Appendix A

Species of plant recorded

Family	Scientific name	Common name	Native[1]
Acanthaceae	*Brunoniella australis*	Blue Trumpet	Y
	Thunbergia alata	Black-eyed Susan	N
Adiantaceae	*Cheilanthes distans*	Bristly Cloak Fern	Y
	Cheilanthes sieberi	Mulga Fern	Y
Amaranthaceae	*Alternanthera pungens*	Khaki Weed	N
	Gomphrena celosioides	Gomphrena Weed	N
Amygdalaceae	*Prunus sp.*		N
Anthericaceae	*Arthropodium sp.*		Y
	Laxmannia gracilis		Y
	Tricoryne elatior	Yellow Autumn-lily	Y
Apiaceae	*Centella asiatica*	Pennywort	Y
	Foeniculum vulgare	Fennel	N
	Hydrocotyle peduncularis		Y
Apocynaceae	*Nerium oleander*	Oleander	N
Asclepiadaceae	*Araujia sericifera*	Moth Vine	N
Asparagaceae	*Asparagus asparagoides*		N
	Myrsiphyllum asparagoides	Florist's Smilax	N
Asphodelaceae	*Bulbine bulbosa*	Bulbine Lily	Y
Asteraceae	*Ageratina adenophora*	Crofton Weed	N
	Ageratina riparia	Mistflower	N
	Arctotheca calendula	Capeweed	N
	Bidens pilosa	Cobbler's Pegs	N
	Bidens subalternans	Greater Beggar's Ticks	N
	Calotis cuneifolia	Purple Burr-Daisy	Y
	Calotis lappulacea	Yellow Burr-daisy	Y
	Cassinia arcuata	Sifton Bush	Y
	Chrysocephalum apiculatum	Common Everlasting	Y
	Cirsium vulgare	Spear Thistle	N
	Conyza albida	Tall Fleabane	N
	Conyza bonariensis	Flaxleaf Fleabane	N
	Cotula sp.		Y
	Gamochaeta calviceps		N
	Gnaphalium coarctatum		N
	Gnaphalium involucratum		Y
	Hypochaeris radicata	Catsear	N
	Lactuca serriola	Prickly Lettuce	N
	Leontodon taraxacoides	Hairy Hawkbit	N
	Ozothamnus diosmifolius	White Dogwood	Y
	Senecio hispidulus var. dissectus		Y
	Senecio madagascariensis	Fireweed	N
	Sonchus oleraceus	Common Sowthistle	N
Asteraceae (cont)	*Tagetes minuta*	Stinking Roger	N

Family	Scientific name	Common name	Native[1]
	Taraxacum officinale	Dandelion	N
	Tragopogon porrifolius	Salsify	N
	Vernonia cinerea		Y
	Vittadinia cuneata	Fuzzweed	Y
Azollaceae	*Azolla filiculoides var. rubra*		Y
Boraginaceae	*Echium plantagineum*	Patterson's Curse	N
Brassicaceae	*Brassica rapa*		N
	Brassica sp.		N
	Lepidium africanum		N
	Rorippa laciniata		Y
Cactaceae	*Opuntia stricta*	Prickly Pear	N
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell	Y
	Wahlenbergia gracilis	Sprawling or Australian Bluebell	Y
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear Chickweed	N
Casuarinaceae	*Casuarina glauca*	Swamp Oak	Y
Chenopodiaceae	*Chenopodium murale*	Nettle-leaf Goosefoot	N
	Einadia hastata	Berry Saltbush	Y
	Einadia polygonoides		Y
	Einadia trigonos	Fishweed	Y
Clusiaceae	*Hypericum japonicum*		Y
	Hypericum perforatum	St. Johns Wort	N
Colchicaceae	*Wurmbea sp.*		Y
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	Y
	Tradescantia albiflora	Wandering Jew	N
Convolvulaceae	*Dichondra repens*	Kidney Weed	Y
	Ipomoea indica	Blue Morning Glory	N
Crassulaceae	*Bryophyllum delagoense*	Mother of millions	N
	Crassula sieberiana	Australian Stonecrop	Y
Cyperaceae	*Carex appressa*	Tussock Sedge	Y
	Cyperus difformis	Dirty Dora	Y
	Cyperus eragrostis	Umbrella Sedge	N
	Fimbristylis dichotoma		Y
	Lepidosperma laterale		Y
Dilleniaceae	*Hibbertia diffusa*		Y
Euphorbiaceae	*Phyllanthus hirtellus*	Thyme Spurge	Y
	Phyllanthus virgatus		Y
	Poranthera microphylla		Y
	Ricinus communis	Castor Oil Plant	N
Fabaceae (Caesalpinioideae)	*Cassia coluteoides*		N
	Gleditsia triacanthos	Honey Locust	N
Fabaceae (Faboideae)	*Bossiaea prostrata*		Y

Family	Scientific name	Common name	Native[1]
	Chorizema parviflorum	Eastern Flame Pea	Y
	Daviesia ulicifolia	Gorse Bitter Pea	Y
	Desmodium rhytidophyllum		Y
	Desmodium varians	Slender Tick-trefoil	Y
	Dillwynia sieberi		Y
	Erythrina X sykesii	Coral tree	N
	Glycine clandestina		Y
	Glycine microphylla		Y
	Glycine tabacina		Y
	Hardenbergia violacea	False Sarsaparilla	Y
	Indigofera australis		Y
	Medicago polymorpha	Burr Medic	N
	Pultenaea parviflora		Y
	Robinia pseudoacacia	Black Locust	N
	Trifolium repens	White Clover	N
	Vicia sativa		N
	Vicia sativa ssp. sativa		N
Fabaceae (Mimosoideae)	*Acacia binervia*	Coast Myall	Y
	Acacia brownii	Heath Wattle	Y
	Acacia decurrens	Black Wattle	Y
	Acacia elongata	Swamp Wattle	Y
	Acacia falcata		Y
	Acacia fimbriata	Fringed Wattle	Y
	Acacia floribunda	White Sally	Y
	Acacia longifolia	Sydney Golden Wattle	Y
	Acacia parramattensis	Parramatta Wattle	Y
	Acacia podalyriifolia	Queensland Silver Wattle	Y
Fumariaceae	*Fumaria muralis*		N
Gentianaceae	*Centaurium erythraea*	Common Centaury	N
	Centaurium tenuiflorum		N
Goodeniaceae	*Goodenia hederacea ssp. hederacea*		Y
Hypoxidaceae	*Hypoxis hygrometrica*	Golden Weather-grass	Y
Iridaceae	*Crocosmia X crocosmiiflora*	Montbretia	N
	Romulea rosea		N
Lamiaceae	*Mentha satureioides*	Native Pennyroyal	Y
	Stachys arvensis	Stagger Weed	N
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	N
Lobeliaceae	*Pratia purpurascens*	Whiteroot	Y
Lomandraceae	*Lomandra filiformis ssp. filiformis*		Y
	Lomandra glauca	Pale Mat-rush	Y
Lomandraceae (cont)	*Lomandra longifolia*	Spiny-headed Mat-rush	Y
	Lomandra multiflora		Y

Family	Scientific name	Common name	Native[1]
Loranthaceae	*Amyema pendulum ssp. pendulum*		Y
Lythraceae	*Lythrum hyssopifolia*	Hyssop Loosestrife	Y
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	N
Myoporaceae	*Eremophila debilis*	Amulla	Y
Myrtaceae	*Angophora floribunda*	Rough-barked Apple	Y
	Callistemon rigidus	Stiff Bottlebrush	Y
	Eucalyptus amplifolia	Cabbage Gum	Y
	Eucalyptus bosistoana	Coast Grey Gum	Y
	Eucalyptus crebra	Narrow-leaved Ironbark	Y
	Eucalyptus eugenioides	Thin-leaved Stringybark	Y
	Eucalyptus fibrosa	Red Ironbark	Y
	Eucalyptus moluccana	Grey Box	Y
	Eucalyptus tereticornis	Forest Red Gum	Y
	Eucalyptus umbra		Y
	Kunzea ambigua	Tick Bush	Y
	Leptospermum laevigatum	Coast Teatree	Y
	Melaleuca decora	White Feather Honeymyrtle	Y
	Melaleuca linariifolia		Y
	Melaleuca sieberi		Y
	Melaleuca styphelioides	Prickly-leaved Tea Tree	Y
	Melaleuca thymifolia		Y
Ochnaceae	*Ochna serrulata*	Mickey Mouse Plant	N
Oleaceae	*Jasminum polyanthum*	White Jasmine	N
	Ligustrum lucidum	Large-leaved Privet	N
	Ligustrum sinense	Small-leaved Privet	N
	Olea europaea	Common Olive	N
Onagraceae	*Oenothera indecora*		N
Orchidaceae	*Diuris maculata*	Spotted Doubletail	Y
Oxalidaceae	*Oxalis corniculata*	Creeping Oxalis	N
	Oxalis latifolia		N
	Oxalis perennans		Y
Papaveraceae	*Papaver somniferum ssp. setigerum*		N
Phormiaceae	*Dianella longifolia*		Y
	Dianella revoluta		Y
	Dianella revoluta var. revoluta		Y
Phytolaccaceae	*Phytolacca octandra*	Inkweed	N
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn	Y
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	N
	Plantago major	Large Plantain	N
Poaceae	*Aristida ramosa*		Y
	Aristida vagans	Threeawn Speargrass	Y
	Aristida warburgii		Y

Family	Scientific name	Common name	Native[1]
	Austrodanthonia fulva		Y
	Avena fatua	Wild Oats	N
	Bothriochloa decipiens	Red Grass	Y
	Briza minor	Shivery Grass	N
	Bromus catharticus	Prairie Grass	N
	Bromus molliformis		N
	Chloris gayana	Rhodes Grass	N
	Chloris truncata	Windmill Grass	Y
	Cortaderia selloana	Pampas Grass	N
	Cymbopogon refractus	Barbed Wire Grass	Y
	Cynodon dactylon	Common Couch	Y
	Dactylis glomerata	Cocksfoot	N
	Dichelachne crinita	Longhair Plumegrass	Y
	Digitaria ciliaris		N
	Digitaria didactyla	Queensland Blue Couch	Y
	Echinochloa frumentacea	Siberian Millet	N
	Ehrharta erecta	Panic Veldtgrass	N
	Eleusine indica	Crowsfoot Grass	N
	Eleusine tristachya	Goose Grass	N
	Entolasia marginata	Bordered Panic	Y
	Entolasia stricta	Wiry Panic	Y
	Eragrostis brownii	Brown's Lovegrass	Y
	Eragrostis curvula	African Lovegrass	N
	Eragrostis leptostachya	Paddock Lovegrass	Y
	Imperata cylindrica	Bladey Grass	Y
	Lolium rigidum	Wimmera Ryegrass	N
	Microlaena stipoides		Y
	Panicum effusum	Poison or Hairy Panic	Y
	Panicum simile	Two-colour Panic	Y
	Paspalidium distans		Y
	Paspalum dilatatum	Paspalum	N
	Paspalum notatum	Bahia Grass	N
	Pennisetum clandestinum	Kikuyu Grass	N
	Phragmites australis	Common Reed	Y
	Poa pratensis	Kentucky Bluegrass	N
	Setaria gracilis	Slender Pigeon Grass	N
	Sorghum sp.		Y
Poaceae (cont)	*Sporobolus creber*	Slender Rat's Tail Grass	Y
	Sporobolus elongatus	Slender Rat's Tail Grass	Y
	Themeda australis	Kangaroo Grass	Y

Family	Scientific name	Common name	Native[1]
Polygonaceae	*Persicaria hydropiper*	Water Pepper	Y
	Rumex brownii	Swamp Dock	Y
	Rumex crispus	Curled Dock	N
Portulacaceae	*Portulaca oleracea*	Pigweed	Y
Primulaceae	*Anagallis arvensis*	Scarlet/Blue Pimpernel	N
Proteaceae	*Grevillea juniperina ssp. juniperina*		Y
	Grevillea robusta	Silky Oak	Y
	Hakea sericea		Y
Ranunculaceae	*Clematis aristata*		Y
	Ranunculus plebeius		Y
Rosaceae	*Rubus fruiticosus*	Blackberry complex	N
Rubiaceae	*Galium aparine*	Goosegrass	N
	Opercularia diphylla		Y
	Pomax umbellata		Y
Sapindaceae	*Dodonaea viscosa*		Y
	Dodonaea viscosa ssp. cuneata		Y
	Dodonaea viscosa ssp. spatulata		Y
Scrophulariaceae	*Verbascum virgatum*	Twiggy Mullein	N
Solanaceae	*Cestrum parqui*	Green Cestrum	N
	Datura ferox	Fierce Thornapple	N
	Lycium ferocissimum	African Boxthorn	N
	Nicotiana glauca	Tree Tobacco	N
	Solanum linnaeanum	Apple of Sodom	N
	Solanum nigrum	Black-berry Nightshade	N
	Solanum sisymbriifolium		N
Stackhousiaceae	*Stackhousia viminea*	Slender Stackhousia	Y
Typhaceae	*Typha orientalis*	Broad-leaved Cumbungi	Y
Urticaceae	*Parietaria judaica*	Pellitory	N
Verbenaceae	*Lantana camara*	Lantana	N
	Verbena bonariensis	Purpletop	N
	Verbena officinalis	Common Verbena	N
	Verbena rigida	Veined Verbena	N

Notes: 1. Y= yes (native); N=no (introduced).

Appendix B

Threatened species and population of plant in the locality

Appendix B: Threatened plants in the local area

This appendix details the Threatened species of plant that have either been recorded in the local area, or that have the potential to occur, based on the Department of Environment and Conservation Atlas of NSW Wildlife locality (Department of Environment and Climate Change 2008a) and the *Environment Protection and Biodiversity Conservation Act 1999* Protected Matters Search Tool (Department of the Environment Water Heritage and the Arts 2008).

Table B-1 Threatened species and population of plant previously recorded or predicted to occur in the study area

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Asclepiadaceae	*Cynanchum elegans*	White-flowered Wax Plant	E1	E	3Ei	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar where it grows in rainforest gullies, scrub and scree slopes (Harden 1992). This species typically occurs at the ecotone between dry subtropical forest/woodland communities (James 1997b; NSW National Parks and Wildlife Service 2002a).	Low, preferred habitat not present
Asclepiadaceae	*Marsdenia viridiflora ssp. viridiflora*	Native Pear	E2			Occurs in subcoastal and southern Queensland but rarely in NSW with a disjunct occurrence near Sydney. It occurs as scattered plants in remnant woodland and scrub (Harden 2002; NSW Scientific Committee 2000c). Grows in vine thickets and open shale woodland (Department of Environment and Climate Change 2008b).	Low. It has not been recorded within the site and is unlikely to occur based on the small area of potential habitat, the poor condition of these areas and the level of survey undertaken.
Casuarinaceae	*Allocasuarina glareicola*		E1	E		Restricted to the Sydney basin where it occurs north east of Penrith in or near Castlereagh State Forest. Grows on lateritic soil in open forest (Harden 2000).	Low, preferred habitat not present
Epacridaceae	*Epacris purpurascens var. purpurascens*		V		2K	Occurs in Gosford and Sydney districts where it grows in sclerophyll forest, scrub and swamps (Harden 1992). Usually found in sites with a strong shale influence (NSW National Parks and Wildlife Service 2002b).	Low, preferred habitat not present
Epacridaceae	*Leucopogon exolasius*		V	V	2V	Restricted chiefly to the Woronora and Grose Rivers and Stokes Creek, Sydney catchments and the Royal National Park. One old record from the Grose River. Grows in woodland on sandstone (Royal Botanic Gardens 2004).	Low, preferred habitat not present

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Epacridaceae	*Leucopogon fletcheri ssp. fletcheri*		E1		2R	Grows in dry eucalypt woodland or in shrubland on clay, lateritic soils or Hawkesbury sandstone (Fairley, Alan 2004). Found on sandstone ridges and upper slopes in heath or woodland, sometimes in or below sandstone-shale ecotone; often associated with lateritic soils with some clay influence (James 1997a; James et al. 1999).	Low, preferred habitat not present
Fabaceae (Faboideae)	*Dillwynia tenuifolia*		V	V	2Vi	Occurs on the Cumberland Plain from the Blue Mountains to Howes Valley area where it grows in dry sclerophyll woodland on sandstone, shale or laterite (Harden 2002). Specifically, occurs within Castlereagh woodlands, particularly in shale gravel transition forest. Associated species include *Eucalyptus fibrosa, E. sclerophylla, Melaleuca decora*, *Daviesia ulicifolia, Dillwynia juniperina* and *Allocasuarina littoralis* (James 1997b).	Low. Although known to occur in the vicinity this species was not recorded.
Fabaceae (Faboideae)	*Pultenaea parviflora*		E1	V	2E	Restricted to the Cumberland Plain where it grows in dry sclerophyll forest on Wianamatta shale, laterite or alluvium (Harden 2002). Locally abundant within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. Also occurs in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland (James 1997b; NSW National Parks and Wildlife Service 2002c).	Occurs within the study area
Fabaceae (Faboideae)	*Pultenaea pedunculata*		E1			Restricted to Wianamatta Shales of the Cumberland Plain from Bankstown to Liverpool and on the South Coast in the Southeast Corner Bioregion at Bournda. If grows on a variety of soils in dry sclerophyll forest and disturbed sites (Harden 2000; NSW National Parks and Wildlife Service 2002d; NSW Scientific Committee 1999b). It is largely confined to loamy soils in dry gullies in populations in the Windellama area (Department of Environment and Climate Change 2008b).	Low, preferred habitat not present

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Fabaceae (Mimosoideae)	*Acacia bynoeana*	Bynoe's Wattle	E1	V	3V	Occurs south of Dora Creek-Morisset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils (Harden 2002). Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with *Corymbia gummifera, Eucalyptus haemastoma, E. gummifera, E. parramattensis, E. sclerophylla, Banksia serrata* and *Angophora bakeri* (NSW National Parks and Wildlife Service 1999a).	Low, preferred habitat not present
Fabaceae (Mimosoideae)	*Acacia gordonii*		E1	E	2K	Occurs in the lower Blue Mountains from Bilpin to Faulconbridge and also in the Glenorie district. Grows on sandstone outcrops and amongst rock platforms in dry sclerophyll forest and heath (Harden 2002; NSW Scientific Committee 1997). Specifically this species occurs in Sydney Sandstone Ridgetop Communities (James 1997b).	Low, preferred habitat not present
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V	V	3Va	Restricted to the Sydney Region from Bilpin to the Georges River and also at Woodford where it usually grows in open sclerophyll forest and woodland on clay soils. Typically it occurs at the intergrade between shales and sandstones in gravely soils often with ironstones (Harden 2002; NSW National Parks and Wildlife Service 2003).	Moderate, not recorded, preferred habitat not present
Haloragaceae	*Haloragis exalata ssp. exalata*		V	V	3Va	Found in the south coast, central coast and north west slopes botanical regions where it appears to require protected and shaded damp situations in riparian habitats (Department of Environment and Climate Change 2008b; Harden 2002).	
Haloragaceae	*Haloragodendron lucasii*		E1	E	2Ea	Confined to the Sydney area where it grows in dry sclerophyll open forest on sheltered slopes near creeks on sandstone (Harden 2002). Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland. Associated with high soil moisture and relatively high soil-phosphorus levels (Department of Environment and Conservation 2005).	Low, preferred habitat not present

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Marsileaceae	*Pilularia novae-hollandiae*	Austral Pillwort	E1			Grows in seasonally dry depressions and margins of marshes and may grow submerged (Harden 2000). It grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. Most of the records in the Albury-Urana area were from table drains on the sides of roads. The ACT record was from a subalpine grassy plain. This species is probably ephemeral (especially in the drier parts of its range), appearing when soils are moistened by rain (Department of Environment and Climate Change 2008b).	Low, waterways within the study area are highly modified and consist of culverts and concrete channels. .
Myrtaceae	*Darwinia biflora*		V	V	2Va	Occurs from Cheltenham to Hawkesbury River where it grows in heath on sandstone or in the understorey of woodland on shale-capped ridges (Harden 2002). Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include *Eucalyptus haemastoma, Corymbia gummifera* and/or *E. squamosa*. The vegetation structure is usually woodland, open forest or scrub-heath (Department of Environment and Climate Change 2008b).	Low, preferred habitat not present
Myrtaceae	*Darwinia peduncularis*		V		3Ri	Occurs from Hornsby to Hawkesbury River and west to Glen Davies where it grows in dry sclerophyll forest on sandstone hillsides and ridges (Harden 2002). Known to occur along watercourses (Benson 2001). Usually grows on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone (Department of Environment and Climate Change 2007b).	
Myrtaceae	*Eucalyptus benthamii*	Nepean River Gum	V	V	2Vi	Restricted to Wallacia to Camden areas, Nepean River and Kedumba Creek, and Reedy and Cedar creeks in the central Blue Mountains. Grows on sandy flats or ridges near streams (Fairley, A. & Moore 2002).	Low, preferred habitat not present
Myrtaceae	*Eucalyptus sp. Cattai*		E1			Occurs in the area between Colo Heights and Castle Hill, historic records include the Royal Botanic Gardens, Sydney. It grows as an emergent tree in scrub, heath and low woodland on sandy soils, generally on flat ridge tops. It usually occurs as isolated individuals or occasionally in small clustered groups (Harden 2002).	Low, preferred habitat not present

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Myrtaceae	*Melaleuca biconvexa*	Biconvex Paperbark	V	V		Occurs as disjunct populations in coastal New South Wales from Jervis Bay to Port Macquarie, with the main concentration of records is in the Gosford/Wyong area (NSW Scientific Committee 1998b). Grows in damp places, often near streams, or low-lying areas on alluvial soils of low slopes or sheltered aspects (Department of Environment and Climate Change 2008b; Harden 2002).	Low, preferred habitat not present
Myrtaceae	*Melaleuca deanei*		V	V	3R	Occurs in coastal districts, including western Sydney (e.g. Baulkham Hills, Liverpool shires) from Berowra to Nowra where it grows in wet heath on sandstone and shallow/skeletal soils near streams or perched swamps (Harden 2002; James 1997b).	Low, preferred habitat not present
Myrtaceae	*Micromyrtus minutiflora*		E1	V	2V	Occurs in the western part of the Cumberland Plain between Richmond and Penrith where it grows on Tertiary sediments in dry sclerophyll forest (Harden 2002; NSW Scientific Committee 2002).	Low, suitable habitat present but species not recorded
Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	V	V	3Ri	Occurs between Buladelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea (Harden 2002). On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities (Department of Environment and Climate Change 2008b).	Low, preferred habitat not present
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue Orchid	V	V	3V	Occurs south from the Gibraltar Range, chiefly in coastal districts but also extends on to tablelands. Grows in swamp-heath and drier forest on sandy soils on granite & sandstone. Occurs in small, localised colonies most often on the flat plains close to the coast but also known from some mountainous areas growing in moist depressions and swampy habitats (Harden 1993; NSW National Parks and Wildlife Service 1999b).	Low, preferred habitat not present
Orchidaceae	*Genoplesium baueri*		V		3R	Grows in sparse sclerophyll forest and moss gardens over sandstone; from the Hunter Valley to Nowra district (Royal Botanic Gardens 2004).	Low, preferred habitat not present

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Orchidaceae	*Pterostylis saxicola*	Sydney Plains Greenhood	E1	E		Known now only from Freemans Reach to Picton district. Grows in Sydney Sandstone Gully Forest in shallow or skeletal soils over sandstone shelves, often near streams (Department of Environment and Climate Change 2007b; Harden 1993; James 1997b)	Low, preferred habitat not present
Polygonaceae	*Persicaria elatior*	Tall Knotweed	V	V	3V	Occurs infrequently in coastal regions where it grows in damp places especially beside streams and lakes. Also occasionally occurs in swamp forest or associated with disturbance (Department of Environment and Conservation 2005; Harden 2000).	Low, not recorded within the study area
Proteaceae	*Grevillea juniperina ssp. juniperina*		V			Restricted to western Cumberland Plain, Marsden Park, Rooty Hill, Riverstone, Plumpton, Castlereagh NR, Blacktown, Penrith and north to Pitt Town, where it grows in open dry sclerophyll (eucalypt-dominated) forest or woodland, at altitudes of less than about 50 m, in sandy to clay-loam soils and red pseudolateritic or sandy gravels (Fairley, Alan 2004; Royal Botanic Gardens 2005). More specifically it grows in Cumberland Plain Woodland and Castlereagh Woodland, typically in moist sites, often beside creeks on acidic soils and often recorded on road verges. Restricted to red sandy to clay soils (often lateritic) on Wianamatta Shale and Tertiary Alluvium (NSW Scientific Committee 2000a).	Observed within study area
Proteaceae	*Grevillea parviflora ssp. parviflora*	Small-flower Grevillea	V	V		Mainly known from the Prospect area (but now extinct there) and lower Georges River to Camden, Appin and Cordeaux Dam areas, with a disjunct populations near Putty, Cessnock and Cooranbong. Grows in heath or shrubby woodland in sandy or light clay soils usually over thin shales (Harden 2002; NSW Scientific Committee 1998a).	Low, preferred habitat not present

