grassy ground cover but is also found in moist forest and heathland.	Yes	Possible
<i>Epacris purpurascens</i> var. <i>purpurascens</i>		V		N	N	N	N	Found in a range of habitat types, most of which have a strong shale soil influence.	No	Low
<i>Chamaesyce psammogeton</i>	Sand Spurge	E1		N	N	N	N	Found on the foredunes and headlands of the eastern coast from Jervis Bay to Queensland	No	Low
<i>Acacia bynoeana</i>	Bynoe's Wattle	E1	V	N	N	N	N	Found in heath and woodland on sandy soils. Prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches.	Yes	Possible
<i>Acacia pubescens</i>	Downy Wattle	V	V	N	N	N	N	Occurs on alluviums, shales and at the intergrade between shales and sandstones. Associated with gravelly soils.	No	Low
<i>Haloragodendron lucasii</i>		E1	E	N	N	N	N	Associated with dry sclerophyll forest.	Yes	Low
<i>Maundia triglochinos</i>		V		N	N	N	N	Grows in swamps, creeks or shallow freshwater on heavy clay.	No	Low
<i>Prostanthera askania</i>	Tranquillity Mintbush	E1	E	N	N	N	Y	Found in moist sclerophyll forests or warm temperate rainforest but occurs only adjacent to creeks or drainage lines on Narrabeen sandstone or its associated alluvial soils.	Yes	Possible
<i>Prostanthera junonis</i>	Somersby Mintbush	E1	E	N	N	N	Y	The species is restricted to the Somersby Plateau. It occurs on both the Somersby and Sydney Town soil landscapes on gently undulating country over weathered Hawkesbury sandstone within open forest/low woodland/open scrub. It occurs in both disturbed and undisturbed sites.	Yes	Possible
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V		N	Y	Y	Y	Grows in dry sclerophyll forest on the coast and adjacent ranges.	Yes	Known
<i>Darwinia biflora</i>		V	V	N	N	N	N	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	No	Low
<i>Darwinia glaucophylla</i>		V		Y	Y	Y	Y	Occurs in sandy heath, scrub and woodland and is associated with sandstone rock platforms or hanging swamps.	Yes	Known
<i>Eucalyptus camfieldii</i>	Heart-leaved Stringybark	V	V	N	N	N	Y	Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges.	Yes	Possible
<i>Kunzea rupestris</i>		V	V	N	N	N	N	Grows in shallow depressions on large flat sandstone rock outcrops. Characteristically found in short to tall shrubland or heathland.	Yes	Possible
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	N	N	N	N	Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	No	Low
<i>Melaleuca deanei</i>	Deane's Paperbark	V	V	N	N	N	N	The species grows in heath on sandstone. Occurs in two distinct areas, in the Kuring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas.	Yes	Possible
<i>Micromyrtus blakelyi</i>		V	V	N	N	N	Y	Typically occurs within heathlands in shallow sandy soil in cracks and depressions of sandstone rock platforms.	Yes	Possible
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	V	V	N	N	N	N	Occurs on gravels, sands, silts and clays in riverside gallery rainforest and remnants of littoral rainforest.	Yes	Possible

Table B.2 Likelihood of Threatened Species Recorded (TSC Act-listed) or Predicted to Occur (EPBC Act-listed) within the Gosford LGA Occurring on the Project Site (Cont'd)

Page 2 of 2

Scientific Name	Common Name	TSC Status	EPBC Status	Popran NP	Study Area	Project Site	Locality	Habitat	Habitat present in Project Site	Likelihood of occurrence
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	E1	V	N	N	N	N	Generally found in grassy sclerophyll woodland on clay loam or sandy soils.	No	Low
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	N	N	N	N	Known from a range of habitats including swamp-heath and woodland.	Yes	Low
<i>Diuris bracteata</i>		E1		N	N	N	N	Occurs in dry sclerophyll woodland	Yes	Possible
<i>Diuris praecox</i>	Rough Double Tail	V	V	N	N	N	N	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey.	No	Low
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid	V	E	N	N	N	N	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest.	Yes	Low
<i>Ancistrachne maidenii</i>		V		N	N	N	Y	Populations occur in distinct bands in areas associated with a transitional geology between Hawkesbury and Watagan soil landscapes. Grows in dry sclerophyll forest on sandstone-derived soils.	Yes	Possible
<i>Grevillea parviflora</i> subsp <i>parviflora</i>		V	V	N	N	N	N	Grows in sandy or light clay soils over thin shales in a range of vegetation types from heath and shrubby woodland to open forest.	No	Low
<i>Grevillea shiressii</i>		V	V	N	N	N	Y	Grows along creek banks in wet sclerophyll forest with a moist understorey in alluvial sandy or loamy soils.	Yes	Possible
<i>Persoonia hirsuta</i>	Hairy Geebung	E1	E	N	N	N	N	Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Yes	Possible
<i>Baloskion longipes</i>	Dense Cord-rush	V		N	N	N	N	Found in swamps or depressions in sandy alluvium or in swales in tall forest.	Yes	Low
<i>Lasiopetalum joyceae</i>		V	V	N	N	N	N	Grows in heath on sandstone.	Yes	Possible

Appendix C

Threatened Species Profiles

(No. of pages excluding this page = 63)

CONTENTS

Page	Page
Callistemon linearifolius.....	3-157
Hibbertia procumbens	3-158
Darwinia glaucophylla	3-160
Acacia bynoeana.....	3-162
Tetradlea glandulosa.....	3-164
Prostanthera junonis	3-166
Eucalyptus camfieldii.....	3-168
Kunzea rupestris	3-170
Melaleuca deanei	3-171
Micromyrtus blakelyi.....	3-173
Diuris bracteata	3-175
Ancistrachne maidenii	3-176
Grevillea shiresii.....	3-178
Persoonia hirsuta	3-179
Lasiopetalum joyceae	3-181
Glossy Black Cockatoo	3-183
Gang-gang Cockatoo	3-185
Powerful Owl	3-187
Masked Owl.....	3-189
Barking Owl	3-191
Yellow-bellied Sheath-tailed Bat.....	3-194
Eastern Freetail-bat.....	3-196
Little Bentwing-bat	3-198
Large-eared Pied Bat	3-200
Large-footed Myotis.....	3-202
Greater Broad-nosed Bat	3-204
Grey-headed Flying-fox	3-206
Eastern Pygmy Possum	3-208
Spotted-tailed Quoll	3-210
Yellow-bellied Glider.....	3-212
Squirrel Glider	3-214
Long-nosed Potoroo.....	3-216
Red-crowned Toadlet	3-218
Giant Burrowing Frog	3-221
Rosenberg's Goanna.....	3-223

C.1 Callistemon linearifolius

C.1.1 Discussion of conservation status

Callistemon linearifolius is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. It is mainly distributed throughout coastal areas of the Sydney Basin Bioregion, from Wollongong to Lake Macquarie, and inland to Kurri Kurri. Its northern limit is Nelson Bay in the NSW North Coast Bioregion (DEC (NSW), 2005y). There is a high risk of local extinction due to low population numbers. *Callistemon linearifolius* is not at the limit of its known distribution.

The key threatening processes that generally threaten *Callistemon linearifolius* are:

- Clearing of native vegetation which leads to a loss of plants and habitat; and
- Ecological consequences of high frequency fires.

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Thirteen priority actions have been identified to help recover this species, including:

- Developing and implementing a population and threat abatement monitoring program (High priority);
- Increasing the level of legislative protection for sites through land use planning mechanisms and conservation agreements (High priority);
- Liaise with landholders to facilitate the implementation of site-specific threat abatement measures (Medium priority);
- Collect seed for NSW seedbank (Medium priority); and
- Provide a map of known occurrences to the Rural Fire Service and seek inclusion of mitigative measures on Bush Fire Risk Management Plans, risk register and/or operation maps (Medium priority).

There are currently only 5-6 populations in the Sydney area, of the 22 populations recorded in the past. Three of these are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park, Popran National Park and Brisbane Water National Park.

C.1.2 Discussion of local and regional abundance

There are currently only 5-6 populations in the Sydney area, of the 22 populations recorded in the past (DECC (NSW), 2007). There are 44 records of the species in the last 20 years in the Sydney Basin Bioregion, mainly around Sydney and Gosford, with additional populations near Kurri Kurri, Budgewoi and Wollongong (NSW Government, 2009).

C.1.3 Discussion of other known local populations

Callistemon linearifolius has been recorded from 8 locations in the Gosford LGA. This species has been recorded on Lion Island Nature Reserve and in the Patonga area (Bell, 2004) and Brisbane Water National Park within Gosford LGA. Based on available records, the occurrence of this species on the subject site forms a disjunct local population.

C.1.4 Discussion of habitat utilisation

This plant was recorded in small groups in four scattered locations on the Project Site. The NE record is of 10 plants, the records in the centre and in the SE are both of a single plant, and in the SW there are 13 plants spread over 3 close locations.

C.1.5 Assessment of habitat

This species typically occurs sporadically within sandstone communities, and although not recorded within the adjacent Popran National Park, it is possible that it is represented there. This species has been recorded in E26 Exposed Hawkesbury Woodland on Lion Island Nature Reserve and in the Patonga area within Gosford LGA (Bell, 2004).

C.1.6 Description of habitat values

E26 Exposed Hawkesbury Woodland occurs throughout the Project Site, and makes up approximately 38% of the total native vegetation (31.8ha out of 83.5ha).

C.1.7 Extent of habitat removal

On the Project Site, *Callistemon linearifolius* was recorded in small groups in four scattered locations, of which only one (within Stage 5) would be cleared as part of the Project, resulting in the loss of a single plant. 24 remaining plants would not be directly impacted by the development. 13.2ha (42%) of known habitat would be cleared from the Project Site as a result of the Project.

C.1.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.2 Hibbertia procumbens

C.2.1 Discussion of conservation status

Hibbertia procumbens is listed as endangered on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. It is known from several locations in the Central Coast area (Gosford and Wyong LGAs). The species occurs in Victoria and Tasmania, although investigation is required to verify that the disjunct NSW populations are the same species. It is susceptible to extinction in NSW from human-induced or random natural events, due to its very restricted distribution, small size and the limited genetic base of its total population. *Hibbertia procumbens* within the Project Site is at the limit of its known distribution.

The key threatening processes that generally threaten *Hibbertia procumbens* are:

- Clearing of native vegetation which leads to a loss of plants and habitat; and
- Ecological consequences of high frequency fires.

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Sixteen priority actions have been identified to help recover this species, including:

- Increasing the level of legislative protection for sites through land use planning mechanisms and conservation agreements (High priority);
- Public authorities undertaking road, trail or easement maintenance activities in habitat to implement measures to avoid impacting upon any populations (High priority);
- Determine if and/or where an ecological burn is required (High priority); and
- Negotiate with managers of freehold sites to prepare and implement site management plans that address threatening processes (Medium priority).

Hibbertia procumbens has been recorded in four conservation reserves: Yengo, Popran and Brisbane Water National Parks and the non-production Strickland State Forest (Bell and Driscoll 2005).

C.2.2 Discussion of local and regional abundance

Within NSW, *Hibbertia procumbens* is known only on the Central Coast in the Gosford and Wyong LGAs (Bell and Driscoll, 2005). *Hibbertia procumbens* has been recorded from 22 locations in the Gosford LGA and 45 locations in the Sydney Basin Bioregion (NSW Government, 2009).

C.2.3 Discussion of other known local populations

This species occurs in moderate densities in other areas of the Somersby Plateau (Bell and Driscoll, 2005). Recently a large population was recorded in Yengo National Park, and smaller populations are also known from Popran and Brisbane Water National Parks (Bell, 2004).

C.2.4 Discussion of habitat utilisation

Hibbertia procumbens has been recorded throughout communities E26 Exposed Hawkesbury Woodland and E29 Hawkesbury Banksia-Scrub Woodland within the Project Site (196 records). This species was recorded throughout much of the Project Site, particularly where surveys were concentrated on higher sections of the Project Site. Concentrations of the species are found in the powerline easement, in the southeast corner (proposed Project Site East Offset Area) and along the southern edge of the Project Site adjoining Popran National Park.

C.2.5 Assessment of habitat

Within Gosford LGA potential habitat exists for this species within all areas mapped as E29 Hawkesbury Banksia Scrub-Woodland, as well as areas adjacent to E54 Sandstone Hanging Swamps (Bell, 2004). This species is also likely to have habitat throughout E26 Exposed Hawkesbury Woodland. E26 and E29 are widespread in the Gosford, Central Coast and Sydney regions.

C.2.6 Description of habitat values

Hibbertia procumbens has been recorded throughout communities E26 Exposed Hawkesbury Woodland and E29 Hawkesbury Banksia-Scrub Woodland within the Project Site. These communities cover approximately 55.6ha of the Project Site, and are common in the locality. Some areas of the Project Site show evidence of relatively recent fire.

C.2.7 Extent of habitat removal

Clearing of the habitat supporting *Hibbertia procumbens* would impact the species within the Project Site. Approximately half of the recorded locations would be impacted by clearing for the two quarries, however other sites will not be impacted. These include the cleared area along the power line easement, along Creek B, in the southeast corner adjacent to Australian Wildlife Walkabout Park, the northwest section between the Stage 3 and 4 quarries, and along the access road to Popran National Park on the southern border of the Project Site. A total of 24.7ha (44%) of known habitat for this species would be cleared from the Project Site.

C.2.8 Consideration of corridors

Habitat to be retained within the Project Site (along the southern and western boundaries) is contiguous with habitat within the adjacent Popran National Park, and therefore fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.3 Darwinia glaucophylla

C.3.1 Discussion of conservation status

Darwinia glaucophylla is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. This species occurs entirely within the Gosford LGA of the Sydney Basin Bioregion

The key threatening processes that generally threaten *Darwinia glaucophylla* are:

- Clearing of native vegetation which leads to a loss of plants and fragmentation of habitat; and

- Ecological consequences of high frequency fires – this species is highly sensitive to too frequent and infrequent fire (recommended fire interval is 5-10 years).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Fifteen priority actions have been identified to help recover this species, including:

- Determine if and/or where an ecological burn is required (High priority);
- Increasing protection for sites through land use planning mechanisms and conservation agreements (High priority);
- Prepare and implement a population monitoring program (High priority);
- Restrict and control access to sites, particularly access by off-road vehicles (High priority);
- Undertake sediment and erosion control works at priority sites (High priority);
- Undertake weed control, priority given to sites at urban interface (High priority); and
- Liaise with landholders to facilitate the implementation of site-specific threat abatement measures (Medium priority).

Darwinia glaucophylla has been recorded in several locations within Brisbane Water National Park and also in Popran National Park. *Darwinia glaucophylla* within the Project Site is at the limit of its known distribution.

C.3.2 Discussion of local and regional abundance

Darwinia glaucophylla occurs entirely within the Gosford LGA, and is known from approximately 15 sites, several within or near Brisbane Water National Park and one within Popran National Park.

C.3.3 Discussion of other known local populations

Darwinia glaucophylla occurs entirely within the Gosford LGA, and is known from approximately 15 sites, several within or near Brisbane Water National Park and one within Popran National Park (DEC (NSW), 2005e).

C.3.4 Discussion of habitat utilisation

Darwinia glaucophylla has been recorded throughout communities E26 Exposed Hawkesbury Woodland and E29 Hawkesbury Banksia-Scrub Woodland within the Project Site (167 records). This species was recorded in seven general sections of the study area including: along the southern edge of the existing quarry; in the southern part of the proposed Stage 4 extraction area, in the powerline easement, part of which will be retained and part will be included in the Stage 4 extraction area; the northern part of the powerline easement in the

Project Site; the southeastern corner of the Project Site (proposed Project Site East Offset Area); within the proposed Stage 5 extraction area; and at the south western corner of the Project Site spreading into the proposed Glenworth Valley Offset Area and Popran National Park.

C.3.5 Assessment of habitat

Darwinia glaucophylla occurs in sandy heath, scrub and woodlands often associated with sandstone rock platforms or near hanging swamps and friable sandstone shallow soils (DEC (NSW), 2005e). It is killed by fire, hence its preference for rocky environments (Benson and McDougall, 1998). Germination is from soil stored seed which requires heat to break seed dormancy. Germination is unlikely in the absence of fire.

C.3.6 Description of habitat values

Darwinia glaucophylla has been recorded throughout communities E26 Exposed Hawkesbury Woodland and E29 Hawkesbury Banksia-Scrub Woodland within the Project Site. These communities cover approximately 55.6ha of the Project Site, and are common in the locality. Some areas of the Project Site show evidence of relatively recent fire.

C.3.7 Extent of habitat removal

Approximately half of the recorded locations would be impacted by clearing for the two quarries, however other sites will not be impacted. These include the cleared area along the power line easement, along Creek B, in the southeast corner adjacent to Australian Wildlife Walkabout Park, the northwest section between the Stage 3 and 4 quarries, and along the access road to Popran National Park on the southern border of the Project Site, particularly the southwest corner. A total of 24.7ha (44%) of known habitat for this species would be cleared from the Project Site.

C.3.8 Consideration of corridors

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.4 Acacia bynoeana

C.4.1 Discussion of conservation status

Acacia bynoeana is listed as endangered on Schedule 1 of the TSC Act. It is listed as vulnerable under the EPBC Act. The species is distributed from Morisset to the Southern Highlands and west to the Blue Mountains. The species is susceptible to local extinction from

catastrophic events because of its disjunct and small populations (DEC (NSW), 2005c). The Project Site is not at the limit of the known distribution for *Acacia bynoeana*.

The key threatening processes that generally threaten *Acacia bynoeana* are:

- Clearing of native vegetation which leads to a loss of plants and habitat;
- Weed invasion (exotic perennial grasses, exotic vines and scramblers, *Lantana camara*); and
- Ecological consequences of high frequency fires (DEC (NSW), 2005c).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Thirteen priority actions have been identified to help recover this species, including:

- Liaise with private and public land managers to facilitate the preparation and implementation of management plans that address threatening processes (Medium priority);
- Incorporate appropriate fire regime into land management practices (Medium priority);
- Restrict access to sites where necessary (Medium priority);
- Undertake targeted bush regeneration works where required (Medium priority);
- Increase the level of legislation protection for sites through land use planning mechanisms and conservation agreements. Retain vegetative linkages between sites where possible (High priority) (DEC (NSW), 2005c).

There are 72 records of the species recorded from the Sydney Basin bioregion from the last 20 years, including populations reserved within Ku-ring-gai Chase National Park, Marra Marra National Park, Dharug National Park, Parr State Conservation Area, Yengo National Park, Blue Mountains National Park, Nattai National Park and Bargo State Conservation Area (NSW Government, 2009).

C.4.2 Discussion of local and regional abundance

There are 2 records of *Acacia bynoeana* in the Gosford LGA from the last 20 years and 72 records from the Sydney Basin bioregion. There are no records from within the locality (NSW Government, 2009).

C.4.3 Discussion of other known local populations

Acacia bynoeana has been recorded from 2 locations in the Gosford LGA, both near Wisemans Ferry Road near Mangrove Creek (NSW Government, 2009).

C.4.4 Discussion of habitat utilisation

This species has not been recorded from the Project Site. Potential habitat exists in the woodland and heath communities on the Project Site.

C.4.5 Assessment of habitat

This species occurs on sandy soils in heath and dry sclerophyll forest (DEC (NSW), 2005c). The species has not been recorded in Popran National Park but potential habitat for the species does occur there.

C.4.6 Description of habitat values

Potential habitat for *Acacia bynoeana* occurs throughout the Project Site in the communities of E25 Hawkesbury Peppermint Apple Forest, E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, and E29 Hawkesbury Banksia Scrub-Woodland. This is approximately 82% of the total native vegetation on the Project Site (68.5ha out of 83.5ha).

C.4.7 Extent of habitat removal

Acacia bynoeana has not been recorded on the Project Site during any of the threatened flora surveys. Approximately 24.7ha (36%) of potential habitat will be cleared as a result of the Project.

C.4.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.5 Tetratheca glandulosa

C.5.1 Discussion of conservation status

Tetratheca glandulosa is listed as vulnerable on Schedule 2 of the TSC Act and as vulnerable under the EPBC Act. It is distributed from Sampsons Pass in Yengo National Park to the north, West Pymble in Lane Cove National Park to the south, Ingleside to the east and East Kurrajong in Wollemi National Park to the west (DEC (NSW), 2005g1). *Tetratheca glandulosa* is not at the limit of its known distribution.

The key threatening processes that generally threaten *Tetratheca glandulosa* are:

- Clearing of native vegetation which leads to a loss of plants and habitat; and
- Ecological consequences of high frequency fires (DEC (NSW), 2005g1).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Sixteen priority actions have been identified to help recover this species, including:

- Encourage community awareness and involvement in threat management works (High priority);
- Reserve Fire Management Strategy to include operational guidelines to protect this species from fire (High priority);
- Increasing the level of legislative protection for sites through land use planning mechanisms and conservation agreements (High priority);
- Undertake identified priority threat management works including weed control, restrict access, stormwater management works and slashing under powerlines (High priority); and
- Undertake works to maintain or improve habitat connectivity between and within populations (Medium priority) (DEC (NSW), 2005g1).

There are 529 records of *Tetratheca glandulosa* from the Sydney Basin bioregion from the last 20 years. The species has been recorded in Yengo, Popran, Dharug, Marra Marra, Ku-ring-gai Chase and Garigal National Parks, Parr State Conservation Area and Berowra Valley Regional Park (NSW Government, 2009).

C.5.2 Discussion of local and regional abundance

There are 529 records of the species in the last 20 years in the Sydney Basin Bioregion, with approximately 150 populations. Strongholds south of the Hawkesbury River are in Berowra Valley Regional Park, Maroota-South Maroota area and Marra Marra National Park. Strongholds north of the Hawkesbury River are in Dharug National Park, the Mangrove Mountain – Central Mangrove Area and Ourimbah State Forest (NSW Government, 2009).

C.5.3 Discussion of other known local populations

Tetratheca glandulosa has been recorded from 92 locations in the Gosford LGA. This species has been recorded nearby at Mt White and in Popran National Park, which is adjacent to the Project Site. Large populations also occur in Dharug National Park and in the Mangrove Mountain area (NSW Government, 2009).

C.5.4 Discussion of habitat utilisation

This plant has not been recorded on the Project Site but has been recorded from Popran National Park, adjacent to the Project Site.

C.5.5 Assessment of habitat

This species is associated with shale-cappings over sandstone and can occur in heath, scrub, woodland and open forest communities (DEC (NSW), 2005g1). *Tetratheca glandulosa* has been recorded in the adjacent Popran National Park but has not been recorded on the Project Site, although it is possible it is present there in woodland and scrub communities.

C.5.6 Description of habitat values

E26 Exposed Hawkesbury Woodland, E25 Hawkesbury Peppermint Apple Forest, E26a Hawkesbury Rock Pavement Heath, E 29 Hawkesbury Banksia Scrub-Woodland, and E29a Hawkesbury Banksia Scrub Woodland (Scrub) occur throughout the Project Site, and make up approximately 97% of the total native vegetation (80.9ha out of 83.5ha).

C.5.7 Extent of habitat removal

Tetratheca glandulosa has not been recorded on the Project Site. Approximately 33.3ha (41%) of potential habitat would be cleared from the Project Site as a result of the project.

C.5.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.6 Prostanthera junonis

C.6.1 Discussion of conservation status

Prostanthera junonis is listed as endangered on Schedule 1 of the TSC Act. It is listed as endangered under the EPBC Act. It has a distribution restricted to the Somersby Plateau with records extending between Central Mangrove and Kariong to the east of the Project Site. An outlying record occurs on the edge of Mooney Mooney Creek near where it meets the Hawkesbury (NSW Government, 2009). The Project Site lies between this outlying record and the main distribution of the species. The species is at risk of extinction because of its restricted distribution.

The key threatening processes that generally threaten *Prostanthera junonis* are:

- Clearing of native vegetation which leads to a loss of plants and habitat;
- Weed invasion (exotic vines and scramblers, Lantana, exotic perennial grasses);
- Susceptibility to infection by *Phytophthora cinnamomi*; and
- Ecological consequences of high frequency fires (DEC (NSW), 2005c1).

