

Roads and Traffic Authority

Pacific Highway Upgrade -
Oxley Highway to Kempsey
Flora and Fauna Working Paper

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Appendix E

Assessment of likelihood of threatened species occurring in the study area

Table E1 **Threatened fauna – assessment of likelihood of occurrence within the study area**

Common name (scientific name)	Most recent record	Closest records		Preferred habitat and comments	Habitat available on site			Potential to utilise study area	Subject species
		10 km	2 km		Breeding	Roosting	Foraging		
Birds									
Australasian bittern (<i>Botaurus poiciloptilus</i>)	2005	6	0	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha spp.</i>) and spikerushes (<i>Eleocharis spp.</i>). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds.	Possible	-	Y	Limited	√
Australian painted snipe (<i>Rostratula australis</i>)	-	-	-	Permanent and temporary shallow inland and coastal wetlands (can be freshwater or brackish), particularly where there is a cover of vegetation. Individuals have been known to use artificial wetlands such as sewage ponds, dams and water-logged grasslands.	N	-	Y	Limited	√
Barking owl (<i>Ninox connivens</i>)	1982	2	0	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as acacia and casuarina species, or the dense clumps of canopy leaves in large eucalypts. Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts.	Y	Y	Y	Limited	√
Barred cuckoo-shrike (<i>Coracina lineata</i>)	2000	8	0	Occurs in subtropical rainforest, wet sclerophyll forest and neighbouring eucalypt forest. Feeds predominantly on fruit and seeds and will frequent isolated fruiting trees. Limited habitat available within the study area.	N	-	Y	Potential visitor	√
Beach stone-curlew (<i>Esacus neglectus</i>)	1990	1	0	Inhabits open, undisturbed beaches, islands, reefs and estuarine intertidal sandflats and mudflats. Prefers beaches with estuaries or mangroves nearby. Also known to frequent river mouths, offshore sandbars and rock platforms.	N	-	Y	Unlikely	-

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		10 km	2 km		Breeding	Roosting	Foraging		
Black bittern (<i>Ixobrychus flavicollis</i>)	1997	2	1	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds. Generally solitary, but occurs in pairs during the breeding season, from December to March. Like other bitterns, but unlike most herons, nesting is solitary. Nests, built in spring are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks.	N	-	Y	Limited	√
Black-breasted buzzard (<i>Hamirostra melanosternon</i>)	1991	1	0	Found in a range of inland habitats, including open woodlands and savannas. Will also hunt over grasslands and sparsely timbered woodlands. Timbered watercourses are the preferred breeding habitat. Very rare on the coastal plains of NSW	N	-	N	Unlikely	-
Black-necked stork (<i>Ephippiorhynchus asiaticus</i>)	2006	107	9	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on intertidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water on a variety of prey including fish, frogs, eels, turtles, crabs and snakes. Breeds in late summer in the north, and early summer further south. A large nest, up to 2 m in diameter, is made in a live or dead tree, in or near a freshwater swamp.	N	-	Y	Moderate	√
Blue-billed duck (<i>Oxyura australis</i>)	2003	2	0	The blue-billed duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. Blue-billed ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland. They feed on the bottom of swamps eating seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies. Blue-billed ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer.	N	-	N	Unlikely	-

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		10 km	2 km		Breeding	Roosting	Foraging		
Brolga (<i>Grus rubicundus</i>)	2005	4	0	Inhabits wetland areas, including shallow swamps, grassy plains, coastal mudflats and irrigated agricultural land. Will also feed in dry grassland and ploughed paddocks and is occasionally observed in mangroves or estuary areas.	N	-	Y	Unlikely	-
Brown treecreeper (<i>Climacteris picumnus</i>)	2004	2	0	Found in eucalypt woodlands (including box-gum woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. Usually not found in woodlands with a dense shrub layer. Fallen timber is an important habitat component for foraging. Sedentary, considered to be resident in many locations throughout its range. Gregarious and usually observed in pairs or small groups of eight to 12 birds. Terrestrial and arboreal in about equal proportions Active, noisy and conspicuous while foraging on trunks and branches of trees and amongst fallen timber; spend much more time foraging on the ground and fallen logs than other treecreepers. Up to 80% of the diet is comprised of ants, with other invertebrates making up the remainder. Hollows in standing dead or live trees and tree stumps are essential for nesting. Although potential habitat occurs few records could be found for the locality. More likely to occur further to the west.	Y	-	Y	Unlikely	-
Bush stone-curlew (<i>Burhinus grallarius</i>)	-	-	-	Lightly-timbered open-forest or woodland often associated with casuarinas, eucalypts or acacias. Also found in dry open grassland and cropland with nearby cover. Although potential habitat occurs no records could be found for the locality. Although an unlikely species, it was targeted during field surveys.	Y	-	Y	Unlikely	-
Comb-crested jacana (<i>Irediparra gallinacea</i>)	2000	7	0	Inhabits permanent wetlands with a good surface cover of floating vegetation, especially water-lilies. Pairs and family groups forage across floating vegetation. They feed primarily on insects and other invertebrates, as well as some seeds and other vegetation. Breeds in spring and summer in NSW, in a nest of floating vegetation. Potential habitat within the preferred route is limited to a small wetland around Fernbank Creek.	Y	-	Y	Limited	√