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Proteaceae	*Grevillea parviflora ssp. supplicans*		E1			Has a very restricted known distribution (approximately 8 by 10 km) and is confined to the north-west of Sydney near Arcadia and the Maroota Marramarra Creek area. It grows in heathy woodland on skeletal sandy soil over sandstone (NSW Scientific Committee 2000b). It is strongly associated with clay-capped ridged of the Lucas Heights and Faulconbridge soil landscapes, suggesting it has a preference for yellow clays with periodically impeded drainage. It may have an affinity with disturbance margins such as trail and road verges where soils are suitable and the availability of light due to clearing has promoted its growth. May be associated with the margins of the Sydney Turpentine Ironbark Forest endangered ecological community and, to a greater extent, with Shale/Sandstone Transition Forest endangered ecological community (Department of Environment and Conservation 2005).	Low, preferred habitat not present
Proteaceae	*Persoonia bargoensis*		E1	V	2V	Grows in woodland to dry sclerophyll forest, on sandstone and laterite. Restricted to the Bargo area (Harden 2002).	Low, study area outside known range and preferred habitat not present
Proteaceae	*Persoonia glaucescens*	Mittagong Geebung	E1	V	2V	Occurs from Picton to Berrima where it grows in woodland to dry sclerophyll forest on sandstone (Harden 2002) ridge-tops, plateaux and upper slopes. Prefers the interface between Lucas Heights and the Hawkesbury and Gymea Soil Landscapes. Commonly associated canopy species are *Corymbia gummifera, Eucalyptus sieberi* and *E. sclerophylla* as well as *E. pauciflora* (NSW National Parks and Wildlife Service 2000a).	Low, study area outside known range and preferred habitat not present
Proteaceae	*Persoonia hirsuta*		E1	E	3Ki	Occurs in central coast and central tableland districts where it grows in woodland to dry sclerophyll forest on sandstone (Harden 2002) and rarely shale (NSW Scientific Committee 1998c). Often occurs in areas with clay influence, in the ecotone between shale and sandstone (James 1997b).	Low, preferred habitat not present

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Proteaceae	*Persoonia mollis ssp. maxima*		E1	E	2E	Restricted to the Hornsby Heights, Mt Colah area north of Sydney. It occurs on sheltered upper hillsides of narrow gullies of Hawkesbury sandstone characterised his by steep sideslopes, rocky benches and broken scarps, with creeks fed by small streams and intermittent drainage depressions. It grows in moist, tall forest (*Angophora costata, Eucalyptus piperita, Corymbia gummifera*), often with warm temperate rainforest influences (*Syncarpia glomulifera, Ceratopetalum apetalum, Callicoma serratifolia*). Sometimes recorded in low densities on the dry upper-hillsides of gullies and in more exposed aspects in association with *E. haemastoma* and *E. punctata* (NSW National Parks and Wildlife Service 2000b).	Low, preferred habitat not present
Proteaceae	*Persoonia nutans*	Nodding Geebung	E1	E	2Ei	Confined to the Cumberland Plain where it grows in Castlereagh Scribbly Gum Woodlands and Agnes Banks Woodlands (Harden 2002; James 1997b; NSW National Parks and Wildlife Service 2001).	Low, preferred habitat not present
Rhamnaceae	*Pomaderris brunnea*		V	V	2V	Confined to the Colo and Upper Nepean Rivers where it grows in open forest (Harden 2000); in western Sydney (Camden to Picton area) known from sandy alluvium on levee and creek banks (James 1997b).	Low, preferred habitat not present
Rubiaceae	*Galium australe*	Tangled Bedstraw	E4			Previously presumed extinct in NSW, this species is now known from a number of sites in coastal regions. In NSW, this species has been recorded in moist gullies of tall forest, *Eucalyptus tereticornis* forest, coastal banksia shrubland, and *Allocasuarina nana* heathland. In other States the species is found in a range of near-coastal habitats, including sand dunes, sand spits, shrubland and woodland (Department of Environment and Conservation 2005; Royal Botanic Gardens 2005).	Low, preferred habitat not present

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Rutaceae	*Zieria involucrata*		E1	V	2Va	Occurs in the Blue Mountains where it grows in wet sclerophyll forest (Harden 2002). Occurs primarily on Hawkesbury sandstone. Also occurs on Narrabeen Group sandstone and on Quaternary alluvium. Found primarily in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest, although some populations extend upslope into drier vegetation. Also known from at least two atypical ridgetop locations. The canopy typically includes *Syncarpia glomulifera* subsp. *glomulifera* (Turpentine), *Angophora costata* (Smooth-barked Apple), *Eucalyptus agglomerata* (Blue-leaved Stringybark) and *Allocasuarina torulosa* (Forest Oak) (Department of Environment and Climate Change 2008b).	Low, preferred habitat not present
Sterculiaceae	*Lasiopetalum joyceae*		V	V	2R	Occurs on lateritic to shaley ridgetops of the Hornsby Plateau where it grows in heath and open woodland in sandy soils on sandstone (Fairley, A. & Moore 2002; Harden 2000; NSW Scientific Committee 1999a).	Low, preferred habitat not present
Thymelaeaceae	*Pimelea curviflora var. curviflora*		V	V		Confined to coastal areas around Sydney where it grows on sandstone and laterite soils. It is found between South Maroota, Cowan, Narrabeen, Allambie Heights, Northmead and Kellyville, but its former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Usually occurs in woodland in the transition between shale and sandstone, often on Lucas Heights soil landscape (Harden 2000; James 1997b; James et al. 1999; NSW Scientific Committee 1998d).	Low, preferred habitat not present
Thymelaeaceae	*Pimelea spicata*		E1	E	3Ei	This species occurs in two disjunct areas: in coastal districts from Lansdowne to Shellharbour, and in Cumberland Plain Woodland inland to Penrith. In western Sydney it grows on Wianamatta Shales in Greybox - Ironbark Woodland with *Bursaria spinosa* and *Themeda australis*. In the Illawarra, it occurs on well structured clay soils in grassland or open woodland (Harden 2000; James 1997b; NSW National Parks and Wildlife Service 2000c).	Low, the study area provide potential habitat for this species. However, it was not recorded during targeted surveys undertaken during its flowering period.

Family Name	*Scientfic Name*	Common Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Likelihood of occurence
Tremandraceae	*Tetratheca glandulosa*		V	V	2V	Occurs from Mangrove Mountain to the Blue Mountains where it grows in sandy or rocky heath or scrub (Harden 1992). Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's Sydney Sandstone Ridgetop Woodland (Map Unit 10ar). Common woodland tree species include: *Corymbia gummifera, C. eximia, Eucalyptus haemastoma, E. punctata, E. racemosa*, and/or *E. sparsifolia*, with an understorey dominated by species from the families Proteaceae, Fabaceae, and Epacridaceae (Department of Environment and Climate Change 2008b).	Low, preferred habitat not present

1: TSC Act - *Threatened Species and Conservation Act 1995*. E1 = Endangered V = Vulnerable E2= Endangered Population

2. EPBC Act - *Environmental Protection and Biodiversity Conservation Act 1999*. E = Endangered V = Vulnerable

3. ROTAP (Rare or Threatened Australian Plants (Briggs & Leigh 1996)) is a conservation rating for Australian plants. Codes are:

1	Species only known from one collection
2	Species with a geographic range of less than 100 km in Australia
3	Species with a geographic range of more than 100 km in Australia
X	Species presumed extinct; no new collections for at least 50 years
E	Endangered species at risk of disappearing from the wild state if present land use and other causal factors continue to operate
V	Vulnerable species at risk of long-term disappearance through continued depletion.
R	Rare, but not currently considered to be endangered.
K	Poorly known species that are suspected to be threatened
C	Known to be represented within a conserved area
a	At least 1,000 plants are known to occur within a conservation reserve(s).
i	Less than 1,000 plants are known to occur within a conservation reserve(s).

4. 'Previously recorded' refers to records of Threatened species that were identified within the locality from the Atlas of NSW Wildlife (Department of Environment and Climate Change 2007a) or Bionet

5. 'Predicted habitat' refers to records of Threatened species that were identified within the locality from the Protected Matters Search Tool (Department of the Environment and Water Resources 2007)

6. Likelihood of Occurrence - High = Recorded during current survey, Medium = Suitable habitat and/or has been previously recorded within the project locality, Low = No suitable habitat and/or has not been recorded within the project locality

Appendix B References

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Appendix C

Threatened species of animal in the locality

Appendix C Threatened animal in the local area

This appendix details the Threatened species of animal that have either been recorded in the local area, or that have the potential to occur, based on the Department of Conservation and Climate Change Atlas of NSW Wildlife (Department of Environment and Climate Change 2007) and the *Environment Protection and Biodiversity Conservation Act 1999* Protected Matters Search Tool (Department of the Environment and Water Resources 2007).

Table C-1 Threatened species of animal previously recorded or predicted to occur in the study area

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
Invertebrates						
Adam's Emerald Dragonfly	*Archaeophya adamsi*	V		Only five adults have ever been collected, and the species is only known from a few sites in the greater Sydney region. Larvae have been found in small creeks with gravel or sandy bottoms, in narrow, shaded riffle zones with moss and rich riparian vegetation (Department of Environment and Climate Change 2008).	Low, preferred habitat not present	Low, preferred habitat not present
Cumberland Plain Land Snail	*Meridolum corneovirens*	E1		Restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River Flat Forest, especially where it meets Cumberland Plain Woodland. It is typically found under logs and other debris, amongst leaf litter and bark around bases of trees. It is also sometimes found under grass clumps and where possible it will burrow into loose soil (NSW National Parks and Wildlife Service 1999b).	High, however, not recorded	Low, preferred habitat not present
Amphibians						
Red-crowned Toadlet	*Pseudophryne australis*	V		Occurs within 160 km of Sydney where it is restricted to Hawkesbury Sandstone. It breeds in deep grass and debris adjacent to ephemeral drainage lines. When not breeding individuals are found scattered on sandstone ridges under rocks and logs (Cogger 2000).	Low, preferred habitat not present	Low, preferred habitat not present
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	Preference for sandstone ridge top habitat and broader upland valleys. Small headwater creeks lines and along slow flowing to intermittent creek lines. They have been observed occupying artificial pond structures such as fire dams, gravel 'borrows', detention basins and box drains that have naturalised over time and are still surrounded by other undisturbed habitat. Do not appear to inhabit areas that have been cleared for agriculture or for urban development. Breed in summer and autumn in burrows in the banks of small creeks. Often spends significant periods of time underground during unfavourable conditions and to avoid detection during the day. (Cogger 2000; NSW National Parks and Wildlife Service 2001a).	Low, preferred habitat not present	Low, preferred habitat not present

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
Green and Golden Bell Frog	*Litoria aurea*	E1	V	The Green and Golden Bell Frog inhabits marshes, dams and stream sides, particularly those containing bullrushes *Typha* spp. or spikerushes Eleocharis spp. Optimum habitat includes water bodies which are unshaded, free of predatory fish *Gambusia holbrooki*, have a grassy area nearby and diurnal sheltering sites available such as vegetation and/or rocks (NSW National Parks and Wildlife Service 1999d).	Low, preferred habitat not present	Low, preferred habitat not present
Heath Frog	*Litoria littlejohn*i	V	V	Distributed along the eastern slopes of the Great Dividing Range from Watagan State Forest near Wyong, south to Buchan in north-eastern Victoria. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude. It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks on high exposed ridges during summer. It is not known from coastal habitats (NSW Scientific Committee 2000).	Low, preferred habitat not present	Low, preferred habitat not present
Stuttering Frog	*Mixophyes balbus*	E1	V	Terrestrial species, found in rainforest, Antarctic beech forest or wet sclerophyll forest. The species depends on freshwater streams and riparian vegetation for breeding and habitation. No records are known from riparian habitat that has been disturbed (Cogger 2000; NSW Scientific Committee 2003).	Low, preferred habitat not present	Low, preferred habitat not present
Giant Barred Frog	*Mixophyes iterates*	E1	E	Terrestrial species which occurs in rainforests, antarctic beech or wet sclerophyll forests. Feeds on insects and smaller frogs (Cogger 2000). The species is associated with permanent flowing drainages, from shallow rocky rainforest streams to slow-moving rivers in lowland open forest. It is not known to utilise still water areas (NSW Scientific Committee 1999). More prevalent at lower altitudes and in larger streams than its congeners, although has been recorded up to 1000 metres asl. (NSW National Parks and Wildlife Service 1999h).	Low, preferred habitat not present	Low, preferred habitat not present
Birds						
Australasian Bittern	*Botaurus poiciloptilus*	V		Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spikerushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in more open territory (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 2002).	Low, preferred habitat not present	Low, preferred habitat not present

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
Bush Stone-curlew	*Burhinus grallarius*	E1		Require sparsely grassed, lightly timbered, open forest of woodland. In southern Australia they often occur where there is a well structured litter layer and fallen timber debris. Feed on a range of invertebrates and small vertebrates, as well as seeds and shoots (NSW National Parks and Wildlife Service 1999a, 2003b).	Low, preferred habitat not present	Low, preferred habitat not present
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V		Occurs in wetter forests and woodland from sea level to an altitude over 2000 metres, timbered foothills and valleys, coastal scrubs, farmlands and suburban gardens (Pizzey & Knight 1997).	Low, preferred habitat not present	Low, preferred habitat not present
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V		Occurs in eucalypt woodland and forest with *Casuarina/Allocasuarina* spp. Characteristically inhabits forests on sites with low soil nutrient status, reflecting the distribution of key *Allocasuarina* species. The drier forest types with intact and less rugged landscapes are preferred by the species. Nests in tree hollows (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 1999c).	Moderate, some suitable habitat present adjacent to subject site.	Low, preferred habitat not present
Brown Treecreeper	*Climacteris picumnus*	V		Occurs in eucalypt woodland and adjoining vegetation. Feeds on ants, beetles and larvae on trees and from fallen timber and leaf litter. Usually nests in hollows (Garnett & Crowley 2000).	Low, preferred habitat not present	Low, preferred habitat not present
Painted Honeyeater	*Grantiella picta*	V		Lives in dry forests and woodlands. Primary food is the mistletoes in the genus *Amyema*, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett & Crowley 2000).	Moderate, some suitable habitat present adjacent to subject site.	Low, preferred habitat not present
Black-tailed Godwit	*Limosa limosa*	V	M	A coastal species found on tidal mudflats, swamps, shallow river margins and sewage farms. Also found inland on larger shallow fresh or brackish waters. A migratory species visiting Australia between September and May (Pizzey & Knight 1997).	Low, preferred habitat not present	Low, preferred habitat not present
Square-tailed Kite	*Lophoictinia isura*	V	M	This species hunts primarily over open forest, woodland and mallee communities as well as over adjacent heaths and other low scrubby habitats in wooded towns. It feeds on small birds, their eggs and nestlings as well as insects. Seems to prefer structurally diverse landscapes (Garnett & Crowley 2000).	Moderate, some suitable habitat present adjacent to subject site.	Low, preferred habitat not present
Turquoise Parrot	*Neophema pulchella*	V		Occurs in the foothills of the great dividing range in eucalypt woodlands and forests with a grassy or sparsely shrubby understorey. Nests in hollows in trees, stumps or even fence posts. It feeds on seeds of both native and introduced grass and herb species (Garnett & Crowley 2000).	Low, preferred habitat not present	Low, preferred habitat not present

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
Superb Fruit-Dove	*Ptilinopus superbus*	V		Occurs in rainforests and fringes, scrubs, mangroves and wooded stream-margins, lantana thickets, isolated figs, pittosporums, lilly pillies and blackberries (Pizzey & Knight 1997).	Low, preferred habitat not present	Low, preferred habitat not present
Speckled Warbler	*Pyrrholaemus sagittatus*	V		Occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies. It feeds on seeds and insects and builds domed nests on the ground (Garnett & Crowley 2000).	Moderate, some suitable habitat present adjacent to subject site.	Low, preferred habitat not present
Diamond Firetail	*Stagonopleura guttata*	V		Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range. Feed on seeds, mostly of grasses (Garnett & Crowley 2000).	Moderate, some suitable habitat present adjacent to subject site.	Low, preferred habitat not present
Freckled Duck	*Stictonetta naevosa*	V	M	In most years this species appear to be nomadic between ephemeral inland wetlands. In dry years they congregate on permanent wetlands while in wet years they breed prolifically and disperse widely, generally towards the coast. In inland eastern Australia, they generally occur in brackish to hyposaline wetlands that are densely vegetated with Lignum (*Muehlenbeckia cunninghamii*) within which they build their nests (Garnett & Crowley 2000).	Low, preferred habitat not present	Low, preferred habitat not present
Masked Owl	*Tyto novaehollandiae*	V		Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett & Crowley 2000).	Low, preferred habitat not present	Low, preferred habitat not present
Sooty Owl	*Tyto tenebricosa*	V		Occurs in wet eucalypt forest and rainforest on fertile soils with tall emergent trees. Typically found in old growth forest with a dense understorey but also occurs in younger forests if nesting trees are present nearby. It nests in large hollows within eucalypts and occasionally caves. It hunts in open and closed forest for a range of arboreal and terrestrial mammals including introduced species and sometimes birds (Garnett & Crowley 2000).	Low, preferred habitat not present	Low, preferred habitat not present

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
White-bellied Sea-Eagle	*Haliaeetus leucogaster*		M	Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs (Pizzey & Knight 1997).	Low, preferred habitat not present	Low, preferred habitat not present
White-throated Needletail	*Hirundapus caudacutus*		M	Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey & Knight 1997).	Low, preferred habitat not present	Low, preferred habitat not present
Swift Parrot	*Lathamus discolour*	E1	EM	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering *Acacia pycnantha*, is indicated. Sites used vary from year to year. (Garnett & Crowley 2000),(Swift Parrot Recovery Team 2001).	Low, preferred habitat not present	Low, preferred habitat not present
Black-chinned Honeyeater	*Melithreptus gularis gularis*	V		Found in dry eucalypt woodland particularly those containing ironbark and box. Occurs within areas of annual rainfall between 400-700 mm. Feed on insects, nectar and lerps (Garnett & Crowley 2000).	Moderate, some suitable habitat present	Low, preferred habitat not present
Rainbow Bee-eater	*Merops ornatus*		M	Usually occur in open or lightly timbered areas, often near water. Breed in open areas with friable, often sandy soil, good visibility, convenient perches and often near wetlands. Nests in embankments including creeks, rivers and sand dunes. Insectivorous, most foraging is aerial, in clearings (Higgins 1999).	Low, preferred habitat not present	Low, preferred habitat not present
Black-faced Monarch	*Monarcha melanopsis*		M	Occurs in rainforests, eucalypt woodlands, coastal scrubs, and damp gullies in rainforest, eucalypt forest and in more open woodland when migrating (Pizzey & Knight 1997 24).	Low, preferred habitat not present	Low, preferred habitat not present
Satin Flycatcher	*Myiagra cyanoleuca*		M	Occurs in heavily vegetated gullies, in forests and taller woodlands. During migration it is found in coastal forests, woodlands, mangroves, trees in open country and gardens (Pizzey & Knight 1997).	Low, preferred habitat not present	Low, preferred habitat not present

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
Powerful Owl	*Ninox strenua*	V		A sedentary species with a home range of approximately 1000 hectares it occurs within open Eucalypt, Casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett & Crowley 2000).	Moderate, some suitable habitat present	Low, preferred habitat not present
Blue-billed Duck	*Oxyura australis*	V	M	Relatively sparse throughout species range. Regularly found breeding in south-east Queensland, north-east South Australia and throughout New South Wales. Found on temperate, fresh to saline, terrestrial wetlands, and occupies artificial wetlands. Prefers deep permanent open water, within or near dense vegetation. Nest in rushes, sedge, *Muehlenbeckia cunnighamii* and paperbark *Melaleuca* (Garnett & Crowley 2000).	Low, preferred habitat not present	Low, preferred habitat not present
Rufous Fantail	*Rhipidura rufifrons*		M	Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Pizzey & Knight 1997).	Low, preferred habitat not present	Low, preferred habitat not present
Painted Snipe	*Rostratula benghalensis*	E1	VM	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as *Eucalyptus camaldulensis* (River Red Gum), *E. populnea* (Poplar Box) or shrubs such as *Muehlenbeckia florulenta* (Lignum) or *Sarcocornia quinqueflora* (Samphire). Feeds at the water's edge and on mudlflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest (Garnett & Crowley 2000).	Low, preferred habitat not present	Low, preferred habitat not present
Regent Honeyeater	*Xanthomyza Phrygia*	E1	EM	Occurs mostly in box-ironbark forests and woodland and prefers the wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with *Casuarina cunninghamiana* and *Amyema cambagei* are important for feeding and breeding. Important food trees include *Eucalyptus sideroxylon* (Mugga Ironbark), *E. albens* (White Box) , *E. melliodora* (Yellow Box) and *E. leucoxylon* (Yellow Gum) (Garnett & Crowley 2000).	Low, preferred habitat not present	Low, preferred habitat not present

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
Mammals						
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	V	C	Usually found in well timbered valleys where it forages on small insects above the canopy. Roosts in caves, old mines, stormwater channels and sometimes buildings and often return to a particular nursery cave each year (Churchill 1998).	Low preferred habitat not present	Low preferred habitat not present
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Occurs in moderately wooded habitats and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. Thought to forage below the forest canopy for small flying insects (Churchill 1998).	Moderate, may forage in study area, however roosting habitat not present	Low preferred habitat not present
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold (NSW National Parks and Wildlife Service 1999h). Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods (NSW National Parks and Wildlife Service 1999f, 1999h).	Low preferred habitat not present	Low preferred habitat not present
Eastern Freetail-bat	*Mormopterus norfolkensis*	V		Thought to live in sclerophyll forest and woodland. Small colonies have been found in tree hollows or under loose bark. It feeds on insects above the forest canopy or in clearings at the forest edge (Churchill 1998).	High, preferred habitat present	Low preferred habitat not present
Large-footed Myotis	*Myotis adversus*	V		Colonies occur in caves, mines, tunnels, under bridges and buildings. Colonies always occur close to bodies of water where this species feeds on aquatic insects (Churchill 1998).	Low preferred habitat not present	Low preferred habitat not present
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E1	V	Occurs in inland and sub-coastal south eastern Australia where it inhabits rock slopes. It has a preference for rocks which receive sunlight for a considerable part of the day. Windblown caves, rock cracks or tumbled boulders are used for shelter. Occur in small groups or "colonies" each usually separated by hundreds of metres (NSW National Parks and Wildlife Service 2003a).	Low preferred habitat not present	Low preferred habitat not present

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
Long-nosed Potoroo	*Potorous tridactylus*	V	V	Disjunct distribution along coastal south-east Australia from near Gladstone in Queensland, to south-west Victoria and in Tasmania. Found from sea level up to 1500 metres in altitude generally in areas with rainfall greater than 760 millimetres. In NSW, it is found throughout coastal and subcoastal areas. Occurs in a range of habitats: coastal forest and woodland with a moderately dense heathy understorey, dense coastal scrubs or heath, wet and dry sclerophyll forest and sub-tropical, warm temperate and cool temperate rainforest of the eastern slopes and highlands. Often associated with gullies and forest ecotones. Open areas are used for foraging while areas of dense groundcover or understorey provide areas for shelter and protection from predators. Relatively thick ground cover is a major habitat requirement and it seems to prefer areas with light sandy soils. Feeds at dusk on roots, tubers, fungi, insects and their larvae and other soft bodied animals in the soil. Moves up and down slope as food resources become seasonally available (Johnston 1995; NSW National Parks and Wildlife Service 1999h).	Low preferred habitat not present	Low preferred habitat not present
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. Feeds on the flowers and nectar of eucalypts and native fruits including lilly pillies. It roosts in the branches of large trees in forests or mangroves (Churchill 1998; NSW National Parks and Wildlife Service 2001b).	Moderate, likely to fly over site. Limited feeding and roosting habitat within study area	Low preferred habitat not present
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	V		Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts in tree hollows. Thought to be a migratory species (Churchill 1998).	High, preferred habitat present	Low preferred habitat not present
Eastern Quoll	*Dasyurus viverrinus*	E1		Found in a variety of habitats including dry sclerophyll forest, scrub, heathland and cultivated land. Lives in dens wich consist of several chambers including underground burrows, hollow logs, rock piles and hay sheds (Strahan 1995).	Low preferred habitat not present	Low preferred habitat not present
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V		Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings. Forages within the canopy of dry sclerophyll forest. It prefers wet habitats where trees are more than 20 metres high (Churchill 1998).	Low preferred habitat not present	Low preferred habitat not present

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
Yellow-bellied Glider	*Petaurus australis*	V		Restricted to tall, mature eucalypt forest in high rainfall areas of temperate to sub-tropical eastern Australia. Feeds on nectar, pollen, the sap of eucalypts and sometimes insects. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide helter and nesting hollows and year round food resources are available from a mixture of eucalypt species (NSW National Parks and Wildlife Service 1999i, 2003d).	Low preferred habitat not present	Low preferred habitat not present
Squirrel Glider	*Petaurus norfolcensis*	V		Found in dry sclerophyll forest and woodland but not found in dense coastal ranges. Nests in hollows and feeds on gum of acacias, eucalypt sap and invertebrates (NSW National Parks and Wildlife Service 1999g).	Low preferred habitat not present	Low preferred habitat not present
Koala	*Phascolarctos cinereus*	V		Found in sclerophyll forest. Throughout New South Wales, Koalas have been observed to feed on the leaves of approximately 70 species of eucalypt and 30 non-eucalypt species. However, in any one area, Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW include Forest Red Gum Eucalyptus tereticornis, Grey Gum E. punctata, Monkey Gum E. cypellocarpa and Ribbon Gum E. viminalis. In coastal areas, Tallowwood E. microcorys and Swamp Mahogany E. robusta are important food species, while in inland areas White Box E. albens, Bimble Box E. populnea and River Red Gum E. camaldulensis are favoured (NSW National Parks and Wildlife Service 1999e, 2003c).	Low preferred habitat not present	Low preferred habitat not present
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V		The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Typically it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill 1998).	High, preferred habitat present	Low, preferred habitat not present
Reptiles						
Broad-headed Snake	*Hoplocephalus bungaroides*	E1	V	A nocturnal species that occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer (Webb, J.K. & Shine 1994; Webb, J.K & Shine 1998).	Low, preferred habitat not present	Low, preferred habitat not present

Common Name	*Latin Name*	TSC Act[1]	EPBC Act[2]	Habitat	Likelihood of occurrence[5]	Within non-certified areas
Heath Monitor	*Varanus rosenbergi*	V		Found in coastal heaths, humid woodlands, wet and dry sclerophyll forests. Mostly a terrestrial species it shelters in burrows, hollow logs and rock crevices (Cogger 2000).	Low, preferred habitat not present	Low, preferred habitat not present

Notes:

1. P= Protected, V= Vulnerable, E1 = Endangered, (*Threatened Species Conservation Act 1995*)

2. V = Vulnerable, E = Endangered, M = Migratory, C = Conservation Dependent (*Environment Protection and Biodiversity Conservation Act 1999*)

3. 'Previously recorded' refers to records of Threatened species that were identified within the locality from the Atlas of NSW Wildlife (Department of Environment and Climate Change 2007).

