AECOM

Chapter 7.0 - Flora Assessment

Document No.: 60047441_EAR_RP_007_0

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7.0 Flora Assessment

7.1 Overview

The purpose of this chapter is to describe the existing terrestrial and aquatic flora occurring within the project area, to outline potential impacts on flora species and communities, and provide recommendations on mitigation measures for these potential impacts.

7.2 Approach and Methodology

Terrestrial and aquatic flora likely to be impacted by the KBP were investigated by undertaking a desktop review of existing literature and databases and by conducting a site-specific flora survey. These investigations are detailed in the following sub-sections.

7.2.1 Desktop review

Commonwealth, Queensland and local databases were consulted to determine the flora species and vegetation communities that were likely to occur within the project area and nearby surrounds. The following databases were consulted for records within a two kilometre radius of the project site:

- Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) *Environment Protection and Biodiversity Conservation Act* (*EPBC Act*) Protected Matters Search Tool;
- Queensland Herbarium records (HERBRECS) for species presence and conservation status in Queensland;
- Queensland Environmental Protection Agency (EPA) Regional Ecosystem (RE) mapping;
- EPA Biodiversity Planning Assessment (BPA) mapping; and
- EPA Wildlife Online.

The searches were centred on the coordinates 27° 31' 17.97" S, 152° 56' 07.60" E, corresponding to an approximate midway point along the length of the proposed KBP. A two kilometre search radius was selected to take in the entire area potentially affected by the KBP. Only Wildlife Online records dating post-1980 were requested.

7.2.1.1 Threatened vegetation communities

The *EPBC Act* Protected Matters search tool detected the critically endangered White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological communities within a two kilometre radius of the project area. Additionally, the project site occurs in the catchment of the Moreton Bay Wetlands, a RAMSAR listed site of international significance. The Moreton Bay Wetlands occur approximately 24 kilometres east of the proposed KBP.

Regional ecosystems (RE) are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. For this study, the bioregion refers to SEQ. The status of REs is gazetted under the *Vegetation Management Act 1999* (their Vegetation Management Status) as Endangered, Of-Concern or Not-of-Concern.

An RE is listed as Endangered under the *Vegetation Management Act 1999* if remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares.

An RE is listed as Of-concern under *Vegetation Management Act 1999* if remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 30 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares.

An RE is listed as Not-of-concern under the *Vegetation Management Act 1999* if remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares.

Remnant woody vegetation is defined as vegetation where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.

Essential Habitat is an area or location with essential resources for the maintenance of populations of priority taxa, typically vulnerable, rare or near threatened species. Essential Habitat may be defined from known records or considered potential according to expert knowledge of habitat relationships.

Regional Ecosystems (RE) mapped Of-concern and Not-of-concern are located to the south-east of the alignment. RE 12.3.11 ('Of-Concern') is located to the south of the preserved corridor, along the Brisbane River upstream of the Centenary Motorway Bridge. An area of the 'Not-of-Concern (RE 12.5.11) was located to the southeast of the persevered corridor and adjacent to the Centenary Motorway. Portions of both these areas of RE were also mapped by the Queensland EPA as Essential Habitat for *Phascolarctos cinereus* (koala). Neither area of RE or Essential Habitat will be directly impacted by the proposed KBP. None of the vegetation along the preserved corridor is mapped remnant in the EPA's RE maps of the area

The RE Description Database (REDD) (EPA 2008) described RE 12.3.11 as:

> Open-forest to woodland of *Eucalyptus tereticornis, E. siderophloia* and *Corymbia intermedia. Corymbia tessellaris, Lophostemon suaveolens* and *Melaleuca quinquenervia* frequently occur and often form a low tree layer. Other species present in scattered patches or low densities include *Angophora leiocarpa, E. exserta, E. grandis, C. trachyphloia, C. citriodora, E. latisinensis, E. tindaliae, E. racemosa, Melaleuca sieberi* and *M. viridiflora. E. seeana* may be present south of Landsborough. Occurs on Quaternary alluvial plains and drainage lines along coastal lowlands. Rainfall usually exceeds 1,000mm/y.