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Freckled duck (<i>Stictonetta naevosa</i>)	1983	3	0	Prefer permanent freshwater swamps and creeks with heavy growth of cumbungi, lignum or tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Generally rest in dense cover during the day, usually in deep water. Feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates.	N	-	N	Unlikely	-
Glossy black-cockatoo (<i>Calyptorhynchus latham</i>)	2005	82	26	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly black she-oak (<i>Allocasuarina littoralis</i>), forest she-oak (<i>A. torulosa</i>) or drooping she-oak (<i>A. verticillata</i>) occur. In the Riverina area, inhabits open woodlands dominated by belah (<i>Casuarina cristata</i>). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites.	Y	Y	Y	High	√
Grass owl (<i>Tyto capensis</i>)	2004	9	0	Found in areas of tall grass, including swampy areas, grassy plains and heath. Also found in areas of tall sedges on floodplains. Roost and nest on trampled down platforms of grass.	Y	Y	Y	Moderate	√
Grey-crowned babbler (<i>Pomatostomus temporalis</i>)	-	-	-	Inhabits open eucalypt woodlands with a grassy groundcover and sparse, tall shrub layer. May also be observed along streams in cleared areas and grassy road verges. Conspicuous large communal nests/roosts are constructed out of twigs. Raucous groups of 2-13 individuals foraging for insects in all substrates.	Y	Y	Y	Limited	√
Hooded robin (<i>Melanodryas cucullata</i>)	1904	1	0	Prefers open areas adjacent to large blocks of woodland, particularly with areas of dead timber and sparse shrub cover. Also recorded in open forests and acacia shrublands. Although potential habitat occurs only one old record could be found for the locality.	N	Y	Y	Unlikely	-
Marbled frogmouth (<i>Podargus ocellatus</i>)	1997	1	1	Subtropical lowland rainforest at altitudes up to 800m, particularly deep, wet, sheltered gullies containing bangalow palms. Also occurs at higher elevations in temperate rainforest and wet eucalypt forest with a rainforest understorey. The study locality is outside of the recognised distribution for this species therefore the one record available is considered dubious.	N	N	N	Unlikely	-

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Masked owl (<i>Tyto novaehollandiae</i>)	2005	14	5	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Y	Y	Y	High	√
Olive whistler (<i>Pachycephala olivacea</i>)	-	-	-	Found in a range of habitats including rainforest, wet forests and woodlands where riparian vegetation occurs. The olive whistler is regarded as largely sedentary, though partial migration to lower altitudes during winter has been observed. Breeding is generally restricted to areas above 1000m asl.	N	-	N	Unlikely	-
Osprey (<i>Pandion haliaetus</i>)	2006	45	6	Highly specialised fish catcher inhabiting coastal areas. Nests in trees, rocky outcrops, on the ground or in artificial towers (eg. electricity towers).	Y	Y	Y	High	√
Painted honeyeater (<i>Grantiella picta</i>)	1983	1	1	Inhabits boree, brigalow and box-gum woodlands and box-ironbark forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> . Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches. Very rare visitor to the coastal plains of NSW	N	-	Y	Unlikely	-