4. 'Predicted habitat' refers to records of Threatened species that were identified within the locality from the Protected Matters Search Tool (Department of the Environment and Water Resources 2007).

5. Likelihood of Occurrence - High = Recorded during current survey, Medium = Suitable habitat and/or has been previously recorded within the project locality, Low = No suitable habitat and/or has not been recorded within the project locality

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Appendix D

Commonwealth Assessment of significance

Cumberland Plain Woodland

Status

Cumberland Plain Woodland is currently listed as an Endangered Ecological Community under the *Threatened Species Conservation Act 1995* and under the *Environment Protection and Biodiversity Conservation Act 1999.* However, on 21 November 2008, the NSW Scientific Committee, established under the TSC Act, made a preliminary determination to list Cumberland Plain Woodland in the Sydney Basin Bioregion (which includes the North West Growth Centre) as a 'critically endangered ecological community' (NSW Scientific Committee 2008). This preliminary determination was on public exhibition until 23 January 2009. A final Determination is yet to be made by the Scientific Committee.

Description

Two forms of Cumberland Plain Woodland have been classified: Shale Hills Woodland and Shale Plains Woodland. Shale Hills Woodland occurs mainly on the elevated and sloping southern half of the Cumberland Plain. The dominant canopy trees include Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*E. tereticornis*) and Narrow-leaved Ironbark (*E. crebra*). It has a shrub layer dominated by Blackthorn (*Bursaria spinosa*), with other shrubs, such as *Acacia implexa*, *Indigofera australis* and *Dodonaea viscosa* ssp. *cuneata*.

Shale Plains Woodland is the most widely distributed form of Cumberland Plain Woodland. The canopy is dominated by trees such as Grey Box (*E. moluccana*), Forest Red Gum (*E. tereticornis*), Spotted Gum (*Corymbia maculata*) and Thin-leaved Stringybark (*E. eugenioides*). *Bursaria spinosa* is the dominant species of shrub.

The diverse understorey layer is similar for both forms of Cumberland Plain Woodland. It is common to find grasses, such as Kangaroo Grass (*Themeda australis*), Weeping Meadow Grass (*Microlaena stipoides* var *stipoides*) and herbs, such as Kidney Weed (*Dichondra repens*), Blue Trumpet (*Brunoniella australis*) and Slender Tick-trefoil (*Desmodium varians*).

Habitat and ecology

This community occurs on soils derived from Wianamatta Shale, and throughout the driest part of the Sydney Basin. It is well adapted to drought and fire, and the understorey plants often rely on underground tubers or profuse annual seed production to survive adverse conditions

The common shrub blackthorn is excellent bird habitat and provides food for a wide range of insects. Cumberland Plain Woodland is habitat for Threatened species such as the Pink Pimelea (*Pimelea spicata*) and the Cumberland Land Snail (*Meridolum corneovirens*).

Distribution

Before European settlement, the community was extensive across the Cumberland Plain. Today, only 9% of the original extent remains intact, with the remnants scattered widely across the Cumberland Plain.

Cumberland Plain Woodland occurs in an area bounded by Scheyville (north), Penrith (west), Parramatta (east) and Thirlmere (south). Cumberland Plain Woodland occurs in the Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly local government areas.

It occurs in conservation reserves including:

- Scheyville National Park
- Mulgoa Nature Reserve
- Windsor Downs Nature Reserve
- Leacock Regional Park.

Threats

Recognised threats to this species include:

- Clearing for urban or rural development, and the subsequent impacts from fragmentation.
- Grazing and mowing, which stops regrowth of the community.
- Inappropriate water run-off entering the site, which leads to increased nutrients and sedimentation.
- Weed invasion, particularly by African lovegrass, African olive, bridal veil creeper and Rhodes grass.
- Inappropriate fire regimes, which have altered the appropriate floristic and structural diversity.

Key threatening processes that affect this community include:

- clearing of native vegetation
- invasion of native plant communities by exotic perennial grasses
- predation, habitat destruction, competition and disease transmission by feral pigs
- human-induced climate change
- Invasion and establishment of exotic vines and scramblers
- high frequency fire
- removal of dead wood and trees
- *Lantana camara*.

What needs to be done to recover this species?

A recovery plan is being developed for Cumberland Plain vegetation and guidelines have been developed to aid in management of vegetation on the Cumberland Plain (Department of Environment and Climate Change 2008b).

Sixteen specific priority actions have been identified for the recovery of Cumberland Plain Woodland (refer Table 1).

Table 1 Priority recovery actions for *Cumberland Plain Woodland*

Recovery actions	Priority
Management of Endangered Ecological Communities is to be included in school environmental management plans where the school land contains Endangered Ecological Communities.	Medium
Management of Endangered Ecological Communities to be included in the conditions for Crown land trusts, lease and licence holders.	Medium
Prepare and implement community awareness, education and involvement strategy.	Medium

Recovery actions	Priority
Support community conservation by providing nursery or other facilities, for regeneration activities.	Low
Local Government prepare plans of management in accordance with the Local Government Act for reserves containing Endangered Ecological Communities, which have conservation as a primary objective, or where conservation is compatible.	High
Promote best practice management guidelines.	Medium
Incorporate consideration of Endangered Ecological Community protection in regional open space planning.	High
Encourage planning authorities to address Endangered Ecological Communities in development of environmental planning instruments and, where possible, seek biodiversity certification.	Medium
Manage, to best practice standards, areas of Endangered Ecological Communities which have conservation as a primary objective, or where conservation is compatible. Priorities are to be based on DEC conservation significance assessment.	High
Encourage and promote best-practice management of Endangered Ecological Communities on private land.	Medium
Ensure the consideration of impacts on Endangered Ecological Communities when enforcing noxious weed or pest species control in Endangered Ecological Communities.	Medium
Develop and implement Cumberland Plain Reservation Strategy and create a protected bushland network through targeted land acquisition as land becomes available.	High
Public authorities will promote management agreements to landholders through their ongoing land use planning activities.	Medium
Investigate the preparation of a recommendation for the declaration of critical habitat.	Low
Investigate the development of a regular monitoring program to assess the change in extent of vegetation across the Cumberland Plain.	Medium
Finalise the multi- Endangered Ecological Community recovery plan as a State priority in accordance with contractual obligations with Department of the Environment, Water, Heritage and the Arts, by July 2007.	Medium
Liaise with institutions to facilitate research relevant to the recovery of Cumberland Plain Endangered Ecological Communities.	Low

Source: (Department of Environment and Climate Change 2008c)

Specific measures to help recover this community include:

- Promote public involvement in restoration activities.
- Apply necessary fire regimes to maintain the community's appropriate floristic and structural diversity.
- Protect habitat by minimising further clearing of the community. This requires recognition of the values of all remnants of the community in the land use planning process, particularly development consents, rezonings and regional planning.
- Promote regeneration by avoiding mowing or prolonged or heavy grazing.
- Protect habitat by controlling run-off entering the site if it would change water, nutrient or sediment levels or cause erosion.
- Weed control.
- Undertake restoration including bush regeneration and revegetation.

Site specific impacts

Remnants of Cumberland Plain Woodland within the study area were in poor condition and generally consisted of isolated trees. Most patches lacked a shrub layer and the ground cover was generally dominated by introduced grasses, herbs and vines.

Seven small patches of this community occur within the rail easement and adjoining areas and would be removed as a result of the project:

- three small patches to the south of Schofields Station
- four patches to north of Quakers Hill Station.

A total of 1.34 ha of Cumberland Plain Woodland would be cleared for the project

Photo 1 Cumberland Plain woodland within the rail corridor

Mitigation measures

- Protect community by preventing access of workers, equipment and vehicles to areas of Cumberland Plain Woodland occurring adjacent to the subject site. These areas of would be clearly identified through fencing and signs.
- Ensure that no stockpiles are located in areas adjacent to remnant Cumberland Plain Woodland.
- Ensure that environmental inductions are provided to all workers prior to commencing work.
- Implement erosion controls.
- Clean equipment, clothes and boots of seeds and soil prior to entering areas adjacent to remnant Cumberland Plain Woodland.
- Revegetate cleared areas and undertake weed control following completion of works.

Significance Assessment - *Environment Protection and Biodiversity Conservation Act 1999*

Is the action likely to lead to a long-term adverse affect on an ecological community?

The vegetation within the site is in poor to moderate condition and is subject to ongoing threats including weed invasion. The proposal would include clearing of approximately 1.34 ha of this modified vegetation. Land clearance is listed as a Key Threatening Processes under the *Environment Protection and Biodiversity Conservation Act 1999* and is considered a major threat to this community. The clearing of seven small, degraded patches, (totalling approximately 1.34 ha) is however unlikely to pose a significant threat to the long-term survival of this community.

The proposal would not increase fragmentation or isolation of this community as the affected areas of Cumberland Plain Woodland are either within the existing railway corridor or immediately adjacent.

The proposal is unlikely to have a long term adverse affect on this community or its recovery.

Is the action likely to reduce the extent of a community?

Regionally, compared to estimates of areal extent prior to 1750, there is considered to be only about 14% of Cumberland Plain Woodland (Shale Plains Woodland and Shale Hills Woodland) remaining.

Cumberland Plain Woodland within the site occurs as small isolated remnants that are in poor condition and are subject to ongoing threats including weed invasion. The proposal would require clearing of seven small linear patches of isolated and degraded woodland (totalling 1.34 ha). There is approximately 9760 hectares of this community remaining (NSW National Parks and Wildlife Service 2002a). The removal of 1.34 ha of degraded and fragmented vegetation is not considered a significant area and would be unlikely to reduce the extent of the community, such that its long term survival is threatened.

Is the action likely to fragment an occurrence of the community?

The affected areas of Cumberland Plain Woodland are within the existing railway corridor or immediately adjacent. Therefore, the proposal will not further fragment or isolate this community.

Is the action likely to adversely affect habitat critical to the survival of an ecological community?

Cumberland Plain Woodland within the site occurs as small isolated patches within or adjacent to the existing railway line. Approximately 1.34 ha would be directly affected by the proposal. This vegetation is in poor condition is subject to ongoing threats including weed invasion. These patches are mapped as “other remnant vegetation” by the *Final Native Vegetation Mapping of the Cumberland Plain, Western Sydney* (NSW National Parks and Wildlife Service 2002a, 2002b) and is unlikely to be critical to the long-term survival of this community.

Is the action likely to modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival?

The proposal will include up to 1.34 ha clearing of this modified native vegetation. Within this very limited area, the proposal will destroy the abiotic factors necessary for the community’s survival. However, these areas are unlikely to be necessary for the community’s survival.

Is the action likely to result in invasive species that are harmful to the critically endangered or endangered community becoming established in an occurrence of the community?

In comparison to adjacent native vegetation, the rail corridor has relatively high weed levels. Increase in weed invasion may be promoted by activities related to the proposal, however proposed mitigation conditions should minimise this potential threat.

Is the action likely to interfere with the recovery of an ecological community?

There is currently no recovery plan for this community. The proposal would include clearing of seven small remnants (totalling 1.34 ha) of degraded Cumberland Plain Woodland. This vegetation cannot be considered important for the long-term survival of the community and its removal is unlikely to significantly interfere with the recovery of this community.

Conclusion

Cumberland Plain Woodland occurs as several small, isolated and degraded remnants within the site and adjacent areas. The proposal would require 1.34 ha of this degraded woodland to be cleared. This is unlikely to have a significant impact on the long term survival of Cumberland Plain Woodland or its recovery.

Pultenaea parviflora

Status

Pultenaea parviflora is listed as Endangered under the *Threatened Species Conservation Act 1995* and Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999.* It has a conservation rating of 2E (Briggs & Leigh 1996) meaning that it has a geographic range of less than 100 km in Australia and is an endangered species at risk of disappearing from the wild state if present land use and other causal factors continue to operate (Briggs & Leigh 1996).

Description

Usually a small erect branching shrub up to 1.8 m tall. Leaves are alternate, narrow- to broad-obovate to cuneate, 2-6 mm long, 1-1.5 mm wide, apex obtuse to slightly notched, strongly recurved.

Flowers occur towards the ends of the branchlets, and are 5 - 7 mm long, yellow and pea-like with reddish markings, single. Ovary hairy only at apex. The pod is usually 5 mm long, turgid (Department of Environment and Conservation 2007; Royal Botanic Gardens 2007).

Surveys for this species can be undertaken any time throughout the year but best when flowering, which peaks in September (Department of Environment and Conservation 2007).

Habitat

This species grows in dry sclerophyll forest on Wianamatta Shale, laterite or alluvium, Cumberland Plain (Royal Botanic Gardens 2007). It may be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. It can also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.

The dominant canopy is usually *Eucalyptus fibrosa* however *Eucalyptus globoidea, E. longifolia, E. parramattensis, E. sclerophylla* and *E. sideroxylon* may also be present or co-dominant, with *Melaleuca decora* frequently forming a secondary canopy layer.

Associated species may include *Allocasuarina littoralis, Angophora bakeri, Aristida* spp. *Banksia spinulosa, Cryptandra* spp*., Daviesia ulicifolia, Entolasia stricta, Hakea sericea, Lissanthe strigosa, Melaleuca nodosa, Ozothamnus diosmifolius* and *Themeda australis*.

It is often found in association with other threatened species such as *Dillwynia tenuifolia, Dodonaea falcata, Grevillea juniperina, Micromyrtus minutiflora, Persoonia nutans* and *Styphelia laeta* (Department of Environment and Conservation 2007).

Critical habitat has not yet been declared for *P. parviflora.*

Ecology

Flowering may occur between August and November depending on environmental conditions. Benson & McDougall (1996) recorded peak flowering to occur in September with seed ripening in December. Pollinators are unknown. Seeds are hard coated and are persistent in the soil seed bank. Dispersal is likely to be localised and ants are the probable vectors.

Current estimates are that reproductive maturity is not reached for 3-4 years, with peak reproduction reached at 5-6 years. It is killed by fire and re-establishes from soil-stored seed. There is no evidence of vegetative spread (Department of Environment and Climate Change 2008c). The lifespan of *P. parviflora* is believed to be approximately 20 years. Germination is prolific after a moderate to high intensity fire. In open areas, the P. parviflora population is likely to persist as the dominant undershrub, in other areas (scrubby or in areas which may develop a dense secondary canopy) the species may retreat to the soil seedbank with only a few scattered individuals present (NSW National Parks and Wildlife Service 2002c).

It may be locally abundant, with populations of *P. parviflora* containing between 10 and 5000+ individuals. Abundance is influenced by past disturbance history, such as fire. The population structure of *P. parviflora* across its range is varied (seedlings through to senescence) and is also linked to disturbance history (Department of Environment and Climate Change 2008c).

Distribution

Endemic to the Cumberland Plain, its core distribution is from Windsor to Penrith and east to Dean Park. Outlier populations occur at Kemps Creek and Wilberforce (Royal Botanic Gardens 2007).

Recorded occurrences in conservation reserves include:

- Scheyville National Park
- Windsor Downs
- Castlereagh Nature Reserves
- the proposed ADI Regional Park (Department of Environment and Climate Change 2008c)
- Agnes Banks Nature Reserve (Department of Environment and Climate Change 2008a).

Threats

Recognised threats to this species include:

- clearance and fragmentation of habitat for residential, industrial and rural purposes
- inappropriate fire regimes
- uncontrolled vehicular access
- fill and rubbish dumping
- weed invasion (Department of Environment and Climate Change 2008c).
- urban runoff
- grazing and trampling (NSW National Parks and Wildlife Service 2004)
- Changes in vegetation structure resulting in competition from monospecific regrowth (e.g. *Allocasuarina littoralis* or *Melaleuca* spp.) following partial clearance (e.g. removal or thinning of the canopy) or frequent fires (NSW National Parks and Wildlife Service 2002c).

Key threatening processes are listed under the NSW *Threatened Species Conservation Act 1995*. The following are relevant to this species:

- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition - P. parviflora is fire sensitive and is therefore vulnerable to high frequency fire.
- Clearing of native vegetation.

What needs to be done to recover this species?

No recovery plans have been developed for this species; however, six priority actions have been identified for the recovery of this species (refer Table 2).

Specific measures to help recover this species include:

- having fire intervals of 10-15 yrs (where there are no needs for asset protection zones)
- protecting areas of known and potential habitat from clearing and further fragmentation (Department of Environment and Climate Change 2008c).

Table 2 Priority recovery actions for *Pultenaea parviflora*

Recovery actions	Priority
Liaise with private landholders priority sites, to encourage the preparation of site management plans and the implementation of appropriate threat abatement measures.	Low
Identify priority sites for conservation actions on private lands.	Medium
Monitor known population for changes in status and operation of threats.	Low
[Threat management] Ensure plans of management for national parks, community lands and other public lands include appropriate actions for species' protection as a result of outcomes from Action 8.	Medium
Conduct research into pollinators of the species.	Low
Identify and survey potential habitat, to detect new populations.	Low

Source: (Department of Environment and Climate Change 2008c)

Site specific impacts

A total of 66 *Pultenaea parviflora* plants have been recorded within the study area including:

- 12 mature plants within the easement, to the west of existing rail and south of the proposed Vineyard Station
- 54 plants (17 seedlings and 37 mature) between the rail corridor and Riverstone Parade (between Norwood Road and Camberwell Road).

The project would result in:

- the clearing of approximately 47 plants (17 seedlings and 28 mature plants) for the proposed bus interchange
- fragmentation of the population (with 2 plants occurring to the north of the proposed interchange and 7 to the south)
- possible indirect impacts to the remaining plants as a result of increased edge effects, fragmentation and isolation.

Twelve plants occurring within the rail corridor would be retained.

Photo 1 Plants and habitat within the rail corridor to be retained

Photo 2 Habitat adjacent to Riverstone Parade

Mitigation measures

- Protect habitat by minimising clearing and access of workers to areas of potential habitat during construction through fencing or clear delineation of extent of work space.
- Prevent access of workers and equipment to areas containing this species through fencing.
- Ensure that no stockpiles are located in areas adjacent to the population or its habitat.
- Ensure that environmental inductions are provided to all workers prior to commencing work.

- Implement erosion controls.
- Clean equipment, clothes and boots of seeds and soil prior to entering site.
- Revegetate cleared areas and undertake weed control following completion of works.

Significance Assessment - *Environment Protection and Biodiversity Conservation Act 1999*

Under the *Environment Protection and Biodiversity Conservation Act 1999*, important populations are:

- likely to be key source populations either for breeding or dispersal

The population within the study area is fragmented and isolated, occurring within a narrow strip within the rail easement and in a narrow strip between the rail corridor and Riverstone Parade. As such, this population is unlikely to be key source population.

- likely to be necessary for maintaining genetic diversity

Pultenaea parviflora populations vary from 10 and 5000+ plants. Given its relatively small population size (66 plants) and disturbed and fragmented habitat within the study area, this population is unlikely to be necessary for maintaining genetic diversity.

- at or near the limit of the species range

Pultenaea parviflora's core distribution is from Windsor to Penrith and east to Dean Park and as such the site is not at or near the limit of distribution of this species.

As such, the population within the site is not considered to be important.

Is the action likely to lead to a long-term decrease in the size of an important population?

No. The site does not contain an important population (as outlined above).

Is the action likely to reduce the area of occupancy of the species, or reduce the area of occupancy of an important population?

No. The site does not contain an important population (as outlined above).

Is the action likely to fragment an existing important population into two or more populations?

No. The site does not contain an important population (as outlined above).

Is the action likely to adversely affect habitat critical to the survival of a species?

This species can be locally abundant and populations of *P. parviflora* contain between 10 and 5000+ individuals. The population within the study area consists of 66 plants within small fragmented patches. This habitat is not likely to be critical to the survival of the species.

Is the action likely to disrupt the breeding cycle of an important population?

No. The site does not contain an important population (as outlined above).

Is the action likely to modify, destroy, remove, isolate or decrease the availability or quality of habitats to the extent that the species is likely to decline?

The project would permanently remove approximately 47 plants and 260m^2 of habitat. Approximately 200 ha of habitat would be retained. This clearing would also result in fragmentation of the remaining population. Populations of this species vary from 10 to more than 5000 plants (NSW National Parks and Wildlife Service 2004), and as such, this population is considered to be relatively small.

Mitigation measures would be implemented to minimise impacts to the habitat of this species including:

- fencing the population and its habitat to prevent access and accidental damage by workers, machinery or vehicles
- providing environmental inductions to all staff prior to commencing work
- weed control measures including cleaning equipment, vehicles, clothing and shoes prior to commencing work in the vicinity of the site
- ensuring stockpiles and equipment emplacement is not in the vicinity of the population
- monitoring of population and its habitat.

There are approximately 400 records of *Pultenaea parviflora* (Department of Environment and Climate Change 2008a) including within conservation reserves in the vicinity (Scheyville National Park; Windsor Downs, Castlereagh and Agnes Banks Nature Reserves). The plants to be removed occur within a narrow, disturbed and weed infested strip between the railway corridor and Riverstone Parade. Small populations in highly insecure, disturbed and weed impacted locales such as roadsides are likely to be non-viable (NSW National Parks and Wildlife Service 2004).

Where a population is small and non-viable, and where adequate representative reservation occur within the vicinity, that area of habitat can be considered insignificant (NSW National Parks and Wildlife Service 2004). As such, the habitat within the subject site is likely to be insignificant and due to the large number of records including within nearby conservation reserves, the removal of part of this population is unlikely to result in the decline of the species.

Is the action likely to result in invasive species that are harmful to the vulnerable species becoming established in the vulnerable species' habitat?

The habitat is in moderate condition and further weed invasion in this area may threaten the viability of the population and its habitat. Provided appropriate mitigation measures are followed during construction it is unlikely that the project would increase weed invasion within the study area. Mitigation measures would include:

- cleaning equipment, vehicles, clothing and shoes prior to commencing work in the vicinity of the site
- fencing the remaining population and its habitat to prevent access and accidental damage by workers, machinery or vehicles
- providing environmental inductions to all staff prior to commencing work
- ensuring stockpiles and equipment emplacement is not in the vicinity of the population
- monitoring of population and its habitat.