RE 12.11.5 is described as:

> Open-forest complex in which spotted gum is a relatively common species. Canopy trees include *Corymbia citriodora, Eucalyptus siderophloia* or *E. crebra* (sub coastal ranges), *E. major* and/or *E. longirostrata* and *E. acmenoides* or *E. portuensis* and/or *E. carnea* and/or *E. eugenioides*. Other species that may be present and abundant locally include *Corymbia henryi, C. intermedia, C. trachyphloia, Eucalyptus tereticornis, E. propinqua, E. biturbinata, E. moluccana, E. melliodora, E. fibrosa* subsp*. fibrosa* and *Angophora leiocarpa. Lophostemon confertus* often present in gullies and as a sub canopy or understorey tree. Mixed understorey of grasses, shrubs and ferns. Occurs on hills and ranges of Paleozoic and older moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.

BPA mapping produced by the EPA (Figure 7.2) shows an area of "State Significance" along the northern bank of the Brisbane River and Moggill Creek, extending upstream of the location of the proposed crossing of the creek. Areas designated as "State Significance" have been assessed as being significant for biodiversity at the bioregional or state scales. The biodiversity data attributes for the area of State significance along the river and Moggill Creek indicates that it is intertidal coastal wetland vegetation with a Very High B1 (Ecosystem Value, Regional Assessment) rating. The BPA mapping also highlights the RE areas referred to above (Figure 7.1), which are variously State Habitat for EVR (endangered, vulnerable or rare) taxa under the *Nature Conservation Act 1992* (*NC* Act) or areas of Regional significance as shown in Figure 7.2.

The proposed KBP alignment will directly impact on the area of State significance mapped along Moggill Creek.

7.2.1.2 Threatened flora species

As detailed in Table 7.1, the desktop study found 14 threatened flora species, listed under the *EPBC Act* and/or *NC Act* that may be present within the project area and/or surrounds. Additionally, four threatened flora species were indicated in the REDD as being associated with RE 12.11.5; these

being *Cycas megacarpa* (syn. *Cycas media*), *Isotropis foliosa, Persoonia amaliae* and *Sophora fraseri.* However, it should be noted that the latter four species are associated with RE 12.11.5 throughout its range in the SEQ bioregion and not specifically with the polygon mapped in the vicinity of the project area.

Under the *EPBC Act,* threatened flora are categorised as extinct (X), extinct in the wild (Xw), critically endangered (Ec), endangered (E), vulnerable (V) and conservation dependent (Cd); while under the *NC Act* threatened flora are categorised as extinct in the wild (Xw), endangered (E), vulnerable (V) or rare (R).

The likely occurrence of any threatened flora in the project area was assessed according to their known habitat preferences and previous recorded Wildlife Online sightings within a two kilometre radius.

Two of the threatened flora species, *Gossia gonoclada* (angle-stemmed myrtle) and *Lilaeopsis brisbanica,* were considered to have a high probability of occurring within the project area.