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Powerful owl (<i>Ninox strenua</i>)	2003	21	2	The powerful owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The powerful owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as turpentine <i>Syncarpia glomulifera</i> , black she-oak <i>Allocasuarina littoralis</i> , blackwood <i>Acacia melanoxylon</i> , rough-barked apple <i>Angorophora floribunda</i> , cherry ballart <i>Exocarpus cupressiformis</i> and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the greater glider, common ringtail possum and sugar glider. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Pairs of powerful owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400-1450 ha. powerful owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	Y	Y	Y	High	√
Regent honeyeater (<i>Xanthomyza phrygia</i>)	2004	1	1	Box-ironbark eucalypt associations, though uses other woodland types and wet lowland coastal forest in times of food shortage. The wandering nature of this species makes it difficult to assess. Known to frequent areas with densely blossoming winter-flowering trees (e.g. spotted gum, red ironbark, forest red gum and swamp mahogany) on an opportunistic basis along the coast and ranges of NSW.	N	-	Y	Potential visitor	√
Rose-crowned fruit-dove (<i>Ptilinopus regina</i>)	-	-	-	This fruit-dove mainly utilises sub-tropical and dry rainforest and will occasionally visit moist eucalypt, swamp forest or mangroves if food is abundant. The rose-crowned fruit-dove is a fruit specialist and forages on fruiting vines, shrubs, trees and palms. The rose-crowned fruit-dove will also forage from introduced flora species (e.g. camphor laurel). It appears that this species is nomadic / migratory to some degree following fruit availability. This dove nests on a small twig platform in a bush or low tree, with a single egg.	N	-	Y	Potential visitor	√
Sooty owl (<i>Tyto tenebricosa</i>)	2006	17	4	Large areas of tall open forest and woodland particularly in and around dense creek and gully areas. Nests in large hollows in rainforest trees and eucalypts.	Y	Y	Y	Moderate	√

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		10 km	2 km		Breeding	Roosting	Foraging		
Speckled warbler (<i>Pyrrholaemus sagittatus</i>)	-	-	-	The speckled warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. More likely to occur further to the west of the study locality.	N	-	Y	Unlikely	-
Square-tailed kite (<i>Lophoictinia isura</i>)	2005	36	13	Specialised canopy predator, feeding on small birds, eggs and insects. Primarily hunts over open forest, woodlands and mallee communities that are rich in passerines, as well as over adjacent heaths and other low scrubby habitats and in wooded towns. Appears to prefer a structurally diverse landscape.	Y	Y	Y	High	√
Superb fruit-dove (<i>Ptilinopus superbus</i>)	-	-	-	Rainforest or closed forest with fleshy fruit resources. Also may forage in eucalypt or acacia woodland where fruit-bearing trees occur. Limited habitat within the study area.	N	Y	Y	Potential visitor	√
Swift parrot (<i>Lathamus discolor</i>)	2004	7	0	The migratory nature of this species makes them difficult to assess. Known to frequent sclerophyll forest and woodlands with winter flowering trees (eg. spotted gum, red ironbark, Eucalyptus crebra and <i>E. siderophloia</i> , forest red gum and swamp mahogany) on an opportunistic basis along the coast and ranges of NSW	N	Y	Y	Potential visitor	√
Wompoo fruit-dove (<i>Ptilinopus magnificus</i>)	1994	4	0	Lowland rainforest, moist eucalypt forest and brush box forest that provides fleshy fruit resources. Rare south of Coffs Harbour.	N	Y	Y	Potential visitor	√
Estuary birds that may extend to freshwater habitats									
Greater sand plover (<i>Charadrius leschenaultii</i>)	1993	1	0	Sheltered sandy beaches and coastal mudflats. Also sandy cays and reef platforms. Occasionally coastal salt marsh, brackish or freshwater wetlands.	N	-	Y	Unlikely	-

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Lesser sand plover (<i>Charadrius mongolus</i>)	1999	3	0	The lesser sand plover uses beaches in sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats. These plovers often stay in flocks, often sharing roosting and feeding sites with other waders. Suitable roost sites include sandy beaches, spits and rocky shores. Insects, crustaceans, molluscs and marine worms form the diet for the lesser sand plover.	N	-	N	Unlikely	-
Little tern (<i>Sterna albifrons</i>)	2000	7	0	Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers. Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. May occasionally forage along the tidal sections of the Hastings and Wilson Rivers	N	-	Y	Unlikely	-
Terek sandpiper (<i>Xenus cinereus</i>)	1982	1	0	The terek sandpiper has been recorded in Coastal mudflats, lagoons, creeks and estuaries, with a preference for mangroves. Worms, crustaceans, small shellfish, flies, beetles and water bugs are all included in the varied diet of this sandpiper. Sandpipers feed whilst walking and pecking and probing with their beak into soft, wet mud catching prey.	N	-	Y	Unlikely	-
Frogs									
Giant barred frog (<i>Mixophyes iteratus</i>)	2006	3	1	Giant barred frogs forage and live amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams from late spring to summer. Females lay eggs onto moist creek banks or rocks above water level, from where tadpoles drop into the water when hatched. Tadpoles grow to a length of 80 mm and take up to 14 months before changing into frogs. When not breeding the frogs disperse hundreds of metres away from streams. They feed primarily on large insects and spiders.	Y	-	Y	Moderate	√