No threat abatement plans relate to this species. A recovery plan has been prepared for *Prostanthera junonis* with the overall objective to identify policies and programs which protect and conserve *P. junonis* and which reduce the risk of extinction of the species. Specific objectives relevant to the Project include:

- Ensure populations are not destroyed by habitat loss, ensure security of lands that support populations; and

- Minimise long term decline through implementation of appropriate threat and habitat management practices (DEC (NSW), 2005c1).

Twenty priority actions have been identified to help recover this species, including:

- Prepare and implement site-specific management plans for all populations outside of the reserve system (Medium priority); and
- Undertake weed control activities as appropriate using approved bush regeneration methods (Medium priority) (DEC (NSW), 2005c1).

When the Recovery Plan for *P. junonis* was prepared, the species was known from 9 populations, eight of which were located within a 10km by 7km spread on the Somersby Plateau. There are currently 396 records for the species, mainly concentrated in the aforementioned distribution but there are also several outlying populations. At least two populations are conserved within Brisbane Waters National Park (NSW Government, 2009).

C.6.2 Discussion of local and regional abundance

There are currently 396 records for the species, with the majority of these occurring in the east of the Somersby Plateau from Central Mangrove to Kariong. Outlying populations occur near where Mooney Mooney Creek meets the Hawkesbury River and records have been lodged with the Royal Botanic Gardens for the species at Mona Vale (NSW Government, 2009).

C.6.3 Discussion of other known local populations

Prostanthera junonis has not been recorded from the Project Site. Other populations within the locality occur further east, generally on the eastern edge of the Somersby Plateau, east of Mooney Mooney Creek.

C.6.4 Discussion of habitat utilisation

This species has not been recorded on the Project Site.

C.6.5 Assessment of habitat

This species occurs on weathered sandstone within open forest, low woodland or open scrub (DEC (NSW), 2005c1). It could potentially occur in E25 Hawkesbury Peppermint Apple Forest, E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub). The species has not been recorded in Popran National Park.

C.6.6 Description of habitat values

E25 Hawkesbury Peppermint Apple Forest, E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a

Hawkesbury Banksia Scrub-Woodland (Scrub) occur throughout the Project Site and make up approximately 97% of the total native vegetation (80.9ha out of 83.5ha).

C.6.7 Extent of habitat removal

Prostanthera junonis has not been recorded on the Project Site. Approximately 33.3ha (41%) of potential habitat would be cleared from the Project Site as a result of the project.

C.6.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.7 Eucalyptus camfieldii

C.7.1 Discussion of conservation status

Eucalyptus camfieldii is listed as vulnerable on Schedule 2 of the TSC Act. It is also listed as vulnerable under the EPBC Act. It is distributed in a narrow band from the Raymond Terrace area to Waterfall. There is a high risk of inbreeding due to low and isolated population numbers (DEC (NSW), 2005d). *Eucalyptus camfieldii* is not at the limit of its known distribution.

The key threatening processes that generally threaten *Eucalyptus camfieldii* are:

- Clearing of native vegetation which leads to a loss of plants and habitat;
- Weed invasion (exotic vines and scramblers, exotic perennial grasses, Lantana); and
- Ecological consequences of high frequency fires (DEC (NSW), 2005d).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Fifteen priority actions have been identified to help recover this species, including:

- Liaise with landholders to facilitate the implementation of site-specific threat abatement measures (High priority);
- Implement appropriate fire regimes using suitable methods for this species (Medium priority);
- Control access at sites with high visitation and disturbance (Medium priority);
- Prepare and implement site-specific plans of management (High priority); and
- Seek to increase the level of legislative protection for sites through land use planning mechanisms and conservation agreements (High priority) (DEC (NSW), 2005d).

There are 186 records from the Sydney Basin bioregion. Several populations are reserved within the Mangrove Creek Dam Water Supply Reserve, Wyong State Forest, Popran National Park, Brisbane Waters National Park and further south in Ku-ring-gai Chase National Park, Berowra Valley Regional Park, Sydney Harbour National Park (at North Head), Royal National Park and Heathcote National Park (NSW Government, 2009).

C.7.2 Discussion of local and regional abundance

There are fourteen records of *Eucalyptus camfieldii* in the Gosford LGA from the last 20 years. There are 186 records from the Sydney Basin bioregion. The species occurs in small, disjunct populations throughout its distribution (NSW Government, 2009).

C.7.3 Discussion of other known local populations

There are 186 records for the species, the majority of which are from the Sydney Basin Bioregion. Several disjunct populations occur within the Gosford LGA including at Point Clare, Popran National Park and the northern section of Brisbane Waters National Park (NSW Government, 2009).

C.7.4 Discussion of habitat utilisation

Eucalyptus camfieldii has not been recorded on the Project Site. It has been recorded from the northern portion of Popran National Park, not from the section adjacent to the Project Site.

C.7.5 Assessment of habitat

This species occurs in shallow sandy soils on sandstone in coastal heath and low open woodland (DEC (NSW), 2005d). It could potentially occur in E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub). The species has not been recorded in the section of Popran National Park adjacent to the Project Site.

C.7.6 Description of habitat values

E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub) occur throughout the Project Site, and make up approximately 83% of the total native vegetation (69.4ha out of 83.5ha).

C.7.7 Extent of habitat removal

Eucalyptus camfieldii does not occur on the Project Site. Approximately 33.3ha (48%) of potential habitat would be cleared from the Project Site as a result of the project.

C.7.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.8 Kunzea rupestris

C.8.1 Discussion of conservation status

Kunzea rupestris is listed as vulnerable on Schedule 2 of the TSC Act. It is also listed as vulnerable under the EPBC Act. It has a restricted distribution, mainly distributed in the Maroota – Sackville – Glenorie area. It is known from only 20 sites (NSW Government, 2009). The northern most records are from Dharug National Park.

The key threatening processes that generally threaten *Kunzea rupestris* are:

- Clearing of native vegetation which leads to a loss of plants and habitat;
- Weed invasion (exotic perennial grasses, exotic vines and scramblers, Lantana); and
- Ecological consequences of high frequency fires (DEC (NSW), 2005q).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Thirteen priority actions have been identified to help recover this species, including:

- Negotiate with sand mining companies to reduce threats posed by mining activities (High priority); and
- Negotiate with private landholders to increase protection of sites through land use planning mechanisms or conservation agreements for sites on private land (Medium priority) (DEC (NSW), 2005q).

There are currently only 46 records from the Sydney Basin bioregion from the last 20 years. The species is conserved within Dharug National Park, Ku-ring-gai Chase National Park and Marra Marra National Park (NSW Government, 2009).

C.8.2 Discussion of local and regional abundance

There are 46 records of *Kunzea rupestris* from the Sydney Basin bioregion from the last 20 years. The main populations are distributed around the Maroota – Sackville – Glenorie area with populations at Maroota, South Maroota and Sackville North. There are two records from the Gosford LGA within the last 20 years, both from Dharug National Park (NSW Government, 2009).

C.8.3 Discussion of other known local populations

The species has not been recorded on the Project Site. The closest populations are those that have been recorded from Dharug National Park. These are the only records for the species north of the Hawkesbury River.

C.8.4 Discussion of habitat utilisation

Kunzea rupestris has not been recorded from the Project Site.

C.8.5 Assessment of habitat

This species grows in shallow depressions on large flat sandstone outcrops in short to tall shrubland or heathland (DEC (NSW), 2005q). Potential habitat occurs for the species in E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub). The species has not been recorded in Popran National Park.

C.8.6 Description of habitat values

E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub) occur throughout the Project Site, and make up approximately 83% of the total native vegetation (69.4ha out of 83.5ha).

C.8.7 Extent of habitat removal

Kunzea rupestris does not occur on the Project Site. Approximately 33.3ha (48%) of potential habitat would be cleared from the Project Site as a result of the project.

C.8.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.9 Melaleuca deanei

C.9.1 Discussion of conservation status

Melaleuca deanei is listed as vulnerable on Schedule 2 of the TSC Act. It is also listed as vulnerable under the EPBC Act. Its main distribution is in the Ku-ring-gai/Berowra and

Holsworthy/Wedderburn areas but occurs as far north as St Albans, as far south as Colymea State Conservation Area and west as Springwood and Bundanoon. There is a high risk of local extinction due to low population numbers (DEC (NSW), 2005f).

The key threatening processes that generally threaten *Melaleuca deanei* are:

- Clearing of native vegetation which leads to a loss of plants and habitat;
- Weed invasion (exotic vines and scramblers, exotic perennial grasses, Lantana); and
- Ecological consequences of high frequency fires (DEC (NSW), 2005f).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Sixteen priority actions have been identified to help recover this species, including:

- Liaise with private and public land managers to facilitate the preparation and implementation of management plans that address threatening processes (Medium priority);
- Incorporate appropriate fire regime into land management practices (Medium priority);
- Restrict vehicular and pedestrian access to sites, where necessary (Medium priority);
- Undertake targeted bush regeneration works, where required (Medium priority); and
- Seek to increase the level of legislative protection for sites through land-use planning mechanisms and conservation agreements. Retain or, where lost, re-establish vegetative linkages between sites where possible (High priority) (DEC (NSW), 2005f).

There are 82 records of *Melaleuca deanei* from the Sydney Basin bioregion in the last 20 years. Many of these are within conservation reserves including Yengo National Park, Parr State Conservation Area, Marra Marra National Park, Ku-ring-gai Chase National Park, Garigal National Park, Lane Cove National Park, Heathcote National Park and Royal National Park. Berowra Valley Regional Park is a strong hold for the species (NSW Government, 2009).

C.9.2 Discussion of local and regional abundance

There are currently 82 records for the species from the Sydney Basin bioregion from the last 20 years. The main populations occur in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas. There is one record of the species in the Gosford LGA from the last 20 years, at Horsfield Bay (NSW Government, 2009).

C.9.3 Discussion of other known local populations

Melaleuca deanei has been recorded at one location in the Gosford LGA in the last 20 years, at Horsfield Bay (NSW Government, 2009). The species has not been recorded on the Project Site or in the adjacent Popran National Park.

C.9.4 Discussion of habitat utilisation

Melaleuca deanei has not been recorded from the Project Site.

C.9.5 Assessment of habitat

This species has not been recorded on the Project Site. Potential habitat occurs in E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub). This species has not been recorded in Popran National Park.

C.9.6 Description of habitat values

E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub) occur throughout the Project Site, and make up approximately 45% of the total native vegetation (37.6ha out of 83.5ha).

C.9.7 Extent of habitat removal

Melaleuca deanei does not occur on the Project Site. Approximately 20.1ha (53%) of potential habitat would be cleared from the Project Site as a result of the project.

C.9.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.10 Micromyrtus blakelyi

C.10.1 Discussion of conservation status

Micromyrtus blakelyi is listed as vulnerable on Schedule 2 of the TSC Act. It is also listed as vulnerable under the EPBC Act. It is mainly distributed in the Baulkham Hills and Hornsby LGAs with the northern limit north of Maroota and the southern limit at Cowan (DEC (NSW), 2005x). There is one record from north of the Hawkesbury River near Mt White (NSW Government, 2009).

The key threatening processes that generally threaten *Micromyrtus blakelyi* are:

- Clearing of native vegetation which leads to a loss of plants and habitat;
- Weed invasion (exotic vines and scramblers, exotic perennial grasses, Lantana); and

- Ecological consequences of high frequency fires (DEC (NSW), 2005x).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Seven priority actions have been identified to help recover this species, none of which are relevant to the Project (DEC (NSW), 2005x).

There are currently 45 records of *Micromyrtus blakelyi* from the Sydney Basin bioregion from the last 20 years. Many records are conserved within Marra Marra National Park with some in Muogamarra Nature Reserve (NSW Government, 2009).

C.10.2 Discussion of local and regional abundance

The majority of records for this species occur south of the Hawkesbury in the region from Maroota to Cowan. There is one record from north of the Hawkesbury River near Mt White (NSW Government, 2009). The species has not been recorded on the Project Site or within Popran National Park.

C.10.3 Discussion of other known local populations

Micromyrtus blakelyi has not been recorded on the Project Site or the adjacent Popran National Park. The species has been recorded once at Mt White (NSW Government, 2009).

C.10.4 Discussion of habitat utilisation

Micromyrtus blakelyi has not been recorded from the Project Site.

C.10.5 Assessment of habitat

This species occurs in shallow sandy soils in cracks and depressions on sandstone rock platforms (DEC (NSW), 2005x). It could potentially occur in E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub). The species has not been recorded in the section of Popran National Park adjacent to the Project Site.

C.10.6 Description of habitat values

E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub-Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub) occur throughout the Project Site, and make up approximately 83% of the total vegetation (69.4ha out of 83.5ha).

C.10.7 Extent of habitat removal

Micromyrtus blakelyi does not occur on the Project Site. Approximately 33.3ha (48%) of potential habitat would be cleared from the Project Site as a result of the project.

C.10.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.11 Diuris bracteata

C.11.1 Discussion of conservation status

Diuris bracteata is listed as endangered on Schedule 1 of the TSC Act. It is not listed under the EPBC Act. Original records for this species were from the Gladesville area and it was once thought to be extinct. The species is now known from only a few locations at Kulnura, Peats Ridge, near Kariong and Duffys Forest. There is a high risk of local extinction due to low population numbers and its restricted distribution (DEC (NSW), 2005g).

Roadside populations of *Diuris bracteata* are under threat from earthworks, herbicide spraying, slashing/mowing and illegal collection (DEC (NSW), 2005g).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. No priority actions have been identified for this species but it generally requires protection of the known roadside populations (DEC (NSW), 2005g).

There 12 records of this species from the Sydney Basin bioregion from the last 20 years (NSW Government, 2009). It has not been recorded from any conservation reserves.

C.11.2 Discussion of local and regional abundance

There are currently only 12 records from the Sydney Basin bioregion, the majority of which are from the Gosford LGA (NSW Government, 2009).

C.11.3 Discussion of other known local populations

Diuris bracteata has not been recorded on the Project Site or the adjacent Popran National Park. The species has been recorded at Kulnura and Peats Ridge (NSW Government, 2009).

C.11.4 Discussion of habitat utilisation

Diuris bracteata has not been recorded from the Project Site.

C.11.5 Assessment of habitat

This species has been recorded from dry sclerophyll woodland (DEC (NSW), 2005g) but has not been recorded on the Project Site or Popran National Park. Potential habitat occurs in E26 Exposed Hawkesbury Woodland and E29 Hawkesbury Banksia Scrub-Woodland.

C.11.6 Description of habitat values

E26 Exposed Hawkesbury Woodland and E29 Hawkesbury Banksia Scrub – Woodland occur throughout the Project Site, and make up approximately 67% of the total native vegetation (55.6ha out of 83.5ha).

C.11.7 Extent of habitat removal

Diuris bracteata does not occur on the Project Site. Approximately 24.7ha (44%) of potential habitat would be cleared from the Project Site as a result of the project.

C.11.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.12 Ancistrachne maidenii

C.12.1 Discussion of conservation status

Ancistrachne maidenii is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. It has a narrow distribution in the St Albans – Mt White – Maroota – Berowra area but has also been found at Shannon Creek near Grafton. There is a high risk of extinction due to low population numbers (DEC (NSW), 2005a).

The key threatening processes that generally threaten *Ancistrachne maidenii* are:

- Clearing of native vegetation which leads to a loss of plants and habitat;
- Weed invasion (exotic vines and scramblers, exotic perennial grasses, Lantana); and
- Ecological consequences of high frequency fires (DEC (NSW), 2005a).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Five priority actions have been identified to help recover this species, including:

- Ensure staff undertaking track and roadside maintenance activities are aware of species and its habitat and habitat requirements (Medium priority) (DEC (NSW), 2005a).

There are 33 records from the Sydney Basin bioregion from the last 20 years of *Ancistrachne maidenii*. Several populations have been recorded from Dharug National Park, one from Parr State Conservation Area, several from Yengo National Park and one near Calga. Populations south of the Hawkesbury River occur at near Wisemans Ferry, Muogamarra Nature Reserve, Marra Marra National Park and Berowra Valley Regional Park (NSW Government, 2009).

C.12.2 Discussion of local and regional abundance

There are 33 records of the species from the Sydney Basin bioregion from the last 20 years. There are 9 records from the Gosford LGA from the last 20 years, the majority of which are within Dharug National Park, with other records occurring near the edge of Brisbane Waters National Park (NSW Government, 2009).

C.12.3 Discussion of other known local populations

Ancistrachne maidenii has not been recorded on the Project Site or the adjacent Popran National Park. The species has been recorded once to the east of Calga.

C.12.4 Discussion of habitat utilisation

Ancistrachne maidenii has not been recorded from the Project Site.

C.12.5 Assessment of habitat

This species occurs in distinct bands between the Hawkesbury and Watagan soil landscapes in dry sclerophyll forests (DEC (NSW), 2005a). Potential habitat occurs within the E25 Hawkesbury Peppermint Apple Forest, Exposed Hawkesbury Woodland and E29 Hawkesbury Banksia Scrub – Woodland. The species has not been recorded from Popran National Park or on the Project Site.

C.12.6 Description of habitat values

E25 Hawkesbury Peppermint Apple Forest, Exposed Hawkesbury Woodland and E29 Hawkesbury Banksia Scrub – Woodland occur throughout the Project Site and represent approximately 42% of the total native vegetation (35.3ha out of 83.5ha).

C.12.7 Extent of habitat removal

Ancistrachne maidenii does not occur on the Project Site. Approximately 11.6ha (32.9%) of potential habitat would be cleared from the Project Site as a result of the project.

C.12.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.13 Grevillea shiresii

C.13.1 Discussion of conservation status

Grevillea shiresii is listed as vulnerable on Schedule 2 of the TSC Act. It is also listed as vulnerable under the EPBC Act. It is known from only two populations: one along Mooney Mooney Creek and one along Mullet Creek (NSW Government, 2009). There is a high risk of local extinction due to low population numbers (DEC (NSW), 2005n).

The key threatening processes that generally threaten *Grevillea shiresii* are:

- Clearing of native vegetation which leads to a loss of plants and habitat; and
- Ecological consequences of high frequency fires (DEC (NSW), 2005n).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Five priority actions have been identified to help recover this species, including:

- Reserve fire management strategy include operational guidelines to protect this species from fire (Medium priority) (DEC (NSW), 2005n).

There are currently only 2 known populations of the species in the Gosford area. There are 34 records of the species in total, with more populations recorded on the past. The two known populations are conserved within Brisbane Waters National Park (NSW Government, 2009).

C.13.2 Discussion of local and regional abundance

There are currently only 2 known populations, both from within the Gosford LGA. These are in the tributaries of Mooney Mooney Creek and Mullet Creek (NSW Government, 2009).

C.13.3 Discussion of other known local populations

Grevillea shiresii has been recorded from 2 locations in the Gosford LGA with a total of 7 records from the last 20 years. These locations are at Mooney Mooney Creek and Mullet Creek. The species has not been recorded on the Project Site or within Popran National Park (NSW Government, 2009).

C.13.4 Discussion of habitat utilisation

Grevillea shiresii has not been recorded from the Project Site.

C.13.5 Assessment of habitat

This species grows along creek banks in wet sclerophyll forest on alluvial sandy or loamy soils (DEC (NSW), 2005n). Potential habitat occurs within the E2 Sandstone Ranges Gully Rainforest community on the Project Site. It has not been recorded on the Project Site or from within Popran National Park.

C.13.6 Description of habitat values

E2 Sandstone Ranges Gully Rainforest occurs in a narrow band along Creek C in the western part of the Project Site and within the proposed Glenworth Valley Offset Area. It represents approximately 0.005% of the total native vegetation (0.5ha out of 83.5ha).

C.13.7 Extent of habitat removal

Grevillea shiresii does not occur on the Project Site. No potential habitat would be cleared from the Project Site as a result of the project.

C.13.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.14 *Persoonia hirsuta*

C.14.1 Discussion of conservation status

Persoonia hirsuta is listed as endangered on Schedule 1 of the TSC Act. It is also listed as endangered under the EPBC Act. This species has been split into two subspecies: *Persoonia hirsuta* subsp. *hirsuta* and *Persoonia hirsuta* subsp. *evoluta*. The subspecies *hirsuta* is recorded from the coastal area of Sydney from Gosford to Berowra, Manly to Royal National Park (DEC (NSW), 2005p).

The key threatening processes that generally threaten *Persoonia hirsuta* are:

- Clearing of native vegetation which leads to a loss of plants and habitat;
- Proliferation of the feral honey bee *Apis mellifera* as it does not pollinate *Persoonia* species adequately; and
- Ecological consequences of high frequency fires (DEC (NSW), 2005p).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Twenty-one priority actions have been identified to help recover this species, including:

- Advise and liaise with private land managers to facilitate the preparation and implementation of site management plans that address threatening processes (High Priority);
- Incorporate best knowledge regarding appropriate fire regime into land management practices (High priority);
- Reserve Fire Management Strategy to include operational guidelines to protect this species from fire (Medium priority);
- Develop and implement site-awareness and protection procedures for use by land owners/managers and public utilities and their contractors when undertaking road, trail, or easement maintenance (High priority);
- Restrict vehicular and pedestrian access to sites, where necessary (High priority);
- Undertake targeted bush regeneration works, where required (High priority);
- Seek to increase the level of legislative protection for sites through land-use planning mechanisms and conservation agreements (Medium priority); and
- Retain or re-establish vegetation and fauna movement linkages between sites (Medium priority) (DEC (NSW), 2005p).

There have been 394 records of *Persoonia hirsuta* from the Sydney Basin bioregion from the last 20 years. These are from Yengo National Park, Parr State Conservation Area, around South Maroota, Wollemi National Park, Ku-ring-gai Chase National Park and many records are from the western side of the Hornsby Plateau near where it meets the Cumberland Plain (NSW Government, 2009).

C.14.2 Discussion of local and regional abundance

There are 394 records of *Persoonia hirsuta* from the Sydney Basin bioregion from the last 20 years. There is only one record of the species from the Gosford LGA during that period, from Dharug National Park (NSW Government, 2009).

C.14.3 Discussion of other known local populations

Persoonia hirsuta has not been recorded on the Project Site or the adjacent Popran National Park. The species has been recorded once from Dharug National Park (NSW Government, 2009).

C.14.4 Discussion of habitat utilisation

Persoonia hirsuta has not been recorded from the Project Site.

C.14.5 Assessment of habitat

This species occurs on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone (DEC (NSW), 2005p). Potential habitat occurs on the Project Site within E25

Hawkesbury Peppermint Apple Forest, E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub). *Persoonia hirsuta* has not been recorded from the Project Site or from Popran National Park.

C.14.6 Description of habitat values

E25 Hawkesbury Peppermint Apple Forest, E26 Exposed Hawkesbury Woodland, E26a Hawkesbury Rock Pavement Heath, E29 Hawkesbury Banksia Scrub Woodland and E29a Hawkesbury Banksia Scrub-Woodland (Scrub) occur throughout the Project Site and represent approximately 83% of the total native vegetation (69.4ha out of 83.5ha).

C.14.7 Extent of habitat removal

Persoonia hirsuta does not occur on the Project Site. Approximately 33.3ha (48%) of potential habitat would be cleared from the Project Site as a result of the project.

C.14.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.15 Lasiopetalum joyceae

C.15.1 Discussion of conservation status

Lasiopetalum joyceae is listed as vulnerable on Schedule 1 of the TSC Act. It is also listed as vulnerable under the EPBC Act. Its main distribution is south of the Hawkesbury River between Berrilee and Duffys Forest. There is a high risk of local extinction due to low population numbers (DEC (NSW), 2005t).

The key threatening processes that generally threaten *Lasiopetalum joyceae* are:

- Clearing of native vegetation which leads to a loss of plants and habitat; and
- Ecological consequences of high frequency fires (DEC (NSW), 2005t).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Nine priority actions have been identified to help recover this species, including:

- Ensure agencies undertaking fire trail or easement maintenance activities can identify the species and are aware of its habitat (High priority) (DEC (NSW), 2005t).