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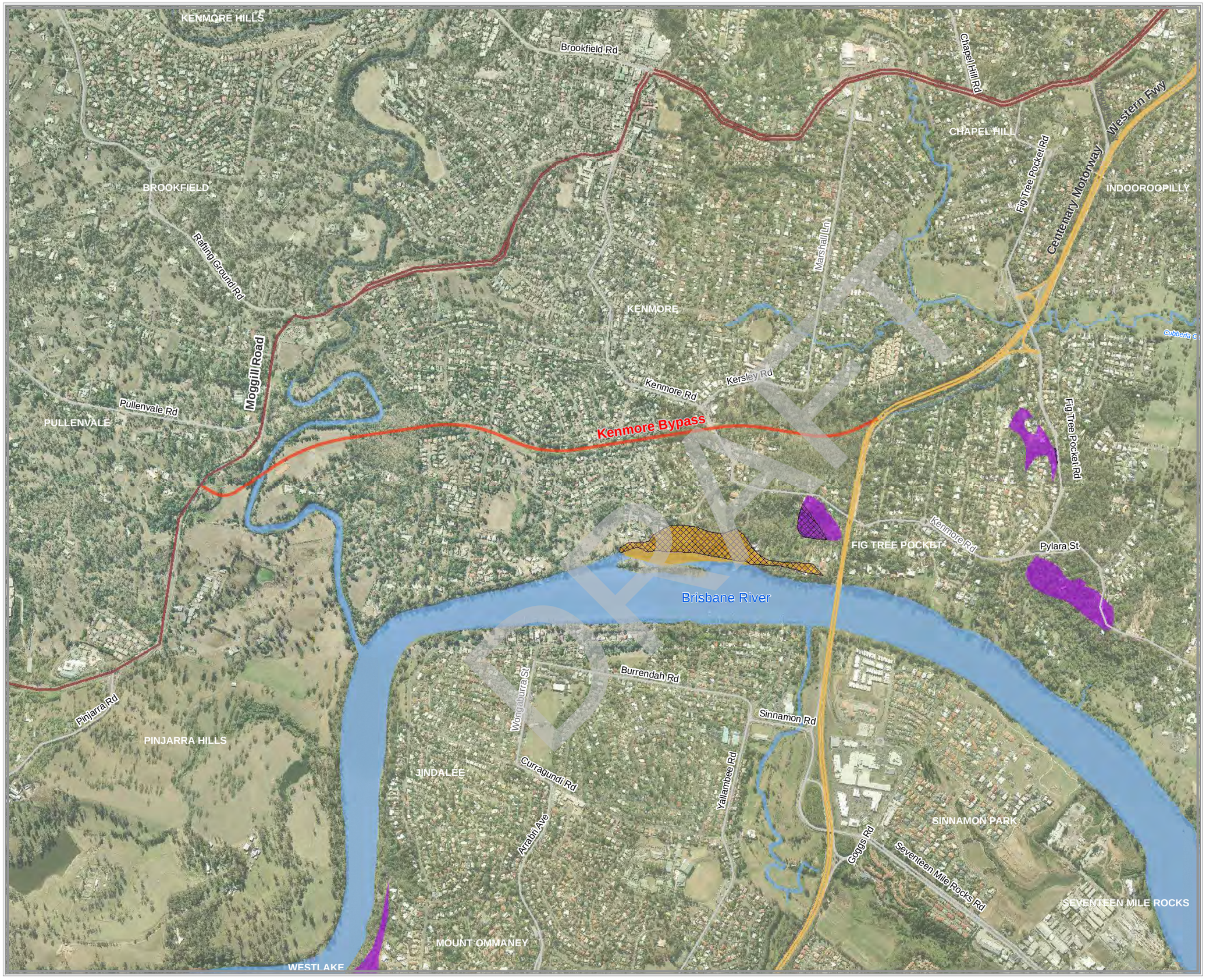

AECOM

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Metres

1:15,000 (when printed at A3)