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Green and golden bell frog (<i>Litoria aurea</i>)	2001	4	0	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha</i> spp.) or spikerushes (<i>Eleocharis</i> spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as plague minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation. Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs. Preyed upon by various wading birds and snakes.	Y	-	Y	Limited	√
Green-thighed frog (<i>Litoria brevipalmata</i>)	2003	25	12	Rainforest and wet sclerophyll forest, with breeding aggregations also occurring around grassy semipermanent pools in uneven ground in paperbark forests.	Y	-	Y	High	√
Stuttering frog (<i>Mixophyes balbus</i>)	-	-	-	Terrestrial inhabitant of rainforest, Antarctic beech or wet sclerophyll forest along permanent streams. Avoids still water localities and areas where stream-side vegetation has been removed. Preys on insects and small frogs along riparian corridors and on the forest floor.	Possible	-	Y	Limited	√
Wallum froglet (<i>Crinia tinnula</i>)	2005	34	1	Found in acid paperbark swamps, sedge and wet heath of the coastal 'wallum' country. The wallum froglet breeds in winter after heavy rain.	Y	-	Y	Limited	√
Reptiles									
Pale-headed snake (<i>Hoplocephalus bitorquatus</i>)	1932	2	0	Nocturnal and partly arboreal snake inhabiting a range of habitats from rainforest and wet sclerophyll forest to drier eucalypt forest. Preferred habitat includes dry hardwood forests and woodlands, particularly in the vicinity of a watercourse. The pale-headed snake appears to require vegetation with old-growth features and is not known to occur in greatly disturbed environments or recently regenerating vegetation. Shelters during the day under loose bark and in the hollow trunks and limbs of dead trees. Predominantly preys on tree frogs, though also takes lizards and small mammals. The habitat within the study area may be too disturbed for this species.	Y	-	Y	Limited	√

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Stephens' banded snake (<i>Hoplocephalus stephensii</i>)	-	1	0	Partly arboreal in rainforest, wetter sclerophyll forests and rocky areas up to 950m. Shelters during the day under loose bark, among vines, under rock slabs or in hollow trunks, limbs and rock crevices. Hunts for frogs, lizards, birds and small mammals at night.	Y	Y	Y	Limited	√
Non-flying terrestrial mammals									
Brush-tailed phascogale (<i>Phascogale tapoatafa</i>)	2006	33	7	Found in dry sclerophyll open forests and woodlands, with a preference for sparse ground cover. Also inhabits heath, swamps, rainforest and wet sclerophyll forest. Requires large areas of intact habitat. Nests and shelters in tree hollow.	Y	Y	Y	High	√
Brush-tailed rock-wallaby (<i>Petrogale penicillata</i>)	-	-	-	In more recent years this rock-wallaby appears to have become restricted to rock outcrops containing suitable caves and tunnels or very dense undergrowth to provide shelter.	N	-	N	Unlikely	-
Common planigale (<i>Planigale maculata</i>)	2004	4	1	Inhabits rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is sufficient surface cover. Usually occurs close to water. The common planigale is nocturnal and shelters during the day in nests built in crevices, hollow logs, beneath bark or under rocks. Preys on insects and small vertebrates.	Y	Y	Y	Moderate	√
Eastern chestnut mouse (<i>Psuedomys gracilicaudatus</i>)	2004	12	0	In NSW the eastern chestnut mouse is mostly found in heathland and is most common in dense wet heath and swampy areas. Has also been recorded from open woodland with a grassy understorey. Population numbers are influenced by fire and it appears to prefer regenerating heathland that has been burnt 18 months to four years previously. In mature heath the numbers of the eastern chestnut mouse drop as the larger swamp rat becomes dominant. Feeds on grass stems, invertebrates, fungi and seeds. Limited potential habitat within the study area	Y	Y	Y	Limited	√
Eastern quoll (<i>Dasyurus viverrinus</i>)	1899	1	0	Variety of habitats including dry sclerophyll forest, scrub, heathland, and cultivated land. In Tasmania individuals are most commonly found where eucalypt forest and pastures are interspersed. Very rare and possibly now extinct on the mainland.	-	-	-	Unlikely	-
Emu (<i>Dromaius novaehollandiae</i>) - endangered population	No records in the locality. DEWHA habitat modelling only			On the north coast this species inhabits open forest, woodland, coastal heath, coastal dunes, wetland areas, tea tree plantations and open farmland, and occasionally in littoral rainforest.	-	-	-	Unlikely	-