There have been 100 records of *Lasiopetalum joyceae* from the Sydney Basin bioregion from the last 20 years. These are from Yengo National Park, Parr State Conservation Area and one from the Mangrove Creek Water Supply Reserve, with records south of the Hawkesbury River

occurring in Berowra Valley Regional Park, Marra Marra National Park and Ku-ring-gai Chase National Park (NSW Government, 2009).

C.15.2 Discussion of local and regional abundance

There are 100 records of *Lasiopetalum joyceae* from the Sydney Basin bioregion from the last 20 years. There is only one record of the species from the Gosford LGA during that period, from Mangrove Creek Water Supply Reserve (NSW Government, 2009).

C.15.3 Discussion of other known local populations

Lasiopetalum joyceae has not been recorded on the Project Site or the adjacent Popran National Park. The species has been recorded once from the Mangrove Creek Water Supply Reserve.

C.15.4 Discussion of habitat utilisation

Lasiopetalum joyceae has not been recorded from the Project Site.

C.15.5 Assessment of habitat

This species occurs in heath on sandstone (DEC (NSW), 2005t). Potential habitat occurs on the Project Site within E26a Hawkesbury Rock Pavement Heath and E29a Hawkesbury Banksia Scrub-Woodland (Scrub). *Lasiopetalum joyceae* has not been recorded from the Project Site or from Popran National Park.

C.15.6 Description of habitat values

E26a Hawkesbury Rock Pavement Heath and E29a Hawkesbury Banksia Scrub-Woodland (Scrub) occur throughout the Project Site and represent approximately 17% of the total vegetation (13.8ha out of 83.5ha).

C.15.7 Extent of habitat removal

Lasiopetalum joyceae does not occur on the Project Site. Approximately 8.6ha (62%) of potential habitat would be cleared from the Project Site as a result of the project.

C.15.8 Consideration of corridors

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (Morgan, 2001). The

Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

C.16 Glossy Black Cockatoo

C.16.1 Discussion of conservation status

The Glossy Black Cockatoo is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. The species occurs along the east coast of Australia from Rockhampton in Queensland to western Victoria with isolated populations on King and Kangaroo Islands (NSW NPWS, 1999). The Glossy Black Cockatoo is not at the limit of its known distribution.

The key threatening processes that generally threaten the Glossy Black Cockatoo are:

- Clearing of native vegetation which leads to a loss of foraging and nesting habitat;
- Competition from feral honeybees which leads to a loss of nesting habitat;
- Ecological consequences of high frequency fires as this leads to habitat fragmentation, loss of foraging and loss of nesting resources; and
- Loss of hollow-bearing trees as this leads to a loss of nesting habitat (DEC(NSW), 2005I).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Nine priority actions have been developed to help recover this species, including:

- Identify and map key breeding and foraging habitat (High priority);
- Encourage the restoration of foraging habitat that has been cleared or degraded by previous impacts (Medium priority); and
- Provide incentives for landholders to fence and manage key sites (Medium priority) (DEC(NSW), 2005I).

The Glossy Black Cockatoo has been recorded in Brisbane Water National Park, Popran National Park, Dharug National Park.

C.16.2 Discussion of local and regional abundance

The Glossy Black Cockatoo has been recorded from 289 locations in the Gosford LGA and 1469 locations in the Sydney Basin Bioregion (NSW Government, 2009).

C.16.3 Discussion of other known local populations

It is unknown how many populations occur in the locality due to the distribution of records, which are scattered throughout the locality (see **Figure 4.1**). It is likely however, that individuals from more than one population interbreed and disperse through the locality.

C.16.4 Discussion of habitat utilisation

Three individuals have been observed on the Project Site, feeding among *Allocasuarina littoralis* and drinking from one of the creeks. The species needs an abundant food source to maintain a population and it is likely that a population or part thereof uses the Project Site as part of a wider foraging range. This family group may also nest on the Project Site.

C.16.5 Assessment of habitat

The Glossy Black Cockatoo is a specialised feeder, only eating seeds of trees from the genera *Casuarina* and *Allocasuarina* (DEC(NSW), 2005I). Its distribution reflects the distribution of these plant genera. The species also requires large tree hollows for nesting (NSW NPWS, 1999). The Glossy Black Cockatoo is usually observed in family parties of no more than 10 birds (NSW NPWS, 1999).

C.16.6 Description of habitat values

The Project Site provides foraging and potential nesting habitat. Foraging habitat occurs across much of the Study Area but the best quality foraging is found in communities E25, E26, E26a, and E29 where *Allocasuarinas* form an abundant understorey. Nesting habitat is present as many of the trees on the Project Site are likely to have formed large hollows. There are approximately 68.5ha of potential foraging habitat on the Project Site. This habitat is in generally good condition across the Project Site, with few weed infestations. Similar habitat is distributed throughout the locality.

C.16.7 Extent of habitat removal

Up to 24.7ha of the 68.5ha of foraging habitat available for this species on the Project Site would be cleared (approximately 36%). Potential nesting hollows will also be lost from the Project Site. Extensive areas of similar habitat exist in the locality, of which some is protected in the adjacent Popran National Park.

C.16.8 Consideration of corridors

Due to the Glossy Black Cockatoo being highly mobile (NSW NPWS, 1999), it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movement of the species.

C.17 Gang-gang Cockatoo

C.17.1 Discussion of conservation status

The Gang-gang Cockatoo is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. The species occurs from southern Victoria through south and central-eastern NSW (DEC (NSW), 2005j). The Gang-gang Cockatoo is not at the limit of its known distribution.

The key threatening processes that generally threaten the Gang-gang Cockatoo are:

- Clearing of native vegetation which leads to a loss of foraging and nesting habitat;
- Competition from feral honeybees which leads to a loss of nesting habitat;
- Ecological consequences of high frequency fires as this leads to habitat fragmentation, loss of foraging and loss of nesting resources;
- Loss of hollow-bearing trees as this leads to a loss of nesting habitat;
- Climate change which may alter the nature and extent of cool temperate habitat; and
- The spread of Psittacine circoviral disease (PCD) (DEC (NSW), 2005j).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Eleven priority actions have been developed to help recover this species, including:

- Increase landholder and public awareness of status, threats and priority actions (Low priority); and
- Negotiate management agreements and covenants over important areas of habitat (Medium priority) (DEC (NSW), 2005j).

The Gang-gang Cockatoo has been recorded in Popran National Park and Dharug National Park.

C.17.2 Discussion of local and regional abundance

The Gang-gang Cockatoo has been recorded from 59 locations in the Gosford LGA and 1131 locations in the Sydney Basin Bioregion (NSW Government, 2009).

C.17.3 Discussion of other known local populations

It is unknown how many populations occur in the locality due to the distribution of records, which are scattered throughout the locality (see **Figure 4.1**). It is likely however, that individuals from more than one population interbreed and disperse through the locality.

C.17.4 Discussion of habitat utilisation

No Gang-gang Cockatoos have been observed on the Project Site, and the occurrence of this species on the Project Site is unlikely. The Project Site does not provide significant habitat for this species.

C.17.5 Assessment of habitat

The Gang-gang Cockatoo is an altitudinal migrant, occurring in tall mountain forests and woodlands during summer, and in drier, more open forest and woodland at lower altitudes during winter. Gang-gang Cockatoos favour old-growth forest communities as forage and nesting habitat (DEC (NSW), 2005j).

C.17.6 Description of habitat values

The Project Site provides potential winter foraging habitat. Foraging habitat occurs across much of the Study Area but the best quality foraging is found where Eucalyptus and Acacia trees are plentiful. Nesting occurs in summer, in tall mountain forests, so the Project Site is not likely to provide significant nesting habitat for the Gang-gang Cockatoo. There is approximately 80ha of potential foraging habitat for the species on the Project Site. This habitat is in generally good condition across the Project Site, with few weed infestations. Similar habitat is distributed throughout the locality.

C.17.7 Extent of habitat removal

Up to 33.3ha of the 80ha of potential foraging habitat available for this species on the Project Site would be cleared (approximately 42%). Extensive areas of similar habitat exist in the locality, of which some is protected in the adjacent Popran National Park. Removal of significant nesting habitat for the Gang-gang Cockatoo within the Project Site is unlikely.

C.17.8 Consideration of corridors

Due to the Gang-gang Cockatoo being highly mobile (DEC (NSW), 2005j), it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movement of the species.

C.18 Powerful Owl

C.18.1 Discussion of conservation status

The Powerful Owl (*Ninox strenua*) is listed as vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee, 2004d). Powerful Owls occur along the south-eastern coast of Australia, from southern Queensland to eastern South Australia (DEC (NSW), 2005z). The Project Site is not near the limit of this species distribution.

The Powerful Owl is at threat from the following:

- Destruction of suitable forest and woodland habitat;
- Forest management practices that reduce availability of food or that result in the loss of old trees and large tree-hollows;
- High-frequency burning; and
- Disturbances during the breeding period, such as clearing, logging or burning.

A recovery plan has been written for large forest owls which includes the Powerful Owl. Objectives include (DEC (NSW), 2006b):

- Protecting habitat off-reserves and in State Forests;
- Minimising impacts of development activities;
- Modelling and mapping owl habitat;
- Monitoring trends in owl populations;
- Assessing management of forestry activities;
- Increasing knowledge of biology and ecology; and
- Increasing community awareness.

Management actions suggested by the DECC include protecting nest sites, retaining riparian areas, and preserving hollow-bearing trees. Twenty-one priority actions have been developed to help recover this species, including:

- Use records of concurrence and licence conditions to develop a set of prescriptive guidelines that may be used to mitigate the impacts of developments on the Powerful Owl outside conservation reserves and State forests (Medium priority); and
- Encourage private landholders to undertake management options to conserve and/or actively manage forest owl habitat (Medium priority).

The Powerful Owl has been recorded in Brisbane Water National Park, Popran National Park

C.18.2 Discussion of local and regional abundance

The Powerful Owl has been recorded from 79 locations in the Gosford LGA and 860 locations in the Sydney Basin Bioregion (NSW Government, 2009).

C.18.3 Discussion of other known local populations

There are a number of records of Powerful Owls from the Somersby Plateau as well as to the west in Dharug National Park (NSW Government, 2009). Although no specific information exists on the local population, a Powerful Owl was recorded by Countrywide Ecological Service from nearby in Popran National Park. This is likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

C.18.4 Discussion of habitat utilisation

No Powerful Owls were recorded on the Project Site, however an individual has been recorded responding to call playback from nearby in Popran National Park (Countrywide Ecological Service 2004). Powerful Owls have large home ranges (DEC (NSW), 2005z) and the Project Site is likely to form part of the home range of this owl.

C.18.5 Assessment of habitat

Powerful Owls breed and hunt in open or closed sclerophyll forest or woodlands and occasionally hunt in open habitats (DEC (NSW), 2005z). They feed on larger arboreal marsupials, megachiropteran bats, and other fauna captured in trees.

Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and would defend a large home range of 400-1450 ha. The Powerful Owl requires large areas of forest or woodland habitat but can occur in fragmented landscapes as well. This species occurs mainly in tall moist eucalypt forest and woodland although its preferred habitat is densely forested gullies with adjacent more open forest containing old growth trees with hollows. They roost by day in dense vegetation, commonly along drainage lines, but require tree hollows for nesting (DEC (NSW), 2005z).

C.18.6 Description of habitat values

A number of large stags and trees with large hollows exist on the Project Site, which could provide nesting opportunities for this species. Arboreal mammals (such as Ring-tailed Possums and Sugar Gliders) utilising the Study Area provide potential prey for Powerful Owls. Approximately 104.5ha of foraging habitat exists on the Project Site. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the subject site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved on site.

C.18.7 Extent of habitat removal

Clearing would only impact on up to 45.7ha of habitat. This is a small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is available in the area. Clearing would include removal of potential roosting and nesting sites, as well as foraging habitat.

C.18.8 Consideration of corridors

Due to the Powerful Owl being highly mobile (DEC (NSW), 2005z), it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movement of the species.

C.19 Masked Owl

C.19.1 Discussion of conservation status

The Masked Owl (*Tyto novaehollandiae*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. Masked Owls occur along the eastern, northern and western coast of Australia. In NSW this species occurs from the coast (where it is most abundant) inland to the western plains (DEC (NSW), 2005w). The Project Site is not near the limit of the distribution of this species.

The Masked Owl is at threat from the following:

- Loss of hollow-bearing trees and recruitment hollow-bearing trees;
- Clearing for grazing, agriculture, forestry or development;
- Grazing and burning affecting habitat of prey;
- Secondary poisoning from rodenticide; and
- Vehicle strike. (DEC (NSW), 2005w)

A recovery plan has been written for large forest owls which includes the Masked Owl. Objectives include (DEC (NSW), 2006b):

- Protecting habitat off-reserves and in State Forests;
- Minimising impacts of development activities;
- Modelling and mapping owl habitat;
- Monitoring trends in owl populations;
- Assessing management of forestry activities;

- Increasing knowledge of biology and ecology; and
- Increasing community awareness.

Management actions suggested by the DECC include protecting nest sites, retaining riparian areas, and preserving hollow-bearing trees. Twenty one priority actions have been developed to help recover this species, including:

- Encourage private landholders to undertake management options to conserve and/or actively manage forest owl habitat (Medium priority);
- Use records of concurrence and licence conditions to develop a set of prescriptive guidelines that may be used to mitigate the impacts of developments on the Masked Owl outside conservation reserves and State forests (Medium priority);
- Monitor and report on effectiveness of concurrence and licence conditions previously applied to reduce impacts of development on Masked Owls and their habitats, by recording conditions, picking case studies and checking owl presence post development (Medium priority) (DEC (NSW), 2005w).

The Masked Owl has been recorded in Brisbane Water National Park, Dharug National Park, Yengo National Park, Ku-ring-gai Chase National Park, Berowra Valley Regional Park, Marra Marra National Park and Blue Mountains National Park (NSW Government, 2009).

C.19.2 Discussion of local and regional abundance

There have been 31 records of the Masked Owl from the Gosford LGA in the last 20 years and 285 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.19.3 Discussion of other known local populations

There are a number of records of Masked Owls from the Mooney Mooney Creek and Mount White Area as well as to the west in Dharug National Park (NSW Government, 2009). Although no specific information exists on the local population, the Masked Owls recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

C.19.4 Discussion of habitat utilisation

No Masked Owls were recorded on the Project Site. Masked Owls have large home ranges (DEC (NSW), 2005w) and the Project Site is likely to form part of the home range of this owl.

C.19.5 Assessment of habitat

Masked Owls roost and breed in moist eucalypt forested gullies, nesting in large tree hollows or occasionally caves and hunt within and at the forest edge. They feed on small arboreal and ground-dwelling mammals, particularly rats (DEC (NSW), 2005w).

Pairs of Masked Owls hunt within a large home range of 500-1000 ha. The Masked Owl requires large areas of forest or woodland habitat but can occur in fragmented landscapes as well.

but they require tree hollows for nesting (DEC (NSW), 2005w).

C.19.6 Description of habitat values

A number of large stags and trees with large hollows exist on the Project Site, which could provide nesting opportunities for this species. Arboreal mammals (such as Ring-tailed Possums and Sugar Gliders) and ground-dwelling mammals (such as Bush Rats and Antechinus) utilising the Study Area provide potential prey for Masked Owls. Approximately 104.5ha of foraging habitat exists on the Project Site. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the subject site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved on site.

C.19.7 Extent of habitat removal

Clearing would only impact on up to 45.7ha of potential habitat. This is a small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is available in the area (i.e. downstream). Clearing would include removal of potential roosting and nesting sites, as well as foraging habitat.

C.19.8 Consideration of corridors

Due to the Masked Owl being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.20 Barking Owl

C.20.1 Discussion of conservation status

The Barking Owl (*Ninox connivens*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. Barking Owls occur throughout Australia except for the central arid areas and Tasmania. In NSW this species occurs most frequently on the western slopes and plains. It is uncommon on the coast and escarpment areas (DEC (NSW), 2005b). The Project Site is not near the limit of the distribution of this species.

The Barking Owl is at threat from the following:

- Loss of hollow-bearing trees and recruitment hollow-bearing trees, and loss of dead wood;
- Clearing for grazing, agriculture, forestry or development;
- Inappropriate forestry practices changing the structure of habitat and removing old growth trees; and
- Grazing and burning affecting habitat of prey (DEC (NSW), 2005b).

A recovery plan has been written for the Barking Owl. Objectives include:

- Increasing knowledge of biology, ecology and management;
- Increase education, awareness and involvement in conservation;
- Undertake threat abatement and mitigation;
- Gain efficiencies through links with other conservation plans and groups; and
- Provide organisational support (NSW NPWS, 2003a).

Management actions suggested by the DECC include protecting retaining riparian and forest habitats, hazard reduction burning in mosaic patterns and preserving hollow-bearing and dead trees. Seventeen priority actions have been developed to help recover this species, including:

- Negotiate with individual land managers to achieve appropriate measures to protect all known Barking Owl nest sites in NSW. Protection will need to address threats such as human disturbance, collision with wires, secondary poisoning from chemicals (Medium priority);
- Incorporate the consideration of Barking Owl habitat and potential habitat as a high priority in the assessment of property for reserve establishment (High priority); and
- Establish formal conservation arrangements for properties with Barking Owls, which can be used to protect wildlife habitat (Low priority) (DEC (NSW), 2005b).

The Barking Owl has been recorded in Yengo National Park, Dharug National Park, Brisbane Water National Park, Ku-ring-gai Chase National Park, Berowra Valley Regional Park, Blue Mountains National Park, Wollemi National Park, Nattai National Park and Yerranderie State Conservation Area (NSW Government, 2009).

C.20.2 Discussion of local and regional abundance

There have been 37 records of the Barking Owl from the Gosford LGA in the last 20 years and 140 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.20.3 Discussion of other known local populations

The Barking Owl has been recorded sporadically throughout the Gosford LGA with records from Dharug National Park near Mangrove Creek, at Mangrove Mountain and one record from Strickland State Forest. The species has been more frequently recorded close to the coast and around Brisbane Water including Bouddi National Park and Brisbane Water National Park (NSW Government, 2009).

C.20.4 Discussion of habitat utilisation

No Barking Owls were recorded on the Project Site. Barking Owls have large home ranges and the Project Site may form part of the home range of this species.

C.20.5 Assessment of habitat

Barking Owls occur in eucalypt woodland, open forest and swamp woodland, especially along watercourses. They roost in dense foliage along creeklines and feed mainly on invertebrates but birds and small mammals are important part of the diet during breeding (DEC (NSW), 2005b).

Barking Owls have a home range of 30 to 200ha that they use year round. Hollows of large, old eucalypts are used for nests (DEC (NSW), 2005b).

C.20.6 Description of habitat values

A number of large stags and trees with large hollows exist on the Project Site, which could provide nesting opportunities for this species. Arboreal mammals (such as Ring-tailed Possums and Sugar Gliders) and ground-dwelling mammals (such as Bush Rats and Antechinus) utilising the study area provide potential prey for Barking Owls. Approximately 104.5ha of foraging habitat exists on the Project Site. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality and will be retained in the Offset Areas. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved within the Offset Areas.

C.20.7 Extent of habitat removal

Clearing would only impact on up to 45.7ha of potential habitat. This is a small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is available in the area. Clearing would include removal of potential roosting and nesting sites, as well as foraging habitat.

C.20.8 Consideration of corridors

Due to the Barking Owl being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.21 Yellow-bellied Sheath-tailed Bat

C.21.1 Discussion of conservation status

The Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. They occur across eastern and northern Australia. In NSW this species occurs from the coast (where it is most abundant) inland to the North-western Slopes (DEC (NSW), 2005i1). The Project Site is not near the limit of the distribution of this species.

The Yellow-bellied Sheath-tail-bat is at threat from the following:

- Loss of hollow-bearing trees and recruitment hollow-bearing trees;
- Clearing for grazing, agriculture, forestry or development;
- Disturbance to roosting and summer breeding sites; and
- Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores (DEC (NSW), 2005i1).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Twenty priority actions have been developed to help recover this species, including:

- Ensure the largest hollow bearing trees (including dead trees and paddock trees) are given highest priority for retention in PVP assessments and or other land assessment tools (High priority);
- Promote the conservation of these High Conservation Value (HCV) private land areas using measures such as incentive funding to landholders, off-setting and biobanking, acquisition for reserve establishment or other means (High priority); and
- Identify areas of private land that contain high densities of large, hollow-bearing trees as areas of high conservation value planning instruments and land management negotiations e.g. LEP, CAPs, PVPs (High priority) (DEC (NSW), 2005i1).

The Yellow-bellied Sheathtail-bat has been recorded in Bouddi National Park, and they are known to occur in Yengo National Park, Ourimbah State Forest, Blue Mountains National Park and Holsworthy Military Area in the Sydney Basin Bioregion (NSW Government, 2009).

C.21.2 Discussion of local and regional abundance

There have been 5 records of the Yellow-bellied Sheathtail-bat from the Gosford LGA in the last 20 years and 52 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.21.3 Discussion of other known local populations

There are few records of Yellow-bellied Sheathtail-bat from the local area, one of which is from Bouddi National Park to the south-east of the Project Site. Although no specific information exists on the local population, the few Yellow-bellied Sheathtail-bats recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

C.21.4 Discussion of habitat utilisation

No Yellow-bellied Sheathtail-bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

C.21.5 Assessment of habitat

Yellow-bellied Sheathtail-bats occur in a variety of habitats, from wet and dry sclerophyll forest and open woodland. They are insectivorous and forage high in the canopy. Animals roost singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows (Churchill, 1998).

Yellow-bellied Sheathtail-bats forage in most habitats across a very wide range, with and without trees and appear to defend an aerial territory. Although unconfirmed, it is thought that they may migrate to southern Australia in late summer and autumn (Churchill, 1998).

C.21.6 Description of habitat values

A number of large stags and trees with large hollows exist on the Project Site, which could provide roosting opportunities for this species. Areas of vegetation, such as the Sandstone Hanging Swamp in the "Glenworth Valley" Offset Area provide particularly high quality foraging habitat due to an abundance of insect life. Approximately 83.5ha of potential foraging habitat exists on the Project Site. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the subject

site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved on site.

C.21.7 Extent of habitat removal

Clearing would only impact on up to 34.7ha of potential habitat for this species. This is a very small proportion of the home range of the species, and is likely to be low quality habitat compared to habitat that is available in the area (i.e. downstream). Clearing would include removal of potential roosting and foraging habitat.

C.21.8 Consideration of corridors

Due to the Yellow-bellied Sheath-tail-bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.22 Eastern Freetail-bat

C.22.1 Discussion of conservation status

The Eastern Freetail-bat (*Mormopterus norfolkensis*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. The species occurs along the east coast from south Queensland to southern NSW. The Project Site is not near the limit of the distribution of this species.

The Eastern Freetail-bat is at threat from the following:

- Loss of hollow-bearing trees and recruitment hollow-bearing trees; and
- Clearing for grazing, agriculture, forestry or development.

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Eighteen priority actions have been developed to help recover this species, including:

- Ensure the largest hollow bearing trees, inc. dead trees and paddock trees, are given highest priority for retention in PVP assessments. Offsets should include remnants in high productivity (High priority);
- Identify areas of private land that contain high densities of large hollow-bearing trees as areas of high conservation value planning instruments and land management negotiations e.g. LEP, CAPs, PVPs (High priority); and

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

The Eastern Freetail-bat has been recorded from Yengo National Park, Olney State Forest, Parr State Conservation Area, Wollemi National Park, Dharug National Park, Bouddi National Park, Brisbane Water National Park, Marra Marra National Park, Cattai National Park, Scheyville National Park, Gulguer Nature Reserve, Mulgoa Nature Reserve, Blue Mountains National Park and Dharawal State Conservation Area in the Sydney Basin Bioregion (NSW Government, 2009).