Is the action likely to introduce disease(s) that may cause the species to decline?

There are no known transmissible diseases, or vectors of disease, likely to be introduced by the Project that would significantly affect P. parviflora, and disease is not listed as one of the key threatening processes for this species (NSW National Parks and Wildlife Service 2004). Provided appropriate mitigation measures such as the cleaning of equipment, vehicles, clothing and shoes prior to commencing work in the vicinity of the site are followed during construction, it is unlikely that the project would result in the introduction of disease that may cause the species to decline.

Is the action likely to interfere with the recovery of the species?

Specific measures to help recover this species identified by the Department of Environment and Climate Change include:

- having fire intervals of 10-15 yrs (where there are no needs for asset protection zones)
- protecting areas of known and potential habitat from clearing and further fragmentation (Department of Environment and Climate Change 2008c).

A total of 66 plants were recorded within the study area, 12 within the rail corridor and 54 between the rail corridor and Riverstone Parade. Approximately 47 plants and 260m^2 of habitat would be removed. Approximately 200m^2 of habitat would be retained.

Populations of this species vary from 10 to more than 5000 plants (NSW National Parks and Wildlife Service 2004), and as such, this population is considered to be relatively small.

There are approximately 400 records of *Pultenaea parviflora* (Department of Environment and Climate Change 2008a) including within conservation reserves in the vicinity (Scheyville National Park; Windsor Downs, Castlereagh and Agnes Banks Nature Reserves). The plants to be removed occur within a narrow, disturbed and weed infested strip between the railway corridor and Riverstone Parade. Small populations in highly insecure, disturbed and weed impacted locales such as roadsides are likely to be non-viable (NSW National Parks and Wildlife Service 2004).

Where a population is small and non-viable, and where adequate reservation occurs within the vicinity, that area of habitat can be considered insignificant (NSW National Parks and Wildlife Service 2004). As such, the removal of this habitat and part of this population is unlikely to interfere substantially with the recovery of this species.

Conclusion

The project would include loss of 47 *Pultenaea parviflora* plants and 260m^2 of habitat. Approximately 200m^2 of habitat would be retained.

Populations of this species vary from 10 to more than 5000 plants (NSW National Parks and Wildlife Service 2004), and as such, this population is considered to be relatively small. Due to the small size, high weed invasion, isolation and disturbed nature of the habitat and number of populations in the vicinity (including within conservation reserves) the removal of this habitat and part of the population is unlikely to have a significant impact on this species or its recovery.

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Appendix E

Assessment of significance

Contents

List of tables

E1. Appendix E Introduction

Projects assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* consider the significance of impacts on biodiversity following the heads of consideration detailed in the draft *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation 2005a), including assessment of the significance of the impacts relative to the conservation importance of the habitat, individuals and populations likely to be affected.

For this Project however, the majority of the study area is located within the North West Growth Centre identified in the Growth Centres SEPP and biodiversity certification has been granted over this area. The majority of the study area has been certified, and therefore these areas should require no further threatened species assessment under the TSC Act.

However, a precautionary approach was taken and for the areas subject to biodiversity certification, significance assessments following the draft *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation 2005a) were conducted for threatened species that had a moderate or greater likelihood of occurring within the study area.

Table E- 1-1 provides a summary of the Threatened biodiversity for which significance have been completed. Microchiropteran bats and woodland birds have been assessed as a group because of their similarity of habitats, habits and potential impacts.

Table E- 1-1 Summary of impact assessments for Threatened species listed under the TSC Act

Species or community	Conservation Status		Likely to be significantly affected
	State [1]	National [2]	
Cumberland Plain Woodland	E	E	**No**
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	E	-	No
Pultenaea parviflora	E	V	No
Dillwynia tenuifolia	V	V	No
Micromyrtus minutiflora	E	-	No
Pimelia spicata	E	E	No
Grevillea juniperina subsp *juniperina*	V	-	No
Cumberland Plain Land Snail (*Meridolum corneovirens*)	E	-	No
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	V	-	No
Painted Honeyeater (*Grantiella picta*)	V	-	No
Square-tailed Kite (*Lophoictinia isura*)	V	-	No
Speckled warbler (*Prryholaemus sagittatus*)	V	-	No
Diamond Firetail (*Stagonopleura guttata*)	V	-	No
Black-chinned Honeyeater (*Melithreptus gularis gularis*)	V	-	No

Species or community	Conservation Status		Likely to be significantly affected
	State [1]	National [2]	
Powerful Owl (*Ninox strenua*)	V	-	No
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	No
Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)	V	-	No
Large-eared Pied Bat (*Chalinolobus dweryi*)	V	V	No
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V	-	No
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	No

1. State conservation status: V= Vulnerable, E = Endangered, (*Threatened Species Conservation Act 1995*).

2. National conservation status: V = Vulnerable, E = Endangered, CE, Critically Endangered (*Environment Protection and Biodiversity Conservation Act 1999*)

E2. Cumberland Plain Woodland

E2.1 Cumberland Plain Woodland profile

Cumberland Plain Woodland is listed as endangered under both the *Threatened Species Conservation Act 1995* and the *Environmental Protection and Biodiversity Conservation Act 1999*. Cumberland Plain Woodland also has a preliminary listing as a Critically Endangered ecological community under the TSC Act (NSW Scientific Committee 2008).

A full profile of this community and priority recovery actions (listed in Table 1) is provided in Appendix D.

E2.2 Cumberland Plain Woodland state significance assessment

This assessment is based on the removal of 1.34 ha of Cumberland Plain Woodland as a result of the Project.

Within the study area this community occurs as seven small, isolated and degraded patches. Approximately 1.34 ha of Cumberland Plain Woodland will be directly affected by the project, all of which occurs within the certified areas of the North West Growth Centre.

Cumberland Plain Woodland within the study area generally consisted of isolated trees including *Eucalyptus crebra, E. moluccana* and *E. tereticornis* regrowth with few large remnant trees providing less than 10% canopy cover. Some remnants also had small trees in the sub-canopy such as *Melaleuca decora* and *Exocarpos cupressiformis.*

The best quality patches observed were located within the Department of Defence lands north of Quakers Hill Station where the ground cover was largely dominated by native understorey species. Most patches within the study area lacked a shrub layer, although some areas contained isolated native shrubs. The ground cover was generally dominated by introduced grasses, herbs and vines, however, also included native species.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable to a Threatened ecological community.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the clearing of 1.34 ha of Cumberland Plain Woodland, occurring as seven small, isolated and degraded remnants. The vegetation which to be removed from within the site is in poor to moderate condition and is subject to ongoing threats including weed invasion.

The Project is unlikely to result in the introduction of new edge effects as the community is already highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities. Additional clearing is unlikely to result in any areas being introduced to new edge effects.

Construction activities have the potential to result in conditions that favour the establishment and proliferation of weeds as a result of exposed soil and stockpiles. The control of weeds will be managed however through the construction environmental management plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable to a Threatened ecological community.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the current disturbance regimes of the Cumberland Plain Woodland. The Project is unlikely to modify the intensity or frequency of fires or the flooding flows in the Cumberland Plain Woodland habitat.

How is the proposal likely to affect habitat connectivity?

Cumberland Plain Woodland within the study area occurs as seven small, isolated patches. These occur within a highly disturbed and fragmented landscape.

The Project is not likely to increase fragmentation or isolation of this community as the affected areas of Cumberland Plain Woodland occur as small isolated patches either within the existing railway corridor or immediately adjacent.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for Cumberland Plain Woodland under the *Threatened Species Conservation Act 1995*. The habitat within the study area is not considered to be critical to the survival of Cumberland Plain Woodland due to its small size, low diversity and high weed invasion. As such it is considered that the habitat to be removed does not warrant protection as critical habitat.

Conclusion

Cumberland Plain Woodland occurs as several small, isolated and degraded remnants within the site and adjacent areas. The Project would require 1.34 ha of this degraded woodland to be cleared. This is unlikely to have a significant impact on the long term survival of Cumberland Plain Woodland.

E3. River-Flat Eucalypt Forest on Coastal Floodplains

E3.1 River-Flat Eucalypt Forest on Coastal Floodplains profile

Conservation status

River-Flat Eucalypt Forest on Coastal Floodplain of the NSW North Coast, Sydney Basin and South East Corner bioregions is listed as an Endangered Ecological Community under the *Threatened Species Conservation Act 1995*. This ecological community is not listed under the *Environment Protection and Biodiversity Conservation Act 1999.*

Description

River-Flat Eucalypt Forest on Coastal Floodplains is a variable community consisting of a tall open tree layer of eucalypts associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically these forests and woodlands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water.

River-Flat Eucalypt Forest on Coastal Floodplains is distinguished from other floodplain Threatened ecological communities by its dominance of either a mixed or single species eucalypt tree layer (including *Angophora* spp.), with few *Casuarina* spp. or *Eucalyptus robusta*, and a prominent groundcover of soft leaved herbs and grasses (Department of Environment and Climate Change 2007). While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis*, *E. amplifolia*, *Angophora floribunda* and *A. subvelutina*. *Casuarina cunninghamiana* subsp. *cunninghamiana* was also locally dominant along some drainage lines in the study area.

Extent within the study area

Approximately 1.47 ha of River-Flat Eucalypt Forest on Coastal Floodplains will be cleared by the Project, all of which occurs within the within the certified areas of the North West Growth Centre.

Threats and recovery of River-Flat Eucalypt Forest on Coastal Floodplains

River-Flat Eucalypt Forest on Coastal Floodplains is subject to a range of ongoing threats, including:

- further clearing for urban and rural development, and the subsequent impacts from fragmentation
- flood mitigation and drainage works
- landfilling and earthworks associated with urban and industrial development
- grazing and trampling by stock and feral animals (particularly pigs)

- changes in water quality, particularly increased nutrients and sedimentation
- weed invasion
- climate change
- activation of acid sulfate soils
- removal of dead wood
- rubbish dumping
- frequent burning which reduces the diversity of woody plant species (Department of Environment and Climate Change 2008b).

A recovery plan has not been prepared for this community under the *Threatened Species and Conservation Act 1995*. The Department of Environment and Climate Change has however, identified 10 priority actions to help recover the ecological community (see Table E-3-1 below).

Table E- 3-1 Priority actions to help recover River-Flat Eucalypt Forest on Coastal Floodplains

Description of priority action[1]	Does action relate to the Project?
Collect seed for NSW Seedbank. Develop collection program in collaboration with Botanical Gardens Trust - all known provenances (conservation collection).	Not applicable
Investigate seed viability, germination, dormancy and longevity (in natural environment and in storage).	Not applicable
Enhance the capacity of persons involved in the assessment of impacts on this EEC to ensure the best informed decisions are made.	Relevant available information has been used in the determination and assessment of the assessment of the impact of the Project on the ecological community.
Liaise with landholders and undertake and promote programs that ameliorate threats such as grazing and human disturbance.	Not applicable
Prepare identification and impact assessment guidelines and distribute to consent and determining authorities.	The identification guidelines (Department of Environment and Climate Change 2007) were used in determining the extent of the ecological community in the study area.
Where this EEC occurs in western Sydney, implement relevant Priorities Action Statement actions identified for Cumberland Plain Woodland.	See Table E-1
Undertake weed control for Bitou Bush and Boneseed at priority sites in accordance with the approved Threat Abatement Plan.	No Bitou Bush or Boneseed was recorded in the study area. General weed control and monitoring within the site will be managed through implementation of an Environmental Management Plan.
Use mechanisms such as Voluntary Conservation Agreements to promote the protection of this EEC on private land.	Not applicable. Biodiversity certification of the State Environmental Planning Policy (Sydney Regional Growth Centres) 2006 will assist this action within the Growth Centre.
Determine location, species composition and threats to remaining remnants to assist with prioritising restoration works.	Not applicable.

Description of priority action[1]	Does action relate to the Project?
Collate existing information on vegetation mapping and associated data for this EEC and identify gaps in knowledge. Conduct targeted field surveys and ground truthing to fill data gaps and clarify condition of remnants.	Not applicable.

Source: Department of Environment and Climate Change (2008b)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

E3.2 River-Flat Eucalypt Forest on Coastal Floodplains state significance assessment

This assessment is based on the removal of 1.47 ha of River-Flat Eucalypt Forest on Coastal Floodplains as a result of the Project.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable to a Threatened ecological community.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the clearing of 1.47 ha of River-Flat Eucalypt Forest on Coastal Floodplains from within the study area.

Five patches of River-Flat Eucalypt Forest on Coastal Floodplains were recorded within the study area. These patches were fragmented, edge-affected and ranged in condition from medium to poor.

Construction activities have potential to result in conditions that favour the establishment and proliferation of weeds, such as exposed soil and stockpiles. The control of weeds will be managed however through the construction environmental management plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable to a Threatened ecological community.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes of the community. The Project will not modify the intensity or frequency of fires, nor is it likely to modify the flooding flows.

How is the proposal likely to affect habitat connectivity?

River-Flat Eucalypt Forest on Coastal Floodplains occurs within the study area as five patches along the rail alignment. These patches are currently fragmented, edge-affected and ranged in condition from medium to poor. The Project will remove approximately 1.47 ha from the outer edge of these patches. The Project will not further decrease the level of connectivity between any of these patches but will however further reduce the extent of the communities. Therefore it is considered that habitat connectivity is not likely to be affected by the Project.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for River-Flat Eucalypt Forest on Coastal Floodplains under the *Threatened Species Conservation Act 1995*. The habitat within the study area is not considered to be critical to the survival of this community in accordance with section 37 of the *Threatened Species Conservation Act 1995*.

River-flat Eucalypt Forest within the study area occurred along the rail alignment as small, fragmented patches, ranging in condition from medium to poor. As such it is considered that the habitat to be removed does not warrant protection as critical habitat.

Conclusion

The Project will result in the clearing from five small patches of River-Flat Eucalypt Forest on Coastal Floodplains (totalling 1.47 ha). The Project is not likely to further fragment, disturb habitat connectivity, or increase existing disturbance regimes within the study area. The Project is unlikely to have a significant impact on this community.

E4. Shale Gravel Transition Forest

E4.1 Shale Gravel Transition Forest profile

Conservation status

Shale Gravel Transition Forest in the Sydney Basin Bioregion is listed as an Endangered Ecological Community under the *Threatened Species Conservation Act 1995*. This ecological community is not listed under the *Environment Protection and Biodiversity Conservation Act 1999.*

Description

Shale Gravel Transition Forest mainly occurs in the northern section of the Cumberland Plain in the Richmond, Marsden Park and Windsor districts (Department of Environment and Climate Change 2005b). Also appears in the Liverpool/ Holsworthy area, and there are small occurrences at Bankstown, Yennora and Villawood and the Kemps Creek area. There are 1,721 ha remaining intact. Good examples can be seen at Windsor Downs Nature Reserve and Kemps Creek Nature Reserve.

This community typically has an open forest structure with a canopy dominated by Broad-leaved Ironbark *Eucalyptus fibrosa*, with Grey Box *E. moluccana* and Forest Red Gum *E. tereticornis* occurring less frequently. Other species that occur less frequently are *Melaleuca decora* Paperbark. This community has a sparse shrub layer is usually present which includes *Bursaria spinosa* Blackthorn, *Daviesia ulicifolia*, and *Lissanthe strigosa* Peach Heath.

Shale Gravel Transition Forest is a transitional plant community, made up of species from both clay and poorer gravel (alluvial) soils. Soil which includes ironstone and are the remnants of an ancient river system. Shale Gravel Transition Forest occurs where these gravel deposits overlay shale soils. It grades into Cumberland Plain Woodland where the influence of gravel soil declines. In areas where gravel deposits are thick, it grades into Cooks River/Castlereagh Ironbark Forest or Castlereagh Scribbly Gum Woodland (Department of Environment and Climate Change 2005b).

Extent within the study area

Approximately 1.71 ha Shale Gravel Transition Forest would be cleared by the Project, all of which occurs within the certified areas of the North West Growth Centre.

Remnants of this community were identified to the south of Bandon Road, along the proposed new rail line, and within part of the proposed new Vineyard Station as well as within the proposed bus interchange and car park.

The Shale Gravel Transition Forest within the proposed new Vineyard Station car park area was in good condition and contained native species within the canopy, sub-canopy, shrub layers. Although the margins (approximately 5 metres wide) of this remnant patch were dominated by the introduced *Eragrostis curvula,* beyond the influence of edge effects this patch has a high diversity of native ground cover species and few weeds were recorded.

The proposed bus interchange site consists of a narrow (up to 3 metre wide) strip of regrowth Shale Gravel Transition Forest occurring between Riverstone Parade and the existing rail corridor. This area displays a high level of disturbance, including past clearing, weed invasion

and roadside litter. The ground cover in this area is patchy and consists of a mix of native ground cover species as well as the introduced species. Although disturbed, this area was in moderate condition and supported the Threatened *Pultenaea parviflora* (54 plants).

To the west of the existing rail line, within the area of the proposed new Vineyard Station and associated rail line, Shale Gravel Transition Forest occurred as young regrowth vegetation, past grazing regimes within this area appeared to have ceased recently. No active regeneration of the canopy or shrub layers was evident within this area.

Threats and recovery of Shale Gravel Transition

Shale Gravel Transition is subject to a range of ongoing threats, including:

- further clearing for rural development, and the subsequent impacts from fragmentation
- grazing, which stops regrowth
- weed invasion
- inappropriate fire regimes, which have altered the appropriate floristic and structural diversity (Department of Environment and Climate Change 2008b).

A recovery plan has not been prepared for this community under the *Threatened Species and Conservation Act 1995*. The Department of Environment and Climate Change has however, identified 15 priority actions to help recover the ecological community (see Table E-4-1 below).

Table E- 4-1 Priority actions to help recover Shale Gravel Transition

Description of priority action[1]	Does action relate to the Project?
Community and land-holder liaison/ awareness and/or education	Not applicable
Develop and implement protocols and guidelines	Not applicable
Habitat management: Ongoing EIA - Advice to consent and planning authorities	The Project is located within the State Environmental Planning Policy (Sydney Regional Growth Centres) 2006 which has biodiversity certification
Habitat management: Other- Manage, to best practice standards, areas of EECs which have conservation as a primary objective, or where conservation is compatible. Priorities are to be based on DEC conservation significance assessment	Not applicable
Habitat management: Site Protection (e.g. Fencing/Signage)	Not applicable
Habitat management: Weed Control	Not applicable
Habitat Protection (inc vca/ jma/ critical habitat nomination etc)	Not applicable
Monitoring	Not applicable
Recovery Plan Preparation: Multi species	Not applicable
Research	Not applicable

Source: Department of Environment and Climate Change (2008b)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

E4.2 Shale Gravel Transition Forest state significance assessment

This assessment is based on the removal of 1.71 ha of Shale Gravel Transition Forest from within the subject site as a result of the Project. The Shale Gravel Transition Forest which is removed occurs within the Growth Centres certified area for which the impacts have been already addressed as part of the certification process.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable to a Threatened ecological community.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the clearing of 1.71 ha of Shale Gravel Transition Forest, near Vineyard Station, including within:

- part of the proposed new Vineyard Station - young regrowth vegetation
- within the proposed bus interchange- a narrow strip (up to 3 metre wide) of regrowth Shale Gravel Transition Forest occurring between Riverstone Parade and the existing rail corridor. This area consists of a mix of native ground cover species as well as the introduced species. Although disturbed, this area was in moderate condition and supported the Threatened *Pultenaea parviflora* (54 plants)
- within the proposed car park at Vineyard- good condition, high diversity of native ground cover species and few weeds.

The Project is unlikely to result in increased fragmentation as the areas to be cleared are on the edge of larger remnants or are already highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities.

Construction activities have potential to result in conditions that favour the establishment or proliferation of weeds, such as exposed soil and stockpiles. The control of weeds will be managed however through the construction environmental management plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not applicable to a Threatened ecological community.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes of Shale Gravel Transition Forest. The Project will not modify the flooding flow or the intensity and frequency of fires within the Shale Gravel Transition Forest habitat.

How is the proposal likely to affect habitat connectivity?

The Project would not increase fragmentation or isolation of this community as the affected areas of Shale Gravel Transition Forest are either within the existing railway corridor or immediately adjacent with the exception of the proposed car park. A number of small patches of Shale Gravel Transition Forest are likely to be affected by the Project. The proposed bus interchange would require the clearing of a small strip (approximately 3 metres wide) of Shale Gravel Transition Forest on the eastern side of the rail alignment, between the rail line and

the road. This small area of habitat is unlikely to be significant for fauna movement within the area due to it relatively small size and poor connectivity and more extensive vegetation to the east. Fauna species using this small area of habitat are unlikely to be restricted from gaining access to adjacent lands.

The proposed Vineyard Station on the western side of the rail alignment contains a small patch of regenerating Shale Gravel Transition Forest. This occurs within a cleared grazing area, adjacent to the existing railway. The clearing of this area will not significantly affect habitat connectivity.

The proposed carpark location contains a large patch of Shale Gravel Transition Forest. This area has good connectivity to the east, south and north. This area has been listed as 'core habitat' (conservation significance assessment class, NSW National Parks and Wildlife Service 2002b). The proposed clearing is restricted to the western margin of this remnant, adjacent to the road and as such connectivity will be retained a north, east and southerly direction.

Therefore it is considered that the Project is unlikely to significantly affect habitat connectivity.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for Shale Gravel Transition Forest under the *Threatened Species Conservation Act 1995*. The habitat within the study area is not considered to be critical to the survival of Cumberland Plain Woodland due to the small size of the remnants and past disturbance regimes.

Conclusion

The Project will result in the clearing of 1.71 ha of Shale Gravel Transition Forest. The Project is not likely to further neither fragment, disturb habitat connectivity, nor increase the existing disturbance regimes within the study area. The Project is unlikely to have a significant impact on this community or its recovery.

E5. Dillwynia tenuifolia

E5.1 *Dillwynia tenuifolia* profile

Conservation status

Dillwynia tenuifolia is listed as a vulnerable species under the *Threatened Species Conservation Act 1995* and under the under the *Environment Protection and Biodiversity Conservation Act 1999.*

Description

Dillwynia tenuifolia is usually a small spreading pea shrub 0.6-1 m but may be spindly, exceeding 1 m high in competition with other shrubs (NSW National Parks and Wildlife Service 2002a).

Distribution

The core distribution is the Cumberland Plain from Windsor to Penrith east to Deans Park. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire. Disjunct localities include: the Bulga Mountains at Yengo in the north, Kurrajong Heights and Woodford in the Lower Blue Mountains.

Habitat

In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. At Yengo, is reported to occur in disturbed escarpment woodland on Narrabeen sandstone.

Life cycle

Flowering occurs sporadically from August to March depending on environmental conditions. Pollinators are unknown. The lifespan is estimated to be 20-30 years. It is thought a minimum of 3-4 years is required before seed is produced. Seeds are hard coated and are persistent in the soil seed bank. Dispersal is likely to be localised and ants are the probable vectors. It is a fire sensitive species, is killed by fire and re-establishes from soil-stored seed. The Abundance of this species is influenced by past disturbance history such as fire. The current high densities at some sites (more than 200,000 individuals) reflect prolific seed germination in response to fire.

Extent within the study area

No individuals were recorded within the study area, however suitable habitat exists within Shale Gravel Transition Forest in the site. Approximately 1.71 ha of suitable habitat for this species is to be removed as a result of the Project, all of which occurs within the certified areas of the North West Growth Centre.

Threats and recovery of *Dillwynia tenuifolia*

Dillwynia tenuifolia is subject to a range of ongoing threats, including:

- further clearing for urban and rural development, and the subsequent impacts from fragmentation
- inappropriate fire regimes
- uncontrolled vehicle access
- fill and rubbish dumping
- weed invasion
- frequent burning which reduces the diversity of woody plant species (Department of Environment and Climate Change 2008b).

A recovery plan has not been prepared for this species under the *Threatened Species and Conservation Act 1995*. The Department of Environment and Climate Change has however, identified 5 priority actions to help recover the species (see Table E-5-1 below).

Table E- 5-1 Priority actions to help recover *Dillwynia tenuifolia*

Description of priority action[1]	Does action relate to the Project?
Habitat protection - Identify priority sites on private land, to encourage the preparation of site management plans and the implementation of appropriate threat abatement measures, such as weed and animal control and fire management.	Not applicable
Monitoring- Monitor known populations, so that potential local extinctions are detected before they occur and mechanisms can be put in place to reverse trends.	Not applicable
Threat management- ensure plans of management for national parks, community lands and other public lands include appropriate actions for species' protection, such as weed and animal control and fire management.	Not applicable
Research into the pollinators of the species, to determine if management actions to ensure pollination are required.	Not applicable
Survey/Mapping and Habitat assessment- Identify and survey potential habitat to detect new populations.	Not applicable

Source: Department of Environment and Climate Change (2008b)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

E5.2 *Dillwynia tenuifolia* state significance assessment

This assessment is based on the clearing of 1.71 ha of suitable habitat (Shale Gravel Transition Forest) for this species.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No *Dillwynia tenuifolia* individuals were recorded within the site despite targeted surveys being conducted. However, suitable habitat for this species is provided by Shale Gravel Transition Forest within the study area. Approximately 1.71 ha of this community would be cleared as a result of the Project.