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Koala (<i>Phascolarctos cinereus</i>)	2005	457	149	Forest and woodland habitats that contain suitable regional eucalypt feed trees. In the locality, the forest red gum and grey gum are listed food trees in SEPP 44.	Y	Y	Y	High	√
Long-nosed potoroo (<i>Potorous tridactylus</i>)	-	-	-	Inhabits coastal heath and dry and wet sclerophyll forests. A relatively thick ground cover is essential and areas with light, sandy soils are preferred.	Y	Y	Y	Limited	√
Parma wallaby (<i>Macropus parma</i>)	-	-	-	Favours wet sclerophyll forest with a thick, shrubby understorey often with nearby grassy patches, rainforest margins and occasionally drier eucalypt forest. Shelters in dense cover during the day. Feeds during the night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. No records for the study locality, more likely to occur in the ranges further to the west.	Y	Y	Y	Unlikely	-
Rufous bettong (<i>Aepyprymnus rufescens</i>)	1999	1	0	Found in a variety of habitats although it prefers open woodland, with a tussock grass understorey. Preferred shelter habitat is a dense cover of tall native grasses. Sleeps during the day in a nest constructed of grass and feeds at night on grasses, herbs, seeds, flowers, roots, tubers, fungi and occasionally insects. Rarely recorded south of Coffs Harbour as preferred habitat is limited.	Y	Y	Y	Low	-
Spotted-tailed quoll (<i>Dasyurus maculatus</i>)	2003	11	3	Inhabits a variety of habitat types from moist and wet sclerophyll through to dry forests and woodlands on the edge of open grasslands. Requires large hollow logs on the ground for den.	Y	Y	Y	Moderate	√
Squirrel glider (<i>Petaurus norfolcensis</i>)	2007	9	0	Usually inhabits dry open sclerophyll forest and woodlands, but has also been observed in moist regenerating forest and moist gullies. Forages on acacia gum, eucalypt sap, nectar, honeydew, manna invertebrates and pollen, utilising areas with an abundance of flowering eucalypts and tall shrubs (eg. banksias). Acacia species are the preferred sap feeding trees. This species requires an abundance of suitably sized hollow-bearing trees.	Y	Y	Y	Moderate	√

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Yellow-bellied glider (<i>Petaurus australis</i>)	2003	17	5	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Den, often in family groups, in hollows of large trees. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar.	Y	Y	Y	Moderate	√
Flying mammals									
Black flying-fox (<i>Pteropus alecto</i>)	2003	2	0	Inhabits coastal areas across northern Australia, through Queensland into northern NSW. Forms large colonies at day-time roosts in coastal subtropical rainforest or swamp forest, often with grey-headed flying foxes. Disperses at dusk to feed on rainforest fruits as well as nectar and pollen from flowering eucalypts, paperbarks and banksias. Although the study area is south of the usual range for this species, individuals have been recorded as far south as Newcastle and they have been sighted at Wingham Brush.	Y	Y	Y	Unlikely	-
Common blossom bat (<i>Syconycteris australis</i>)	2000	4	0	Occurs in coastal areas of north-east NSW and eastern Queensland. Roosts singly within foliage in littoral rainforest. Also known to roost in other forest types containing rainforest elements. The common blossom bat is a specialised nectar feeder and generally feeds in heathland and paperbark swamp on paperbark, bottlebrush, banksia and bloodwood flowers. Also known to feed on banana flowers. Generally changes roost sites daily, though will return to favoured feeding sites on consecutive nights. Most likely to occur closer to the coastal strip within the study locality.	N	N	Y	Unlikely	-
Eastern bent-wing bat (<i>Miniopterus schreibersii oceanensis</i>)	2006	27	2	Forages within a variety of habitat types including moist and dry eucalypt forest, woodland, rainforest, heath and open environments, including urban areas. Reliant on suitable roosting/breeding habitat in caves and mine tunnels, though will also roost in stormwater channels, road culverts and other comparable structures (including buildings). Estimated nightly foraging range of 20 kilometres.	N	Y	Y	High	√