C.22.2 Discussion of local and regional abundance

There have been 17 records of the Eastern Freetail-bat from the Gosford LGA in the last 20 years and 357 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.22.3 Discussion of other known local populations

There are a number of records of the Eastern Freetail-bat from the Gosford LGA, from near Popran National Park, Point Clare to the east, and Somersby and Peats Ridge to the north of the Project Site (NSW Government, 2009). Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

C.22.4 Discussion of habitat utilisation

No Eastern Freetail-bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

C.22.5 Assessment of habitat

Eastern Freetail-bats occur in dry sclerophyll forest and woodland east of the Great Dividing Range. They roost mainly in tree hollows but will also roost under bark or in man-made structures. Little is known about their diet, although it is likely that they are insectivorous (Churchill, 1998, DEC (NSW), 2005h).

C.22.6 Description of habitat values

A number of large stags and trees with large hollows exist on the Project Site, which could provide roosting opportunities for this species. Areas of vegetation, such as the Sandstone Hanging Swamp in the "Glenworth Valley" Offset Area provide particularly high quality foraging habitat due to an abundance of insect life. Approximately 83.5ha of potential foraging habitat exists on the Project Site. Large expanses of potential foraging and roosting habitat are

present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved in the Offset Areas.

C.22.7 Extent of habitat removal

Clearing would only impact on up to 34.7ha of potential habitat. This is a very small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is available in the Offset Areas. Clearing would include removal of potential roosting and foraging habitat.

C.22.8 Consideration of corridors

Due to the Eastern Freetail-bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.23 Little Bentwing-bat

C.23.1 Discussion of conservation status

The Little Bentwing-bat (*Miniopterus australis*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. They occur on coastal north-eastern NSW and eastern Queensland (DEC (NSW), 2005u). The Project Site is not near the limit of the distribution of this species.

The Little Bentwing-bat is at threat from the following:

- Destruction of caves that provide seasonal or potential roosting sites; and
- Clearing for grazing, agriculture, forestry or development (DEC (NSW), 2005u).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Twenty-five priority actions have been developed to help recover this species, including:

- Protect significant roosts and forest habitat within 10 km of roosts in PVP assessments (offsets should include nearby remnants in high productivity) and other environmental planning instruments (Medium priority); and
- Promote the conservation of these significant roost areas using measures such as incentive funding to landholders, offsetting and biobanking, acquisition for reserve establishment or other means (Low priority) (DEC (NSW), 2005u).

The Little Bentwing-bat has been recorded in Brisbane Water National Park and Bouddi National Park in the Gosford LGA. They are known to occur in Newnes State Forest, Wollemi National Park, Lake Macquarie State Conservation Area and Olney State Forest in the Sydney Basin Bioregion (NSW Government, 2009).

C.23.2 Discussion of local and regional abundance

There have been 34 records of the Little Bentwing-bat from the Gosford LGA in the last 20 years and 190 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.23.3 Discussion of other known local populations

There are a number records of Little Bentwing-bats from the local area, one of which is from Brisbane Water National Park, and further to the east of the Project Site around Bouddi NP and Gosford (NSW Government, 2009). Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

C.23.4 Discussion of habitat utilisation

No Little Bentwing-bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species. The Project Site does not provide suitable breeding habitat for this species as they require deep caves.

C.23.5 Assessment of habitat

Little Bentwing-bats occur in moist eucalypt forest, rainforest or dense coastal banksia scrub. They roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Roost sites can be shared with other micro-bat species such as the Common Bentwing-bat and, in winter, the two species may form mixed clusters (DEC (NSW), 2005u).

In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (*M. schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear the young (DEC (NSW), 2005u).

C.23.6 Description of habitat values

No known maternity sites or caves occur on the Project Site, although sandstone outcrops may provide suitable habitat in the study area. Areas of vegetation, such as the Sandstone Hanging Swamp in the "Glenworth Valley" Offset Area provide particularly high quality foraging habitat due to an abundance of insect life. Approximately 83.5ha of potential foraging habitat

exists on the Project Site. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved within the Offset Areas.

C.23.7 Extent of habitat removal

Clearing would only impact on up to 34.7ha of potential foraging habitat. This is likely to represent a small proportion of the home range for this species. Clearing would include removal of potential foraging habitat but would not affect roosting habitat.

C.23.8 Consideration of corridors

Due to the Little Bentwing-bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.24 Large-eared Pied Bat

C.24.1 Discussion of conservation status

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is listed as vulnerable on Schedule 2 of the TSC Act and as vulnerable under the EPBC Act. The species occurs along coastal north-eastern NSW and in eastern Queensland (DEC (NSW), 2005r). The Project Site is not near the limit of the distribution of this species.

The Large-eared Pied Bat is at threat from the following:

- Clearing and isolation of forest near roost habitat for development, agriculture, through forestry and fire;
- Damage to roost and maternity caves through mining and recreational caving; and
- Use of pesticides (DEC (NSW), 2005u).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Twenty-five priority actions have been developed to help recover this species, including:

- Ensure protection of caves and overhangs in area of suitable geology when undertaking PVP assessments (offsets should include nearby remnants in high productivity) or other land assessment tools (High priority) (DEC (NSW), 2005u).

The Large-eared Pied Bat has been recorded in Yengo National Park, Wollemi National Park, Newnes State Forest, Watagans National Park, Olney State Forest, Bouddi National Park, Scheyville National Park, Blue Mountains National Park, Mulgoa Nature Reserve and Royal National Park in the Sydney Basin bioregion (NSW Government, 2009).

C.24.2 Discussion of local and regional abundance

There have been 5 records of the Large-eared Pied Bat from the Gosford LGA in the last 20 years and 289 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.24.3 Discussion of other known local populations

There are few records of Large-eared Pied Bats from the Gosford LGA, with three records from around Central Mangrove and McPherson State Forest, one from Bouddi National Park and one near Gosford (NSW Government, 2009). Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

C.24.4 Discussion of habitat utilisation

No Large-eared Pied Bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species. The Project Site may provide some suitable breeding habitat for this species as they used domed sandstone caves as maternity roosts. This type of habitat is more typical of the Offset Areas than the proposed extraction areas.

C.24.5 Assessment of habitat

Large-eared Pied Bats occur in well-timbered areas containing gullies. They roost in domed sandstone caves, crevices in cliffs and disused mines. The species is likely to forage for insects beneath the forest canopy. The species has high fidelity to roost sites and females raise young in maternity colonies in caves (DEC (NSW), 2005u).

C.24.6 Description of habitat values

No known maternity sites or caves occur on the Project Site, although sandstone outcrops may provide suitable habitat in the study area. The species is most likely to occur in the taller forest along the gully of Creek C on the Project Site, which will be conserved as part of the Offset Areas. Approximately 83.5ha of potential foraging habitat exists on the Project Site. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of

known habitat for the species and a proportion of this habitat would be retained and conserved within the Offset Areas.

C.24.7 Extent of habitat removal

Clearing would only impact on up to 34.7ha of potential habitat. This is likely to represent a small proportion of the home range for this species. Clearing would include removal of potential roosting and foraging habitat.

C.24.8 Consideration of corridors

Due to the Large-eared Pied Bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.25 Large-footed Myotis

C.25.1 Discussion of conservation status

The Large-footed Myotis (*Myotis macropus*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. The species occurs in a coastal band from north-western Australia, across the top end and down the east coast through to western Victoria (DEC (NSW), 2005s). The Project Site is not near the limit of the distribution of this species.

The Large-footed Myotis is at threat from the following:

- Reduction in stream foraging resources and surrounding habitat;
- Loss of or disturbance to roost sites; and
- Use of pesticides in and around foraging habitat (DEC (NSW), 2005s).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Fifteen priority actions have been developed to help recover this species, including:

- Ensure the largest hollow bearing trees in riparian zones are given highest priority for retention in PVP assessments or other land clearing assessment tools (Low priority); and
- Encourage recovery of natural hydrological regimes, including retention and rehabilitation of riparian vegetation (Medium priority) (DEC (NSW), 2005s).

The Large-footed Myotis has been recorded in Wollemi National Park, Yengo National Park, Blue Mountains National Park, Olney State Forest, Munmorah State Conservation Area, MacPherson State Forest, Ourimbah State Forest, Popran National Park, Brisbane Water National Park, Dharug National Park, Scheyville National Park, Castlereach Nature Reserve, Blue Mountains National Park and Royal National Park in the Sydney Basin bioregion (NSW Government, 2009).

C.25.2 Discussion of local and regional abundance

There have been 43 records of the Large-footed Myotis from the Gosford LGA in the last 20 years and 969 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.25.3 Discussion of other known local populations

There are many records of Large-footed Myotis scattered throughout the Gosford LGA, including one at the Mangrove Creek Dam, one in Dharug National Park near the Hawkesbury River, several around Brisbane Water likely to have been recorded from surrounding creeks, and from Avoca Lagoon (NSW Government, 2009). Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

C.25.4 Discussion of habitat utilisation

There was a possible record of the Large-footed Myotis from the eastern side of the Project Site; however, as this part of the Project Site is the highest, it is less likely to be used by the species as it forages over water. The species is more likely to forage over the lower lying creeks. Potential roosting habitat is provided on the Project Site in hollow-bearing trees.

C.25.5 Assessment of habitat

The Large-footed Myotis roosts close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings and in dense foliage. They forage over streams and pools, raking their feet across the surface to catch insects and small fish (DEC (NSW), 2005s).

C.25.6 Description of habitat values

The Large-footed Myotis is most likely to use the creeks on the Project Site for foraging compared with the drier, heath areas. Potential roosting habitat is available in the hollow-bearing trees on the Project Site, although the species usually roosts near water, therefore the hollow-bearing trees closer to the creeks are those most likely to be used by the Large-footed Myotis. Minimal potential habitat exists on the Project Site, restricted to areas surrounding pools in creeks. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good,

due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved within the Offset Areas.

C.25.7 Extent of habitat removal

Clearing would only impact on any pools that occur within Creek A. This is likely to represent a small proportion of the home range for this species. Clearing would include removal of potential roosting habitat.

C.25.8 Consideration of corridors

Due to the Large-footed Myotis being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movement of the species.

C.26 Greater Broad-nosed Bat

C.26.1 Discussion of conservation status

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. The species occurs along the east coast of Australia from the Atherton Tablelands in Queensland to north-eastern Victoria up to altitudes of 500m (DEC (NSW), 2005m). The Project Site is not near the limit of the distribution of this species.

The Greater Broad-nosed Bat is at threat from the following:

- Disturbance to roosting and breeding sites;
- Clearing of foraging habitats;
- Loss of hollow-bearing trees;
- Use of pesticides and herbicides; and
- Changes to water regimes affecting insect availability (DEC (NSW), 2005m).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Eighteen priority actions have been developed to help recover this species, including:

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

- Promote the conservation of these HCV private land areas using measures such as incentive funding to landholders, off-setting and biobanking, acquisition for reserve establishment or other means (High priority); and
- Identify areas of private land that contain high densities of large, hollow-bearing trees as areas of high conservation value in planning instruments and land management negotiations e.g. LEP, CAPs, PVPs (High priority) (DEC (NSW), 2005m).

The Greater Broad-nosed Bat has been recorded from Yengo National Park, Wollemi National Park, Blue Mountains National Park, Royal National Park, Wyrabalong National Park, Munmorah State Conservation Area, Olney State Forest, MacPherson State Forest, Dharug National Park, Brisbane Water National Park, Bouddi National Park, Castlereagh Nature Reserve, Cattai National Park, Scheyville National Park, Mulgoa Nature Reserve and Kemps Creek Nature Reserve in the Sydney Basin Bioregion (NSW Government, 2009).

C.26.2 Discussion of local and regional abundance

There have been 19 records of the Greater Broad-nosed Bat from the Gosford LGA in the last 20 years and 321 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.26.3 Discussion of other known local populations

There are a number of records of the Greater Broad-nosed Bat from the Gosford LGA, from near Popran National Park, Kariong, Dharug National Park, McPherson State Forest and in rural residential areas east of Gosford (NSW Government, 2009). Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

C.26.4 Discussion of habitat utilisation

No Greater Broad-nosed Bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

C.26.5 Assessment of habitat

The Greater Broad-nosed Bat is most commonly found in tall, wet forest but also occurs in woodland, dry eucalypt forest and rainforest. It roosts in tree hollows but has also been recorded roosting in buildings. Females give birth and raise young at maternity sites in suitable trees, where they exclude males (DEC (NSW), 2005m).

C.26.6 Description of habitat values

A number of large stags and trees with large hollows exist on the Project Site, which could provide roosting opportunities for this species. Areas of vegetation, such as the Sandstone Hanging Swamp in the "Glenworth Valley" Offset Area provide particularly high quality foraging habitat due to an abundance of insect life. Approximately 83.5ha of potential foraging habitat exists on the Project Site. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved in the Offset Areas.

C.26.7 Extent of habitat removal

Clearing would only impact on up to 34.7ha of potential habitat. This is a very small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is available in the Offset Areas. Clearing would include removal of potential roosting and foraging habitat.

C.26.8 Consideration of corridors

Due to the Greater Broad-nosed Bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.27 Grey-headed Flying-fox

C.27.1 Discussion of conservation status

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as vulnerable on Schedule 2 of the TSC Act and as vulnerable under the EPBC Act. The species occurs in a 200km wide coastal strip from Bundaberg in Queensland to Melbourne in Victoria (DEC (NSW), 2005o). The Project Site is not near the limit of the distribution of this species.

The Grey-headed Flying-fox is at threat from the following:

- Disturbance to roosting sites;
- Clearing of foraging habitats;
- Unregulated shooting; and
- Electrocution on powerlines (DEC (NSW), 2005o).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Thirty-one priority actions have been developed to help recover this species, including:

- Protect and enhance priority foraging habitat for Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land (Low priority); and
- Increase the extent and viability of foraging habitat for Grey-headed Flying-foxes that is productive during winter and spring (generally times of food shortage), including habitat restoration/rehabilitation works (High priority) (DEC (NSW), 2005o).

The Grey-headed Flying-fox has been recorded from Yengo National Park, Lower Hunter Regional Park, Awaba State Forest, Lake Macquarie State Conservation Area, Munmorah State Conservation Area, Wyrribalong National Park, Brisbane Water National Park, Popran National Park, Dharug National Park, Strickland State Forest, Ku-ring-gai Chase National Park, Muogamarra National Park, Cattai National Park, Scheyville National Park, Wollemi National Park, Berowra Valley Regional Park, Garigal National Park, Lane Cove National Park, Blue Mountains National Park, Towra Point Nature Reserve, Georges River National Park, Royal National Park and Heathcote National Park in the Sydney Basin Bioregion (NSW Government, 2009).

C.27.2 Discussion of local and regional abundance

There have been 2024 records of the Grey-headed Flying-fox from the Gosford LGA in the last 20 years and 4096 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.27.3 Discussion of other known local populations

There are many records of the Grey-headed Flying-fox from the Gosford LGA, from Mangrove Mountain, Dharug and Popran National Parks and many records from around Gosford including Brisbane Water National Park, urban and rural residential areas (NSW Government, 2009). Grey-headed Flying-foxes roost in specific camps. The animals that have been observed in the northern part of the study area are likely to roost in the camp near Mangrove Mountain and do not roost on the Project Site but use it for foraging as part of a much larger range.

C.27.4 Discussion of habitat utilisation

The Grey-headed Flying-fox was recorded during studies conducted to the north of the Project Site but was not recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

C.27.5 Assessment of habitat

The Grey-headed Flying-fox roosts, mates and rears young in camps with high site fidelity, with camps established in gullies with dense vegetation. It forages in subtropical and temperate rainforest, tall sclerophyll forest and woodland, heaths, swamps, urban gardens and orchards (DEC (NSW), 2005o).

C.27.6 Description of habitat values

The Grey-headed Flying-fox is not known to roost on the Project Site and therefore would only use the study area for foraging. The species may forage across the entire Project Site and the Glenworth Valley Offset, with the exception of cleared areas. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved in the Offset Areas.

C.27.7 Extent of habitat removal

Clearing would only impact on up to 34.7ha of potential habitat. This is a very small proportion of the home range for this species and represents foraging habitat only.

C.27.8 Consideration of corridors

Due to the Grey-headed Flying-fox being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.28 Eastern Pygmy Possum

C.28.1 Discussion of conservation status

The Eastern Pygmy Possum (*Cercartetus nanus*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. The species is distributed from southern Queensland to eastern South Australia. In NSW it occurs as far west as the western slopes (DEC (NSW), 2005i).

The Eastern Pygmy Possum is at threat from the following:

- Loss and fragmentation of habitat for agriculture, forestry and urban development;
- Changing fire regimes affecting abundance of flowering shrubs;

- Overgrazing by stock and rabbits affecting diversity of flowering shrubs;
- Predation by cats, dogs and foxes; and
- Loss of nest sites due to removal of firewood (DEC (NSW), 2005i).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Seven priority actions have been developed to help recover this species, including:

- Encourage and support land managers to undertake management actions that benefit the species (Medium priority); and
- Reserve fire management strategies to include operational guidelines to protect this species from fire; with fire frequency of >10 years (Medium priority) (DEC (NSW), 2005i).

The Eastern Pygmy Possum has been recorded from Wollemi National Park, Yengo National Park, Blue Mountains National Park, Royal National Park, Heathcote National Park, Dharawal State Conservation Area, Garigal National Park, Ku-ring-gai Chase National Park, Berowra Valley Regional Park, Marra Marra National Park, Muogamarra Nature Reserve, Olney State Forest, Munmorah State Conservation Area, McPherson State Forest, Strickland State Forest and Brisbane Water National Park in the Sydney Basin Bioregion (NSW Government, 2009).

C.28.2 Discussion of local and regional abundance

There have been 57 records of the Eastern Pygmy Possum from the Gosford LGA in the last 20 years and 248 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.28.3 Discussion of other known local populations

There are many records of the Eastern Pygmy Possum from the Gosford LGA, from Mangrove Creek Water Supply Reserve, several from McPhersons State Forest, around Peats Ridge, Calga and Kariong, and many records from around Gosford including Brisbane Water National Park and rural residential areas. The Eastern Pygmy Possum recorded on the Project Site is likely to be part of a population that uses heath areas from the Calga – Peats Ridge area (NSW Government, 2009).

C.28.4 Discussion of habitat utilisation

The Eastern Pygmy Possum was recorded along Creek A on the Project Site, near the southern edge of the Stage 4 extraction area. Heath and woodland are the preferred habitats of the species on the Central Coast but the individual observed during spotlighting surveys was in open forest.

C.28.5 Assessment of habitat

The Eastern Pygmy Possum prefers woodlands and heaths in most parts of its range in NSW except the north east where it is more common in rainforest. The species also occurs in sclerophyll forest. It feeds on nectar and pollen collected from flowering shrubs and eucalypts. The species shelters in tree hollows, rotten stumps, holes in the ground, abandoned birds nests and Ringtail Possum dreys, and in thickets of vegetation (DEC (NSW), 2005i).

C.28.6 Description of habitat values

The Eastern Pygmy Possum was recorded in open forest on the Project Site but is highly likely to occur throughout the heath and woodland communities where abundant flowering shrubs including *Banksia* and *Acacia* species occur. The species may forage across the entire Project Site and the Glenworth Valley Offset, with the exception of cleared areas. Large expanses of potential foraging and sheltering habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site represents a large area of habitat for the species and a proportion of this habitat would be retained and conserved in the Offset Areas.

C.28.7 Extent of habitat removal

Clearing would only impact on up to 34.7ha of known and potential habitat. This represents both foraging and sheltering habitat.

C.28.8 Consideration of corridors

The Eastern Pygmy Possum is small, relies on movement on the ground to disperse and it is considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would isolate this species.

C.29 Spotted-tailed Quoll

C.29.1 Discussion of conservation status

The Spotted-tailed Quoll (*Dasyurus maculatus*) is listed as vulnerable on Schedule 2 of the TSC Act and as endangered under the EPBC Act. The species occurs in coastal NSW, eastern Victoria, north-eastern Queensland and in Tasmania (DEC (NSW), 2005d1).

The Spotted-tailed Quoll is at threat from the following:

- Loss, fragmentation and degradation of habitat;
- Accidental poisoning in fox and dog baiting programs; and
- Competition with cats and foxes (DEC (NSW), 2005d1).

No recovery plan has been prepared for this species. The Fox Threat Abatement Plan is relevant to this species: the Spotted-tailed Quoll is a medium priority species affected by foxes. The Project is not inconsistent with the objectives on this threat abatement plan. Thirty-two priority actions have been developed to help recover this species, including:

- Reserve Fire management Strategy(s) include operational guidelines that protect rocky outcrops and riparian zones within areas of known habitat (High priority) (DEC (NSW), 2005d1).

The Spotted-tailed Quoll has been recorded from Yengo National Park, Dharug National Park, Olney State Forest, MacPherson State Forest, Wyrabalong National Park, Popran National Park, Brisbane Water National Park, Ku-ring-gai Chase National Park, Cattai National Park, Blue Mountains National Park, Wollemi National Park, Nattai National Park and Royal National Park in the Sydney Basin Bioregion (NSW Government, 2009).

C.29.2 Discussion of local and regional abundance

There have been 87 records of the Spotted-tailed Quoll from the Gosford LGA in the last 20 years and 704 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.29.3 Discussion of other known local populations

There are many records of the Spotted-tailed Quoll from the Gosford LGA, including from Dharug National Park along the Hawkesbury River, in the Kulnura – Mangrove Mountain area extending to the northern section of Popran National Park, Mt White and the southern part of Popran National Park, Brisbane Water National Park and in coastal areas east of Gosford including Bouddi National Park (NSW Government, 2009). The species has not been recorded from the Project Site but potential habitat does occur there.

C.29.4 Discussion of habitat utilisation

No Spotted-tailed Quolls were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

C.29.5 Assessment of habitat

The Spotted-tailed Quoll occurs in a range of habitats including rainforest, open forest, woodland, coastal heath and inland riparian forest. The species dens in tree hollows, fallen logs, small caves, rock crevices, boulder fields and rocky cliff faces (DEC (NSW), 2005d1).

C.29.6 Description of habitat values

A number of large stags and trees with large hollows exist on the Project Site, which could provide denning opportunities for this species, as could the sandstone outcropping where shallow caves are formed. Approximately 83.5ha of potential foraging habitat exists on the Project Site with all vegetation communities providing potential foraging habitat. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and a proportion of this habitat would be retained and conserved in the Offset Areas.

C.29.7 Extent of habitat removal

Clearing would only impact on up to 34.7ha of potential habitat. This represents both foraging and sheltering habitat.

C.29.8 Consideration of corridors

The Spotted-tailed Quoll moves along the ground but contiguous vegetation is not necessarily required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would isolate this species.

C.30 Yellow-bellied Glider

C.30.1 Discussion of conservation status

The Yellow-bellied Glider (*Petaurus australis*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. The species occurs from southern Queensland to Victoria from the coast to the western slopes (DEC (NSW), 2005h1).

The Yellow-bellied Glider is at threat from the following:

- Loss and fragmentation of habitat;
- Loss of hollow-bearing trees; and
- Loss of feed trees (DEC (NSW), 2005h1).

There are no threat abatement plans relevant to this species. A recovery plan has been prepared for this species and include the objectives:

- To encourage and assist in improving the protection and management of the Yellow-bellied Glider and its habitat; and

- To increase community awareness of the Yellow-bellied Glider and encourage community involvement in its conservation (NSW NPWS, 2003b).

Fourteen priority actions have been developed to help recover this species, including:

- Consider species in reserve management and planning to protect and enhance habitat and connection corridors (High priority) (DEC (NSW), 2005h1).

The Yellow-bellied Glider has been recorded from Yengo National Park, Wollemi National Park, Blue Mountains National Park, Olney State Forest, Wyong State Forest, Ourimbah State Forest, MacPherson State Forest, Popran National Park, Bouddi National Park, Dharug National Park, Parr State Conservation Area, Cattai National Park, Castlereach Nature Reserve, Lane Cove National Park and Nattai National Park in the Sydney Basin Bioregion (NSW Government, 2009).