Date - 13 May 2009

GDA

MGA94 Zone 56

Legend

- Centenary Motorway
- Kenmore Bypass
- Moggill Road
- River/creek

Regional Ecosystem

- Dominant - of concern
- Not of concern
- Essential Habitat

KENMORE BYPASS FLORA

Regional Ecosystems and Essential Habitat

Figure 7.1

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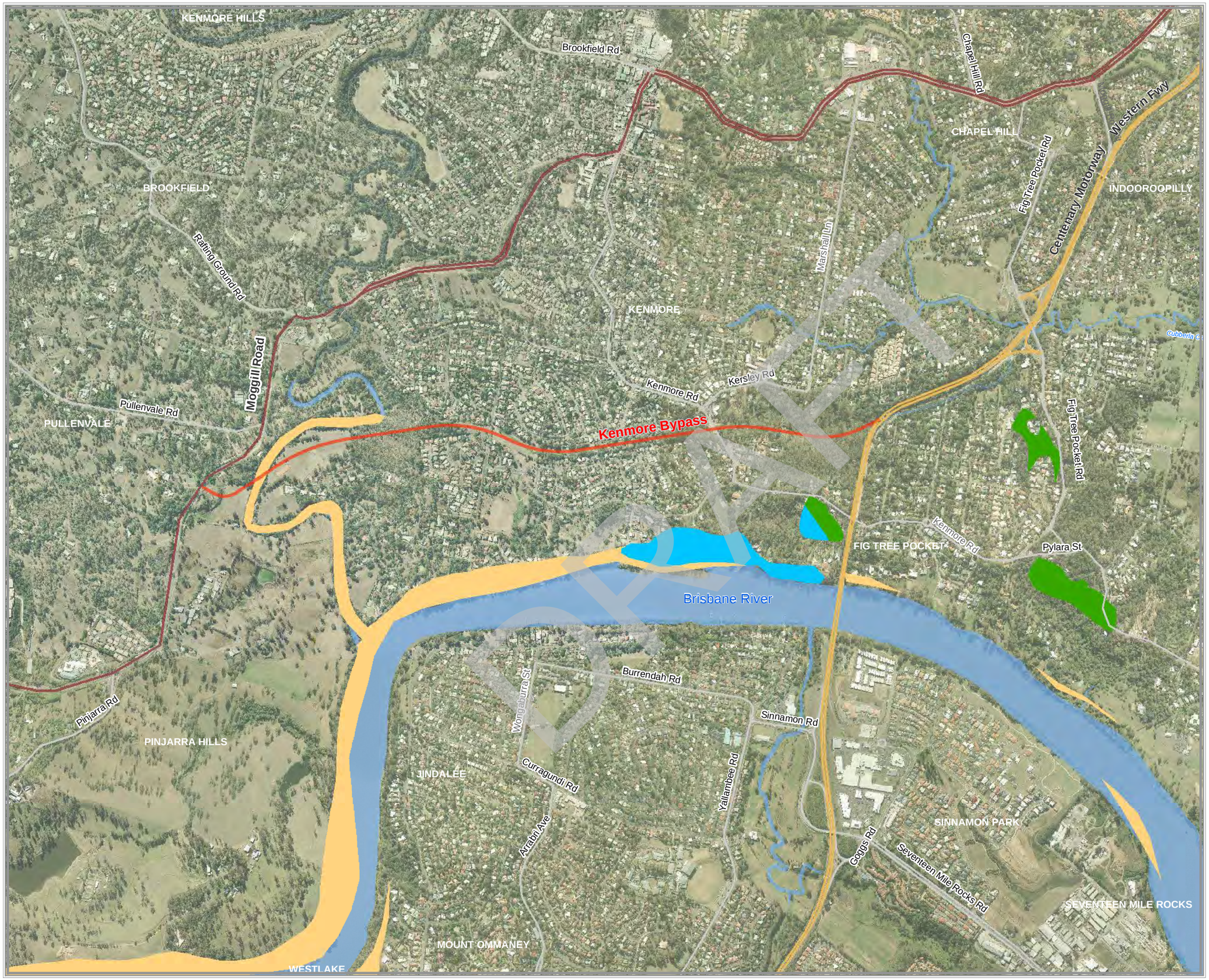

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Date - 13 May 2009

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MGA94 Zone 56

Legend

- Centenary Motorway
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- River/creek

Biodiversity Planning Assessment

- State Habitat for EVR taxa
- State
- Regional
- Local or Other Values
- Non Bioregion Ecosystem