Despite no *Dillwynia tenuifolia* plants being recorded a seed bank may still be present. Therefore it is considered that the Project may result in the loss or disturbance of a seedbank.

The Project is unlikely to impact upon the dispersal ability of this species as no mature specimens were recorded. The pollinators for this species are unknown therefore no certainty can be concluded that the Project will not impact upon the pollinator species for *Dillwynia tenuifolia*.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No *Dillwynia tenuifolia* plants were recorded within the site. However approximately 1.71 ha of suitable habitat (Shale Gravel Transition Forest) is to be removed as a result of the Project.

The Project is not likely to increase disturbance regimes within the habitat for this species. It is likely that exotic species will become more prevalent within disturbed areas as a result of the Project.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

No *Dillwynia tenufolia* individuals were recorded within the study area. The current known limit of distribution is Yengo in the north, Woodford and Kurrajong Heights in the west, Kemps Creek vicinity in the south and Dean. The study area is not at the limit of its distribution.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes within areas of suitable habitat for *Dillwynia tenuifolia*. The Project will not modify the intensity or frequency of fires, nor is it likely to modify flooding flows.

How is the proposal likely to affect habitat connectivity?

The Project would not increase fragmentation or isolation of the *Dillwynia tenuifolia* habitat (Shale Gravel Transition Forest) either within the existing railway corridor or immediately adjacent.

The proposed bus interchange would require the clearing of a small strip (approximately 3 m wide) of Shale Gravel Transition Forest on the eastern side of the rail alignment, between the rail line and the road. This small area of habitat is unlikely to be significant for fauna movement within the area due to it relatively small size and poor connectivity and more extensive vegetation to the east. Fauna species using this small area of habitat are unlikely to be restricted from gaining access to adjacent lands.

The proposed Vineyard Station on the western side of the rail alignment contains a small patch of regenerating Shale Gravel Transition Forest. This occurs within a cleared grazing area, adjacent to the existing railway. The clearing of this area will not significantly affect habitat connectivity.

The proposed carpark location contains a large patch of Shale Gravel Transition Forest. This area has good connectivity to the east, south and north. This area has been listed as 'core habitat' (conservation significance assessment class, NSW National Parks and Wildlife Service 2002b). The proposed clearing is restricted to the western margin of this remnant, adjacent to the road and as such connectivity will be retained a north, east and southerly direction.

The potential habitat to be removed is not likely to be significant or constitute an important habitat corridor for seed dispersal for *Dillwynia tenuifolia* within the locality. Therefore it is considered that the Project is unlikely to significantly affect habitat connectivity for this species.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for *Dillwynia tenuifolia* under the *Threatened Species Conservation Act 1995*. The habitat within the study area is not considered to be critical to the survival of this community due to its small size and past disturbance.

Conclusion

The Project will result in the clearing of 1.7 ha of potential habitat for this species (Shale Gravel Transition Forest). Despite targeted surveys no individuals of this species were recorded within the site. However, the Project would clear 1.71 ha of suitable habitat for this species and may remove or modify a seedbank for this species if present.

The Project is not likely to further fragment, disturb habitat connectivity, or increase the existing disturbance regimes within the study area. The Project is therefore unlikely to have a significant impact on the long term survival of *Dillwynia tenuifolia*.

E6. Micromyrtus minutiflora

E6.1 *Micromyrtus minutiflora* profile

Conservation status

Micromyrtus minutiflora is listed as an Endangered under the *Threatened Species Conservation Act 1995*. This species is also listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999.*

Description

Micromyrtus minutiflora is a slender spreading shrub to 2 m high.

Distribution

The current known limits of distribution is restricted to the general area between Richmond and Penrith, western Sydney, the study area is not at the limit of its distribution.

Habitat

Micromyrtus minutiflora grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.

Life Cycle

Micromyrtus minutiflora flowers sporadically from June to March in response to fire. *Micromyrtus minutiflora* may regenerate via re-sprouting or germination of soil-stored seed (NSW Scientific Committee 2002).

Extent within the study area

No individuals were recorded within the study area; however suitable habitat exists within the site, provided within Shale Gravel Transition Forest. Approximately 1.71 ha of suitable habitat for this species is to be removed as a result of the Project, all of which occurs within the certified areas of the North West Growth Centre.

Threats and recovery of *Micromyrtus minutiflora*

Micromyrtus minutiflora is subject to a range of ongoing threats, including:

- habitat loss through vegetation clearing for urban development
- habitat degradation through weed invasion, recreation and rubbish dumping (Department of Environment and Climate Change 2008b).

A recovery plan has not been prepared for this community under the *Threatened Species and Conservation Act 1995*. The Department of Environment and Climate Change has however, identified eight priority actions to help recover the species (see Table E-6-1 below).

Table E- 6-1 Priority actions to help recover *Micromyrtus minutiflora*

Description of priority action[1]	Does action relate to the Project?
Community and land-holder liaison/ awareness and/or education	Not applicable
Habitat management: Other- Liaise with public landholders regarding appropriate management on public lands.	Not applicable
Habitat Protection (inc vca/ jma/ critical habitat nomination etc)	Not applicable
Research- Conduct general biological and ecological research to assess responses to management/disturbance regimes	Not applicable
Survey/Mapping and Habitat assessment- Identify priority sites for conservation actions on private property.	Not applicable

Source: Department of Environment and Climate Change (2008b)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

E6.2 *Micromyrtus minutiflora* state significance assessment

This assessment is based on the removal of 1.71 ha of Shale Gravel Transition Forest which provides suitable habitat for *Micromyrtus minutiflora*.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No *Micromyrtus minutiflora* individuals were recorded within the study area. However, Shale Gravel Transition Forest provides suitable habitat for this species. Approximately 1.71 ha of this community is proposed to be cleared as a result of the Project.

Although no *Micromyrtus minutiflora* plants were recorded a seed bank may still be present. Therefore it is considered that the Project may result in the loss or disturbance of a seedbank.

The Project is unlikely to impact upon the dispersal ability of this species as no individuals were recorded. The pollinators for this species are unknown therefore no certainty can be concluded that the Project will not impact upon the pollinator species for *Micromyrtus minutiflora*.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No *Micromyrtus minutiflora* plants were recorded within the site. However approximately 1.71ha of suitable habitat is to be cleared as a result of the Project.

The Project is not likely to increase disturbance regimes. It is likely that exotic species will become more prevalent within the disturbed areas, however, mitigation measures will minimise this.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

This species is restricted to the area between Richmond and Penrith in western Sydney. As such, the study area is not at the limit of its distribution.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes in areas of suitable habitat for *Micromyrtus minutiflora*. The Project will not modify the intensity or frequency of fires, nor is it likely to modify the flooding flows.

How is the proposal likely to affect habitat connectivity?

The Project would not increase fragmentation or isolation of habitat (Shale Gravel Transition Forest) for this species either within the existing railway corridor or immediately adjacent.

The proposed bus interchange would require the clearing of a small strip (approximately 3 metres wide) of Shale Gravel Transition Forest on the eastern side of the rail alignment, between the rail line and the road. This small area of habitat is unlikely to be significant for fauna movement within the area due to it relatively small size and poor connectivity and more extensive vegetation to the east. Fauna species using this small area of habitat are unlikely to be restricted from gaining access to adjacent lands.

The proposed Vineyard Station on the western side of the rail alignment contains a small patch of regenerating Shale Gravel Transition Forest. This occurs within a cleared grazing area, adjacent to the existing railway. The clearing of this area will not significantly affect habitat connectivity.

The proposed carpark location contains a large patch of Shale Gravel Transition Forest. This area has good connectivity to the east, south and north. This area has been listed as 'core habitat' (conservation significance assessment class, NSW National Parks and Wildlife Service 2002b). The proposed clearing is restricted to the western margin of this remnant, adjacent to the road and as such connectivity will be retained a north, east and southerly direction.

The potential habitat to be removed is not likely to be significant or constitute an important habitat corridor for seed dispersal for this species within the locality. Therefore it is considered that the Project is unlikely to significantly affect habitat connectivity for this species.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for *Micromyrtus minutiflora* under the *Threatened Species Conservation Act 1995*. The habitat within the study area is not considered to be critical to the survival of this community due to its small size and past disturbance.

Conclusion

The Project will result in the clearing of 1.71 ha of potential habitat for this species. This species was not recorded within this area, however a seedbank may be present.

The Project is not likely to further neither fragment, disturb habitat connectivity, nor increase the existing disturbance regimes within the study area. The removal of 1.71 ha of habitat is unlikely to have a significant impact on the long term survival of *Micromyrtus minutiflora.*

E7. Pimelea spicata

E7.1 *Pimelea spicata* profile

Conservation status

Pimelea spicata is listed as an Endangered under the *Threatened Species Conservation Act 1995* and under the *Environment Protection and Biodiversity Conservation Act 1999.*

Description

Pimelea spicata or the Spiked Rice-flower is a shrub to 50 cm tall that may be erect or somewhat prostrate in habit.

Distribution

Pimelea spicata has a relatively scattered distribution occurring in two disjunct areas, the Cumberland Plain (western Sydney) and coastal Illawarra, south of Sydney. There are 26 known extant populations of *P. spicata*, including 21 within the Cumberland Plain and five within the Illawarra. In western Sydney *Pimelea spicata* the current known distribution extends from Mount Annan and Narellan Vale in the south to Freemans Reach in the north and from Penrith in the west to Georges Hall in the east. In the Illawarra, the species is associated with coastal headlands and hill tops from Mount Warrigal in the north to Minnamurra and potentially Gerroa in the south, the study area is not at the limit of its distribution.

Habitat

Pimelea spicata is found on the Cumberland Plain and in the Illawarra. This species is found on well-structured clay soils. On the inland Cumberland Plain sites it is associated with Grey Box and Ironbark. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a more well developed shrub and grass understorey.

Life Cycle

Pimelea spicata possesses an underground tap-root that enables mature plants to re-sprout after defoliation caused by fire, drought, mechanical damage, or herbicide application (NSW National Parks and Wildlife Service 2000).

Pimelea spicata flowers sporadically throughout the year, with peak flowering likely to depend upon climatic conditions, particularly rainfall. The mating system of *P. spicata* is uncertain, however anecdotal evidence and flower morphology suggests the species may be capable of self-pollination. Fruit production is extremely variable within and between populations, and also between years, and is probably associated with environmental conditions such as rainfall and disturbance history (NSW National Parks and Wildlife Service 2000).

Extent within the study area

No individuals were recorded, however potential habitat exists within the study area. Cumberland Plain Woodland provides potential habitat for this species. Approximately 1.34 ha of suitable habitat would be cleared as a result of the Project, all of which occurs within the certified areas of the North West Growth Centre.

Threats and recovery of *Pimelea spicata*

Pimelea spicata is subject to a range of ongoing threats, including:

- loss of habitat to urban development
- high frequency fire
- mowing, grazing or other types of habitat modification such as weed invasion, rubbish dumping or urban runoff (NSW National Parks and Wildlife Service 2000).

A draft recovery plan has been prepared for this species under the *Threatened Species and Conservation Act 1995* (Department of Environment and Conservation 2004a). The following priority actions have been identified in the recovery plan and by the Department of Environment and Climate Change to help recover this species (see Table E-7-1 below).

Table E- 7-1 Priority actions to help recover *Pimelea spicata*

Description of priority action[1]	Does action relate to the Project?
Conserve *P. spicata* using land-use and conservation planning mechanisms	Not applicable
Identify and minimise the operation of threats at sites where P. spicata occurs	Not applicable
Implement a survey and monitoring program that will provide information on the extent and viability of P. spicata	Not applicable
Provide the community with information that assists in conserving the species	Not applicable
Raise awareness of the species and involve the community in the recovery program	Not applicable
Promote research questions that will assist future management decisions	Not applicable
Liaise with the land manager regarding the implementation of threat abatement measures at Killalea State Park	Not applicable
Threat abatement measures, in accordance with site management statements, to be implemented for freehold populations	Not applicable
Advise private landholders regarding conservation agreements and covenants	Not applicable
Assist community groups with funding applications for recovery actions for the species	Not applicable
Distribute information on the progress of the recovery program for this species	Not applicable
Inform the DEC of planning and land-use decisions that affect the species	Not applicable

Description of priority action[1]	Does action relate to the Project?
Liaise with landholder regarding the preparation of site management statements for freehold populations	Not applicable
Plans of management to be prepared for populations on Council community land	Not applicable
Distribute new site records through the Wildlife Atlas promptly	Not applicable
Update species profile and EIA guidelines	Not applicable
Site management statements will be prepared for populations on DEC estate	Not applicable
Consider the need for a critical habitat recommendation by 2010	Not applicable
Threat abatement measures to be implemented for populations on DEC estate	Not applicable
Threat abatement measures will be implemented for populations on Council community land	Not applicable
Undertake field studies to monitor seedling establishment and survivorship	Not applicable
Design and implement a long-term monitoring program	Not applicable
Conduct surveys of populations that were permanently tagged in 1993	Not applicable
Conduct surveys of potential habitat	Applicable

Source: Department of Environment and Climate Change (2008b)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

E7.2 *Pimelea spicata* state significance assessment

This assessment is based on the clearing of 1.34 ha of potential habitat (Cumberland Plain Woodland).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

No *Pimelea spicata* plants were recorded within the site despite targeted surveys being conducted during this species' flowering period. Although not recorded, approximately 1.34 ha of potential habitat for this species would be removed as a result of the Project.

Although no *Pimelea spicata* plants were recorded, a seed bank may still be present for this species and may be removed as a result of the project.

The Project is unlikely to impact upon the dispersal ability of this species, the mechanism of seed dispersal, if any, are unknown (NSW National Parks and Wildlife Service 2000). *Pimelea spicata* has no obvious adaptations to aid seed dispersal and observations of seedling emergence following fire suggest seed dispersal is likely to be very low, with the majority of seedlings being within 30cm of adult plants (NSW National Parks and Wildlife Service 2000).

The mating system of *P. spicata* is uncertain, however anecdotal evidence and flower morphology suggests the species may be capable of self-pollination (Department of Environment and Conservation 2004a), and therefore no certainty can be concluded that the Project will not impact upon the pollinator species for *Pimelea spicata.*

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No *Pimelea spicata* plants were recorded within the study area. However approximately 1.34 ha of potential habitat would be cleared. This area may also contain a seedbank.

The Project is not likely to increase disturbance regimes. It is likely that exotic species will become more prevalent within the disturbed areas, however, mitigation measures will minimise this.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Pimelea spicata has a relatively scattered distribution occurring in two disjunct areas, the Cumberland Plain (western Sydney) and coastal Illawarra, south of Sydney. There are 26 known extant populations of *P. spicata*, including 21 within the Cumberland Plain and five within the Illawarra.

In western Sydney, the current known distribution extends from Mount Annan and Narellan Vale in the south to Freemans Reach in the north and from Penrith in the west to Georges Hall in the east.

In the Illawarra, the species is associated with coastal headlands and hill tops from Mount Warrigal in the north to Minnamurra and potentially Gerroa in the south.

The study area is not at the limit of distribution for this species.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes for areas of potential habitat for *Pimelea spicata*. The Project will not modify the intensity or frequency of fires, nor is it likely to modify the flooding flows.

How is the proposal likely to affect habitat connectivity?

The Project would not increase fragmentation or isolation of habitat as the areas to be cleared are either within the existing railway corridor or immediately adjacent.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for *Pimelea spicata* under the *Threatened Species Conservation Act 1995*. The habitat within the study area is not considered to be critical to the survival of this community due to the small size of potential habitat patches and the past and ongoing disturbance of these areas.

Conclusion

No *Pimelea spicata* plants were recorded within the study area despite targeted surveys. The Project will however remove a small area of potential habitat (1.34 ha of Cumberland Plain Woodland) for this species. The area of potential habitat to be cleared occurs as several small, isolated and degraded remnants. The Project would require 1.34 ha of this degraded habitat to be cleared. This is unlikely to have a significant impact on the long term survival of *Pimelea spicata*.

E8. Pultenaea parviflora

E8.1 *Pultenaea parviflora* profile

Pultenaea parviflora is listed as Endangered under the *Threatened Species Conservation Act 1995* and Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999.*

A full profile of this community and priority recovery actions (listed in Table 2) is provided in Appendix D.

E8.2 *Pultenaea parviflora* state significance assessment

A total of 66 *Pultenaea parviflora* plants have been recorded within the study area, including:

- 12 mature plants in the existing rail corridor easement, to the west of the existing rail line and south of the proposed new Vineyard Station
- 54 plants (17 seedlings and 37 mature) between the rail corridor and Riverstone Parade (between Norwood Road and Camberwell Road).

All these plants were recorded within Shale Gravel Transition Forest, near Vineyard Station.

This assessment is based on the loss of 47 *Pultenaea parviflora* plants within 0.026 ha of known habitat and the clearing of a further 1.69 ha of potential habitat. Approximately 0.02 ha of suitable habitat containing 19 individuals would be retained.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Sixty six *Pultenaea parviflora* plants were recorded within the site during targeted surveys.

The project would permanently remove approximately 47 plants and 260m^2 of habitat. Approximately 200 ha of habitat would be retained. This clearing would also result in fragmentation of the remaining population.

There are approximately 400 records of *Pultenaea parviflora* (Department of Environment and Climate Change 2008a) including within conservation reserves in the vicinity (Scheyville National Park; Windsor Downs, Castlereagh and Agnes Banks Nature Reserves). Populations of this species vary from 10 to more than 5000 plants (NSW National Parks and Wildlife Service 2004), and as such, this population is considered to be relatively small. The plants to be removed occur within a narrow, disturbed and weed infested strip between the railway corridor and Riverstone Parade. Small populations in highly insecure, disturbed and weed impacted locales such as roadsides are likely to be non-viable (NSW National Parks and Wildlife Service 2004).

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The *Pultenaea parviflora* population within the study area is fragmented and isolated, occurring within a narrow strip within the rail easement and in a narrow strip between the rail corridor and Riverstone Parade. As such, this population is unlikely to be key source population.

Pultenaea parviflora populations vary from 10 and 5000+ plants. Given its relatively small population size (66 plants) and disturbed and fragmented habitat within the study area, this population is unlikely to be necessary for maintaining genetic diversity.

The project would permanently remove approximately 47 plants from 0.026 ha of known habitat. Approximately 0.02 ha of habitat would be retained. This clearing would also result in fragmentation of the remaining population. Populations of this species vary from 10 to more than 5000 plants (NSW National Parks and Wildlife Service 2004), and as such, this population is considered to be relatively small.

Mitigation measures would be implemented to minimise impacts to the habitat of this species including:

- fencing the population and its habitat to prevent access and accidental damage by workers, machinery or vehicles
- providing environmental inductions to all staff prior to commencing work
- weed control measures including cleaning equipment, vehicles, clothing and shoes prior to commencing work in the vicinity of the site
- ensuring stockpiles and equipment emplacement is not in the vicinity of the population
- monitoring of population and its habitat.

There are approximately 400 records of *Pultenaea parviflora* (Department of Environment and Climate Change 2008a) including within conservation reserves in the vicinity (Scheyville National Park; Windsor Downs, Castlereagh and Agnes Banks Nature Reserves). The plants to be removed occur within a narrow, disturbed and weed infested strip between the railway corridor and Riverstone Parade. Small populations in highly insecure, disturbed and weed impacted locales such as roadsides are likely to be non-viable (NSW National Parks and Wildlife Service 2004).

Where a population is small and non-viable, and where adequate representative reservation occur within the vicinity, that area of habitat can be considered insignificant (NSW National Parks and Wildlife Service 2004). As such, the habitat within the subject site is likely to be insignificant and due to the large number of records including within nearby conservation reserves, the removal of part of this population is unlikely to result in the decline of the species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Pultenaea parviflora is endemic to the Cumberland Plain. Its core distribution is from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. The study area is not at the limit of its distribution.

How is the proposal likely to affect current disturbance regimes?

Habitat for this species is in moderate condition and further weed invasion in this area may threaten the viability of the population and its habitat. Provided appropriate mitigation measures are followed during construction it is unlikely that the project would increase weed invasion within the study area. Therefore it is considered that the Project is unlikely to increase current disturbance regimes.

Mitigation measures would include:

- cleaning equipment, vehicles, clothing and shoes prior to commencing work in the vicinity of the site
- fencing the remaining population and its habitat to prevent access and accidental damage by workers, machinery or vehicles
- providing environmental inductions to all staff prior to commencing work
- ensuring stockpiles and equipment emplacement is not in the vicinity of the population
- monitoring of population and its habitat.

How is the proposal likely to affect habitat connectivity?

The known habitat for the population *Pultenaea parviflora* within the study area is already fragmented and isolated, occurring within a narrow strip within the rail easement and in a narrow strip between the rail corridor and Riverstone Parade. The Project will further reduce the extent of these strips but will not further reduce habitat connectivity.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for *Pultenaea parviflora* under the *Threatened Species Conservation Act 1995*. This species can be locally abundant and populations of *P. parviflora* contain between 10 and 5000+ individuals. The population within the study area consists of 66 plants within small fragmented patches. This habitat is not likely to be critical to the survival of the species.

Conclusion

The project would include loss of 47 *Pultenaea parviflora* plants and 0.026 ha of known habitat. Approximately 0.02 ha of habitat for this species would be retained.

Populations of this species vary from 10 to more than 5000 plants (NSW National Parks and Wildlife Service 2004), and as such, this population is considered to be relatively small. Due to the small size, high weed invasion, isolation and disturbed nature of the habitat and number of populations in the vicinity (including within conservation reserves) the removal of this habitat and part of the population is unlikely to have a significant impact on this species or its recovery.

E9. Grevillea juniperina subsp. juniperina

E9.1 *Grevillea juniperina* subsp*. juniperina* profile

Conservation status

Grevillea juniperina subsp*. juniperina* is listed as a Vulnerable species under the *Threatened Species Conservation Act 1995*. This species is not listed under the *Environment Protection and Biodiversity Conservation Act 1999.*

Description

Grevillea juniperina subsp. *juniperina* is a broadly spreading to erect prickly shrub to 2.5 m high.

Distribution

Grevillea juniperina subsp. *juniperina* is endemic to Western Sydney. *Grevillea juniperina subsp. juniperina* distribution is centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town, the study area is not at the limit of its distribution.

Habitat

Grevillea juniperina subsp. *juniperina* is known to grow on reddish clay and sandy soils derived from Wianamatta Shale and Tertiary alluvium which often has a shale influence and typically contains lateritic gravels (NSW National Parks and Wildlife Service 2002c).

Grevillea juniperina subsp*. juniperina* has been recorded within Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest.

Life Cycle

Grevillea juniperina subsp. *juniperina* flowers sporadically throughout the year between July and October. Flowers are reported to be bird pollinated although bees have also been observed visiting flowers.

Grevillea juniperina subsp*. juniperina* plants are killed by fire with regeneration solely from soil-stored seed (NSW National Parks and Wildlife Service 2002c). Fire leads to a sudden increase in the recruitment of seedlings. Physical disturbance of the soil appears to result in an increase in seedling recruitment. *Grevillea juniperina* subsp. *juniperina* is also reported to have a tendency to colonise mechanically disturbed areas (NSW National Parks and Wildlife Service 2002c).

Extent within the study area

Two *Grevillea juniperina* subsp *juniperina* plants were recorded within the study area, including:

- one mature plant within a cleared paddock approximately 10 m west of the rail corridor south of New Schofields Station
- one mature plant to the north of Bandon Road outside of the proposed subject site.

Threats and recovery of *Grevillea juniperina* subsp*. juniperina*

Grevillea juniperina subsp*. juniperina* is subject to a range of ongoing threats, including:

- degradation and reduction of habitat following clearing and fragmentation of native vegetation is a major threat
- other threats include disturbance by rubbish dumping, trampling, road works, dumping of fill, changes in drainage, recreational activities, weed invasion and inappropriate fire regimes. (Department of Environment and Climate Change 2008b).

A recovery plan has not been prepared for this species under the *Threatened Species and Conservation Act 1995*. The Department of Environment and Climate Change has however, identified 4 priority actions to help recover the species (see Table E-9-1 below).