C.30.2 Discussion of local and regional abundance

There have been 100 records of the Yellow-bellied Glider from the Gosford LGA in the last 20 years and 1915 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.30.3 Discussion of other known local populations

There are many records of the Yellow-bellied Glider from the Gosford LGA, particularly in the western parts including the Mangrove Creek Water Supply Reserve, McPherson State Forest and Dharug National Park, the northern section of Popran National Park and in the eastern parts of the LGA east of Gosford including Bouddi National Park (NSW Government, 2009). The species has not been recorded from the Project Site but potential habitat does occur there.

C.30.4 Discussion of habitat utilisation

No Yellow-bellied Gliders were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

C.30.5 Assessment of habitat

The Yellow-bellied Glider occurs in tall, mature eucalypt forest in high rainfall areas with nutrient rich soils. The species dens in the hollows of large trees (DEC (NSW), 2005h1).

C.30.6 Description of habitat values

The area of the Project Site that this species is most likely to use is the gully surrounding Creek C where the forest is taller, including the communities: Hawkesbury Peppermint Apple

Forest, Sandstone Ranges Gully Rainforest and Dharug Footslopes Apple Redgum Forest in the Glenworth Offset Area. It is not likely to use the shorter heath and woodland communities that predominate throughout the proposed extraction areas. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and all of the potential habitat for this species would be retained and conserved in the Offset Areas.

C.30.7 Extent of habitat removal

Clearing would not impact on any potential habitat for this species. Potential habitat for the species will be retained within the Offset Areas.

C.30.8 Consideration of corridors

As the Yellow-bellied Glider is relatively mobile, but is considered to require tree connectivity for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.31 Squirrel Glider

C.31.1 Discussion of conservation status

The Squirrel Glider (*Petaurus norfolcensis*) is listed as vulnerable on Schedule 2 of the TSC Act. It is not listed under the EPBC Act. The species occurs in eastern Australia from northern Queensland to western Victoria (DEC (NSW), 2005e1).

The Squirrel Glider is at threat from the following:

- Loss and fragmentation of habitat;
- Loss of hollow-bearing trees;
- Loss of flowering understorey and midstorey shrubs in forests; and
- Individuals getting caught in barbed wire while gliding (DEC (NSW), 2005e1).

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Thirty-one priority actions have been developed to help recover this species, including:

- Ensure the largest hollow bearing trees (including dead trees) are given highest priority for retention in PVP assessments and other environmental planning instruments, or other land assessment tools (Medium priority) (DEC (NSW), 2005e1).

The Squirrel Glider has been recorded from Yengo National Park, Munmorah State Conservation Area, Olney State Forest, Wyong State Forest, Wyrabalong National Park, Popran National Park, Brisbane Water National Park, Bouddi National Park, Dharug National Park, Wollemi National Park, Ku-ring-gai Chase National Park, Blue Mountains National Park and Nattai National Park in the Sydney Basin Bioregion (NSW Government, 2009).

C.31.2 Discussion of local and regional abundance

There have been 17 records of the Squirrel Glider from the Gosford LGA in the last 20 years and 556 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.31.3 Discussion of other known local populations

There are many records of the Squirrel Glider from the Gosford LGA, with a few records in the western part of the LGA from Kulnura, Dharug National Park and the northern section of Popran National Park. Most records are from the eastern part of the LGA from around Gosford, Niagara Park, Kariong, Erina, Brisbane Water National Park and Bouddi National Park (NSW Government, 2009). The species has not been recorded from the Project Site but potential habitat does occur there.

C.31.4 Discussion of habitat utilisation

No Squirrel Gliders were recorded on the Project Site. Potential foraging and denning habitat is present throughout the native vegetation on the Project Site.

C.31.5 Assessment of habitat

The Squirrel Glider inhabits mature or old growth species, particularly Blackbutt – Bloodwood forest in coastal areas. It prefers mixed-species stands with a shrubby or Acacia midstorey. The species nests and shelters in tree hollows and feed on Acacia gum, eucalypt sap, nectar, honeydew, manna, insects and pollen (DEC (NSW), 2005e1).

C.31.6 Description of habitat values

Much of the Project Site provides potential habitat for the Squirrel Glider, with potential nesting habitat being provided in the treed vegetation communities. Large expanses of potential foraging and roosting habitat are present throughout the National Parks in the locality. The condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and all of the potential habitat for this species would be retained and conserved in the Offset Areas.

C.31.7 Extent of habitat removal

Clearing would only impact on up to 33.3ha of potential habitat. This represents both foraging and sheltering habitat.

C.31.8 Consideration of corridors

The Squirrel Glider is relatively mobile, but is considered to require tree connectivity for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.32 Long-nosed Potoroo

C.32.1 Discussion of conservation status

The Long-nosed Potoroo (*Potorous tridactylus*) is listed as vulnerable on Schedule 2 of the TSC Act and as vulnerable under the EPBC Act. The species occurs along the south east coast of Australia from Queensland to eastern Victoria and Tasmania (DEC (NSW), 2005v). It occurs east of the Great Dividing Range in NSW.

The Long-nosed Potoroo is at threat from the following:

- Loss and fragmentation of habitat from clearing for residential and agricultural development;
- Predation by foxes, cats and dogs;
- Frequent fires and grazing by stock reducing the density and diversity of understorey and vegetation; and
- Logging regimes and other disturbances reducing availability and abundance of food resources (DEC (NSW), 2005v).

No recovery plan has been prepared for this species. The Fox Threat Abatement Plan is relevant to this species. The Project is not inconsistent with the objectives of this plan.

Nineteen priority actions have been developed to help recover this species, including:

- Encourage private landholders to exclude livestock from key habitat to reduce the impact of grazing, trampling and the spread of weeds (Medium priority);
- Encourage private landholders to protect known and potential Long-nosed Potoroo habitat from inappropriate fire regimes (Medium priority);
- Undertake control burn using a mosaic pattern to ensure adequate vegetation cover (Low priority);

- Control weeds, particularly those that affect the understorey layer, in Long-nosed Potoroo habitat (Low priority);
- Seek formal protection of all remaining areas of known habitat under voluntary conservation agreements, joint management agreements or as critical habitat (Low priority);
- Increase habitat via revegetation work and/or establishing corridors to link multiple patches of suitable habitat to expand the effective area of habitat (Low priority); and
- Prevent the spread of *Phytophthora* sp (Low priority) (DEC (NSW), 2005v).

The Long-nosed Potoroo has been recorded from Heaton State Forest, Olney State Forest and Wambina Nature Reserve in the Sydney Basin Bioregion (NSW Government, 2009).

C.32.2 Discussion of local and regional abundance

There have been 7 records of the Long-nosed Potoroo from the Gosford LGA in the last 20 years and 118 records from the last 20 years in the Sydney Basin Bioregion (NSW Government, 2009).

C.32.3 Discussion of other known local populations

There are few records of the Long-nosed Potoroo from the Gosford LGA, with records from near Mangrove Mountain, Point Clare, Narara and east of Gosford (NSW Government, 2009). The species has not been recorded from the Project Site but potential habitat does occur there.

C.32.4 Discussion of habitat utilisation

No Long-nosed Potoroos were recorded on the Project Site. Potential habitat is provided throughout the native vegetation on the Project Site.

C.32.5 Assessment of habitat

The Long-nosed Potoroo occurs in coastal heaths, dry and wet sclerophyll forests. It requires dense understorey with occasional open areas such as grass trees, sedges, ferns, heath or low shrubs. The species feeds on hypogeous (underground fruiting) fungi, roots, tubers and insects, and shelters in dense vegetation (DEC (NSW), 2005v).

C.32.6 Description of habitat values

Much of the Project Site provides potential habitat for the Long-nosed Potoroo. Large expanses of potential habitat are present throughout the National Parks in the locality. The

condition of habitat in the locality is good, due to much of it being in conservation reserves. The potential habitat on the Project Site is not a significant area of known habitat for the species and all of the potential habitat for this species would be retained and conserved in the Offset Areas.

C.32.7 Extent of habitat removal

Clearing would only impact on up to 34.7ha of potential habitat. This represents both foraging and sheltering habitat.

C.32.8 Consideration of corridors

The Long-nosed Potoroo is considered to require vegetation cover to disperse between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

C.33 Red-crowned Toadlet

C.33.1 Discussion of conservation status

The Red-crowned Toadlet is listed as vulnerable under the TSC Act. This species is confined to the Sydney Basin, from Pokolbin in the north, Mt Victoria in the west and Nowra to the south (NSW NPWS, 2001d). The Project Site is not at the limit of distribution for this species.

The Red-crowned Toadlet is threatened by the following key threatening processes:

- Bushrock removal as this would reduce shelter sites. This process would only impact on the species if bushrock is collected illegally from habitat areas that are to be retained;
- Clearing of native vegetation as this would remove potential dispersal habitat across the subject site;
- Ecological consequences of high frequency fires as frequent fires can destroy individuals and make habitat unsuitable; and
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands as changes to water quality such as pollution and siltation has the potential to make habitat unsuitable for the species and changes to flow rates can affect suitability of habitat for breeding (DEC (NSW), 2005a1).

The Project may also exacerbate the following processes, further impacting on the species:

- Infection of frogs by Amphibian Chytrid Fungus causing the disease chytridiomycosis (key threatening process) as it has the potential to be fatal to all frog species. The Red-crowned Toadlet appears to be less susceptible to the disease as it does not breed in streams. The Project is not likely to affect the susceptibility of the species to the chytrid fungus (DEC (NSW), 2005a1).

No recovery plans have been drafted or finalised for this species (NSW NPWS, 2001d)) (NSW NPWS, 2001d). Fourteen priority actions have been developed to help recover this species, including:

- Develop best practice management strategies that buffer and protect important headwater/ridge-top breeding sites from changes to water flow, flow regimes and water quality changes (High priority);
- Prepare guide to creating, rehabilitating or augmenting habitat for the species; this might include provision of rock/log groundcover, diversion of water, provision of breeding sites and material (High priority);
- Develop preferred mitigation measures to minimize impact of wildlife and/or suppression operations (Medium priority); and
- Develop a guide to fire-trail, track and road construction and maintenance that includes details of microhabitat manipulation likely to be beneficial to the species (Medium priority) (DEC (NSW), 2005a1).

The Red-crowned Toadlet has been recorded in Brisbane Water National Park, Popran National Park, Dharug National Park, Yengo National Park and Bouddi National Park, as well as national parks within the Sydney area (NSW Government, 2009).

C.33.2 Discussion of local and regional abundance

The species is limited to the Sydney Basin Bioregion and the northern margin of the South Eastern Highlands Bioregion, with its known distribution extending from Pokolbin State Forest and Wollemi National Park in the north, to the Nowra district in the south and Mt Victoria in the west (NSW NPWS, 2001b). The Red-crowned Toadlet has been recorded from 196 locations in the Gosford LGA and 989 locations in the Sydney Basin Bioregion (NSW Government, 2009).

C.33.3 Discussion of other known local populations

No specific information exists regarding populations of Red-crowned Toadlets on the Somersby Plateau. There are records of this species along the ridge between Calga and Mt White (NSW Government, 2009), which are likely to form the local population. These species do not disperse great distances, so the local subpopulation is likely to be restricted to the Project Site and the adjacent Popran National Park.

C.33.4 Discussion of habitat utilisation

Red-crowned Toadlets were recorded in five areas of which three (C, D and E) are associated with the upper section of Creek A. The creek passes through areas of stepped sandstone that are overlain in several sections by a thick bed of sand. Creek A does not appear to be a permanent creek but the banks retain moisture for long periods, as evidenced by the growth of Coral Fern (*Glychenia sieberi*), Swamp Rose (*Bauera ruboides*) and Saw-sedge (*Gahnia sp.*).

It is possible that habitat for this species extends northwards from Creek A, towards the sandstone exposures nearby. Habitat for Red-crowned Toadlets appears to be lacking on the southern (drier) side of the central valley, with only one potential habitat area (J) identified along Creek B. An additional record of the species was made among sandstone overhangs away from the ephemeral creeks, in the northern section of the Project Site. It is likely that more individuals occur on the Project Site, on and off the subject site but the species is cryptic and can be difficult to detect. The individuals detected on the Project Site are likely to be residents as Red-crowned Toadlets do not disperse more than tens of metres (NSW NPWS, 2001b).

The Project is likely to affect Red-crowned Toadlets along Creek A as the quarry would remove a large portion of this ephemeral drainage line. Creek B would be retained, however with quarries on either side the water levels are likely to be reduced in this creek.

The Project is not likely to affect the viability of the species in the locality. The population in the Study Area and surrounding bushland areas would remain viable. Habitat is contiguous between these areas and other parts of the locality and as such other populations in the locality are not reliant on the habitat in the Study Area for viability.

C.33.5 Assessment of habitat

The Red-crowned Toadlet generally occurs on the escarpment areas and plateaus of Triassic sandstones in the Sydney Basin, usually within 100m of the ridge top. The species utilises moist microhabitats rather than permanent water, such as under bushrock, logs on soil, thick ground litter and horizontal rock crevices along the ground. The Toadlets are usually found along permanently moist soaks in ephemeral feeder creeks. The species generally occurs in open woodland or heath communities that have a low, open tree cover with a xeromorphic (drought tolerant) understorey (NSW NPWS, 2001b). It tends to be found in disjunct locations where suitable microhabitats occur.

This pattern is likely to occur throughout the locality and region. The distribution of the species is contained within the Sydney Basin Bioregion and the northern margin of the South Eastern Highlands Bioregion. Ridge top and upper slope habitats are often disturbed by development. However, there are also many national parks within the Sydney Basin Bioregion and the Red-crowned Toadlet is known to occur in several of these including Blue Mountains, Bouddi, Brisbane Water, Dharug, Garigal, Heathcote, Ku-ring-gai Chase, Lane Cove, Marramarra, Popran, Royal, Sydney Harbour, Wollemi and Yengo National Parks, Barren Grounds, Muogamarra and Nattai Nature Reserves, Berowra Valley Regional Park, and Dharawal and Parr State Recreation Area (NSW NPWS, 2001b).

C.33.6 Description of habitat values

On the Project Site, the Red-crowned Toadlet uses ephemeral drainage lines which are feeder creeks to the creek running west from the Project Site. Red-crowned Toadlets have been detected in association with the two smaller ephemeral creeks on the Project Site. These drainage lines contain a series of sandstone ledges with shallow sandy soil which retain some moisture and tall ground cover plants which provide shelter and feeding habitat (White, 2005).

It is unknown how much habitat is used on the Project Site as either breeding or dispersal habitat as it is difficult to determine the range through which individuals might move (NSW NPWS, 2001b).

There is much sandstone outcropping on the Project Site, containing shelters in the form of crevices. There is also loose bushrock on the Project Site under which the species could shelter and there is dense ground vegetation across most areas of the Project Site in all communities. These areas would provide shelter and foraging habitat for Red-crowned Toadlets and would be ideal for the species to use in dispersing across the Project Site.

C.33.7 Extent of habitat removal

Up to 0.11ha (approximately 5%) of known habitat would be removed as a result of the Project, as well as up to 1.77ha (approximately 87%) of potential habitat.

C.33.8 Discussion of corridors

Corridors or dispersal habitat for the Red-crowned Toadlet would be maintained on the Project Site. If the dispersal corridor through the subject site proves unsuccessful, there would still be opportunities for Red-crowned Toadlets to disperse around other areas of the Project Site, allowing them to move to the north and south along the ridge. The Project Site provides habitat which is continuous with Popran National Park, and is therefore part of the local corridor system for flora and fauna. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (NSW NPWS, 2001c).

C.34 Giant Burrowing Frog

C.34.1 Discussion of conservation status

The Giant Burrowing Frog is listed as vulnerable under the TSC Act. This species occurs from the NSW Central Coast to eastern Victoria, but is most common on the Sydney Sandstone (DEC (NSW), 2005k). The Project Site is not at the limit of distribution for this species.

The Giant Burrowing Frog is threatened by the following processes:

- Bushrock removal (key threatening process) as this would reduce shelter sites. This process would only impact on the species if bushrock is collected illegally from habitat areas that are to be retained;
- Clearing of native vegetation (key threatening process) as this would remove potential dispersal habitat across the subject site;
- Ecological consequences of high frequency fires (key threatening process) as frequent fires can destroy individuals and make habitat unsuitable; and
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands (key threatening process) as changes to water quality such as pollution and siltation has the potential to make habitat unsuitable for the species and changes to flow rates can affect suitability of habitat for breeding (DEC (NSW), 2005k).

The Project may also exacerbate the following processes, further impacting on the species:

- Infection of frogs by Amphibian Chytrid Fungus causing the disease chytridiomycosis (key threatening process) as it has the potential to be fatal to all frog species. The Giant Burrowing Frog appears to be less susceptible to the disease as it does not exclusively breed in streams. The Project is not likely to affect the susceptibility of the species to the chytrid fungus (DEC (NSW), 2005k).

No recovery plans have been drafted or finalised for this species (NSW NPWS, 2001a) Twenty-four priority actions have been developed to help recover this species, including:

- Develop best practice guidelines for road/drain construction and maintenance within reserves, forests and utility access easements (High priority);
- Develop interim minimum fire frequency recommendations based on best available knowledge (High priority);
- Ensure that appropriate erosion, sedimentation and water quality control measures are applied around known locations (Medium priority); and
- Develop guidelines for construction of microhabitat features as components of land management best practice (Medium priority) (DEC (NSW), 2005k).

The Giant Burrowing Frog has been recorded in Brisbane Water National Park, Popran National Park and Yengo National Park (NSW Government, 2009).

C.34.2 Discussion of local and regional abundance

The Great Burrowing Frog has been recorded from 159 locations in the Gosford LGA and 457 locations in the Sydney Basin Bioregion in the last 20 years, including Popran, Brisbane Water, Dharug and Yengo National Parks (NSW Government, 2009).

C.34.3 Discussion of other known local populations

No specific information exists regarding populations of Great Burrowing Frogs on the Somersby Plateau. There are records of this species in the southern section of the adjacent portion of Popran National Park, on the eastern side of the Calga Interchange, and to the south-west of the Project Site (see **Figure 4.1**).

C.34.4 Discussion of habitat utilisation

No Giant Burrowing Frogs have been detected on the Project Site, however habitat for this species exists, of which a large area would be retained.

C.34.5 Assessment of habitat

The Giant Burrowing shows a preference for sandstone ridge top habitat and broader upland valleys. In these locations the frog is associated with small headwater creek lines and along slow flowing to intermittent creeklines. The species often spends significant periods of time underground during unfavourable conditions. Limited observations on this species suggest an ability to range widely, frequently being observed on roads at considerable distance from suitable riparian breeding, or other moist habitat (DEC (NSW), 2005k).

C.34.6 Description of habitat values

Potential habitat for the Giant Burrowing Frog is also on the Project Site and appears confined between the 170m and 190 m contours between creeks A and B (Figure 2). This area has a hanging swamp nested in deep sand. Above the 190 m contour, the sandstone layer does not seem to retain ground moisture; similarly below the 180 m contour, the sandstone is not deeply weathered and appears unsuitable. This zone contains two discrete hanging swamp ecosystems, one being dominated by Tea Trees (*Leptospermum* sp), and the other by Saw-sedges (*Gahnia* sp). These swamps do not appear to retain open water and breeding may not be possible in this area. If Giant Burrowing Frogs are present, then breeding is most likely to occur in pools in the upper parts of Creek A, although no tadpoles of this species were found there.

C.34.7 Extent of habitat removal

Up to 3.23ha (approximately 44%) of potential habitat for this species would be removed as a result of the Project.

C.34.8 Consideration of corridors

Corridors are being maintained on the Project Site, particularly along Creeks B and C, which would enable this species to move around. The Project Site provides habitat which is continuous with Popran National Park, and is therefore part of the local corridor system for flora and fauna. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (Morgan, 2001).

C.35 Rosenberg's Goanna

C.35.1 Discussion of conservation status

Rosenberg's Goanna is listed as vulnerable under the TSC Act. In NSW this species occurs from the Central Coast and Wollemi National Park in the north to Cooma and Khancoban in the south. It also occurs in South Australia and Western Australia (DEC (NSW), 2005b1). The Project Site is near the northern limit of distribution for this species.

Rosenberg's Goanna is threatened by the following processes:

- Removal of habitat elements such as termite mounds and fallen timber (key threatening process);
- Clearing of native vegetation (key threatening process) as this would remove potential dispersal habitat across the subject site; and
- Predation by cats and dogs (DEC (NSW), 2005b1).

No recovery plans have been drafted or finalised for this species (NSW NPWS, 2001d, DEC (NSW), 2005b1). Nine priority actions have been developed to help recover this species, including:

- Identify key habitats or areas for protection and enhanced management on private lands through management agreements and incentives (High priority);
- Provide map of known occurrences to the Rural Fire Service and seek protection of rocky outcrops and riparian zones on Bush Fire Risk Management Plans, risk register and/or operation maps (Medium priority); and
- Implement management strategies that reduce the prevalence of bush rock removal, including surveillance (Medium priority) (DEC (NSW), 2005b1).

Rosenberg's Goanna has been recorded in Dharug National Park and Ku-ring-gai Chase National Park.

C.35.2 Discussion of local and regional abundance

The Rosenberg's Goanna has been recorded from 9 locations in the Gosford LGA and 141 locations in the Sydney Basin Bioregion in the last 20 years (NSW Government, 2009).

C.35.3 Discussion of other known local populations

Recorded locations within the LGA are mainly along the Hawkesbury River, as well as one north-east of Gosford (NSW Government, 2009). There is no information on the local population associated with the Study area.

C.35.4 Discussion of habitat utilisation

This species has not been recorded on the Project Site, but has been recorded in the Study Area.

C.35.5 Assessment of habitat

This species relies on termite mounds for laying its eggs, and shelter in hollow logs, rock crevices and burrows (DEC (NSW), 2005b1). Home range for this species is approximately 20ha (King and Green 1999).

C.35.6 Description of habitat values

Foraging habitat for this species exists across the Project Site. Rock crevices and fallen logs provide shelter for this species. Woodland and heath dominate the vegetation on the Project Site, and the sandy soils provide habitat for termites, whose nests are a critical habitat component for this species (DEC (NSW), 2005b1).

C.35.7 Extent of habitat removal

Up to 33.3ha of potential habitat for this species would be cleared from the Project Site, which is approximately 48% of the available habitat on the Project Site. Extensive similar habitat exists in the locality, including habitat which is protected in Popran National Park.

C.35.8 Consideration of corridors

The Project Site is located adjacent to Popran National Park which is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

This page has intentionally left blank

Appendix D

Assessments of Significance

(No. of pages excluding this page = 77)

CONTENTS

Page	Page
Callistemon linearifolius.....	3-229
Hibbertia procumbens	3-231
Darwinia glaucophylla	3-233
Acacia bynoeana.....	3-235
Tetratheca glandulosa.....	3-237
Prostanthera junonis	3-239
Eucalyptus camfieldii.....	3-241
Kunzea rupestris	3-243
Melaleuca deanei	3-245
Micromyrtus blakelyi.....	3-246
Diuris bracteata	3-248
Ancistrachne maidenii	3-250
Grevillea shiresii.....	3-252
Persoonia hirsuta	3-253
Lasiopetalum joyceae	3-255
Glossy Black-cockatoo.....	3-257
Gang-gang Cockatoo.....	3-260
Powerful Owl	3-262
Masked Owl.....	3-264
Barking Owl	3-267
Yellow-bellied Sheath-tail-bat	3-270
Eastern Freetail-bat.....	3-272
Little Bentwing-bat.....	3-274
Large-eared Pied Bat	3-276
Large-footed Myotis.....	3-278
Greater Broad-nosed Bat	3-280
Grey-headed Flying-fox	3-283
Eastern Pygmy Possum	3-285
Spotted-tailed Quoll.....	3-287
Yellow-bellied Glider.....	3-289
Squirrel Glider	3-291
Long-nosed Potoroo.....	3-293
Red-crowned Toadlet	3-295
Giant Burrowing Frog	3-298
Rosenberg's Goanna.....	3-300

D1 Callistemon linearifolius

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

Callistemon linearifolius has been recorded from 8 locations in the Gosford LGA and 44 locations in the Sydney Basin Bioregion in the last 20 years (all on the Central Coast) (DEC (NSW), 2005y). On the Project Site, this species was recorded in four locations, of which only one would be cleared as part of the Project, resulting in the loss of one known plant. 24 plants spread over the remaining locations would not be directly impacted by the Project. These plants form a disjunct population, as other records in the LGA are further to the east, around Gosford. No targeted surveys for this species have been carried out in the adjacent Popran National Park, however, it is likely that it occurs there. The Project is not likely to have an adverse effect on this species such that the population on the subject site is placed at risk of extinction.