KENMORE BYPASS FLORA

Biodiversity Planning Assessment

Figure 7.2

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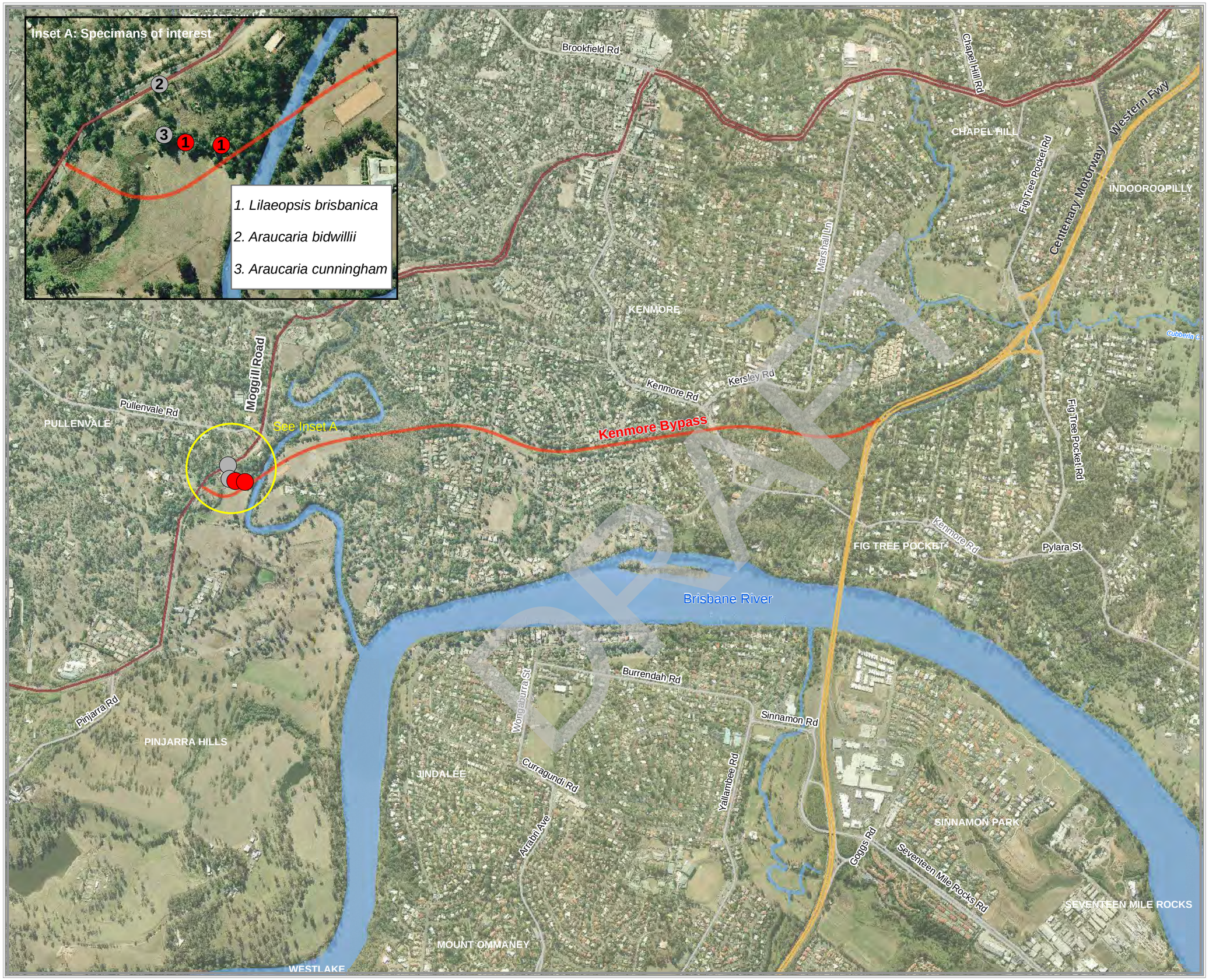

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Date - 13 May 2009

GDA
MGA94 Zone 56

Legend

- Centenary Motorway
- Kenmore Bypass
- Moggill Road
- River/creek

Specimens of Interest

- Threatened Species
- Natural Heritage Interest

KENMORE BYPASS FLORA

Species of Interest

Figure 7.3

Table 7.1: Endangered, Vulnerable or Rare Flora Species

Species	Common Name	*EPBC Act* Status	*NC Act* Status	Records	Habitat Requirements	Likelihood of Occurrence within project area
Arthraxon hispidus	hairy joint grass	V	V	4	Damp shady places (Stanley & Ross 1989); moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps (DECC 2008).	MODERATE Potential habitat present within project area. No records of individuals within vicinity of project area.
Bosistoa selwynii	heart-leaved bosistoa	V	-	4	Mainly lowland rainforest (Stanley & Ross 1995).	MODERATE Limited suitable habitat within project area. No records of individuals within vicinity of project area.
Bosistoa transversa	three-leaved bosistoa	V	-	4	Mainly lowland rainforest (Stanley & Ross 1995).	MODERATE Limited suitable habitat within project area. No records of individuals within vicinity of project area.
Bulbophyllum globuliforme	hoop pine orchid	V	R	4	McPherson Ranges, also Maleny and Noosa areas; apparently only growing on trunks and branches of *Araucaria cunninghamii* (Stanley & Ross 1989).	MODERATE Limited suitable habitat within project area. No records of individuals within vicinity of project area.
Corchorus cunninghamii	native jute	E	E	4	Rainforest fringes or margins, Brisbane area (Stanley & Ross 1986).	MODERATE Limited habitat within project area. No records of individuals within vicinity of project area.
Cryptostylis hunteriana	leafless tongue-orchid	V	-	4	The species occurs in coastal heathlands, coastal forest, dry woodland, lowland forest and on the edges of coastal swamps and sedgelands. *C. hunteriana* grow in moist sands, moist to dry clay loam and may be found growing in accumulated eucalypt leaves. This species is known to occur in Queensland, near Tinnanbar, and north of the Glasshouse Mountains into Tin Can Bay (DEWHA 2008).	LOW No suitable habitat within project area. No records of individuals within vicinity of project area.
Cycas megacarpa (syn. Cycas media)	zamia palm	E	E	4	Wide Bay and Burnett districts usually on hillsides on stony soils in open forests (Stanley & Ross 1989). Scattered and localised on clay-loam soils over various substrates, usually on sloping country in wet eucalypt forests or rainforests (RBGS 2002).	LOW Outside of known habitat range. No records of individuals within vicinity of project area.
Fontainea venosa	-	V	V	4	Shrub or tree to 18 metres. Occurs in notophyll vine forest with a mean annual rainfall of 1,000 – 1,100 mm on soils derived from and containing abundant andesitic rocks. One known population southwest of Beenleigh, about 30 kilometres southeast of Brisbane. Populations from Kilcoy and Glastonbury have been relocated (Jessup & Guymer 1985).	LOW No suitable habitat within project area. No records of individuals within vicinity of project area.
Gossia gonoclada	angle-stemmed myrtle	E	E	4, 2	Rainforest usually of drier types, Moreton and Wide Bay districts (Stanley & Ross 1986); found below peak flood level on alluvial terraces along permanent watercourses subject to some degree of tidal influence. Remnant lowland riparian rainforest between Logan and Brisbane Rivers (QPWS 2001).	HIGH Habitat in vicinity of project area. Individuals recorded in vicinity of project area.
Hernandia bivalvis	cudgerie	-	R	2	Coastal districts in rainforest (Stanley & Ross 1983).	LOW Limited habitat in vicinity of project area. Historical record of the species in proximity of the project area (November 1875; HERBRECS data requested 2008).