Table E- 9-1 Priority actions to help *Grevillea juniperina* subsp. *juniperina*

Description of priority action1	Does action relate to the Project?
Habitat management: Other- Liaise with public and private land managers to encourage the preparation of site management plans and the implementation of appropriate threat abatement measures, particularly in fire management and fencing and signage to prevent accidental loss.	Not applicable
Habitat protection (inc vca/ jma/ critical habitat nomination etc)- Seek to increase the level of legislative protection for priority sites (public and private) through land use planning mechanisms and conservation agreements.	Not applicable
Monitoring –Monitor known populations, so that potential local extinctions are detected before they occur and mechanisms can be put in place to reverse trends	Not applicable
Identify and survey potential habitat to detect new populations.	Not applicable

Source: Department of Environment and Climate Change (2008b)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

E9.2 *Grevillea juniperina* subsp. *juniperina* state significance assessment

This assessment is based on the retention of two *Grevillea juniperina subsp. juniperina* plants, occurring within a cleared paddock approximately 10 m west of the rail corridor south of New Schofields Station; and another plant was recorded to the north of Bandon Road.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Two specimens of *Grevillea juniperina subsp. juniperina* were recorded within the study area, outside the proposed area of impact. This includes:

- one mature plant within a cleared paddock approximately 10 m west of the rail corridor south of New Schofields Station – this would be removed

- and one mature plant to the north of Bandon Road outside of the proposed subject site.

The removal of one, isolated individual as a result of the Project is unlikely to interfere with the reproductive lifecycle for this species. *Grevillea juniperina* subsp. *juniperina* flowers are reported to be bird and bee pollinated (National Parks and Wildlife Service 2002). The Project is not likely to interfere with pollination for this species.

Seed dispersal is likely to be minimal for this species with most seedlings growing within 2-3 m of the parent plant (NSW National Parks and Wildlife Service 2002c). No seedlings were recorded and both plants occur within grazed or disturbed areas where seedling growth is unlikely. .

Therefore it is considered that the Project is unlikely to affect the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project is unlikely to affect habitat of this species, as both plants and their surrounding habitats will be retained.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Grevillea juniperina subsp. *juniperina* is endemic to Western Sydney. Its distribution is centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town. The study area is not at the limit of its distribution.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes. The Project will not modify the intensity or frequency of fires, nor is it likely to modify the flooding flows. The Project may cause soil seedbank, if present, to germinate as a response to mechanical disturbance (NSW National Parks and Wildlife Service 2002c).

How is the proposal likely to affect habitat connectivity?

The two plants within the study area are currently fragmented and isolated, with one mature plant within a cleared paddock approximately 10 m west of the rail corridor south of New Schofields Station and one mature plant to the north of Bandon Road outside of the proposed subject site. The Project will not result in further fragment suitable habitat for this species.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for *Grevillea juniperina* subsp. *juniperina* under the *Threatened Species Conservation Act 1995*. The habitat within the study area is not considered to be critical to the survival of this community due to the small area of habitat, low number of plants and ongoing disturbance of these areas.

Conclusion

Two *Grevillea juniperina* subsp *juniperina* plants were recorded within the study area as isolated individuals. The removal of one individual, occurring within a grazed paddock, is unlikely to significantly affect this species or interfere with its recovery.

E10. Cumberland Plain Land Snail (Meridolum corneovirens)

E10.1 Cumberland Plain Land Snail profile

Status

The Cumberland Plain Land Snail (*Meridolum corneovirens*) is listed as Endangered under the *Threatened Species Conservation Act 1995*.

Description

Cumberland Plain Land Snail is a terrestrial species of snail that is generally tan to dark orange in colour ranging in size from 15-30 mm which occurs in Cumberland Plain Woodland and Castlereagh Woodlands in western Sydney (NSW National Parks and Wildlife Service 1999a).

Microhabitat features used by the species include the underparts of logs and other debris, leaf and bark accumulations around the bases of trees and sometimes under grass clumps. Loose soil is sometimes used by the species for burrowing, and the species is a fungal feeder and generally active at night. The bulk of the known populations are small, isolated and vulnerable to impacts from clearing and habitat modification such as the removal of ground cover as this removes shelter, breeding habitat and sources of food (NSW National Parks and Wildlife Service 1999a).

Very little is currently known about the biology and life history of the Cumberland Plain Land Snail (NSW National Parks and Wildlife Service 1999a). It is hermaphroditic and lays clutches of small round white eggs of about 20-25, typically laid in microhabitats that are moist and dark (such as under logs), taking about 2-3 weeks to hatch (Stephanie Clarke personal communication, 2002). Recent observations suggest that it can reproduce year round when conditions are suitable. Nothing is currently known about rates of fecundity, length of life span, dispersal and foraging patterns or the distances over which individuals can move.

The species is known to be genetically structured over short distances. Spatial autocorrelation analysis has shown individuals from any one location (within a few metres of each other) are very likely to be genetically related and the 'genetic neighbourhood' is limited to about 350 m (Clarke & Richardson 2002). As a result, small and isolated populations may be subject to reduced genetic and morphological diversity and increased rates of inbreeding (Clarke & Richardson 2002).

Distribution in the study area

Targeted searches for the species were conducted in all woodland remnants and patches of derived native grasslands. No live specimens or shells of the Cumberland Plain Land Snail were identified within the study area. Potentially suitable habitat for this species exists in remnant Cumberland Plain Woodland and Shale Gravel Transition Forest. Cumberland Plain Woodland proposed for clearing is degraded, highly fragmented, and in some areas contains African Olive which is toxic to the Cumberland Plain Land Snail. Other patches of remnant vegetation in the study area were too highly modified (including lack of ground cover habitat

as a result of grazing and/or high weed infestations) to provide suitable habitat for the Cumberland Plain Land Snail.

A total of 3.05 ha of potential Cumberland Plain Land Snail habitat will be affected by the Project.

Threats and recovery of Cumberland Plain Land Snail

Clearing and degradation of Cumberland Plain Woodland remnants is the primary threat to the Cumberland Plain Land Snail. There is however a poor understanding of other threats to this species (Department of Environment and Climate Change 2008b).

A recovery plan has not been prepared for the Cumberland Plain Land Snail under the *Threatened Species and Conservation Act 1995*. The Department of Environment and Climate Change have, however, identified nine priority actions to help recover the species (see Table E- 10-1).

Table E- 10-1 Priority actions to help recover Cumberland Plain Land Snail

Description of priority action[1]	Does action relate to the Project?
Approach priority private site landholders to negotiate implementing protective management regimes.	Not applicable.
Review species' conservation status with consideration of data obtained since listing as endangered.	Not applicable.
Implement appropriate fire regimes (ones that allow build up of grass and litter layers).	Not applicable.
Reserve Fire Management Strategy to include operational guidelines to protect this species from fire. .	Not applicable.
Ensure public land plans of management include appropriate actions for species' protection.	Not applicable.
Install structures (where necessary) to prevent accidental slashing and removal of plant debris.	Not applicable.
Implement weed control at sites where necessary.	Not applicable.
Investigate population census techniques and responses to environmental conditions, with the aim of developing estimates of true population size based on numbers detected in standard surveys.	Not applicable.
Identify priority sites for conservation actions on private land.	Not applicable.
Approach priority private site landholders to negotiate implementing protective management regimes.	Not applicable.

Source: Department of Environment and Climate Change (2008b)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

E10.2 Cumberland Plain Land Snail state significance assessment

This assessment is based on the amount of potential Cumberland Plain Land Snail habitat in the study area (approximately 3.05 ha). No Cumberland Plain Land Snails were indentified in the study area during targeted surveys.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Project will result in the removal of 3.05 ha of potential Cumberland Plain Land Snail habitat within the certified areas. While the removal of 3.05 ha of suitable habitat has the potential to impact upon a population of the Cumberland Plain Land Snail, no shells or live specimens of the species were identified within the certified areas despite targeted surveys being undertaken. Given that this species was not identified during targeted surveys, the Project is unlikely to have a significant impact on the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the removal of 3.05 ha of potential Cumberland Plain Land Snail habitat. The potential habitat proposed for clearing is fragmented and in poor condition, subject to ongoing threats including weed invasion. High concentrations of weeds detrimentally modify the habitat of the Cumberland Plain Land Snail. An accumulation of fallen leaves of some introduced weed species (such as African Olive, which was present within the study area) creates an environment toxic to the species (Michael Shea, Malacologist, Australian Museum, *personal communication*, October 2008). While high concentrations of exotic weeds can significantly modify native woodland communities, the Cumberland Plain Land Snail can sometimes persist around the base of mature trees in these situations. However, exotic weeds typically create favourable conditions for introduced molluscs (e.g. Asian Bush Snail, *Bradybaena similaris*) that are detrimental to the Cumberland Plain Land Snail.

The Project is unlikely to result in other modification to habitat suitable for this species, such as through changes to the fire or flooding regime, or introduction of weeds that will modify the vegetation or ground cover habitat structure. While construction activities have the potential to result in conditions that favour the establishment and proliferation of weeds as a result of exposed soil and stockpiles, the control of weeds will be managed through the construction environmental management plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Cumberland Plain Land Snails occur throughout Cumberland Plain Woodland and Castlereagh Woodlands in western Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains (NSW National Parks and Wildlife Service 1999a). Records for the species are known from Vineyard, Quakers Hill, Doonside, Rouse Hill and Schofields (Michael Shea, Malacologist, Australian Museum, *personal communication*, October 2008) which are within the vicinity of the study area. The study area is therefore not at the limit of the known distribution for this species.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes relevant to the Cumberland Plain Land Snail or its habitat. The Project will not modify the intensity or frequency of fires, nor will it modify the flooding flows in its habitat.

How is the proposal likely to affect habitat connectivity?

The Project will result in the removal of approximately 3.05 ha of vegetation within the certified areas which could provide potential habitat for the Cumberland Plain Land Snail. However, this vegetation occurs within a highly disturbed and fragmented landscape as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities.

The Project is therefore not likely to increase fragmentation or isolation of habitat for the Cumberland Plain Land Snail as the potential habitat proposed for removal occurs as small isolated patches of vegetation either within the existing railway corridor or immediately adjacent. As such, the Project will not affect habitat connectivity.

How is the proposal likely to affect critical habitat?

No critical habitat has been listed for the Cumberland Plain Land Snail. The potential habitat within the certified areas is in poor condition and fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities and is therefore not considered to be critical to the survival of Cumberland Plain Land Snail

Conclusion

No evidence of the Cumberland Plain Land Snail was detected during targeted surveys within the study area. Impacts to Cumberland Plain Land Snail within the study area will result in loss of 3.05 ha of potential habitat; however this is fragmented, in poor condition and is subject to ongoing threats such as weed invasion. As such it is unlikely that the Project will have a significant impact on the Cumberland Plain Land Snail in the local area.

E11. Grey-headed Flying-fox (Pteropus poliocephalus)

E11.1 Grey-headed Flying-fox profile

Conservation status

Grey-headed Flying-fox is listed Vulnerable under both the *Threatened Species Conservation Act 1995* and the *Environment Protection and Biodiversity Conservation Act 1999*.

Description

The Grey-headed Flying-fox has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. This species can be distinguished from other flying-fox species by leg fur which extends to the ankle. Wing membranes are black and the wingspan can be up to one metre (Department of Environment and Climate Change 2008b).

Distribution and habitat

The Grey-headed Flying-fox occurs within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria (Department of Environment and Climate Change 2008b). They occur predominantly in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species (NSW National Parks and Wildlife Service 2001). The Grey-headed Flying-fox forage on the nectar and pollen of native trees, in particular eucalypts, melaleucas and banksias, and fruits of rainforest trees and vines and is an important pollinator and seed-disperser of many native species of plant (Parry-Jones & Augee 1991).

Extent within the study area

The Grey-headed Flying-fox was not recorded flying over or foraging within the study area during the field survey. The Grey-headed Flying-fox is likely to seasonally forage in Shale Plains Woodland and Shale Gravel Transition Forest within the study area. The Project will result in the removal of 3.05 ha of foraging habitat within the study area.

No Grey-headed Flying-foxes were recorded roosting in the study area during day time surveys and no known camps are located within the study area. The closest historic colony site is the Cabramatta Creek camp in south-western Sydney.

Threats and recovery of Grey-headed Flying-fox

Grey-headed Flying-fox is subject to a range of threats including:

- unregulated shooting
- electrocution on powerlines
- loss of foraging habitat.
- disturbance of roosting sites (Department of Climate Change 2008).

A recovery plan has not been prepared for the Grey-headed Flying-fox under either the *Threatened Species and Conservation Act 1995* or the *Environment Protection and Biodiversity Conservation Act 1999*. The Action Plan for Australian Bats (Duncan *et al.* 1999) identified the following objectives for recovery of the species:

- stabilise the population at its current level
- define patterns of landscape use, and identify and protect essential habitat
- develop non-destructive methods for crop protection
- develop non-destructive methods for management of camps in problem areas
- ensure consistent management of the species across all range states (Queensland, New South Wales and Victoria).

The Department of Environment and Climate Change has identified 31 priority actions (also referred to as the Priority Action Statement or PAS) to help recover the species (see Table E-11-1).

Table E- 11-1 Priority actions for the Grey-headed Flying-fox

Description of priority action[1]	**Does action relate to the Project and associated works?**
Provide educational resources to improve public attitudes toward Grey-headed Flying-foxes.	Not applicable.
Develop materials for public education & provide them to land managers & local community groups working with controversial flying-fox camps, highlighting species status, reasons for being in urban areas, reasons for decline etc.	Not applicable.
Monitor public attitudes towards flying-foxes.	Not applicable.
Review & evaluate camp site management activities, summarising outcomes of past experiences at controversial camps. Noise impacts on neighbours of camps to be considered. For use in managing future conflicts with humans at flying-fox camps.	Not applicable.
Conduct periodic range-wide assessments of the population size of Grey-headed Flying-foxes to monitor population trends.	Not applicable.
Grey-headed Flying-fox National Recovery Team to undertake an annual review of the national recovery plan's implementation.	Not applicable.
Enhance and sustain the vegetation of camps critical to the survival of Grey-headed Flying-foxes.	Not applicable.
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.	Not applicable.
Protect roosting habitat critical to the survival of Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land.	Not applicable. No roosting camps areas located in the study area.
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.	Not applicable.

Description of priority action[1]	Does action relate to the Project and associated works?
Develop and implement a grower-based program to monitor trends in damage to commercial fruit crops by flying-foxes, and use the results to monitor the performance of actions to reduce crop damage.	Not applicable.
Systematically document the levels of flying-fox damage to the horticulture industry within the range of the Grey-headed Flying-fox.	Not applicable.
Develop guidelines to assist land managers dealing with controversial flying-fox camps.	Not applicable.
Complete national recovery plan in 2007.	This plan was not prepared at the time of preparation of this assessment.
Develop and promote incentives to reduce killing of flying-foxes in commercial fruit crops.	Not applicable.
Develop methods for rapid estimates of flying-fox damage on commercial crops, allowing the long-term monitoring of industry-wide levels and patterns of flying-fox damage.	Not applicable.
Review and improve methods used to assess population size of Grey-headed Flying-foxes.	Not applicable.
Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts.	Not applicable.
Describe the species, age structure & demographics of flying-foxes killed in fruit crops to improve the understanding of the impact by assessing trends in the species, sex, age & reproductive status of animals killed on crops.	Not applicable.
Determine characteristics of roosting habitat for Grey-headed Flying-foxes, exploring the roles of floristic composition, vegetation structure, microclimate and landscape features, and assess the status of camps.	Not applicable.
Investigate the age structure and longevity of Grey-headed Flying-foxes.	Not applicable.
Assess the impacts Grey-headed Flying-fox camps have on water quality, and publish results in a peer-reviewed journal.	Not applicable.
Develop methods to monitor landscape scale nectar availability trends, to explain/potentially predict crop damage trends where crop protection is absent, & promote importance of foraging habitat productive in seasons critical to the horticulture industry.	Not applicable.
Investigate between-year fidelity of Grey-headed Flying-fox individuals to seasonal camps.	Not applicable.
Investigate the differences in genetic relatedness, sex, age etc. between sedentary and transient Grey-headed Flying-foxes.	Not applicable.
Investigate the genetic structure within Grey-headed Flying-fox camps, including levels of relatedness within and between members of adult groups, occupants of individual trees etc.	Not applicable.
Investigate the patterns of juvenile Grey-headed Flying-fox dispersal and mortality, allowing identification of the specific habitat requirements of juveniles.	Not applicable.
Identify the commercial fruit industries that are impacted by Grey-headed Flying-foxes, to provide an information base for use by the various stakeholders.	Not applicable.
Set priorities for protecting foraging habitat critical to the survival of Grey-headed Flying-foxes and generate maps of priority foraging habitat.	Not applicable.

Description of priority action[1]	Does action relate to the Project and associated works?
Establish & maintain a range-wide database of Grey-headed Flying-fox camps, including information on location, tenure, zoning & history of use, for distribution to land management/planning authorities, researchers & interested public.	Not applicable.
Improve knowledge of Grey-headed Flying-fox camp locations, targeting regional areas and seasons where information is notably incomplete, such as inland areas during spring and summer.	Not applicable.

Source: Department of Environment and Climate Change (2008b)

1. Actions may apply to one type of geographic area (CMA, LGA and DECC national park administration area) or to specific land managers only (i.e. Catchment Management Authority, Local Council, National Park or private landowners).

E11.2 Grey-headed Flying-fox state significance assessment

This assessment is based on the Grey-headed Flying-fox habitat within the study area (approximately 3.05 ha).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Project will not affect or disrupt any Grey-headed Flying-fox roosting habitat (camps) and therefore will not affect the life cycle of the species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

While the Project will remove 3.05 ha of Grey-Headed Flying-fox foraging habitat within the certified areas, this habitat is in poor condition and highly fragmented. Good quality foraging resources are widely available outside the impacted areas and within the wider locality and given the Grey-headed Flying-fox is a highly mobile species which travels in response to fruiting or flowering events, the Project will not significantly affect foraging habitat for this species. The Project will not affect or disrupt any Grey-headed Flying-fox roosting habitat (camps).

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Grey-headed Flying-fox occurs within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria (Department of Environment and Climate Change 2008b). The study area is not at the limit of Grey-headed Flying-fox distribution.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes of the Grey-Headed Flying-fox habitats within the study area, such as changes to the fire or flooding regime. While construction activities have the potential to result in conditions that favour the establishment and proliferation of weeds as a result of exposed soil and stockpiles, the control of weeds will be managed through the construction environmental management plan.

How is the proposal likely to affect habitat connectivity?

Grey-Headed Flying-foxes are highly mobile animals that can travel up to 50 km each night to forage. Due to their large ranges and the small amount of vegetation clearing, the Project would not create a barrier to the movement of the species between other foraging habitats or otherwise fragment Grey-headed Flying-fox habitat.

How is the proposal likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There is no critical habitat listed for the Grey-headed Flying-fox and the areas of impact for the Project are not considered to be critical to the survival of this species as it is in poor condition and highly fragmented from past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities.

Conclusion

The Project will result in the removal of 3.05 ha of Grey-Headed Flying-fox foraging habitat within the study area, and given the high mobility of the species this is unlikely to represent a significant reduction in the availability of foraging resources within the species' range. The Project will not affect or disrupt and Grey-headed Flying-fox roosting habitat (camps) and therefore will not affect the life cycle of the species.

As such it is unlikely that the Project will have a significant impact on the Grey-headed Flying-fox within the local area.

E12. Microchiropteran bats

Microchiropteran bats have been assessed collectively because of their similarity of habitats, habits and potential impacts.

E12.1 Microchiropteran bat profiles

No threatened species of microchiropteran bat was recorded in the study area but potential roosting habitat is present within the study area for species including:

- Eastern Freetail-bat Mormopterus norfolkensis
- Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*
- Large-eared Pied Bat *Chalinolobus dwyeri*
- Greater Broad-nosed Bat *Scoteanax rueppellii*

These species have been considered as a group because of their similar habitat requirements, habits and threats, which are described below in Table E-12-1.

Table E- 12-1 Details of threatened species of microchiropteran bat

Common name (Scientific name)	**Threats**	**Habitat and distribution**	**TSC Act[1]**	**EPBC Act[2]**
Eastern Freetail Bat (*Mormopterus norfolkensis*)	Vulnerable to loss of tree hollows and loss of feeding grounds by forestry activities, clearing for agriculture and housing. Its population is suspected to have been reduced. It is an ecological specialist and depends on particular types of diet or habitat (Churchill 1998).	Thought to live in Sclerophyll forest and woodland. Small colonies have been found in tree hollows or under loose bark. It feeds on insects above the forest canopy or in clearings at the forest edge (Churchill 1998). The distribution of this species is follows the east coast of NSW from south of Sydney extending to south-eastern QLD just outside of Brisbane (Churchill 1998).	V	-
Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris)*	Disturbance to roosting and summer breeding sites. Foraging habitats being cleared for residential and agricultural developments. Loss of hollow-bearing trees, clearing and fragmentation of forest and woodland habitat.	Occurs in Eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts in tree hollows(Churchill 1998). Thought to be a migratory species, this species is wide-ranging and occurs throughout tropical Australia with many records in south-eastern Australia (Churchill 1998).	V	-

Common name (Scientific name)	Threats	Habitat and distribution	TSC Act[1]	EPBC Act[2]
Large-eared Pied Bat (*Chalinolobus dwyeri)*	Clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture, forestry or development. Damage to roosting and maternity sites from mining operations and recreational caving activities. Use of pesticides.	Occurs in moderately wooded habitats and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. Thought to forage below the forest canopy for small flying insects (Churchill 1998). The distribution of the Large-eared Pied Bat extends from south-eastern QLD to NSW, from the coastal regions to the western slopes of the Dividing Range (Churchill 1998).	V	V
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	Its population is suspected to have been reduced. It is an ecological specialist (it depends on particular types of diet and habitat).	The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill 1998). The distribution for this species extends from North QLD to southern NSW along the coastal regions (Churchill 1998).	V	-

Notes: 1 = Vulnerable under the Threatened Species Conservation Act 1995

2 = Vulnerable under the Environmental Protection and Biodiversity Conservation Act 1999

Distribution in the study area

Remnant woodland (approximately 4.60 ha) within the certified areas is considered to be provide potential roosting and foraging habitat for the Eastern Freetail Bat, Yellow-bellied Sheathtail Bat and the Greater Broad-nosed Bat. The remnant woodland within the certified area could provide potential foraging habitat for the Large-eared Pied Bat. It is unlikely there would be a roost site for this species within the certified areas as they roost primarily in caves and mines.

Threats and recovery

Microbats are subject to a range of threats (refer Table E- 12-2). These generally relate to loss of or disturbance to roosting sites and foraging habitats and the effects of pesticides and herbicides to food availability or bioaccumulation.

The Department of Environment and Climate Change has identified priority actions (also referred to at the Priority Action Statement or PAS) to direct recover actions for Threatened microbats (refer Table E- 12-3). None of these actions relate to impacts of the Project. Several actions however relate to the value of hollow bearing trees, and these important microhabitat elements should be considered when determining offsets for the Project.