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

There are no endangered populations of *Hibbertia procumbens* listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- (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,**

On the Project Site, *Callistemon linearifolius* was recorded in small groups in four scattered locations, of which only one (within Stage 5) would be cleared as part of the Project, resulting in the loss of a single plant. The 24 remaining plants would not be directly impacted by the development. 13.2ha (42%) of known habitat would be cleared from the Project Site as a result of the Project.

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

Callistemon linearifolius occurs in vegetation communities on the Project Site which are common in the sandstone plateaus at Calga and surrounding areas. While a sizable area of habitat would be removed from the Project Site, approximately 17,200ha of similar habitat are present within Gosford LGA. Habitat is protected in Brisbane Water National Park (Bell, 1998), (Bell, 2004), and potential habitat exists in Dharug and Yengo National Parks (Clarke and Benson, 1986, Bell et al., 1993). Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No recovery plan has been prepared for this species. No threat abatement plans are relevant to this species. DECC has identified 13 priority actions to help recover the *Callistemon linearifolius* in New South Wales. These include:

- Seek to increase the level of legislative protection for sites through land-use planning mechanisms and conservation agreements;
- Liaise with landholders to facilitate the implementation of site-specific threat abatement measures;
- Conduct management-related ecological research, particularly into fire response;
- Undertake population viability analysis particularly for those small populations with a high risk of local extinction; and
- Collect seed for NSW Seedbank.

A number of these priority actions could be carried out on the Project Site or adjacent land.

(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.

Callistemon linearifolius is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear habitat for this species. Habitat will be retained on the Project Site, and the species can be replanted as part of the rehabilitation program; and

- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D2 *Hibbertia procumbens*

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

Clearing of the habitat supporting *Hibbertia procumbens* would impact the species within the Project Site. Approximately half of the recorded locations would be impacted by clearing for the two quarries, however other sites will not be impacted. These include the cleared area along the power line easement, along Creek B, in the southeast corner adjacent to Australian Wildlife Walkabout Park, the northwest section between the Stage 3 and 4 quarries, and along the access road to Popran National Park on the southern border of the Project Site. A total of 24.7ha (44%) of known habitat for this species would be cleared from the Project Site.

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

There are no endangered populations of *Hibbertia procumbens* listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing of the habitat supporting *Hibbertia procumbens* would impact the species within the Project Site. Less than half of the recorded locations would be impacted by clearing for the two extraction stages, however, other sites will not be impacted. These include the cleared area along the power line easement, along Creek B, in the southeast corner adjacent to

Australian Wildlife Walkabout Park, the northwest section between the Stage 3 and 4 quarries, and along the access road to Popran National Park on the southern border of the Project Site. A total of 24.7ha (44%) of known habitat for this species would be cleared from the Project Site.

Habitat to be retained within the Project Site (along the southern and western boundaries) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

Within Gosford LGA potential habitat exists for this species within all areas mapped as E29 Hawkesbury Banksia Scrub-Woodland, as well as areas adjacent to E54 Sandstone Hanging Swamps (Bell, 2004). This species is also likely to have habitat throughout E26 Exposed Hawkesbury Woodland. E26 and E29 are widespread in the Gosford, Central Coast and Sydney regions.

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

No critical habitat for this endangered species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No recovery plan has been prepared for this species. No threat abatement plans are relevant to this species. DECC has identified 16 priority actions to help recover *Hibbertia procumbens* in New South Wales. These include:

- Seek to increase the level of legislative protection for sites on freehold land through land-use planning mechanisms and conservation agreements;
- Negotiate with the managers of freehold sites to prepare and implement site management plans that address threatening processes;
- Encourage research Projects on the ecological requirements of the species and its response to disturbance;
- Restrict access to sites, where necessary; and
- Undertake targeted bush regeneration works, where required.

A number of these priority actions could be carried out on the Project Site or adjacent land.

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.

Hibbertia procumbens is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear habitat for this species. Habitat will be retained on the Project Site, and the species can be replanted as part of the rehabilitation program; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D3 Darwinia glaucophylla

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

Darwinia glaucophylla has been recorded from 28 locations in the Gosford LGA. This species is only known from this LGA. Several sites are within Brisbane Water National Park and one is known from Popran National Park. This species was recorded across the higher elevations of the Project Site (where clearing for the Project is to take place), and into the adjacent Popran National Park. It is killed by fire, hence its preference for rocky environments (Benson and McDougall, 1998). In the absence of sufficient data for the adjacent Popran National Park, it is possible that a significant impact may be felt on a local population of this species, however, the viability of the species as a whole is not at risk as a result of the Project.

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

There are no endangered populations of *Darwinia glaucophylla* listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

- c) **in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- 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**
 - is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

- 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,**

Approximately half of the recorded locations would be impacted by clearing for the two extraction areas, however other sites will not be impacted. These include the cleared area along the power line easement, along Creek B, in the southeast corner adjacent to Australian Wildlife Walkabout Park, the northwest section between the Stage 3 and 4 quarries, and along the access road to Popran National Park on the southern border of the Project Site, particularly the southwest corner. A total of 24.7ha (44%) of known habitat for this species would be cleared from the Project Site.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

Darwinia glaucophylla has been recorded throughout communities E26 Exposed Hawkesbury Woodland and E29 Hawkesbury Banksia-Scrub Woodland within the Project Site. These communities cover approximately 55.6ha of the Project Site. The communities within which this species occurs in the Project Site are common in the locality. Some areas of the Project Site show evidence of relatively recent fire.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No recovery plan has been prepared for this species. No threat abatement plans are relevant to this species. DECC has identified 15 priority actions to help recover *Darwinia glaucophylla* in New South Wales. These include:

- Increase protection of sites through land-use planning mechanisms and conservation agreements;
- Prepare and implement a population monitoring program;
- Restrict and control access to sites, particularly access by off-road vehicles;
- Undertake sediment and erosion control works at priority sites; and
- Undertake weed control, priority given to sites at urban interface

A number of these priority actions could be carried out on the Project Site or adjacent land.

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.

Darwinia glaucophylla is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear habitat for this species. Habitat will be retained on the Project Site, and the species can be replanted as part of the rehabilitation program; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase. This species is killed by fire, hence its preference for rocky environments (Benson and McDougall 1998). Germination is from soil stored seed which requires heat to break seed dormancy. Germination is unlikely in the absence of fire.

Conclusion

The Project is not likely to have a significant impact on this species.

D4 Acacia bynoeana

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

Acacia bynoeana has been recorded from 2 locations in the Gosford LGA, both near Wiseman's Ferry Road at Mangrove Creek. These occur within Dharug National Park (NSW Government, 2009). This species has not been recorded on the Project Site. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Acacia bynoeana* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

- 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,**

Acacia bynoeana has not been recorded on the Project Site during any of the threatened flora surveys. Approximately 24.7ha (36%) of potential habitat will be cleared as a result of the Project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) **whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Thirteen priority actions have been identified to help recover this species, including:

- Liaise with private and public land managers to facilitate the preparation and implementation of management plans that address threatening processes (Medium priority);
- Incorporate appropriate fire regime into land management practices (Medium priority);
- Restrict access to sites where necessary (Medium priority);
- Undertake targeted bush regeneration works where required (Medium priority); and
- Increase the level of legislative protection for sites through land use planning mechanisms and conservation agreements. Retain vegetative linkages between sites where possible (High priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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.

Acacia bynoeana is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D5 Tetratheca glandulosa

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

Tetratheca glandulosa has been recorded from 92 locations in Gosford LGA. This species has been recorded nearby at Mt White and in Popran National Park (NSW Government, 2009), which is adjacent to the Project Site. Large populations also occur in Dharug National Park and in the Mangrove Mountain area. This species has not been recorded on the Project Site. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Tetratheca glandulosa* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

- 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,**

Tetratheca glandulosa has not been recorded on the Project Site. Approximately 33.3ha (41%) of potential habitat would be cleared from the Project Site as a result of the project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area and known habitat occurs within Popran National Park.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) **whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Sixteen priority actions have been identified to help recover this species, including:

- Encourage community awareness and involvement in threat management works (High priority);
- Reserve Fire Management Strategy to include operational guidelines to protect this species from fire (High priority);
- Increasing the level of legislative protection for sites through land use planning mechanisms and conservation agreements (High priority);
- Undertake identified priority threat management works including weed control, restrict access, stormwater management works and slashing under powerlines (High priority); and
- Undertake works to maintain or improve habitat connectivity between and within populations (Medium priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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.

Tetratheca glandulosa is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D6 Prostanthera junonis

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

Prostanthera junonis has not been recorded from the Project Site. Other populations within the locality occur further east, generally on the eastern edge of the Somersby Plateau, east of Mooney Mooney Creek (NSW Government, 2009). This species has not been recorded on the Project Site. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Prostanthera junonis* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

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,**

Prostanthera junonis has not been recorded on the Project Site. Approximately 33.3ha (41%) of potential habitat would be cleared from the Project Site as a result of the project.

Potential habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species. A recovery plan has been prepared for *Prostanthera junonis* with the overall objective to identify policies and programs which protect and conserve *P. junonis* and which reduce the risk of extinction of the species. Specific objectives relevant to the Project include:

- Ensure populations are not destroyed by habitat loss, ensure security of lands that support populations; and
- Minimise long term decline through implementation of appropriate threat and habitat management practices.

Twenty priority actions have been identified to help recover this species, including:

- Prepare and implement site-specific management plans for all populations outside of the reserve system (Medium priority); and
- Undertake weed control activities as appropriate using approved bush regeneration methods (Medium priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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.

Prostanthera junonis is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D7 *Eucalyptus camfieldii*

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

Several disjunct populations occur within the Gosford LGA including at Point Clare, Popran National Park and the northern section of Brisbane Waters National Park. This species has not been recorded on the Project Site. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Eucalyptus camfieldii* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Eucalyptus camfieldii does not occur on the Project Site. Approximately 33.3ha (48%) of potential habitat would be cleared from the Project Site as a result of the project.

Potential habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) **whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Fifteen priority actions have been identified to help recover this species, including:

- Liaise with landholders to facilitate the implementation of site-specific threat abatement measures (High priority);
- Implement appropriate fire regimes using suitable methods for this species (Medium priority);
- Control access at sites with high visitation and disturbance (Medium priority);
- Prepare and implement site-specific plans of management (High priority); and
- Seek to increase the level of legislative protection for sites through land use planning mechanisms and conservation agreements (High priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

- 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.**

Eucalyptus camfieldii is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;

- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D8 Kunzea rupestris

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

The species has not been recorded on the Project Site. The closest populations have been recorded from Dharug National Park. These are the only records for the species north of the Hawkesbury River (NSW Government, 2009). Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Kunzea rupestris* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Kunzea rupestris does not occur on the Project Site. Approximately 33.3ha (48%) of potential habitat would be cleared from the Project Site as a result of the project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Thirteen priority actions have been identified to help recover this species, including:

- Negotiate with sand mining companies to reduce threats posed by mining activities (High priority); and
- Negotiate with private landholders to increase protection of sites through land use planning mechanisms or conservation agreements for sites on private land (Medium priority)

A number of these priority actions could be carried out on the Project Site or adjacent land.

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.

Kunzea rupestris is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D9 Melaleuca deanei

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

Melaleuca deanei has been recorded at one location in the Gosford LGA in the last 20 years, at Horsfield Bay (NSW Government, 2009). The species has not been recorded on the Project Site or in the adjacent Popran National Park. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Melaleuca deanei* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Melaleuca deanei does not occur on the Project Site. Approximately 20.1ha (53%) of potential habitat would be cleared from the Project Site as a result of the project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Sixteen priority actions have been identified to help recover this species, including:

- Liaise with private and public land managers to facilitate the preparation and implementation of management plans that address threatening processes (Medium priority);
- Incorporate appropriate fire regime into land management practices (Medium priority);
- Restrict vehicular and pedestrian access to sites, where necessary (Medium priority);
- Undertake targeted bush regeneration works, where required (Medium priority); and
- Seek to increase the level of legislative protection for sites through land-use planning mechanisms and conservation agreements. Retain or, where lost, re-establish vegetative linkages between sites where possible (High priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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.

Melaleuca deanei is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D10 Micromyrtus blakelyi

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

The majority of records for this species occur south of the Hawkesbury in the region from Maroota to Cowan. There is one record from north of the Hawkesbury River near Mt White (NSW Government, 2009). The species has not been recorded on the Project Site or within Popran National Park. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Micromyrtus blakelyi* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

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,**

Micromyrtus blakelyi does not occur on the Project Site. Approximately 33.3ha (48%) of potential habitat would be cleared from the Project Site as a result of the project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Seven priority actions have been identified to help recover this species, none of which are relevant to the Project.

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.

Micromyrtus blakelyi is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D11 Diuris bracteata

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

Diuris bracteata has not been recorded on the Project Site or the adjacent Popran National Park. The species has been recorded at Kulnura and Peats Ridge. (NSW Government, 2009) This species has not been recorded on the Project Site. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Diuris bracteata* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Diuris bracteata does not occur on the Project Site. Approximately 24.7ha (44%) of potential habitat would be cleared from the Project Site as a result of the project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) **whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. No priority actions have been identified for this species but it generally requires protection of the known roadside populations.

- 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.**

Diuris bracteata is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D12 Ancistrachne maidenii

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

Ancistrachne maidenii has not been recorded on the Project Site or the adjacent Popran National Park (NSW Government, 2009). The species has been recorded once to the east of Calga. This species has not been recorded on the Project Site. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Ancistrachne maidenii* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,

Ancistrachne maidenii does not occur on the Project Site. Approximately 11.6ha (32.9%) of potential habitat would be cleared from the Project Site as a result of the project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Five priority actions have been identified to help recover this species, including:

- Ensure staff undertaking track and roadside maintenance activities are aware of species and its habitat and habitat requirements (Medium priority).

This priority action could be carried out on the Project Site or adjacent land.

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.

Ancistrachne maidenii is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D13 *Grevillea shiresii*

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

Grevillea shiresii has been recorded from 2 locations in the Gosford LGA with a total of 7 records from the last 20 years. These locations are at Mooney Mooney Creek and Mullet Creek (NSW Government, 2009). The species has not been recorded on the Project Site or within Popran National Park.

This species has not been recorded on the Project Site. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Grevillea shiresii* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Grevillea shiresii does not occur on the Project Site. No potential habitat would be cleared from the Project Site as a result of the project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Five priority actions have been identified to help recover this species, including:

- Reserve fire management strategy include operational guidelines to protect this species from fire (Medium priority).

This priority action could be carried out on the Project Site or adjacent land.

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.

Grevillea shiresii is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D14 *Persoonia hirsuta*

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

Persoonia hirsuta has not been recorded on the Project Site or the adjacent Popran National Park. The species has been recorded once from Dharug National Park (NSW Government, 2009). This species has not been recorded on the Project Site. Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not

likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Persoonia hirsuta* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Persoonia hirsuta does not occur on the Project Site. Approximately 33.3ha (48%) of potential habitat would be cleared from the Project Site as a result of the project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Twenty-one priority actions have been identified to help recover this species, including:

- Advise and liaise with private land managers to facilitate the preparation and implementation of site management plans that address threatening processes (High Priority);
- Incorporate best knowledge regarding appropriate fire regime into land management practices (High priority);
- Reserve Fire Management Strategy to include operational guidelines to protect this species from fire (Medium priority);
- Develop and implement site-awareness and protection procedures for use by land owners/managers and public utilities and their contractors when undertaking road, trail, or easement maintenance (High priority);
- Restrict vehicular and pedestrian access to sites, where necessary (High priority);
- Undertake targeted bush regeneration works, where required (High priority);
- Seek to increase the level of legislative protection for sites through land-use planning mechanisms and conservation agreements (Medium priority); and
- Retain or re-establish vegetation and fauna movement linkages between sites (Medium priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

- **whether the action proposed constitutes or is part of a key threatening process or is** Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

g) likely to result in the operation of, or increase the impact of, a key threatening process.

Persoonia hirsuta is threatened by or the Project would further impact the species through the following processes:

Conclusion

The Project is not likely to have a significant impact on this species.

D15 *Lasiopetalum joyceae*

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

Lasiopetalum joyceae has not been recorded on the Project Site or the adjacent Popran National Park. The species has been recorded once from the Mangrove Creek Water Supply

Reserve (NSW Government, 2009). Potential habitat for the species occurs on the Project Site and within the proposed offset areas. The Project is not likely to have an adverse effect on the life cycle of this species such that a local population is likely to be placed at risk of extinction.

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

There are no endangered populations of *Lasiopetalum joyceae* listed for under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Lasiopetalum joyceae does not occur on the Project Site. Approximately 8.6ha (62%) of potential habitat would be cleared from the Project Site as a result of the project.

Habitat to be retained within the Project Site (in the southern and north-western portions) is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Nine priority actions have been identified to help recover this species, including:

- Ensure agencies undertaking fire trail or easement maintenance activities can identify the species and are aware of its habitat (High priority).

This priority action could be carried out on the Project Site or adjacent land.

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.

Lasiopetalum joyceae is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential habitat for this species. This process will not significantly affect this species as potential habitat will be retained on the Project Site;
- Weed invasion but this will be managed through the implementation of the Threatened Species and Habitat Management Plan; and
- Ecological consequences of high frequency fires as fire can destroy individual plants and habitats for plants. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.

Conclusion

The Project is not likely to have a significant impact on this species.

D16 Glossy Black-cockatoo

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

One family group (three birds) has been recorded utilising the Project Site, and also may be nesting on the Project Site. Hollow-bearing trees and Allocasuarinas will be retained on the Project Site. Clearing for the Project may interrupt the life cycle of this family group, however a population is likely to continue in the locality, and would not 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,

There are no endangered populations of Glossy Black-cockatoos listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

- 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,**

Up to 24.7ha of the 68.5ha of foraging habitat available for this species on the Project Site would be cleared (approximately 36%). Potential nesting hollows will also be lost from the Project Site. Extensive areas of similar habitat exist in the locality, of which some is protected in the adjacent Popran National Park.

Due to the Glossy Black Cockatoo being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

The Glossy Black-cockatoo inhabits forests on sites with low soil nutrient status, reflecting the distribution of key *Allocasuarina* spp (Tanton 1994). One of the main threats to this species is logging of nest trees within the proximity of food resources. Feeding habitat and potential nesting habitat would be cleared as a result of the Project, however approximately 20,000ha of similar habitat is present in the Gosford LGA. Habitat to be retained within the Project Site is contiguous with habitat within the adjacent Popran National Park, and fragmentation and isolation of habitat would not occur. Replanting areas with Casuarina trees and promotion of their growth and development during the rehabilitation stage would replace some of the foraging habitat lost.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No recovery plan for this species has been prepared by the NSW National Parks and Wildlife Service to date. The threat abatement plan for predation by the red fox is relevant to this

species. The Project is not inconsistent with these objectives, which focus on fox control programs. DECC has identified nine priority actions to help recover the Netted Bottle Brush in New South Wales. These include:

- Encourage the restoration of foraging habitat that has been cleared or degraded by previous impacts;
- Assist landholders who wish to enter into voluntary conservation agreements at key sites; and
- Continue existing monitoring programs (e.g. Goonoo population) and encourage other community groups to develop a monitoring program of local populations.

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Glossy Black Cockatoo is threatened by or the Project would further impact the species through the following processes.

- Clearing of native vegetation as this will clear foraging habitat. However, potential nesting and further potential foraging habitat will be retained on the Project Site.
- Competition from feral honeybees as they can form hives in tree hollows that also form potential nesting habitat for the Glossy Black Cockatoo. The Project is not likely to exacerbate this process.
- Ecological consequences of high frequency fires as fire can destroy tree hollows that form potential nesting habitat. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.
- Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations as it can leave Glossy Black Cockatoos prone to other infections. However, the Project will not exacerbate the likelihood of this disease infecting a local population.
- Predation by the European red fox as fledglings can become prey items for foxes. Foxes already exist on the Project Site and are not likely to be increased in number by the Project.
- The removal of dead wood and dead trees, and loss of hollow-bearing trees, as dead trees are often hollow and contain potential nesting habitat. Hollow-bearing trees would be removed as a result of the Project, however many will also be retained on the Project Site.

Conclusion

The Project is not likely to have a significant impact on this species.

D17 Gang-gang Cockatoo

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

It is unknown how many populations occur in the locality due to the distribution of records, which are scattered throughout the locality. It is likely however, that individuals from more than one population interbreed and disperse through the locality. Potential habitat will be retained on the Project Site, however a population is likely to continue in the locality, and would not 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,**

There are no endangered populations of Gang-gang Cockatoos listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Up to 33.3ha of the 80ha of potential foraging habitat available for this species on the Project Site would be cleared (approximately 42%). Extensive areas of similar habitat exist in the locality, of which some is protected in the adjacent Popran National Park. It is unlikely that there will be removal of significant nesting habitat for the Gang-gang Cockatoo within the Project Site.

Due to the Gang-gang Cockatoo being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the

locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

The potential habitat to be removed is not likely to be important for the long term survival of the species because it has not been recorded on the project site. Large areas of potential habitat will be conserved within the proposed offset area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Eleven priority actions have been developed to help recover this species, including:

- Increase landholder and public awareness of status, threats and priority actions (Low priority); and
- Negotiate management agreements and covenants over important areas of habitat (Medium priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Gang-gang Cockatoo is threatened by or the Project would further impact the species through the following processes.

- Clearing of native vegetation as this will clear foraging habitat. However, potential nesting and further potential foraging habitat will be retained on the Project Site.
- Competition from feral honeybees as they can form hives in tree hollows that also form potential nesting habitat for the Glossy Black Cockatoo. The Project is not likely to exacerbate this process.
- Ecological consequences of high frequency fires as fire can destroy tree hollows that form potential nesting habitat. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.
- Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations as it can leave Glossy Black Cockatoos prone to other infections. However, the Project will not exacerbate the likelihood of this disease infecting a local population.
- The removal of dead wood and dead trees, and loss of hollow-bearing trees, as dead trees are often hollow and contain potential nesting habitat. Hollow-bearing trees

would be removed as a result of the Project, however many will also be retained on the Project Site.

Conclusion

The Project is not likely to have a significant impact on this species.

D18 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 a viable local population of the species is likely to be placed at risk of extinction,**

The Powerful Owl has been recorded from the adjacent to the Study Area. The species is likely to use the Project Site for foraging but may also nest on the Project Site as there are large tree hollows present in which the owls could nest. Given the large home range of the species (pairs maintain and hunt throughout a home range that may be over 1000 ha), the presence of suitable adjacent habitat and its ability to adapt to disturbance within its home range, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Powerful Owl listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would only impact on up to 45.7ha of habitat. This is a small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is

available in the area (i.e. downstream). Clearing would include removal of potential roosting and nesting sites, as well as foraging habitat.

Due to the Powerful Owl being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species. The Project is not likely to fragment or isolate any areas of habitat for this species as it is highly mobile. The species is capable of flying over developed areas.

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The species hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats, with the main prey being Ring-tailed Possums, gliders and small birds (DEC (NSW), 2005e). The Project Site affords foraging habitat for the species as well as potential roosting and nesting habitat. The area of habitat to be retained on the Project Site may also be used for foraging and nesting. As the Powerful Owl is highly mobile, it is likely to use a much broader area of habitat, including large areas of Popran and Brisbane Water National Parks. Therefore the land affected by the Project is not important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

A draft recovery plan for the Large Forest Owls has been prepared and is relevant to the Powerful Owl. The overall objective of this plan is *“to ensure that the three species persist in the wild in NSW in each region where they presently occur.”* Specific objectives relevant to the Project include:

Objective 1: To minimise further loss and fragmentation of habitat outside conservation reserves and State Forests by protection and management of significant owl habitat (including individual nests).