Common name (scientific name)	Most recent record	Closest records		Preferred habitat and comments	Habitat available on site			Potential to utilise study area	Subject species
		10 km	2 km		Breeding	Roosting	Foraging		
East-coast freetail-bat (<i>Mormopterus norfolkensis</i>)	2005	8	0	The habitat preference of this species is unclear. It has been predominantly recorded in dry eucalypt forest and woodland, but has been recorded in moist and edge environments. The wing morphology indicates that this species is adapted to the more open habitats. This species primarily roosts in tree hollows, although the roofs of buildings are also used.	Y	Y	Y	Moderate	√
Eastern false pipistrelle (<i>Falsistrellus tasmaniensis</i>)	2003	1	0	Tall forest, woodland or heath/ grassland edges. Roosts in hollow trunk of the largest trees and sometimes buildings.	Y	Y	Y	Moderate	√
Golden-tipped bat (<i>Kerivoula papuensis</i>)	2001	5	2	Rainforest or rainforest gullies in wet sclerophyll forest. Roosts in scrubwren and gerygone nests. Roost sites limited to dense moist riparian habitat along permanent freshwater creeks within the study area.	Y	Y	Y	Limited	√
Greater broad-nosed bat (<i>Scoteanax rueppellii</i>)	2004	9	1	Forages for insects over a range of natural and altered habitats, including tall forest, woodland or heath/grassland edges, often along the tree line boundary. Prefers tree hollows in large, often isolated, mature trees for roosting. Usually associated with tall moist open forest.	Y	Y	Y	Moderate	√
Grey-headed flying-fox (<i>Pteropus poliocephalus</i>)	2005	85	20	Regularly occurs along the eastern coastal plain through NSW. Roosts in camps, usually in dense riparian habitats. At dusk disperses in search of the preferred food source, mainly eucalypt blossom and rainforest fruits. Long distances are covered (30+km) in search of food. No permanent or temporary camps are known to occur within the proposed road easement.	N	Y	Y	High	√
Large-eared pied bat (<i>Chalinobus dwyeri</i>)	-	-	-	Range of well-wooded habitats, including dry sclerophyll forests and woodlands of coastal and semi-arid areas. Occasionally in sub-alpine woodlands and at the edge of rainforest and semi-arid areas. Reliant on suitable roosting habitat including caves and mine tunnels (though may use other structures, eg. abandoned fairy martin nests). Most often recorded foraging within forest/woodland adjacent to rocky escarpments.	N	Y	Y	Limited	√

Common name (scientific name)	Most recent record	Closest records		Preferred habitat and comments	Habitat available on site			Potential to utilise study area	Subject species
		10 km	2 km		Breeding	Roosting	Foraging		
Little bent-wing bat (<i>Miniopterus australis</i>)	2006	45	14	Forages in a range of habitats, including forest, woodland, heath, coastal swamps and rainforest. A nightly foraging range of 20km from roost sites has been reported. Reliant on suitable roosting habitat in caves and mine tunnels, though has been recorded roosting in hollowed out tree bases and dense foliage.	N	Y	Y	High	√
Southern myotis (<i>Myotis macropus</i>)	2006	11	4	Habitats adjacent to large bodies of water for hunting aquatic insects. Usually forages over or adjacent to water-bodies and associated terrestrial habitats. Roosts in caves, mines, tunnels, bridges, culverts and tree hollows.	Y	Y	Y	High	√
Yellow-bellied sheath-tail-bat (<i>Saccolaimus flaviventris</i>)	-	-	-	Wide range of habitats, including open forest. Forages above the canopy in wooded areas and lower down in more open areas or along creeklines. Reliant on suitable trees with hollows for roosting. Has a patchy, although widespread, distribution in coastal NSW.	Y	Y	Y	Limited	√
Invertebrates									
Giant dragonfly (<i>Petalura gigantea</i>)	2006	1	0	Boggy seepages and swamps. The larvae occupy permanent burrows in wetland soils that open above the water level. They emerge from the burrows at night and in wet weather to feed. Most likely to occur in the wetlands of the Hastings and Wilson Rivers mainly to the east of the proposed road easement	Y	Y	Y	Limited	√
Laced fritillary (<i>Argyreus hyperbius</i>)	-	-	-	Very localised distribution – restricted to open swampy coastal areas where the larval food plant (<i>Viola betonicifolia</i>) grows. It occurs from just south of Gympie, Queensland, to just north of Port Macquarie. Most likely to occur closer to the coastal strip.	N	N	Y	Unlikely	-