Table E- 12-2 Threats to microbats

Description of threats[1]	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Large-eared Pied Bat	Greater Broad-nosed Bat
Disturbance to roosting and seasonal breeding sites.	●		●	●
Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.	●	●	●	●
Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat.	●	●	●	●
Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.	●	●	●	●
Damage to or disturbance of roosting caves, particularly during winter or breeding.			●	

Source: Department of Environment and Climate Change (2008b)

Table E- 12-3 Priority actions for microbats

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Large-eared Pied Bat	Greater Broad-nosed Bat
Better define species distribution through survey in coastal lowlands on- and off-reserve.	Not applicable.		●		
Confirm species taxonomy of NSW populations, relative to other Australian populations.	Not applicable.				
Control foxes and feral cats around roosting sites, particularly maternity caves and hibernation sites.	Not applicable.	●	●		●
Determine the effectiveness of PVP assessment, offsets and actions for bats.	Not applicable.	●	●	●	●
Develop and promote State-wide bat awareness programs for schools, CMAs, landholders and industry groups etc.	Not applicable.	●	●	●	●

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Large-eared Pied Bat	Greater Broad-nosed Bat
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.	Not applicable.	●	●	●	●
Ensure protection of known roosts and forest within 10 km of roosts in PVP assessments (offsets should include nearby remnants in high productivity) and other environmental planning instruments.	Not applicable.	●	●		●
Ensure the Code of Practice for private native forestry includes adequate measures to protect large, hollow-bearing trees and viable numbers of recruit trees.	Not applicable.	●	●		●
Establish a community program to encourage the reporting of roost trees.	Not applicable.	●			
Establish a gating design for disused mines across species range that will not adversely impact species. Consultation with cave bat specialist prior to any gating operations.	Not applicable.			●	
Exclude prescription burns from 100m from cave entrance, ensure smoke/flames of fires do not enter caves/roosts in artificial structures.	Not applicable.			●	
For roost caves vulnerable to human disturbance, monitor their visitation by people, particularly during winter and spring/summer maternity season and in school holidays.	Not applicable.			●	
Control feral goats in rock overhangs and caves in the species range.	Not applicable.			●	
Identify and protect significant roost habitat in artificial structures (e.g. culverts, old buildings and derelict mines).	Not applicable.			●	
Identify areas of private land that contain high densities of large hollow-bearing trees as areas of high conservation value (HCV) planning instruments and land management negotiations e.g. LEP, CAPs, PVPs.	Not applicable.	●	●	●	●
Identify important foraging range and key habitat components for this species.	Not applicable.		●	●	●
Identify the effects of fragmentation in a range of fragmented landscapes i.e. the farmland/forest interface and the urban/forest interface e.g. movement and persistence across a range of fragment sizes.	Not applicable.	●	●	●	●
Identify the susceptibility of the species to pesticides.	Not applicable.	●	●	●	●
Investigate the effectiveness of logging prescriptions.	Not applicable.	●	●		●

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Large-eared Pied Bat	Greater Broad-nosed Bat
Measure genetic population structure among cave roosts of maternity colonies to estimate dispersal and genetic isolation, and vulnerability to regional population extinction.	Not applicable.			●	
Monitor the breeding success of a representative sample of maternity colonies in cave roosts over a number of years to determine the viability of regional populations.	Not applicable.			●	
Prepare EIA guidelines which address the retention of hollow bearing trees maintaining diversity of age groups, species diversity and structural diversity. Give priority to largest hollow bearing trees.	Not applicable.	●			●
Prepare fire management plans for significant roost caves, disused mines, culverts, especially maternity and winter roosts.	Not applicable.			●	
Prepare management plans for significant bat roosts especially all known maternity colonies and winter colonies.	Not applicable.			●	
Promote bats throughout the rural community as ecologically interesting and important, but sensitive to disturbance at caves/disused mine tunnels. Promote the conservation of these key roost areas using measures such as incentive funding to landholders, offsetting and Biobanking, acquisition for reserve establishment or other means. 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.	Not applicable.	●	●	●	●
Quantify any benefits of local bat populations to reducing the impact of insect pests on commercial crops.	Not applicable.		●		●
Raise awareness of the effects of pesticides.	Not applicable.	●	●	●	●
Regular censuses of maternity colonies (Wee Jasper, Bungonia, Willi-Willi, Riverton) and other key roosts in network, especially where there are population estimates from banding in the 1960s.	Not applicable.				
Research the degree of long-term fidelity to roost trees and roosting areas in order to assess their importance and the effects of their removal.	Not applicable.	●	●		●
Research the effect of different burning regimes on cave and roosting habitat disturbance and surrounding foraging habitat.	Not applicable.	●	●	●	●

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Large-eared Pied Bat	Greater Broad-nosed Bat
Research the effectiveness of rehabilitation measures intended to increase bat populations in degraded landscapes, such as revegetating riparian zones and installing bat boxes.	Not applicable.	●	●		●
Research the potential for long distance/seasonal movement.	Not applicable.	●			
Research the roosting ecology of tree-roosting bats. For example identifying the attributes of key roosts.	Not applicable.	●	●		●
Research to identify important foraging range and key habitat components around significant roosts.	Not applicable.	●	●	●	●
Research to quantify any benefits of local bat populations to reducing the impact of insect pests on commercial crops.	Not applicable.	●			
Restrict access where possible to known maternity sites. (e.g.: signs; bat-friendly, preferably external gates at caves).	Not applicable.			●	
Restrict caving activities at significant roosts during important stages of the annual bat life cycle (eg winter hibernation, summer maternity season).	Not applicable.			●	
Restrict caving activity during critical times of year in important roosts used by species, particularly maternity and hibernation roosts.	Not applicable.			●	
Implement key threat abatement actions for longwall mining.	Not applicable.			●	
Search for significant roost sites and restrict access where possible (e.g. gating of caves). Significant includes maternity, hibernation and transient sites including in artificial structures.	Not applicable.			●	
Study the ecological requirements of maternity colonies and their environs and migratory patterns.	Not applicable.			●	
Study the ecology, habitat requirements and susceptibility to logging and other forestry practices of this little-known species.	Not applicable.	●	●	●	●
Study the species biology such as reproductive capacity, longevity, mortality rate and life history, or thermal and energy requirements to better determine capacity to respond to changes in climate or recover from losses in the population.	Not applicable.	●			
Study the susceptibility of this species to pesticide accumulation.	Not applicable.	●		●	●

Description of priority action[1]	Does action relate to the current project?	Yellow-bellied Sheathtail Bat	Eastern Freetail Bat	Large-eared Pied Bat	Greater Broad-nosed Bat
Undertake a systematic survey of productive coastal river valleys to quantify the importance of private land relative to public lands.	Not applicable.				●
Undertake long-term monitoring of populations cross tenure in conjunction with other bat species to document changes.	Not applicable.	●	●		●
Undertake non-chemical removal of weeds (e.g. lantana, blackberry) to prevent obstruction of cave entrances.	Not applicable.			●	
Use radio-tracking to identify important foraging range and help interpret density of records.	Not applicable.	●		●	

E12.2 Microbat state significance assessment

This assessment is based on the extent of potential microbat roosting and foraging habitat within the study area (approximately 4.60 ha).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Project will result in the removal of 4.60 ha of potential microbat habitat. Tree hollows of suitable size for microbats were recorded in low abundance throughout the study area. However, some species of microbat (e.g. The Eastern Freetail Bat) are known to roost under loose bark or in fissures of various species of Eucalypt (Churchill 1998).

Only two significant hollow-bearing trees were recorded within the study area as well as a few scattered dead trees. Some fallen dead branches would also be removed as part of the Project across the study area. The hollow-bearing trees are located within the proposed Vineyard Station area and Department of Defence lands opposite Manorhouse Boulevard.

Microbats are highly mobile species and many species are known to change their roosts daily (Churchill 1998). Given the proposed vegetation clearing protocols for habitat trees aim to remove microbats prior to felling/clearing; the Project is unlikely to result in direct mortalities of Threatened microbats. Additionally, it is unlikely that any of the tree hollows recorded within the certified areas would be a suitable size for a maternity colony for any of these threatened microbats. The Project therefore, is unlikely to significantly disrupt their breeding cycle.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the removal of 4.60 ha of microbat foraging and roosting habitat within the study area. This is likely to result in the loss of two hollow-bearing trees and isolated dead trees which may provide potential roosting habitat for microbats. The Project will also result in the removal of grassland (less than 1 ha) which may provide potential foraging habitat for microbats. However these areas are relatively small in relation to similar habitats available in the local area, and this is unlikely to represent a significant reduction in the availability of foraging and roosting resources.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The distribution for the threatened microbat species is listed in Table E- 12-1 and extends along the coastal regions of eastern Australia into the Great Dividing Range. The study area is not at the limit of the known distributions for populations these four species of microbat.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes of the microbat habitat within the study area such as changes to the fire or flooding regime. While construction activities have the potential to result in conditions that favour the establishment and proliferation of weeds as a result of exposed soil and stockpiles, the control of weeds will be managed through the construction environmental management plan.

How is the proposal likely to affect habitat connectivity?

Microbats are highly mobile species that fly between patches of suitable habitat for foraging and roosting. Due to their relatively large ranges and the small amount of vegetation clearing, the Project would not create a barrier to the movement of the species between other foraging or roosting habitats.

The Project is therefore not likely to increase fragmentation or isolation of habitat for microbats as the potential habitat proposed for removal occurs as small isolated patches of vegetation either within the existing railway corridor or immediately adjacent. As such, the Project will not affect habitat connectivity.

How is the proposal likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There is no critical habitat listed for the species of microbat and the areas of impact are not considered to be critical to the survival of these species as they are in poor condition and highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities.

Conclusion

The Project will result in the removal of approximately 4.60 ha of microbat habitat within the study area, including the removal of two significant hollow-bearing trees. However this area is relatively small in relation to similar habitats available in the local area, and this is unlikely to represent a significant reduction in the availability of foraging resources within the species' range. As such it is unlikely that the project will have a significant impact on these species. Additionally, due to the paucity of suitably sized tree hollows within certified areas, the Project will not affect or disrupt any maternity colonies and therefore will not affect the life cycle of the listed microbats.

E13. Glossy Black-cockatoo (Calyptorhynchus lathami)

E13.1 Glossy Black-cockatoo profile

Status

The Glossy Black-cockatoo is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995.*

Description

The Glossy Black-cockatoo is a dusky brown to black cockatoo with a massive, bulbous bill and a broad, red band through the tail. The red in the tail is barred black and edged with yellow. The female usually has irregular pale-yellow markings on the head and neck and yellow flecks on the underparts and underwing. They are smaller than other black cockatoos (about 50 cm in length), with a smaller crest (Pizzey & Knight 1997).

The Glossy Black-cockatoo is dependent on *Allocasuarina* and *Casuarina* trees for feeding. It prefers woodland dominated by *Allocasuarina/Casuarina spp.,* or open Sclerophyll forests or woodlands, with middle stratum of *Allocasuarina* below a canopy of *Eucalyptus* or *Angophora* species. It is often confined to remnant patches in hills and gullies, surrounded by cleared agricultural land (Arnett & Pepper 1997; Higgins 1999).

Glossy Black-cockatoos breed in hollow stumps, spouts in living or dead eucalypt limbs, and tree hollows of tall trees. It breeds mainly within woodland or remnant woodland, but has also been recorded in dead, ringbarked eucalypt in cleared country. Entrances to hollows are either a hole in the side of trunk, broken top of stump, or end of spout or limb (NSW National Parks and Wildlife Service 1999b).

Glossy Black-cockatoos mostly roost in the canopy of live, leafy trees; preferring eucalypt trees, but will use other species, usually a kilometre from the feeding site and, during breeding season, within 30 m of the nesting tree.

Distribution

The Glossy Black-cockatoo has a patchy distribution in Australia, having once been widespread across most of the south-eastern part of the country. It is now distributed throughout an area which extends from the coast near Eungella in eastern Queensland to Mallacoota in Victoria. In New South Wales, the current distribution of the Glossy Black-cockatoo covers areas from the coast to the tablelands, and as far west as the Riverina and Pilliga Scrub (NSW National Parks and Wildlife Service 1999b).

Extent within the study area

The Glossy Black-cockatoo was not recorded during the current survey, however several suitable habitat trees (e.g. *Casuarina glauca*) were observed within the drainage lines (Riparian Corridors) in the study area. Tree hollows observed within the study area do not appear to be suitable as breeding sites for Glossy Black-cockatoos in that the trees are not mature enough and the hollows are not very large.

Threats and recovery of the Glossy Black-cockatoo

The Glossy Black-cockatoo is subject to a range of threats including:

- loss of tree hollows
- reduction of suitable habitat through clearing for development
- excessively frequent fire which reduces the abundance and recovery of she-oaks
- illegal bird smuggling and egg-collecting (Department of Environment and Climate Change 2005c).

A recovery plan has not been prepared for the Glossy Black-cockatoo under the *Threatened Species and Conservation Act 1995.* The Department of Environment and Climate Change has however identified 9 priority actions (also referred to as the Priority Action Statement or PAS) to help recover the species (see Table E- 13-1). The Project is unlikely to affect these recovery actions.

Table E- 13-1 Priority actions for the Glossy Black-cockatoo

Description of priority action	Does the action relate to the Project and associated works
Increase landholder and public awareness and interest in Glossy Black-cockatoo conservation and habitat management.	Not Applicable
Utilise the Glossy Black-cockatoo as a flagship threatened species for woodland and forest conservation education and awareness programs.	Not Applicable
Develop/encourage strategic planning approach for Glossy Black-cockatoo at the local and regional level.	Not Applicable
Prepare and distribute EIA guidelines to decision makers.	Not Applicable
Provide incentives for landholders to fence and manage key sites.	Not Applicable
Assist landholders who wish to enter into voluntary conservation agreements at key sites.	Not Applicable
Encourage the restoration of foraging habitat that has been cleared or degraded by previous impacts.	Not Applicable
Continue existing monitoring programs (e.g. Goonoo population) and encourage other community groups to develop a monitoring program of local populations.	Not Applicable
Identify and map key breeding and foraging habitat, similar to the mapping done by Robinson (2004) at St Georges Basin.	Not Applicable

E13.2 Glossy Black-cockatoo state significance assessment

This assessment is based on the extent of potential Glossy Black-cockatoo foraging habitat within the study area (approximately 1.47 ha).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

River-flat Eucalyptus Forest in the study area includes the Glossy Black-cockatoo feed tree species (*Casuarina glauca)* in either the canopy or sub-canopy stratum. The Project will remove approximately 1.47 ha of vegetation that includes *Casuarina glauca* and hence is suitable for foraging. Although tree hollows are present in this area they do not appear to be

suitable as breeding sites for Glossy Black-cockatoos in that the trees are generally not tall enough and the hollows are small.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the removal of 1.47 ha of potential foraging habitat for the Glossy Black-cockatoo within the certified area; however it is in poor condition and highly fragmented by roads, rail, powerlines, urban development and land clearing for agriculture. Good quality foraging resources are widely available outside the impacted areas and within the wider locality and given the Glossy Black-cockatoo is a mobile species which travels between patches of suitable foraging and roosting habitat, the Project will not significantly affect foraging habitat for this species. The Project will not affect or disrupt any Glossy Black-cockatoo roosting habitat.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

In NSW, the distribution of the Glossy Black-cockatoo covers areas from the coast to the tablelands, and as far west as the Riverina and Pilliga Scrub (NSW National Parks and Wildlife Service 1999b). The study area is not at the limit of the distribution of the Glossy Black-cockatoo.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes of the remaining Glossy Black-cockatoo habitat within the study area such as changes to the fire or flooding regime. While construction activities have the potential to result in conditions that favour the establishment and proliferation of weeds as a result of exposed soil and stockpiles, the control of weeds will be managed through the construction environmental management plan.

How is the proposal likely to affect habitat connectivity?

The Glossy Black-cockatoo is a highly mobile species that flies between patches of suitable habitat for foraging and roosting. The River-Flat Eucalypt Forest which provides potential foraging habitat for the Glossy Black-cockatoo occurs within the study area as five patches along the rail alignment. These patches are fragmented, edge-affected and range in condition from medium to poor. Given these patches are already highly fragmented by roads, rail, powerlines, urban development and land clearing for agriculture, the Project is therefore not likely to increase fragmentation or isolation of foraging habitat for the Glossy Black-cockatoo as the potential habitat proposed for removal occurs as small isolated patches of vegetation either within the existing railway corridor or immediately adjacent. As such, the Project will not affect habitat connectivity.

How is the proposal likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There is no critical habitat listed for the Glossy Black-cockatoo and the areas of impact are not considered to be critical to the survival of these species as they are in poor condition and highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities.

Conclusion

Although the Project will remove approximately 1.47 ha of habitat suitable for foraging by the Glossy Black-cockatoo, this area is relatively small, poor in condition and fragmented in relation to similar habitats available in the local area. Important habitat resources such as nesting hollows/trees are not abundant in the area, nor will they be removed by the Project. As such it is unlikely that the Project will have a significant impact on this species.

E14. Powerful Owl (Ninox strenua)

E14.1 Powerful Owl profile

Status

The Powerful Owl is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act*.

Description

The Powerful Owl is a typical hawk-owl, with staring yellow eyes and no facial-disc and is one of the largest forest owl species in Australasia (Simpson & Day 1996). Adults reach 60 cm in length, have a wingspan of up to 140 cm and weigh up to 1.45 kg (Pizzey & Knight 1997). The upper parts of the Powerful Owl are dark, greyish-brown with indistinct off-white bars. The underparts are whitish with dark greyish-brown V-shaped markings. Juvenile Powerful Owls have a white crown and underparts that contrasts with its small, dark streaks and dark eye patches. The slow, deep and resonant double hoot call of this species may be heard at any time of the year, but it is more vocal during the winter breeding season (NSW National Parks and Wildlife Service 1998).

The Powerful Owl inhabits a range and mosaic of vegetation types, from woodland and open sclerophyll forest (on productive sites) to tall open wet forest and rainforest, with mesic gullies and permanent streams (Debus & Chafer 1994). The owl requires large tracts of forest or woodland habitat but can also occur in fragmented landscapes. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats.

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. The nest sites are situated 12 – 40 m above the ground, often at the head of a gully, or on the face of a hill (Kavanagh & Debus 1994).

The main prey items are medium-sized arboreal marsupials, particularly the slow-moving Greater Glider, as well as Common Ringtail Possum and Sugar Glider. As most prey species require hollows and a shrub layer, these are important habitat components for the species. Insects, large birds and a variety of other mammals including flying foxes are also taken (Department of Environment and Conservation 2005b).

The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In New South Wales, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. The Powerful Owl is now uncommon throughout its range where it occurs at low densities (Department of Environment and Conservation 2005b).

Extent within the study area

The Powerful Owl was not recorded within the study area and tree hollows observed within the study area do not appear to be suitable as nesting sites for the Powerful Owl in that the trees are not old enough or of a suitable height and the hollows are not very deep.

Threats and recovery of the Powerful Owl

Specific threats to Powerful Owl identified by the Department of Environment and Conservation (2005b) include:

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

The Project will involve three key threatening processes that relate to Large Forest Owls - clearing of native vegetation, removal of dead wood and loss of hollow-bearing trees. Threat abatement plans have not been prepared for these processes.

A recovery plan has been finalised and approved for Large Forest Owls (Department of Environment and Conservation 2006), in which a number of recovery actions are listed (refer Table E-14-1). The overall objective of the NSW Large Forest Owl Recovery Plan is to ensure that these species persist in the wild in NSW in each region where they presently occur.

Table E- 14-1 Recovery actions for Large Forest Owls

Recovery Action	Likely to be affected by the Project
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 protection of individual nest sites)	**No**
Prepare an information package containing: a species profile for each species (that contains information about the conservation status and management issues affecting each owl and its habitat); habitat protection and management guidelines (to provide additional information on identification of significant habitat for owls, appropriate strategies for its protection, and for habitat creation as part of revegetation programs); and survey and assessment guidelines.	No

Recovery Action	Likely to be affected by the Project
Make the information packages available from DEC offices and the DEC internet website, and distribute to key groups such as local Councils, Catchment Management Boards, community landcare groups, and interested individuals.	No
Encourage Catchment Management Boards and other groups such as Landcare, to protect existing habitat (particularly known nest sites) and establish new habitat (particularly linking existing fragments of habitat or around nest sites).	No
Actively source and publicise funds to be used for owl conservation on private land as a management incentive and for specific protective or rehabilitative projects.	No
Seek to secure sympathetic management of large forest owl habitat (and particularly nest sites) on private land through liaison with private landholders to discuss management options such as property management plans, voluntary conservation agreements and management incentives.	No
Objective 2: To minimise the impacts of development activities on large forest owls and their habitats outside conservation reserves and State forests.	**No**
Prepare environmental impact assessment guidelines to assist consent and determining authorities and environmental consultants to assess impacts of developments on the large forest owls.	No
Monitor and report on the effectiveness of concurrence and licence conditions that have previously been applied to reduce the impacts of developments on the three large forest owl species or their habitats. This will involve keeping a record of such conditions, selecting case studies and then checking for the presence of owls at long intervals post development.	No
Use this information to develop a set of prescriptive guidelines that may be used to mitigate the impacts of developments on the three large forest owls outside conservation reserves and State forests	No
Objective 3: To assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected.	**No**
Update and refine existing owl habitat models using the best available information.	No
Map the amount of modelled habitat across forested land in NSW.	No
Design a sampling strategy to test the modelled habitat for the presence of owls and locate identified sites.	No
Field validation of modelled habitat for the presence of owls.	No
Estimate the areal amount of mapped modelled habitat for each owl species that is occupied (based on the proportion of sample sites with owls in them) and use this estimate to further estimate the number of owl territories present within different land tenures (based on home range data).	No
Objective 4: To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species and across different land tenures and disturbance histories.	**No**
Develop a sampling methodology stratified across different land tenures and disturbance histories, as well as a set of standardised regional monitoring protocols. Investigate and pursue the cooperative involvement of other agencies, researchers and the community in the implementation of the regional monitoring program.	No
Implement a regional monitoring program.	No
Objective 5: To assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber-harvesting operations on the three owl species and, (if necessary), to use this information to refine the prescriptions so that forestry activities on State forests are not resulting in adverse changes in species abundance and breeding success.	**No**
Investigate the implementation by DPI (Forests NSW) of the forestry TSL owl prescriptions by carrying out proactive audits targeting these prescriptions (DEC) and through IFOA monitoring and reporting (DPI).	No

Recovery Action	Likely to be affected by the Project
Carry out post harvest surveys in locations where owls were detected prior to logging to determine if they are continuing to occupy the habitat.	No
Encourage student radiotracking projects examining the use of logged and unlogged forest by the three owl species.	No
Make an assessment of the implementation and effectiveness of forestry owl prescriptions using data collected in this action.	No
If necessary, refine the prescriptions and negotiate changes to the forestry TSLs.	No
Objective 6: To improve the recovery and management of the three large forest owls based on an improved understanding of key areas of their biology and ecology.	**No**
Promote awareness of the research needs of the three large forest owls among the scientific and academic community	No
Encourage involvement of researchers and students in the recovery efforts for the three large forest owls, particularly in habitat survey, and population monitoring.	No
Seek avenues to raise additional funds through sponsorship and public appeals to support research projects that are not funded	No
Provide scholarship funds for an identified aboriginal student to investigate the cultural and historic significance of the three species.	No
Objective 7: To raise awareness of the conservation requirements of the three large forest owls amongst the broader community, to involve the community in owl conservation efforts and in so doing increase the information base about owl habitats and biology.	**No**
Encourage and coordinate the involvement of community-based groups (eg the Australian Bird and Bat Study Association) and animal care groups (e.g. WIRES) in the implementation of recovery actions.	No
Set up a website linked to the DEC internet site and targeted specifically at the community that will serve to provide information on owl identification (including photographs and samples of calls), habitat identification and protection, any current activities that they can be involved in as well as information on how and where to report sightings and other relevant information. Ensure this site has links to other key internet sites such as the Australasian Raptor Association.	No
Objective 8: To coordinate the implementation of the recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives	No
Coordination of implementation of actions.	No
Seek to integrate recovery actions with other recovery plan actions and conservation initiatives.	No
Review of plan and rewrite in final year.	No
Convene a threatened owl workshop with relevant experts and stakeholders to reassess the State conservation status of the three large forest owls. This action will be undertaken upon conclusion of the implementation of all of the above actions.	No

Note 1: These guidelines have not been prepared by DECC as yet.

The Project is not consistent with the objectives of minimising habitat loss outside of conservation reserves. However given that the habitat is marginal within the study area this is not considered to be significant.

E14.2 Powerful Owl state significance assessment

This assessment is based on the extent of potential Powerful Owl foraging habitat within the study area (approximately 4.60 ha).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Project will remove approximately 4.60 ha of potential foraging habitat for the Powerful Owl, although this habitat is considered to be marginal within the study area because it is in poor condition and highly fragmented by roads, rail, powerlines, urban development and land clearing for agriculture. The Project will not affect or disrupt any Powerful Owl roosting habitat as tree hollows present in this area. The trees do not appear to be suitable for use as nesting sites by Powerful Owls because they are not old enough or of a suitable height and the hollows are not very deep. Impacts of the Project would be restricted to the clearing of marginal foraging habitat. No nesting sites would be impacted and as such the Project is unlikely to affect the lifecycle of the Powerful Owl.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the removal of 4.60 ha of potential foraging habitat for the Powerful Owl within the study area. However, given that vegetation in this area is already fragmented by infrastructure, urban development and land clearing and the habitat to be removed is largely adjacent to the existing rail corridor, the Project is unlikely to further create a barrier for this species. Good quality foraging resources are widely available outside the impacted areas within the wider locality and given the Powerful Owl is a mobile species which travels between patches of suitable foraging and roosting habitat, the Project will not significantly affect foraging habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Distribution of the Powerful Owl ranges across eastern and south-eastern Australia, but it is mainly confined to within 200 km of the coast. In New South Wales, it is widely distributed throughout the eastern forests from the coast inland to tablelands and as such, the study area is not at the limit of the known distribution of the Powerful Owl.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes, such as fire frequency and intensity or flood flows, of Powerful Owl foraging habitat within the study area.

How is the proposal likely to affect habitat connectivity?

The Powerful Owl is a highly mobile species that flies between patches of suitable habitat for foraging and nesting. They usually require large tracts of forest or woodland habitat for hunting and breeding, but they occasionally hunt in open habitats. The potential foraging habitat for the Powerful owl occurs within the study area as small isolated patches of vegetation either within the existing railway corridor or immediately adjacent. Given these patches are in medium to poor condition and are already highly fragmented by roads, rail, powerlines, urban development and land clearing for agriculture, the Project is therefore not likely to increase fragmentation or isolation of foraging habitat for the Powerful Owl. Since the vegetation within the study area is already highly fragmented, the Project will not form a barrier or otherwise further fragment Powerful Owl foraging habit available in the wider locality.