Species	Common Name	*EPBC Act* Status	*NC Act* Status	Records	Habitat Requirements	Likelihood of Occurrence within project area
Hydrocharis dubia	frogbit	V	V	4	Eastern parts of SEQ, floating in deep water or rooted in shallow water, in pools, lakes or slow moving streams (Stanley & Ross 1989).	MODERATE Habitat in vicinity of project area. No recent sightings in the project area or vicinity. Last official record from Ipswich area in 1960 (Qld Herbarium 2006). Warrill Creek, west of Ipswich, may provide habitat.
Isotropis foliosa			R	5	On foothill slopes vegetated by tall open eucalypt forest. Only known from two very small populations in the D'Aguilar Range: 13 kilometres northeast of Ipswich, between Kholo Creek and Wirrabara Road, five kilometres east of Mt Crosby summit (27°32'S, 152°32'E); and foothills of D'Aguilar Range four kilometres south of Mt Glorious (27°21'S, 152°43'E).	LOW Not recorded in HERBRECS database search for the project area. Low likelihood of occurrence in this highly modified environment.
Lilaeopsis brisbanica			E	1, 2, 3	Currently known from only an 11 kilometre section of the Brisbane River, between Moggill Creek and Oxley Creek. It grows along tidal riverbanks in grey saline mud in association with mangrove trees, particularly *Excoecaria agallocha* and *Aegiceras corniculatum* and° often adjacent to or mixed with *Triglochin striata* (Bean 1997).	HIGH Habitat within project area. Individuals recorded in vicinity of project area
Persoonia amaliae				4	Occurs in dry sclerophyll forest and vine forest, on granite and other well-drained substrata, from 150 metres to 700 metres altitude on near-coastal ranges between Eungella and Coast Range, south of Biggenden and on Ropers Peak, Denham Range (ABRS 2008).	LOW No habitat present and outside known distribution
Pterostylis nigricans	dark greenhood orchid		R	4	Recorded from Stradbroke Island on sandy soils under light coastal scrub (Stanley & Ross 1989).	LOW Low likelihood of occurrence in this highly modified environment. No recent sightings in the project area or vicinity. Recorded from Ipswich locality probably between 1907 and 1910 (Qld Herbarium 2006).
Sophora fraseri	small-leaved necklace pod	V	V	4	Recorded along the sea coast (Stanley & Ross 1983).	LOW No recent sightings in the area. Recorded from Upper Brisbane River, Pine Mountain 1916 (Qld Herbarium 2006). Low likelihood of occurrence in this highly modified environment.
Thesium australe	Austral toadflax	V	V	4	Scattered throughout district, often in damp areas. Root parasite (Stanley & Ross 1983).	LOW Low likelihood of occurrence in this highly modified environment. No recent sightings have been reported in the area. Last recorded in Ipswich locality 1930 (Qld Herbarium 2006).