Objective 2: To minimise the impacts of development activities on large forest owls and their habitats outside conservation reserves and State Forests.

Although the Project would remove some potential foraging habitat for the species, potential foraging and nesting habitat would be retained on the Project Site. The Project Site is on the outskirts of a large tract of native vegetation, and as such large areas of habitat will remain in the locality.

The threat abatement plan for predation by the red fox is relevant to this species. The Project is not inconsistent with these objectives, which focus on fox control programs.

DECC has identified 21 priority actions to assist with the recovery of this species in New South Wales. These include:

- Encourage private landholders to undertake management options to conserve and/or actively manage forest owl habitat;
- Use records of concurrence and licence conditions to develop a set of prescriptive guidelines that may be used to mitigate the impacts of developments on the Powerful Owl outside conservation reserves and State forests; and
- Develop a sampling methodology stratified across different land tenures and disturbance histories, as well as a set of standardised regional monitoring protocols.

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Powerful Owl is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential foraging habitat. However, potential nesting and further potential foraging habitat will be retained on the Project Site.
- Competition from feral honeybees as they can form hives in tree hollows that also form potential nesting habitat for the Powerful Owl. The Project is not likely to exacerbate this process.
- Ecological consequences of high frequency fires as fire can destroy tree hollows that form potential nesting habitat. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.
- Predation by the European red fox as fledglings can become prey items for foxes. Foxes already exist on the Project Site and are not likely to be increased in number by the Project.
- The removal of dead wood and dead trees as dead trees are often hollow and contain potential nesting habitat. Hollow trees and stags would be removed as a result of the Project, but no dead trees or trees with hollows would be removed outside the Subject Area.

Conclusion

The Project is not likely to have a significant impact on this species.

D.19 Masked 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 a viable local population of the species is likely to be placed at risk of extinction,

The Masked Owl has not been recorded in the Study Area. Records in the locality (NSW Government, 2009) indicate that the species is likely to use the Project Site for foraging and may also nest on the Project Site as there are large tree hollows present in which the owls could nest. Given the large home range of the species (pairs maintain and hunt throughout a home range that may be over 1000 ha), the presence of suitable adjacent habitat and its ability to adapt to disturbance within its home range, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Masked Owl listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would only impact on up to 45.7ha of potential habitat. This is a small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is available in the area (i.e. downstream). Clearing would include removal of potential roosting and nesting sites, as well as foraging habitat.

Due to the Masked Owl being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species. The Project is not likely to fragment or isolate any areas of habitat for this species as it is highly mobile. The species is capable of flying over developed areas.

The Masked Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The species hunts in open or closed sclerophyll

forest or woodlands and occasionally hunts in open habitats, with the main prey being Ring-tailed Possums, gliders and small birds (DEC (NSW), 2005e). The Project Site affords foraging habitat for the species as well as potential roosting and nesting habitat. The area of habitat to be retained on the Project Site may also be used for foraging and nesting. As the Masked Owl is highly mobile, it is likely to use a much broader area of habitat, including large areas of Popran and Brisbane Water National Parks. Therefore the land affected by the Project is not important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

A draft recovery plan for the Large Forest Owls has been prepared and is relevant to the Masked Owl. The overall objective of this plan is *“to ensure that the three species persist in the wild in NSW in each region where they presently occur.”* Specific objectives relevant to the Project include:

Objective 1: To minimise further loss and fragmentation of habitat outside conservation reserves and State Forests by protection and management of significant owl habitat (including individual nests).

Objective 2: To minimise the impacts of development activities on large forest owls and their habitats outside conservation reserves and State Forests.

Although the Project would remove some potential foraging habitat for the species, potential foraging and nesting habitat would be retained on the Project Site. The Project Site is on the outskirts of a large tract of native vegetation, and as such large areas of habitat will remain in the locality.

The threat abatement plan for predation by the red fox is relevant to this species. The Project is not inconsistent with these objectives, which focus on fox control programs.

DECC has identified 21 priority actions to assist with the recovery of this species in New South Wales. These include:

- Encourage private landholders to undertake management options to conserve and/or actively manage forest owl habitat;
- Use records of concurrence and licence conditions to develop a set of prescriptive guidelines that may be used to mitigate the impacts of developments on the Masked Owl outside conservation reserves and State forests; and
- Develop a sampling methodology stratified across different land tenures and disturbance histories, as well as a set of standardised regional monitoring protocols.

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Masked Owl is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential foraging habitat. However, potential nesting and further potential foraging habitat will be retained on the Project Site.
- Competition from feral honeybees as they can form hives in tree hollows that also form potential nesting habitat for the Masked Owl. The Project is not likely to exacerbate this process.
- Ecological consequences of high frequency fires as fire can destroy tree hollows that form potential nesting habitat. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase.
- Predation by the European red fox as fledglings can become prey items for foxes. Foxes already exist on the Project Site and are not likely to be increased in number by the Project.
- The removal of dead wood and dead trees as dead trees are often hollow and contain potential nesting habitat. Hollow trees and stags would be removed as a result of the Project, but no dead trees or trees with hollows would be removed outside the Subject Area.

Conclusion

The Project is not likely to have a significant impact on this species.

D.20 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 a viable local population of the species is likely to be placed at risk of extinction,

No Barking Owls were recorded on the Project Site. Barking Owls have large home ranges and the Project Site may form part of the home range of this species. The Barking Owl has been recorded sporadically throughout the Gosford LGA with records from Dharug National Park near Mangrove Creek, at Mangrove Mountain and one record from Strickland State Forest. The species has been more frequently recorded close to the coast and around Brisbane Water including Bouddi National Park and Brisbane Water National Park.

Records in the locality (NSW Government, 2009) indicate that the species is likely to use the Project Site for foraging but may also nest on the Project Site as there are large tree hollows present in which the owls could nest. Given the large home range of the species (pairs maintain and hunt throughout a home range that may be over 1000 ha), the presence of suitable adjacent habitat and its ability to adapt to disturbance within its home range, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Masked Owl listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would only impact on up to 45.7ha of potential habitat. This is a small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is available in the area (i.e. downstream). Clearing would include removal of potential roosting and nesting sites, as well as foraging habitat.

Due to the Barking Owl being highly mobile (DEC (NSW), 2005z), it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

Barking Owls occur in eucalypt woodland, open forest and swamp woodland, especially along watercourses. They roost in dense foliage along creeklines and feed mainly on invertebrates but birds and small mammals are important part of the diet during breeding. Hollows of large, old eucalypts are used for nests. Barking Owls have a home range of 30 to 200ha that they use year round. Therefore the land affected by the Project is not important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

A draft recovery plan for the Large Forest Owls has been prepared and is relevant to the Masked Owl. The overall objective of this plan is *“to ensure that the three species persist in the wild in NSW in each region where they presently occur.”* Specific objectives relevant to the Project include:

Objective 1: To minimise further loss and fragmentation of habitat outside conservation reserves and State Forests by protection and management of significant owl habitat (including individual nests).

Objective 2: To minimise the impacts of development activities on large forest owls and their habitats outside conservation reserves and State Forests.

Although the Project would remove some potential foraging habitat for the species, potential foraging and nesting habitat would be retained on the Project Site. The Project Site is on the outskirts of a large tract of native vegetation, and as such large areas of habitat will remain in the locality.

The threat abatement plan for predation by the red fox is relevant to this species. The Project is not inconsistent with these objectives, which focus on fox control programs.

Management actions suggested by the DECC include protecting retaining riparian and forest habitats, hazard reduction burning in mosaic patterns and preserving hollow-bearing and dead trees. Seventeen priority actions have been developed to help recover this species, including:

- Negotiate with individual land managers to achieve appropriate measures to protect all known Barking Owl nest sites in NSW. Protection will need to address threats such as human disturbance, collision with wires, secondary poisoning from chemicals (Medium priority);
- Incorporate the consideration of Barking Owl habitat and potential habitat as a high priority in the assessment of property for reserve establishment (High priority); and
- Establish formal conservation arrangements for properties with Barking Owls, which can be used to protect wildlife habitat (Low priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Barking Owl is at threat from the following:

- Loss of hollow-bearing trees and recruitment hollow-bearing trees, and loss of dead wood;
- Clearing for grazing, agriculture, forestry or development;

- Inappropriate forestry practices changing the structure of habitat and removing old growth trees; and
- Grazing and burning affecting habitat of prey.

Conclusion

The Project is not likely to have a significant impact on this species.

D21 Yellow-bellied Sheathtail-bat

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

No Yellow-bellied Sheathtail-bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

There are few records of Yellow-bellied Sheathtail-bat from the local area, one of which is from Bouddi National Park to the south-east of the Project Site. Although no specific information exists on the local population, the few Yellow-bellied Sheathtail-bats recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

Given the mobility of this species and large areas over which they forage, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Masked Owl listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,

Clearing would only impact on up to 34.7ha of potential habitat for this species. This is a very small proportion of the home range of the species, and is likely to be low quality habitat compared to habitat that is available in the area (i.e. downstream). Clearing would include removal of potential roosting and foraging habitat.

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

Yellow-bellied Sheathtail-bats occur in a variety of habitats, from wet and dry sclerophyll forest and open woodland. They are insectivorous and forage high in the canopy. Animals roost singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows (Churchill, 1998). Therefore the land affected by the Project is not likely to be important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No recovery plan or threat abatement plan specific to this species have been prepared or drafted to date.

Management actions suggested by the DECC include protecting retaining forest habitats and preserving hollow-bearing and dead trees. Twenty priority actions have been developed to help recover this species, including:

- Ensure the largest hollow bearing trees (including dead trees and paddock trees) are given highest priority for retention in PVP assessments and or other land assessment tools (High priority);
- Promote the conservation of these HCV private land areas using measures such as incentive funding to landholders, off-setting and biobanking, acquisition for reserve establishment or other means (High priority); and
- Identify areas of private land that contain high densities of large, hollow-bearing trees as areas of high conservation value planning instruments and land management negotiations e.g. LEP, CAPs, PVPs (High priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Yellow-bellied Sheath-tail-bat is at threat from the following:

- Loss of hollow-bearing trees and recruitment hollow-bearing trees;
- Clearing for grazing, agriculture, forestry or development;
- Disturbance to roosting and summer breeding sites; and
- Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.

Conclusion

The Project is not likely to have a significant impact on this species.

D22 Eastern Freetail-bat

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

No Eastern Freetail-bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

There are a number of records of the Eastern Freetail-bat from the Gosford LGA, from near Popran National Park, Point Clare to the east, and Somersby and Peats Ridge to the north of the Project Site. Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

Given the mobility of this species and large areas over which they forage, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Eastern Freetail-bat listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

- 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,**

Clearing would only impact on up to 34.7ha of potential habitat. This is a very small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is available in the Offset Areas (i.e. downstream). Clearing would include removal of potential roosting and foraging habitat.

Habitat within the Project Site is contiguous with Popran National Park, and fragmentation and isolation of habitat would not occur. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna.

Eastern Freetail-bats occur in dry sclerophyll forest and woodland east of the Great Dividing Range. They roost mainly in tree hollows but will also roost under bark or in man-made structures. Little is known about their diet, although it is likely that they are insectivorous (Churchill, 1998, DEC (NSW), 2005h).

Due to the large areas of potential habitat available to this species in the locality, the land affected by the Project is not likely to be important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No recovery plan or threat abatement plan specific to this species have been prepared or drafted to date.

Management actions suggested by the DECC include protecting retaining forest habitats and preserving hollow-bearing and dead trees. Eighteen priority actions have been developed to help recover this species, including:

- Ensure the largest hollow bearing trees, inc. dead trees and paddock trees, are given highest priority for retention in PVP assessments. Offsets should include remnants in high productivity (High priority);

- Identify areas of private land that contain high densities of large hollow-bearing trees as areas of high conservation value planning instruments and land management negotiations e.g. LEP, CAPs, PVPs (High priority); and
- Promote the conservation of these private land areas using measures such as incentive funding to landholders, off-setting and biobanking, acquisition for reserve establishment or other means (High priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Eastern Freetail-bat is at threat from the following:

- Loss of hollow-bearing trees and recruitment hollow-bearing trees; and
- Clearing for grazing, agriculture, forestry or development.

Conclusion

The Project is not likely to have a significant impact on this species.

D23 Little Bentwing-bat

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

No Little Bentwing-bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species. The Project Site does not provide suitable breeding habitat for this species as they require deep caves.

There are a number of records of Little Bentwing-bats from the local area, one of which is from Brisbane Water National Park, and further to the east of the Project Site around Bouddi NP and Gosford (NSW Government, 2009). Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

Given the mobility of this species and large areas over which they forage, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Little Bentwing-bat listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would only impact on up to 34.7ha of potential foraging habitat. This is likely to represent a small proportion of the home range for this species. Clearing would include removal of potential foraging habitat but would not affect roosting habitat.

Due to the Little Bentwing-bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

Little Bentwing-bats occur in moist eucalypt forest, rainforest or dense coastal banksia scrub. They roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Roost sites can be shared with other micro-bat species such as the Common Bentwing-bat and, in winter, the two species may form mixed clusters.

In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (*M. schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear the young.

Due to the lack of suitable caves for breeding and the large areas of potential foraging habitat available to this species in the locality, the land affected by the Project is not likely to be important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Twenty-five priority actions have been developed to help recover this species, including:

- Protect significant roosts and forest habitat within 10 km of roosts in PVP assessments (offsets should include nearby remnants in high productivity) and other environmental planning instruments (Medium priority); and
- Promote the conservation of these significant roost areas using measures such as incentive funding to landholders, offsetting and biobanking, acquisition for reserve establishment or other means (Low priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Little Bentwing-bat is at threat from the following:

- Destruction of caves that provide seasonal or potential roosting sites; and
- Clearing for grazing, agriculture, forestry or development.

Conclusion

The Project is not likely to have a significant impact on this species.

D24 Large-eared Pied Bat

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

No Large-eared Pied Bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species. The Project Site may provide some suitable breeding habitat for this species as they used domed sandstone caves as maternity roosts. This type of habitat is more typical of the Offset Areas than the proposed extraction areas.

There are few records of Large-eared Pied Bats from the Gosford LGA, with three records from around Central Mangrove and McPherson State Forest, one from Bouddi National Park and one near Gosford. Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

Given the mobility of this species and large areas over which they forage, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Large-eared Pied Bat listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would only impact on up to 34.7ha of potential habitat. This is likely to represent a small proportion of the home range for this species. Clearing would include removal of potential roosting and foraging habitat.

Due to the Large-eared Pied Bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

Large-eared Pied Bats occur in well-timbered areas containing gullies. They roost in domed sandstone caves, crevices in cliffs and disused mines. The species is likely to forage for insects beneath the forest canopy. The species has high fidelity to roost sites and females raise young in maternity colonies in caves.

Due to the lack of suitable caves for breeding and the large areas of potential foraging habitat available to this species in the locality, the land affected by the Project is not likely to be important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Twenty-five priority actions have been developed to help recover this species, including:

- Ensure protection of caves and overhangs in area of suitable geology when undertaking PVP assessments (offsets should include nearby remnants in high productivity) or other land assessment tools (High priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Large-eared Pied Bat is at threat from the following:

- Clearing and isolation of forest near roost habitat for development, agriculture, through forestry and fire;
- Damage to roost and maternity caves through mining and recreational caving; and
- Use of pesticides.

Conclusion

The Project is not likely to have a significant impact on this species.

D25 Large-footed Myotis

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

There was a possible record on the Large-footed Myotis from the eastern side of the Project Site, however, as this part of the Project Site is the highest, it is less likely to be used by the species as it forages over water. The species is more likely to forage over the low lying creeks. Potential roosting habitat is provided on the Project Site in hollow-bearing trees.

There are many records of the Large-footed Myotis scattered throughout the Gosford LGA, including one at the Mangrove Creek Dam, one in Dharug National Park near the Hawkesbury River, several around Brisbane Water likely to have been recorded from surrounding creeks,

and from Avoca Lagoon. Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

Given the mobility of this species and large areas over which they forage, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Large-footed Myotis listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

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,**

Clearing would only impact on any pools that occur within Creek A. This is likely to represent a small proportion of the home range for this species. Clearing would include removal of potential roosting habitat.

Due to the Large-footed Myotis being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

The Large-footed Myotis roosts close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings and in dense foliage. They forage over streams and pools, raking their feet across the surface to catch insects and small fish.

The Large-footed Myotis is most likely to use the creeks on the Project Site for foraging compared with the drier, heath areas. Potential roosting habitat is available in the hollow-

bearing trees on the Project Site, although the species usually roosts near water, therefore the hollow-bearing trees closer to the creeks are those most likely to be used by the Large-footed Myotis. Therefore, the land affected by the Project is not likely to be important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Fifteen priority actions have been developed to help recover this species, including:

- Ensure the largest hollow bearing trees in riparian zones are given highest priority for retention in PVP assessments or other land clearing assessment tools (Low priority); and
- Encourage recovery of natural hydrological regimes, including retention and rehabilitation of riparian vegetation (Medium priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Large-footed Myotis is at threat from the following:

- Reduction in stream foraging resources and surrounding habitat;
- Loss of or disturbance to roost sites; and
- Use of pesticides in and around foraging habitat.

Conclusion

The Project is not likely to have a significant impact on this species.

D26 Greater Broad-nosed Bat

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

No Greater Broad-nosed Bats were recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

There are a number of records of the Greater Broad-nosed Bat from the Gosford LGA, from near Popran National Park, Kariong, Dharug National Park, McPherson State Forest and in rural residential areas east of Gosford. Although no specific information exists on the local population, those recorded in the locality are likely to be part of a broadly distributed population which exists in the northern part of the Sydney Basin Bioregion.

Given the mobility of this species and large areas over which they forage, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Greater Broad-nosed Bat listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

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,**

Clearing would only impact on up to 34.7ha of potential habitat. This is a very small proportion of the home range for this species, and is likely to be low quality habitat compared to habitat that is available in the Offset Areas (i.e. downstream). Clearing would include removal of potential roosting and foraging habitat.

Due to the Greater Broad-nosed Bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

The Greater Broad-nosed Bat is most commonly found in tall, wet forest but also occurs in woodland, dry eucalypt forest and rainforest. It roosts in tree hollows but has also been

recorded roosting in buildings. Females give birth and raise young at maternity sites in suitable trees.

The majority of vegetation removed by the Project is dry woodland and heath, which is a less suitable habitat type for the Greater Broad-nosed Bat. Due to the large areas of potential habitat available to this species in the locality, the land affected by the Project is not likely to be important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Eighteen priority actions have been developed to help recover this species, including:

- Ensure largest hollow bearing trees, inc. dead trees and paddock trees are given highest priority for retention in PVP assessments (offsets should include remnants in high productivity) and/or other land assessment tools (High priority);
- Promote the conservation of these HCV private land areas using measures such as incentive funding to landholders, off-setting and biobanking, acquisition for reserve establishment or other means (High priority); and
- Identify areas of private land that contain high densities of large, hollow-bearing trees as areas of high conservation value in planning instruments and land management negotiations e.g. LEP, CAPs, PVPs (High priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Greater Broad-nosed Bat is at threat from the following:

- Disturbance to roosting and breeding sites;
- Clearing of foraging habitats;
- Loss of hollow-bearing trees;
- Use of pesticides and herbicides; and
- Changes to water regimes affecting insect availability.

Conclusion

The Project is not likely to have a significant impact on this species.

D27 Grey-headed Flying-fox

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

The Grey-headed Flying-fox was recorded during studies conducted to the north of the Project Site but was not recorded on the Project Site. They forage over large areas and the Project Site is likely to form part of the broader foraging area for this species.

There are many records of the Grey-headed Flying-fox from the Gosford LGA, from Mangrove Mountain, Dharug and Popran National Parks and many records from around Gosford including Brisbane Water National Park, urban and rural residential areas. Grey-headed Flying-foxes roost in specific camps. The animals that have been observed in the northern part of the study area are likely to roost in the camp near Mangrove Mountain and do not roost on the Project Site but use it for foraging as part of a much larger range.

Given the mobility of this species and large areas over which they forage, it is unlikely that the viability of the local population will be adversely affected by the Project.

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

There are no endangered populations of the Grey-headed Flying-fox listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would only impact on up to 34.7ha of potential habitat. This is a very small proportion of the home range for this species and represents foraging habitat only.

Due to the Grey-headed Flying-fox being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

The Grey-headed Flying-fox roosts, mates and rears young in camps with high site fidelity, with camps established in gullies with dense vegetation. It forages in subtropical and temperate rainforest, tall sclerophyll forest and woodland, heaths, swamps, urban gardens and orchards.

No known maternity camps exist on or adjacent to the Project Site. Foraging habitat is abundant in the locality, therefore the land affected by the Project is not likely to be important habitat for the species.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Thirty-one priority actions have been developed to help recover this species, including:

- Protect and enhance priority foraging habitat for Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land (Low priority); and
- Increase the extent and viability of foraging habitat for Grey-headed Flying-foxes that is productive during winter and spring (generally times of food shortage), including habitat restoration/rehabilitation works (High priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Grey-headed Flying-fox is at threat from the following:

- Disturbance to roosting sites;
- Clearing of foraging habitats;
- Unregulated shooting; and

- Electrocutation on powerlines.

Conclusion

The Project is not likely to have a significant impact on this species.

D28 Eastern Pygmy Possum

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

There are many records of the Eastern Pygmy Possum from the Gosford LGA, from Mangrove Creek Water Supply Reserve, several from McPhersons State Forest, around Peats Ridge, Calga and Kariong, and many records from around Gosford including Brisbane Water National Park and rural residential areas. The Eastern Pygmy Possum recorded on the Project Site is likely to be part of a metapopulation that uses heath areas from the Calga – Peats Ridge area. Clearing for the Project may interrupt the life cycle of this family group, however a population is likely to continue in the locality, and would not 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,**

There are no endangered populations of the Eastern Pygmy Possum listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would only impact on up to 34.7ha of known and potential habitat. This represents both foraging and sheltering habitat.

The Eastern Pygmy Possum is small, relies on movement on the ground to disperse and it is considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would isolate this species.

The Eastern Pygmy Possum was recorded on a part of the Project Site occurring close to the Stage 4 extraction area but that will be retained in the Offset Areas. The species may use habitat across the majority of the Project Site including offset and extraction areas and although a large area of potential habitat will be cleared for the species, habitat will be retained and conserved in the Offset Areas, which is likely to ensure the long-term survival of the species in the study area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Seven priority actions have been developed to help recover this species, including:

- Encourage and support land managers to undertake management actions that benefit the species (Medium priority); and
- Reserve fire management strategies to include operational guidelines to protect this species from fire; with fire frequency of >10 years (Medium priority).

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Eastern Pygmy Possum is threatened by or the Project would further impact the species through the following processes.

- Clearing of native vegetation as this will clear foraging habitat. However, potential foraging habitat will be retained on the Project Site;
- Ecological consequences of high frequency fires as this can diminish the abundance of flowering shrubs used by this species for foraging. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase;
- Predation by the European red fox as individuals can become prey items for foxes. Foxes already exist on the Project Site and are not likely to be increased in number by the Project;

- Predation by feral cats as individuals can become prey items for cats. It is unknown as to whether feral cats exist on the Project Site but numbers are not likely to be increased as a result of the Project;
- Grazing by feral rabbits as this can affect the diversity of flowering shrubs. It is unlikely that the presence of rabbits will increase in the Offset Areas as a result of the Project;
- The removal of dead wood and dead trees, as the removal of wood on the ground can reduce potential nest sites. Dead wood would be removed as a result of the Project, however all dead wood will be retained in the Offset Areas.

Conclusion

The Project is not likely to have a significant impact on this species.