Table E2 **Threatened flora – assessment of likelihood of occurrence within the study area**

Scientific name (common name)	Latest record	Records within		Preferred habitat and comments	Habitat available on site	Potential to occur within study area	Subject species
		10 km	2 km				
<i>Acronychia littoralis</i> (scented acronychia)	2006	4	0	Littoral rainforest on sand.	Marginal	Moderate – unconfirmed records in 2 places by HWR Ecological (2005)	Y
<i>Allocasuarina defungens</i> (dwarf heath casuarina)	1998	28	0	Mainly tall heath on sand, but can also occur on clay soils and sandstone. The species also extends onto exposed nearby-coastal hills or headlands adjacent to sandplains.	Marginal	Low – probably a little too far from the coast.	N
<i>Arthraxon hispidus</i> (hairy-joint grass)	2001	1	1	Moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps.	Yes - by creeks, swamps and in moist communities	Moderate to High	Y
<i>Chamaesyce psammogeton</i> (sand spurge)	1987	1	0	Grows on fore-dunes and exposed headlands, often with spinifex (<i>Spinifex sericeus</i>).	No	Minimal – too far from the coast.	N
<i>Cynanchum elegans</i> (white-flowered wax plant)	-	1	0	Usually occurs on the edge of dry rainforest vegetation, rainforest gullies scrub and scree slopes. Other associated vegetation types include littoral rainforest; coastal tea-tree – coastal banksia scrub; forest red gum aligned open forest and woodland; spotted gum aligned open forest and woodland and bracelet honeymyrtle <i>Melaleuca armillaris</i> scrub to open scrub.	Possibly in rainforest areas or moist gullies	Low to Moderate Nominally suitable habitat available, but only one record within the locality	N
<i>Cryptostylis hunteriana</i> (leafless tongue-orchid)	No records in the locality. DEWHA habitat modelling only			Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland.	Nominally suitable habitat in some areas.	Low – no records for the locality	N
<i>Hakea archaeoides</i> (big Nellie hakea)	-	1	0	Found on steep, rocky, sheltered slopes and in deep gullies in open eucalypt forest. Commonly occurs at the interface of dry eucalypt forest and gully communities.	Possibly	Low to Moderate Nominally suitable habitat available, but only one record within the locality.	N
<i>Hydrocharis dubia</i> (frogbit)	No records in the locality. DEWHA habitat modelling only.			Grows in small shallow freshwater bodies or swamps.	Possibly	Low – potential habitat available but no records for the locality	N

Scientific name (common name)	Latest record	Records within		Preferred habitat and comments	Habitat available on site	Potential to occur within study area	Subject species
		10 km	2 km				
<i>Marsdenia longiloba</i> (clear milkvine)	No records in the locality. DEWHA habitat modelling only.			Subtropical and warm temperate rainforest, lowland moist eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops.	Possibly	Low – potential habitat available but no records for the locality	N
<i>Maundia triglochinooides</i>	1999	2	0	Swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Associated with wetland species e.g. <i>Triglochin procerum</i> .	Yes	Moderate Suitable habitat present but only 2 records for the locality.	Y
<i>Melaleuca biconvexa</i> (biconvex paperbark)	2005	10	3	Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Yes – damp areas associated with streams and floodplains.	Moderate to High	Y
<i>Melaleuca groveana</i> (Grove's paperbark)	-	2	0	Heath and shrubland, often in exposed sites at high elevations on rocky outcrops and cliffs. It also occurs in dry woodlands.	Unlikely	Low	N
<i>Oberonia titania</i> (red-flowered king of the fairies)	2008	1	0	Occurs in littoral and subtropical rainforest and paperbark swamps, but it can also occur in eucalypt-forested gorges and in mangroves	Possibly in paperbark swamp, rainforest or moist areas.	Low – the sole record for the locality is in the urban area of Port Macquarie and likely to be a garden specimen.	N
<i>Parsonsia dorrigoensis</i> (milky silkpod)	1997	1	0	Subtropical and warm-temperature rainforest, on rainforest margins, and in moist eucalypt forest up to 800 m, on brown clay soils. Appears to be able to withstand, and maybe even favour, light to moderate physical disturbance.	Possibly in moist gullies and rainforest areas.	Moderate – Potentially suitable habitat available, although only one record for the locality.	Y
<i>Phaius australis</i> (southern swamp-orchid)	No specific listed records in the locality, but known to occur according to HWR Ecological (2005)			Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas.	Possibly in swampy, rainforest or moist areas.	Moderate Nominally suitable habitat available	Y
<i>Phaius tancervilleae</i> (swamp-orchid)	1991	2	0	Found in swampy grassland or swampy forest, including rainforest, eucalypt and paperbark forest.	Possibly in swampy, rainforest or moist areas.	Moderate Nominally suitable habitat available	Y