How is the proposal likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There is no critical habitat listed for the Powerful Owl and the areas of potential impact are not considered to be critical to the survival of this species as they are in poor condition and highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities.

Conclusion

Although the project will remove approximately 4.60 ha of potential foraging habitat for the Powerful Owl, this area is relatively small in relation to similar habitats available in the local area. Important habitat resources such as nesting hollows are not present within the study area. As such it is unlikely that the project will have a significant impact on this species.

E15. Square-tailed Kite (Lophoictinia isura)

E15.1 Square-tailed Kite profile

Status

The Square-tailed Kite is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act*.

Description

The Square-tailed Kite is a long-winged raptor that is medium in size (50-56 cm) (Simpson & Day 1996). Adults have a white face with thick black streaks on the crown and finer streaks elsewhere. The saddle, rump and central upper tail coverts are blackish with grey-brown barring. The underparts are predominantly grey-brown with black tips on the grey, square-tipped tail and wing edges. The long fingered, upswept wings have a large white patch at the base of the barred 'fingers' on the outer ends of the wings a is a reddish (Pizzey & Knight 1997).

Habitat

The Square-tailed Kite inhabits permanent wetlands that have a good surface cover of floating vegetation. On the coast, this species is found in a variety of timbered habitats including dry woodlands and open forests particularly those on fertile soil, however it shows a particular preference for inland timbered watercourses (Debus et al. 1993; Pizzey & Knight 1997). Square-tailed Kites will range into open habitats nearby, but not into extensive treeless regions. It will also forage over partially cleared pastoral land and coastal heath. A common feature of Square-tailed Kite habitat is the presence of profuse eucalypt blossom and attendant nectivorous birds on which the preys (Marchant & Higgins 1993). Rough-barked Apple (*Angophora floribunda*) appears to be an important nest tree (Debus et al. 1993).

Ecology

The Square-tailed Kite are a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage (Debus et al. 1993). The species has also been observed to eat frogs, insects and reptiles. Breeding is from July to February, with nest sites generally located along or near watercourses near surrounding forest or woodland, in a fork or on large horizontal limbs of living trees (Debus et al. 1993).

Distribution

The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In New South Wales, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems (Department of Environment and Conservation 2005c). It is a summer breeding migrant to the south-east, including the New South Wales south coast, arriving in September and leaving by March (Debus et al. 1993).

Distribution within the study area

This species has been previously recorded in the locality (Department of Environment and Climate Change 2008a) and may potentially utilise woodland stands scattered throughout the area for foraging purposes on occasion. However, the Square-tailed Kite was not observed within the study area during field surveys undertaken for the biodiversity assessment and no nests for this species were identified.

Threats and recovery of the Square-tailed Kite

Specific threats to Square-tailed Kite identified by the Department of Environment and Conservation (2005c) include:

- Clearing, logging, burning, and grazing of habitats resulting in a reduction in nesting and feeding resources.
- Disturbance to or removal of potential nest trees near watercourses.
- Illegal egg collection and shooting.

A recovery plan has not been prepared for the Square-tailed Kite under the *Threatened Species and Conservation Act 1995.* The Department of Environment and Climate Change has however identified three priority actions (also referred to as the Priority Action Statement or PAS) to help recover the species (see Table E-15-1). The Project is unlikely to affect these recovery actions.

Table E- 15-1 Priority actions for the Square-tailed Kite

Description of priority action	Does action relate to the Project and associated works?
Identify and protect nest trees, and monitor reproduction.	Not applicable.
Ensure implementation of management strategies that reduce disturbance of riparian areas.	Not applicable.
Liaise with local field ornithologist to obtain data on the Square-tailed Kite in the area.	Not applicable.

E15.2 Square-tailed Kite state significance assessment

This assessment is based on the extent of potential Square-tailed Kite foraging habitat within the study area (approximately 4.60 ha).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Project will remove approximately 4.60 ha of potential foraging habitat for the Square-tailed Kite, although this habitat is considered to be marginal within the study area because it is highly disturbed and fragmented. Larger areas of potential foraging habitat occur throughout the locality and provide habitat for a wider variety of passerine bird species which are the primary prey of the Square-tailed Kite.

Whilst the vegetation to be cleared by the Project contributes to the potential habitat for an individual or a pair of Square-tailed Kites in the locality, it is likely to constitute only a minor proportion of the available habitat given the extent of suitable habitat in the surrounding area. Additionally, it is fragmented by infrastructure, urban development and land clearing and the habitat to be cleared is largely adjacent to the existing rail corridor. Good quality foraging resources are widely available outside the impacted areas within the wider locality and given the Square-tailed Kite is a mobile species with a large home range (at least 100km^2) and travels between patches of suitable foraging and roosting habitat, the Project will not significantly affect foraging habitat for this species.

No nest sites of the Square-tailed Kite were recorded in the study area and the Project will not involve the removal or modification of nest sites for the Square-tailed Kite, and should not have a significant impact on the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the clearing of 4.60 ha of potential foraging habitat for the Square-tailed Kite within the study area. Although, the small area of fragmented woodland and derived grasslands to be cleared would only constitute a very small proportion of the home range (at least 100km^2) of an individual or pair of Square-tailed Kites.

Additionally, since the vegetation in this area is already fragmented by infrastructure, urban development and land clearing and the habitat to be removed is largely adjacent to the existing rail corridor, the Project is unlikely to further create a barrier for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

In New South Wales, the Square-tailed Kite, is distributed throughout the north, coastal regions of the north-east and along the major west-flowing river systems (Department of Environment and Conservation 2005c). This species has been previously recorded in the locality (Department of Environment and Climate Change 2008a) and may potentially utilise woodland stands scattered throughout the area for foraging purposes on occasion. Therefore, the study area is not considered to be at the limit of the known distribution of the Square-tailed Kite.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes, such as fire frequency and intensity or flood flows, of Square-tailed Kite foraging habitat within the study area.

How is the proposal likely to affect habitat connectivity?

The Square-tailed Kite is a highly mobile species that flies between patches of suitable habitat for foraging and nesting, and is not reliant on large continuous tracts of forest and woodland for movement. Since the vegetation within the study area is already highly fragmented and this species able to cross open areas, the Project will not form a barrier or otherwise further fragment Square-tailed Kite foraging habitat available in the wider locality.

How is the proposal likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There is no critical habitat listed for the Square-tailed Kite and the areas of potential impact are not considered to be critical to the survival of this species as they are in poor condition and highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities.

Conclusion

Although the Project will remove approximately 4.60 ha of habitat suitable for foraging by the Square-tailed Kite, this area is relatively small in relation to larger areas of potential foraging habitat within the locality which would provide habitat for a wider variety of passerine bird species which are the primary prey of the Square-tailed Kite. No nests consistent with the Square-tailed Kite were identified within the study area, nor will they be removed by the Project. As such it is unlikely that the Project will have a significant impact on this species.

E16. Woodland Birds

E16.1 Woodland bird profiles

No threatened species of woodland bird was recorded in the study area but potential foraging and nesting habitat is present within the study area for species including:

- Speckled Warbler Pyrrholaemus sagittatus
- Diamond Firetail Stagonopleura guttata

These two species are listed as Vulnerable under Schedule 2 of the TSC Act and have been considered collectively because of their similar habitat requirements, habits and threats, which are described in Table E-16-1.

Threats and recovery

Woodland birds are subject to a range of threats (refer Table E-16-1). These generally relate to clearing of remnant grassy woodland habitat and modification and destruction of ground habitat which results in the loss of important food plants.

Table E- 16-1 Details of threatened species of woodland birds

Common name (Scientific name)	Habitat	Distribution	Threats
Speckled Warbler (*Pyrrholaemus sagittatus*)	Inhabit woodlands with a grassy understorey, often on ridges or gullies. The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. They forage on the ground and in the understorey for arthropods and seeds (Ford et al. 1986). Home ranges vary from 6-12 hectares.	The Speckled Warbler inhabits Eucalypt and *Callitris* woodlands mostly on the western slopes and tablelands of the Great Dividing Range, with some populations in the rain shadow woodlands such as the Snowy River Valley, Cumberland Plains near Sydney and the Hunter Valley (Garnett & Crowley 2000).	Risk of local extinction due to small, isolated populations Clearing of remnant grassy woodland habitat for agriculture and firewood Poor regeneration of grassy woodland habitats Modification and destruction of ground habitat through removal of litter and fallen timber, introduction of exotic pasture grasses, heavy grazing and compaction by stock and frequent fire Significant (>80%) nest failure rates in isolated fragments Nest failure due to predation by native and non-native birds, cats, dogs and foxes

Common name (Scientific name)	Habitat	Distribution	Threats
Diamond Firetail (*Stagonopleura guttata)*	The Diamond Firetail finch occupies eucalypt woodlands, forests and mallee where there is a grassy understorey and some shrub cover (Antos *et al.* 2008). Pairs breed singly or in small colonies of up to 20 nests. Diamond firetails forage extensively on the seeds of many introduced plants that have colonised much of the range of the finches and potentially replaced many of the native seed of plants (Pizzey & Knight 1997).	The Diamond Firetail is widely distributed in NSW, but mainly known from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. It is not commonly found in coastal districts, however there are records from near Sydney, the Hunter Valley and the Bega Valley (Pizzey & Knight 1997).	Clearing of remnant grassy woodland habitat for agriculture and firewood Poor regeneration of grassy woodland habitats Modification and destruction of ground habitat through removal of litter and fallen timber, introduction of exotic pasture grasses, heavy grazing and compaction by stock and frequent fire Invasion of weeds, resulting in the loss of important food plants Predation of eggs and nestlings by increased populations of native predators such as the Pied Currawong *Strepera graculina.*

The Department of Environment and Climate Change has identified seven priority actions (also referred to as the Priority Action Statement or PAS) to direct recovery actions for the Speckled Warbler and Diamond Firetail (refer Table E-16-2). None of these actions relate to impacts of the Project.

Table E- 16-2 Recovery actions for Woodland birds

Recovery Action	Speckled Warbler	Diamond Firetail	Likely to be affected by the Project
Develop an Expression of Interest targeted towards private landowners to locate new sites and from this negotiate, develop and implement conservation management agreements.	●	●	No
Increase understanding of woodland birds through promotion of the DECC website and other educational material.	●	●	No
Implement sympathetic habitat management in conservation reserves, council reserves and crown reserves where the species occurs.	●	●	No
Identify key habitats on a regional basis or areas for protection and enhanced management through incentives.	●	●	No
Conduct ecological research to determine habitat and resource requirements, threats and conservation issues.	●	●	No
Develop habitat identification, management and enhancement guidelines for woodland birds.	●	●	No

Recovery Action	Speckled Warbler	Diamond Firetail	Likely to be affected by the Project
Undertake surveys for threatened woodland birds in new and existing conservation reserves containing suitable habitat to assess the species' conservation status and identify key breeding and foraging habitat.	●	●	No

Distribution within the study area

No threatened woodland bird species were detected within the study area. The remnant woodland and grassland habitat (4.60 ha) within the study area is considered to be potential foraging habitat for these two threatened species of woodland bird.

E16.2 Woodland Birds state significance assessment

This assessment is based on the extent of potential Woodland Bird foraging habitat within the study area (approximately 4.60 ha).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Project will remove approximately 4.60 ha of woodland and grassland vegetation which could provide potential foraging and nesting habitat for threatened woodland bird species including the Speckled Warbler and the Diamond Firetail, although this habitat is in poor condition and highly fragmented within the study area compared to what is widely available in the locality.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the removal of 4.60 ha of potential foraging habitat for woodland birds within the study area. However, since vegetation in the study area is fragmented by roads, rail, powerlines, urban development and land clearing for agriculture, the Project is unlikely to increase barriers or fragmentation for these species because the habitat to be removed is already fragmented and largely occurs adjacent to the existing rail corridor.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

In NSW, the Speckled Warbler is distributed in Eucalypt and Callitris woodlands in the Snowy River Valley, Cumberland Plain and the Hunter Valley. The Diamond Firetail is widely distributed in NSW, but mainly known from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina, however there are records from near Sydney, the Hunter Valley and the Bega Valley. The study area is not at the limit of the known distribution of these species of woodland birds.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes of the remaining Woodland Bird habitat within the study area. The Project will not modify the intensity or frequency of fires, nor will it modify the flooding flows in its habitat.

How is the proposal likely to affect habitat connectivity?

The Speckled Warbler and Diamond Firetail form small, restricted populations but can fly locally between patches of suitable habitat for foraging and nesting. The vegetation within the study area is already highly fragmented by infrastructure, urban development and land clearing and the habitat to be cleared is largely adjacent to the existing rail corridor. Good quality foraging resources are widely available outside the impacted areas within the wider locality. As such, the Project will not form a barrier or otherwise further fragment foraging habit for these woodland bird species, which is widely available in the locality.

How is the proposal likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There is no critical habitat listed for the Speckled Warbler or Diamond Firetail and the areas of potential impact are not considered to be critical to the survival of this species as they are in poor condition and highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities.

Conclusion

Although the project will remove approximately 4.60 ha of habitat suitable for foraging by threatened woodland birds, this area is relatively small and of poor quality compared to larger areas of similar habitat available in the local area. No nests consistent with these species were identified within the study area, nor will they be removed by the Project. As such it is unlikely that the project will have a significant impact on these species.

E17. Black-chinned Honeyeater (Melithreptus gularis gularis)

E17.1 Black-chinned Honeyeater profile

Status

The Black-chinned Honeyeater is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act*.

Description

The Black-chinned Honeyeater is a medium-sized green and white passerine bird with a black crown, white nape and pale blue skin around the eye. The black chin for which it is named is indistinct. The species builds compact, cup-shaped nests and feeds on arthropods, nectar and lerp from eucalypt foliage and bark (Blakers *et al.* 1984).

Habitat

In NSW, the subspecies is mainly found in woodlands containing box-ironbark associations and River Red Gum. Black-chinned Honeyeaters are also known from drier coastal woodlands of the Cumberland Plain, Western Sydney and in the Hunter, Richmond and Clarence Valleys (Blakers *et al.* 1984).

Ecology

They are usually found high up in the canopy of large eucalypts and have a strong 'churring' call. They are a gregarious bird and live in small communal groups, often in association with other bird species, providing benefits from predation and competition for similar food sources (Department of Environment and Climate Change 2005a). They move in response to the flowering cycles of their food plants and the availability of insects, their primary food source (Blakers *et al.* 1984).

Black-chinned Honeyeaters are likely to experience high levels of competition from aggressive honeyeater species such as Noisy Miners or White-plumed Honeyeaters, both of which occur at high densities in small remnants of Red Gum and box-ironbark associations. In addition, increased nest predation is expected from increasing populations of predators such as Pied Currawongs and Australian Ravens, particularly in small remnants (Major *et al.* 1996).

Distribution

The eastern form of the Black-chinned Honeyeater is found predominantly west of the Great Dividing Range in a narrow belt through NSW into southern Queensland, and south into Victoria and South Australia where it occupies eucalypt woodlands within an approximate annual rainfall range of 400-700mm (Blakers *et al.* 1984).

Distribution within the study area

The Black-chinned Honeyeater was not detected within the study area. The remnant woodland habitat (approximately 4.60 ha) within the study area is considered to provide potential foraging habitat for this threatened species.

Threats and Recovery of the Black-chinned Honeyeater

The Black-chinned Honeyeater is subject to a range of threats including:

- clearing of remnant open forest and woodland habitat
- poor regeneration of open forest and woodland habitats because of intense grazing
- possible exclusion from smaller remnants by aggressive species such as the Noisy Miner (*Manorina melanocephala*) (Department of Environment and Climate Change 2005a).

The Department of Environment and Climate Change has identified six priority actions (also referred to as the Priority Action Statement or PAS) to direct recovery actions for the Black-chinned Honeyeater (refer Table E-17-1). None of these actions relate to impacts of the Project.

Table E- 17-1 Recovery actions for the Black-chinned Honeyeater

Recovery Action	Likely to be affected by the Project
Develop an Expression of Interest targeted towards private landowners to locate new sites and from this negotiate, develop and implement conservation management agreements.	No
Increase understanding of woodland birds through promotion of the DECC website and other educational material.	No
Implement sympathetic habitat management in conservation reserves, council reserves and crown reserves where the species occurs.	No
Identify key habitats or areas for protection and enhanced management through incentives.	No
Conduct ecological research to determine habitat and resource requirements, threats and conservation issues.	No
Develop habitat identification, management and enhancement guidelines for woodland birds.	No
Undertake surveys for threatened woodland birds in new and existing conservation reserves containing suitable habitat to assess the species' conservation status and identify key breeding and foraging habitat.	No

E17.2 Black-chinned Honeyeater state significance assessment

This assessment is based on the extent of potential Black-chinned Honeyeater foraging habitat within the study area (approximately 4.60 ha).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Project will remove approximately 4.60 ha of woodland and grassland vegetation which could provide potential foraging and nesting habitat for the Black-chinned Honeyeater, although this habitat is in poor condition and highly fragmented within the study area compared to what is widely available in the locality.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the removal of 4.60 ha of potential foraging habitat for the Black-chinned Honeyeater within the study area. However, given vegetation in the study area is fragmented by roads, rail, powerlines, urban development and land clearing for agriculture, the Project is unlikely to increase barriers or fragmentation for this species because the habitat to be removed is already fragmented and largely occurs adjacent to the existing rail corridor.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

In NSW, the distribution of the Black-chinned Honeyeater is patchy, but records are known from as far south as the Illawarra region past Sydney. The study area is not at the limit of the known distribution of the Black-chinned Honeyeater.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes of the remaining Black-chinned Honeyeater habitat within the study area. The Project will not modify the intensity or frequency of fires, nor will it modify the flooding flows in its habitat.

How is the proposal likely to affect habitat connectivity?

The Black-chinned Honeyeater is considered to be locally nomadic due to its large feeding territory of at least 5 ha (Department of Environment and Climate Change 2005a). Since the vegetation within the study area is already highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities, the Project will not form a barrier or otherwise further fragment foraging habit for this species, which is widely available in the locality.

How is the proposal likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There is no critical habitat listed for the Black-chinned Honeyeater and the areas of potential impact are not considered to be critical to the survival of this species as it is considered to be in medium-

poor condition and is highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities.

Conclusion

Although the project will remove approximately 4.60 ha of habitat suitable for foraging by the Black-chinned Honeyeater, this area is relatively small and of poor quality compared to similar habitat available in the local area. As such it is unlikely that the project will have a significant impact on this species.

E18. Painted Honeyeater (Grantiella picta)

E18.1 Painted Honeyeater profile

Status

The Painted Honeyeater is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act*.

Description

The Painted Honeyeater is a small, distinctive bird (approximately 16 cm), with a black head and back and white underparts with dark streaks on the flanks. The wings and tail are black with bright yellow edgings. The sharp bill is pink with a dark tip. The female is usually greyer on the upperparts and has less streaking on the flanks (Department of Environment and Climate Change 2005d). Although similar in size and colour to the White-cheeked Honeyeater (*Phylidonyris nigra)*, and the New Holland Honeyeater (*P. novaehollandiae)*, the Painted Honeyeater is plumper with a much shorter tail, and is the only yellow-winged honeyeater with almost completely white underparts (Simpson & Day 1996).

Habitat and Ecology

The Painted Honeyeater inhabits Boree, Brigalow, Box-Gum Woodlands and Box-Ironbark Forests and is considered to be a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias (Department of Environment and Climate Change 2005d). It has been reported to selectively feed on mistletoes of the genus *Amyema* and insects and nectar from mistletoe or eucalypts are occasionally eaten (Oliver *et al.* 2003).

The Painted Honeyeater breeds in loose colonies, and usually forms pair bonds for the duration of the breeding season (Department of Environment and Climate Change 2005d). In some areas, the Painted Honeyeater shows a strong site fidelity and the same nest or tree will be re-used over several years (Department of Environment and Climate Change 2005d). Breeding males will vigorously defend a breeding territory from other males and occasionally other species such as the Mistletoebird (Higgins *et al.* 2001).

Male Painted Honeyeaters give display flights during the breeding season, flying steeply upwards from a high perch then descending quickly to another tree, singing the whole time. These flights help the males advertise their territory, attract a mate and repel other males (Higgins *et al.* 2001).

The Painted Honeyeater nests from spring to autumn and builds a thin, cup-shaped nest from grass and fine roots which is bound with spider web. The nest hangs within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches (Department of Environment and Climate Change 2005d). The eggs and young are tended by both sexes, and fledglings may be fed for some time before they disperse (Higgins *et al.* 2001). Eggs have been known to be taken from the nest by the Spiny-cheeked Honeyeater (Simpson & Day 1996).

Distribution

The Painted Honeyeater is a nomadic species found in Queensland and New South Wales west of the Great Dividing Range, through to northern Victoria. It is considered to be rare within its range, occurring in low densities. During the winter it is more likely to be found in the north of its distribution (Department of Environment and Climate Change 2005d). Some north-south migratory movements have been reported for the Painted Honeyeater and its movements are usually in response to fruiting events of mistletoe (Higgins *et al.* 2001).

Distribution within the study area

The Painted Honeyeater was not detected within the study area. The remnant woodland habitat (approximately 4.60 ha) within the study area is considered to provide potential foraging habitat for this threatened species.

Threats and Recovery of the Painted Honeyeater

The Painted Honeyeater is subject to a range of threats including:

- clearing of woodlands and open forests
- removal of large, old trees with heavy mistletoe infestations
- degradation of open forest and woodland remnants, including thinning of trees bearing mistletoe
- heavy grazing of grassy woodlands (Department of Environment and Climate Change 2005d).

The Department of Environment and Climate Change has identified five priority actions (also referred to as the Priority Action Statement or PAS) to direct recovery actions for the Painted Honeyeater (refer Table E-18-1). None of these actions relate to impacts of the Project.

Table E- 18-1 Recovery actions for the Painted Honeyeater

Recovery Action	Likely to be affected by the Project
Inform stakeholders of the importance of mistletoes to this species	No
Encourage retention of natural densities of mistletoes, particularly *Amyema* sp.	No
Encourage and undertake studies to determine the species status, distribution, habitat and resource requirements	No
Promote sustainable grazing of habitat patches	No
Restore habitat in agriculturally-productive areas	No

E18.2 Painted Honeyeater state significance assessment

This assessment is based on the extent of potential Painted Honeyeater foraging habitat within the study area (approximately 4.60 ha).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Project will remove approximately 4.60 ha of woodland and grassland vegetation which could provide potential foraging and nesting habitat for the Painted Honeyeater, although this habitat is in poor condition and highly fragmented within the study area compared to what is widely available in the locality.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Project will result in the removal of 4.60 ha of potential foraging habitat for the Painted Honeyeater within the study area. However, given vegetation in the study area is fragmented by roads, rail, powerlines, urban development and land clearing for agriculture, the Project is unlikely to increase barriers or fragmentation for this species because the habitat to be removed is already fragmented and largely occurs adjacent to the existing rail corridor. Additionally, no large infestations of mistletoe, which is the primary food source for the Painted Honeyeater, were recorded within the study area.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Painted Honeyeater is a nomadic species and considered to be rare within its range, occurring in low densities. Its distribution in New South Wales occurs west of the Great Dividing Range, through to northern Victoria. There are records from the Hunter region and in Sydney it occurs on Shale formations. The study area is not at the limit of the distribution of the Painted Honeyeater.

How is the proposal likely to affect current disturbance regimes?

The Project is unlikely to affect the existing disturbance regimes of the remaining Painted Honeyeater habitat within the study area. The Project will not modify the intensity or frequency of fires, nor will it modify the flooding flows in its habitat.

How is the proposal likely to affect habitat connectivity?

The Painted Honeyeater is a specialist feeder of mistletoes and is nomadic in response to fruiting events. Given the mobility of the species and that vegetation within the study area is already highly fragmented, the Project will not form a barrier or otherwise further fragment foraging habit for this species, which is widely available in the locality.

How is the proposal likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There is no critical habitat listed for the Painted Honeyeater and the areas of potential impact are not considered to be critical to the survival of this species as it is considered to be in medium-poor condition

and is highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities. Additionally, no large infestations of mistletoe, which is the primary food source for the Painted Honeyeater, were recorded within the study area.

Conclusion

Although the Project will remove approximately 4.60 ha of woodland and open forest habitat suitable for foraging by the Painted Honeyeater, this area is relatively small, in poor condition and highly fragmented compared to similar habitat available in the local area. No large infestations of mistletoe were recorded within the study area and as such it is unlikely that the project will have a significant impact on this species.

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