D29 Spotted-tailed Quoll

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

There are many records of the Spotted-tailed Quoll from the Gosford LGA, including from Dharug National Park along the Hawkesbury River, in the Kulnura – Mangrove Mountain area extending to the northern section of Popran National Park, Mt White and the southern part of Popran National Park, Brisbane Water National Park and in coastal areas east of Gosford including Bouddi National Park. The species has not been recorded on the Project Site but potential habitat does occur there. Potential habitat will be retained on the Project Site, however, a population is likely to continue in the locality, and would not 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,**

There are no endangered populations of the Spotted-tailed Quoll listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would only impact on up to 34.7ha of potential habitat. This represents both foraging and sheltering habitat.

The Spotted-tailed Quoll moves along the ground but contiguous vegetation is not necessarily required for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would isolate this species.

The Spotted-tailed Quoll has not been recorded on the Project Site. The species may use habitat across the majority of the Project Site including offset and extraction areas and although a large area of potential habitat will be cleared for the species, habitat will be retained and conserved in the Offset Areas, which is likely to ensure the long-term survival of the species in the study area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) **whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No recovery plan has been prepared for this species. The Fox Threat Abatement Plan is relevant to this species: the Spotted-tailed Quoll is a medium priority species affected by foxes. The Project is not inconsistent with the objectives on this threat abatement plan. Thirty-two priority actions have been developed to help recover this species, including:

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

This priority action could be carried out on the Project Site or adjacent land.

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

The Spotted-tailed Quoll is threatened by or the Project would further impact the species through the following processes.

- Clearing of native vegetation as this will clear foraging habitat. However, potential habitat will be retained on the Project Site;

- Competition from feral honeybees as they can form hives in tree hollows that also form potential denning habitat for the Spotted-tailed Quoll. The Project is not likely to exacerbate this process.
- Competition with the European red fox for prey items. Foxes already exist on the Project Site and are not likely to be increased in number by the Project.
- The removal of dead wood and dead trees, and loss of hollow-bearing trees, as dead trees and logs are often hollow and contain potential denning habitat. Hollow-bearing trees would be removed as a result of the Project, however many will also be retained on the Project Site.

Conclusion

The Project is not likely to have a significant impact on this species.

D30 Yellow-bellied Glider

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

There are many records of the Yellow-bellied Glider from the Gosford LGA, particularly in the western parts including the Mangrove Creek Water Supply Reserve, McPherson State Forest and Dharug National Park, the northern section of Popran National Park and in the eastern parts of the LGA east of Gosford including Bouddi National Park. The species has not been recorded on the Project Site but potential habitat does occur there. Potential habitat will be retained on the Project Site, however, a population is likely to continue in the locality, and would not 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,**

There are no endangered populations of the Yellow-bellied Glider listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would not impact on none of the potential habitat for this species. Potential habitat for the species will be retained within the Offset Areas.

As the Yellow-bellied Glider is relatively mobile, but is considered to require tree connectivity for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

The Yellow-bellied Glider has not been recorded on the Project Site. The species may use habitat across the majority of the Project Site including offset and extraction areas but preferred habitat for the species will be retained and conserved in the Offset Areas, which is likely to ensure the long-term survival of the species in the study area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) **whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

There are no threat abatement plans relevant to this species. A recovery plan has been prepared for this species and includes the objectives:

- To encourage and assist in improving the protection and management of the Yellow-bellied Glider and its habitat; and
- To increase community awareness of the Yellow-bellied Glider and encourage community involvement in its conservation.

Fourteen priority actions have been developed to help recover this species, including:

- Consider species in reserve management and planning to protect and enhance habitat and connection corridors (High priority).

This priority action could be carried out on the Project Site or adjacent land.

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

The Yellow-bellied Glider is threatened by or the Project would further impact the species through the following processes.

- Clearing of native vegetation as this will clear potential habitat. However, potential foraging and denning habitat will be retained on the Project Site;
- Competition from feral honeybees as they can form hives in tree hollows that also form potential denning habitat for the Yellow-bellied Glider. The Project is not likely to exacerbate this process.
- The removal of dead wood and dead trees, and loss of hollow-bearing trees, as dead trees are often hollow and contain potential denning habitat. Hollow-bearing trees would be removed as a result of the Project, however many will also be retained on the Project Site.

Conclusion

The Project is not likely to have a significant impact on this species.

D31 Squirrel Glider

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

There are many records of the Squirrel Glider from the Gosford LGA, with a few records in the western part of the LGA from Kulnura, Dharug National Park and the northern section of Popran National Park. Most records are from the eastern part of the LGA from around Gosford, Niagara Park, Kariong, Erina, Brisbane Water National Park and Bouddi National Park. The species has not been recorded from the Project Site but potential habitat does occur there. Potential habitat will be retained on the Project Site, however a population is likely to continue in the locality, and would not 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,**

There are no endangered populations of the Squirrel Glider listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Clearing would only impact on up to 33.3ha of potential habitat. This represents both foraging and sheltering habitat.

As the Squirrel Glider is relatively mobile, but is considered to require tree connectivity for dispersal between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

The Squirrel Glider has not been recorded on the Project Site. The species may use habitat across the majority of the Project Site including offset and extraction areas and although a large area of potential habitat will be cleared for the species, habitat will be retained and conserved in the Offset Areas, which is likely to ensure the long-term survival of the species in the study area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No threat abatement plans relate to this species and no recovery plan has been prepared for this species. Thirty-one priority actions have been developed to help recover this species, including:

- Ensure the largest hollow bearing trees (including dead trees) are given highest priority for retention in PVP assessments and other environmental planning instruments, or other land assessment tools (Medium priority).

This priority action could be carried out on the Project Site or adjacent land.

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

The Squirrel Glider is threatened by or the Project would further impact the species through the following processes.

- Clearing of native vegetation as this will clear potential habitat. However, potential habitat will be retained on the Project Site;
- Competition from feral honeybees as they can form hives in tree hollows that also form potential denning habitat for the Squirrel Glider. The Project is not likely to exacerbate this process.
- The removal of dead wood and dead trees, and loss of hollow-bearing trees, as dead trees are often hollow and contain potential denning habitat. Hollow-bearing trees would be removed as a result of the Project, however many will also be retained on the Project Site.

Conclusion

The Project is not likely to have a significant impact on this species.

D32 Long-nosed Potoroo

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

There are few records of the Long-nosed Potoroo from the Gosford LGA, with records from near Mangrove Mountain, Point Clare, Narara and east of Gosford. The species has not been recorded from the Project Site but potential habitat does occur there and will be retained. A population is likely to continue in the locality, and would not be placed at risk of extinction by the development.

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

There are no endangered populations of the Long-nosed Potoroo listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,

Clearing would only impact on up to 34.7ha of potential habitat. This represents both foraging and sheltering habitat.

The Long-nosed Potoroo is considered to require vegetation cover to disperse between habitat areas. Broad corridors occur in the locality through Popran, Brisbane Water and Dharug National Parks and across the region. Vegetation on the Project Site makes up part of a corridor between these National Parks in the locality and although the width of the corridor would be reduced, it is not likely that the Project would hinder movements of the species.

The Long-nosed Potoroo has not been recorded on the Project Site. The species may use habitat across the majority of the Project Site including offset and extraction areas and although a large area of potential habitat will be cleared for the species, habitat will be retained and conserved in the Offset Areas, which is likely to ensure the long-term survival of the species in the study area.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No recovery plan has been prepared for this species. The Fox Threat Abatement Plan is relevant to this species. The Project is not inconsistent with the objectives of this plan.

Nineteen priority actions have been developed to help recover this species, including:

- Encourage private landholders to exclude livestock from key habitat to reduce the impact of grazing, trampling and the spread of weeds (Medium priority);
- Encourage private landholders to protect known and potential Long-nosed Potoroo habitat from inappropriate fire regimes (Medium priority);
- Undertake control burn using a mosaic pattern to ensure adequate vegetation cover (Low priority);
- Control weeds, particularly those that affect the understorey layer, in Long-nosed Potoroo habitat (Low priority);
- Seek formal protection of all remaining areas of known habitat under voluntary conservation agreements, joint management agreements or as critical habitat (Low priority);
- Increase habitat via revegetation work and/or establishing corridors to link multiple patches of suitable habitat to expand the effective area of habitat (Low priority); and
- Prevent the spread of *Phytophthora* sp (Low priority).

This priority action could be carried out on the Project Site or adjacent land.

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

The Long-nosed Potoroo is threatened by or the Project would further impact the species through the following processes.

- Clearing of native vegetation as this will clear potential habitat. However, potential habitat will be retained on the Project Site;
- Predation by the European red fox as individuals can become prey items for foxes. Foxes already exist on the Project Site and are not likely to be increased in number by the Project;
- Ecological consequences of high frequency fires as this can diminish the dense understorey vegetation used for sheltering. There will be no need for regular burning, and as such the frequency of fire on the Project Site is unlikely to increase;
- Predation by feral cats as individuals can become prey items for cats. It is unknown as to whether feral cats exist on the Project Site but numbers are not likely to be increased as a result of the Project; and
- The removal of dead wood and dead trees, as the removal of wood on the ground can reduce potential nest sites. Dead wood would be removed as a result of the Project, however all dead wood will be retained in the Offset Areas.

Conclusion

The Project is not likely to have a significant impact on this species.

D33 Red-crowned Toadlet

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

Red-crowned Toadlets were recorded from four locations within the Project Site: two along Creek A, one along Creek B and another in a rock overhang away from the creeks. The size and extent of Red-crowned Toadlet populations are difficult to determine without intensive survey. The extensive surveys that have been conducted in the study area have only detected a few individuals, which may be part of one or several much larger populations. Assuming that dispersal is possible between all sites where Red-crowned Toadlets have been detected, it is possible that a large ranging population extends over the Project Site and into neighbouring bushland.

The population is likely to have been once part of a much larger population that extended throughout sandstone ridge top habitats before development occurred in the locality. Gene flow would have occurred throughout these sandstone habitats. The population on the Project Site occurs in a habitat which is well-represented throughout the locality and therefore it is likely to be similar in genetic construct to other populations in the locality.

Breeding is likely to occur along the ephemeral creeks which are present in the Project Site. Much of Creek A would be removed as a result of the Project, which would remove a significant area of known habitat for this species, however small patches of known habitat would be retained, as well as other potential areas for breeding. The population would remain viable as breeding habitat would be retained on the Project Site.

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

There are no endangered populations of the Red-Crowned Toadlet listed under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

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,**

A large area of potential habitat would be cleared as a result of the Stage 4 extraction stage, however, habitat would be retained on the Project Site, and much larger areas of habitat for this species exists throughout the Somersby Plateau and habitat is protected within the adjacent Popran National Park. No known habitat would be removed as a result of the Project, although up to 1.5ha (approximately 75%) of potential habitat will be removed.

While vegetation corridors are being maintained through the Project Site, movement of Red-crowned Toadlets is restricted to rock outcrops and damp areas. Creek B would be retained and Evans & Peck (2008) predicts the reduction in surface flows within the retained creeks of the Project Site would be (at worst 33%) and more likely less than 15%. There is much sandstone outcropping on the Project Site, containing shelters in the form of crevices. These areas would provide shelter and foraging habitat for Red-crowned Toadlets and would be ideal for the species to use in dispersing across the Project Site.

The Red-crowned Toadlet generally occurs on the sandstone escarpment areas and plateaus in the Sydney basin, usually within 100m of the ridge top. It utilises moist microhabitats and are usually found along permanently moist soaks in ephemeral feeder creeks (NSW NPWS, 2001d). Within the Project Site the species is found in isolated habitats along the two

ephemeral upper creeks. The habitat present on the Project Site is similar to large areas found throughout the Somersby Plateau.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No recovery plan has been prepared for this species. No threat abatement plans are relevant to this species. DECC has identified 14 priority actions to help recover this species in NSW. These include:

- develop preferred mitigation measures to minimize impact of wildlife and/or suppression operations;
- develop best practice management strategies that buffer and protect important headwater/ridge top breeding sites from changes to water flow, flow regimes and water quality changes;
- prepare guide to creating, rehabilitating or augmenting habitat for the species; this might include provision of rock/log ground cover, diversion of water, provision of breeding/nesting sites and material; and
- monitor the various initiatives and trials of habitat manipulation for effectiveness.

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Red-crowned Toadlet is threatened by or the Project would further impact the species through the following processes.

- Bushrock removal as this will reduce shelter sites. This process will only impact on the species if bushrock is collected illegally from habitat areas that are to be retained.
- Clearing of native vegetation as this will remove potential dispersal habitat across the Project Site. A corridor of sandstone outcropping and ground layer vegetation will be retained as a dispersal corridor through the Project Site between the Stage 4 and Stage 5 quarries.
- Ecological consequences of high frequency fires as frequent fires can destroy individuals and make habitat unsuitable. No hazard reduction burning is proposed for the Project Site and fire frequency is likely to remain low.
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands as changes to water quality such as pollution and siltation has the potential to make habitat unsuitable for the species and changes to flow rates can affect suitability of

habitat for breeding. The Project is likely to affect Red-crowned Toadlets along Creek A as the Project would remove a large portion of this ephemeral drainage line. Creek B would be retained, however, some reduction in surface and base groundwater flows has been predicted by GeoTerra (Dawkins, 2009) and Evans & Peck (2008).

The Project may also exacerbate the following processes, further impacting on the species:

- Infection of frogs by Amphibian Chytrid Fungus causing the disease chytridiomycosis as it has the potential to be fatal to all frog species. The Red-crowned Toadlet appears to be less susceptible to the disease as it does not breed in streams. The Project is not likely to affect the susceptibility of the species to the chytrid fungus.

Conclusion

The Project is not likely to have a significant impact on this species.

D34 Giant Burrowing Frog

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

The Giant Burrowing Frog has not been recorded on the Project Site, but has been recorded in the Study Area. Potential habitat for the Giant Burrowing Frog occurs on the Project Site and appears confined between the 170m and 190 m contours between Creeks A and B (Figure 2). This area has a hanging swamp nested in deep sand. Above the 190 m contour, the sandstone layer does not seem to retain ground moisture; similarly below the 180 m contour, the sandstone is not deeply weathered and appears unsuitable. This zone contains two discrete hanging swamp ecosystems, one being dominated by Tea Trees (*Leptospermum* sp), and the other by Saw-sedges (*Gahnia* sp). These swamps do not appear to retain open water and breeding may not be possible in this area. If Giant Burrowing Frogs are present, then breeding is most likely to occur in pools in the upper parts of Creek A, although no tadpoles of this species were found there.

Up to 3.23ha (approximately 44%) of potential habitat for this species would be removed as a result of the Project. Extensive similar habitat exists in the locality, including habitat which is protected in Popran National Park. Patches of potential habitat on the Project Site would be retained, as well as other potential areas for breeding. The population would remain viable as breeding habitat would be retained on the Project Site.

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

There are no endangered populations of Giant Burrowing Frogs listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

Not applicable.

- 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,**

Up to 3.23ha (approximately 44%) of potential habitat for this species would be removed as a result of the Project.

Corridors are being maintained on the Project Site, particularly along Creeks B and C, which would enable this species to move around. The Project Site provides habitat which is continuous with Popran National Park, and is therefore part of the local corridor system for flora and fauna. Popran National Park is part of a large corridor linking Brisbane Water National Park and the Blue Mountains National Park (Morgan, 2001). No areas of habitat will become isolated or fragmented as part of the proposed development.

Extensive similar habitat exists in the locality, including habitat which is protected in Popran National Park. Therefore the habitat to be removed on the Project Site is not considered to be important for the long term survival of this species in the locality.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

- f) **whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

No recovery plan has been prepared for this species. No threat abatement plans are relevant to this species. DECC has identified 24 priority actions to help recover this species in NSW. These include:

- develop best practice guidelines for road/drain construction and maintenance within reserves, forests and utility access easements;

- ensure that appropriate erosion, sedimentation and water quality control measures are applied around known locations;
- develop guidelines for construction of microhabitat features as components of land management best practice; and
- investigate performance of supplementary habitat design and construction in trial locations.

A number of these priority actions could be carried out on the Project Site or adjacent land.

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

The Giant Burrowing Frog is threatened by or the Project would further impact the species through the following processes:

- Clearing of native vegetation as this will remove potential dispersal habitat across the Project Site. A corridor of sandstone outcropping and ground layer vegetation will be retained as a dispersal corridor through the Project Site between the Stage 4 and Stage 5 extraction area;
- Ecological consequences of high frequency fires as frequent fires can destroy individuals and make habitat unsuitable. No hazard reduction burning is proposed for the Project Site and fire frequency is likely to remain low; and
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands as changes to water quality such as pollution and siltation has the potential to make habitat unsuitable for the species and changes to flow rates can affect suitability of habitat for breeding. The Project would affect Giant Burrowing Frogs along Creek A if they occur on the Project Site as the quarry would remove a large portion of this ephemeral drainage line. Creek B would be retained, however with quarries on either side the water levels are likely to be reduced in this creek.

The Project may also exacerbate the following processes, further impacting on the species.

- Infection of frogs by Amphibian Chytrid Fungus causing the disease chytridiomycosis as it has the potential to be fatal to all frog species. The Giant Burrowing Frog appears to be less susceptible to the disease as it does not breed in streams. The Project is not likely to affect the susceptibility of the species to the chytrid fungus.

Conclusion

The Project is not likely to have a significant impact on this species.

D35 Rosenberg's Goanna

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

This species has not been recorded on the Project Site, but has been recorded in the Study Area. This species relies on termite mounds for laying its eggs, and shelters in hollow logs, rock crevices and burrows (DEC (NSW), 2005b1). The home range for this species is approximately 20ha (King and Green 1999). Foraging and nesting habitat would be retained on the Project Site. In the absence of sufficient data for the adjacent Popran National Park, it is possible that a significant impact may be felt on a local population of this species, however the viability of the species as a whole is not at risk as a result of the Project.

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

There are no endangered populations of Rosenberg's Goanna listed for the area under Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

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

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

Not applicable.

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,**

Up to 33.3ha of potential habitat for this species would be cleared from the Project Site, which is approximately 48 of the available habitat on the Project Site. Extensive similar habitat exists in the locality, including habitat which is protected in Popran National Park.

The Project Site is located adjacent to Popran National Park which is part of a large corridor linking Brisbane Water National Park and the Blue Mountains (Morgan, 2001). The Project Site provides native vegetation which is continuous with the vegetation of Popran National Park, and is therefore part of the local corridor system for flora and fauna. While there will be fragmentation of potential habitat on the Project Site, this will not be isolated from adjacent habitat areas.

Rosenberg's Goanna relies on termite mounds for laying its eggs, and shelter in hollow logs, rock crevices and burrows (DEC (NSW), 2005b1). Home range for this species is variable, averaging approximately 20ha (King and Green, 1999). Foraging and nesting habitat would be retained on the Project Site. Similar habitat exists throughout the adjacent Popran National Park, and habitat would not be isolated as a result of the Project.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the DECC.

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

No recovery plan has been prepared for this species. No threat abatement plans are relevant to this species. DECC has identified nine priority actions to help recover this species in NSW. These include:

- identify key habitats or areas for protection and enhanced management on private land through management agreements and incentives;
- undertake investigations into general biology and ecology of the species, particularly movement patterns and tree use, rock crevice use and termitaria use; and
- develop habitat identification, management and enhancement guidelines.

A number of these priority actions could be carried out on the Project Site or adjacent land.

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.

Rosenberg's Goanna is threatened by or the Project would further impact the species through the following processes.

- Clearing of native vegetation as this will clear foraging habitat. Potential foraging habitat will be retained on the Project Site.
- Predation by the European red fox as young goannas can become prey items for foxes. Foxes already exist on the Project Site and are not likely to be increased in number by the Project.
- The removal of dead wood and dead trees as dead wood is often hollow and contain potential den habitat. Some dead wood would be removed as a result of the Project, however much will also be retained on the Project Site.

Conclusion

The Project is not likely to have a significant impact on this species.

Appendix E

Tree Hollow Plot Data

(No. of pages excluding this page = 2)

Species	Scientific Name	Dbh (cm)	Height (m)	# Hollows	Approx hollow size	Comments
Plot 1						
Grey Gum	<i>Eucalyptus punctata</i>	40	10	3	<5cm	
Grey Gum	<i>Eucalyptus punctata</i>	35	12	1	<5cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	55	15	2	<5cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	55	8	1	<5cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	80	20	3	>20cm 5-20cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	25	8	0		
Scribbly Gum	<i>Eucalyptus racemosa</i>	20	10	0		
Scribbly Gum	<i>Eucalyptus racemosa</i>	60	15	1 1	10cm <5cm	Scratches
Scribbly Gum	<i>Eucalyptus racemosa</i>	35	10	0		
Scribbly Gum	<i>Eucalyptus racemosa</i>	70	10	1 1	<5cm >20cm	Basal hollow
Scribbly Gum	<i>Eucalyptus racemosa</i>	35	8	0		
Scribbly Gum	<i>Eucalyptus racemosa</i>	10	8	0		
Stringybark	<i>Eucalyptus sparsifolia</i>	50	8	1	15cm	Basal hollow
Grey Gum	<i>Eucalyptus punctata</i>	55	15	1	10-15cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	70	8	1	15cm	Basal hollow
Scribbly Gum	<i>Eucalyptus racemosa</i>	45	10	2	20cm	nest in hollow
Scribbly Gum	<i>Eucalyptus racemosa</i>	60	8	1	20cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	80	10	1	5-10cm	
Stringybark	<i>Eucalyptus sparsifolia</i>	40	12	1	5cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	80	10	1 1	10cm 5cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	30	8	1 1	10cm 5cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	80	12	3	5-10cm	
Scribbly Gum	<i>Eucalyptus racemosa</i>	20	8	1	10cm	Basal hollow
Scribbly Gum	<i>Eucalyptus racemosa</i>	80	11	1 1 1	15cm 20cm 20cm	3 entrances Basal hollow
Total hollows				35		
Plot 2						
Smooth-barked Apple	<i>Angophora costata</i>	30	12	2	<5cm	
Smooth-barked	<i>Angophora</i>	30	8	4	<5cm	

Apple	<i>costata</i>					
Smooth-barked Apple	<i>Angophora costata</i>	45	12	1	10-15cm	
Smooth-barked Apple	<i>Angophora costata</i>			1	5-10cm	
Smooth-barked Apple	<i>Angophora costata</i>	30	10	1	15cm	
Stag		45	12	1	>20cm	
				1	15cm	
				2	<5cm	
Smooth-barked Apple	<i>Angophora costata</i>	45	15	2	10cm	
Scribbly Gum	<i>Eucalyptus haemastoma</i>	70	9	1	<5cm	
Stag		65	7	2	>20cm	
Smooth-barked Apple	<i>Angophora costata</i>	45	15	1	>20cm	
Smooth-barked Apple	<i>Angophora costata</i>	35	12	1	<5cm	
Grey Gum	<i>Eucalyptus punctata</i>	20	8	0		
Grey Gum	<i>Eucalyptus punctata</i>	70	12	2	<5cm	
Smooth-barked Apple	<i>Angophora costata</i>	40	15	1	<5cm	
Smooth-barked Apple	<i>Angophora costata</i>	50	8	3	5-15cm	
Smooth-barked Apple	<i>Angophora costata</i>	25	8	1	5cm	
Bloodwood	<i>Corymbia gummifera</i>	65	18	2	15-20cm	
Stag		25	7	2	10-15cm	
Smooth-barked Apple	<i>Angophora costata</i>	30	15	1	<5cm	
Bloodwood	<i>Corymbia gummifera</i>	35	15	1	5-10cm	
Grey Gum	<i>Eucalyptus punctata</i>	20	8	0		
Total hollows				33		
Recorded incidentally						
Smooth-barked Apple	<i>Angophora costata</i>	110	25	3	>15cm	
Smooth-barked Apple	<i>Angophora costata</i>	100	25	1	>50cm	Trunk
				3	5-10cm	
Scribbly Gum	<i>Eucalyptus haemastoma</i>	150	20	3	>30cm	
				2	<5cm	
Bloodwood	<i>Corymbia gummifera</i>	110	22	5	>20cm	
				2	<5cm	

This page has intentionally been left blank