Scientific name (common name)	Latest record	Records within		Preferred habitat and comments	Habitat available on site	Potential to occur within study area	Subject species
		10 km	2 km				
<i>Quassia</i> sp. Moonee Creek (Moonee quassia)	No records in the locality. DEWHA habitat modelling only			Shrubby layer below tall moist eucalypt forest and tall dry eucalypt forest, including forest edges, mostly at lower altitudes.	Nominally suitable habitat in rainforest or moist areas	Low – no records for the locality	-
<i>Thesium australe</i> (austral toadflax)	No records in the locality. DEWHA habitat modelling only			Occurs in grassland or grassy woodland. Often found in damp sites in association with kangaroo grass.	Nominally suitable habitat in some areas.	Low – no records for the locality	-
Non-threatened rare species (not listed by legislation)							
<i>Acacia blakei</i> subsp. <i>diphylla</i>	-	2	0	Dry sclerophyll forest and dry rainforest, on steep slopes.	Possibly	Low to Moderate	
<i>Acacia tessellata</i>	-	1	0	Grows in wet sclerophyll forest and on the edge of cool-temperate rainforest and in scrub in more exposed sites, usually at higher altitudes on the escarpment ranges from the Washpool National Park to Werrikimbe National Park.	Unlikely	Low	
<i>Adenostemma lavenia</i> (sticky daisy)	No records in the locality. DECC habitat modelling only.			Grows in damp shaded places.	Possibly	Low to Moderate	
<i>Bertya brownii</i>	-	1	0	Found in deep moist sandstone gullies in rainforest and eucalypt forest.	Possibly	Low to Moderate	
<i>Boronia chartacea</i>	-	2	0	Grows in moist gullies, restricted to the Wauchope–Grafton– Copmanhurst areas.	Possibly	Low to Moderate	
<i>Callerya australis</i> (blunt wisteria)	-	1	0	Grows in warmer rainforest on the coast and adjacent ranges.	Possibly	Low to Moderate	
<i>Callistemon flavovirens</i> (green bottlebrush)	1993	1	1	Chiefly grows in granite country.	Generally unsuitable	Low to Moderate – one record within 2 km occurs	
<i>Claoxylon australe</i> (brittlewood)	-	1	0	Warmer rainforest on the coast and adjacent ranges.	Possibly	Low to Moderate	
<i>Dodonaea megazyga</i>	1893	1	-	Usually grows in dry sclerophyll forest or on margins of rainforest usually on sandstone.	Possibly	Low – the sole record for the locality is historic.	

Scientific name (common name)	Latest record	Records within		Preferred habitat and comments	Habitat available on site	Potential to occur within study area	Subject species
		10 km	2 km				
<i>Gahnia insignis</i>	-	1	0	Grows on slopes in forest and occasionally in heath, often on volcanic soils; usually on the ranges.	Unlikely	Low	
<i>Goodenia fordiana</i>	2003	5	0	Grows in sclerophyll forest on the lower escarpment ranges.	Possibly	Moderate	
<i>Grevillea linsmithii</i>	-	1	0	Grows in rocky situations in dry sclerophyll forests on granite, dacite, trachyte; upper reaches of Hastings R. and Forbes R. east of Yarrowitch.	Unlikely	Low	
<i>Kunzea</i> sp. 'Middle Brother Mountain'	-	2	0	Wet sclerophyll forest; restricted to ranges between Taree and Kempsey.	Possibly in moister forest	Low to Moderate	
<i>Schistotylus purpuratus</i> (dwarf tangleroot orchid)	1959	1	0	Grows in rainforest and swampy heath on the outer twigs of trees, on the coastal ranges and escarpment between 600 and 900 m.	Unlikely – elevation too low	Low	