Table 7.2: Legend

Occurrence Rating	Habitat	Recorded Sightings
Low	habitat absent	0 individuals recorded
Moderate	habitat absent	individuals found within two (2) kilometres
Moderate	habitat exists	0 individuals recorded
High	habitat exists	individuals found within two (2) kilometres

EPBC Act / *NC Act* Status		Records	
E	Endangered	1	Found
V	Vulnerable	2	HERBRECS
R	Rare	3	Wildlife online records
		4	EPBC records
		5	REDD

7.2.2 Field Survey

Sampling was conducted over five (5) days in September 2008. The entire alignment of the proposed KBP was traversed on foot to assess each discrete unit of remnant native vegetation. Within each discrete vegetation unit, the composition and qualitative structural attributes of the vegetation was recorded at one or more points.

Where native vegetation occurred over areas of one hectare or more, and retained structural and compositional integrity, quantitative information on forest structure was collected including stand basal area and canopy height. Stand basal area, measured in units of m^2/ha, is the cross sectional area of all tree stems in a forest stand. It can be considered to summarise in a single measure, the number and size of trees in a stand. Stand basal area is also related to stand volume and biomass and is also correlated with competition or stand density (no. of stems/ha) (Brack 1999). Canopy and ground cover estimates were also made.

Targeted searches of suitable habitat were conducted for the two threatened species with a high likelihood of occurring within the project area, *Gossia gonoclada* and *Lilaeopsis brisbanica*.

7.3 Description of Existing Environment

7.3.1 General Vegetation Features

For discussion purposes the alignment was divided into the following five sections:

- Section A - Centenary Motorway to Kenmore Road;
- Section B - Kenmore Road to Gem Road;
- Section C - Gem Road to Moggill Creek;
- Section D - Moggill Creek and tributary; and
- Section E - Moggill Creek to Moggill Road.

For consistency, species are listed alphabetically in the discussion. Features of the vegetation of the various sections of the corridor are set out in Table 7.3. A list of species observed along and adjacent to the corridor is provided in Appendix 7-A.

Table 7.3: Description of Vegetation Features along KBP Route

Section	Location	General Description	Predominant canopy species	Shrub and small tree species	Groundcover species	Weed species
A	Centenary Motorway to Kenmore Road	Disturbed open eucalypt forest bisected by a gully that drains into Cubberla Creek	*Corymbia citriodora* (spotted gum), *Eucalyptus crebra* (narrow-leaved ironbark), *E. major* (grey gum) *E. molucanna* (grey box), *E. tereticornis* (forest red gum), *Lophostemon confertus* (brush box).	*Abrus precatorius* (crab's eye), *A. disparrima* (hickory wattle), *A. falcata*, *A. fimbriata* (Brisbane wattle), *A. leiocalyx* (black wattle), *A. melanoxylon* (blackwood), *Alectryon tomentosus* (hairy bird's eye), *Alphitonia excelsa* (red ash), *Canthium vaciniifolium, Cupaniopsis anacardioides* (tuckeroo), *Dodonaea viscosa* (sticky hop bush), *Drypetes deplanchei* (yellow tulip), *Flindersia australis* (crow's ash), *Flindersia schottiana* (bumpy ash), *Geitonoplesium cymosum* (scrambling lily), *Jagera pseudorhus* (foambark), *Leucopogon juniperinus* (prickly beard-heath), *Notelaea longifolia* (long-leaved mock olive), *Pandorea pandorana* (wonga vine), *Parsonsia straminea* (common silkpod), *Polyscias elegans* (celery wood).	*Aristida* sp. (wire grass), *Dianella longifolia* (blue flax lily), *Eustrephus latifolius* (wombat berry), *Geitonoplesium cymosum* (scrambling lily), *Goodenia* rotundifolia (star goodenia), *Hardenbergia violacea* (native sarsaparilla), *Pratia purpurascens* (white root), *Themeda triandra* (kangaroo grass).	*Agave sisalana* (sisal), *Ageratum houstonianum* (blue billygoat weed), *Asclepias curassavica* (redhead cotton bush), bamboo, *Brachiaria mutica* (para grass), *Bryophyllum delagoense* (mother-of-millions), *Callisia fragrans* (inch plant), *Eriobotrya japonica* (loquat tree), *Ficus elastica* (rubber tree), *Ipomoea cairica* (coast morning glory), *Lantana camara* (lantana), *L. montevidensis* (creeping lantana), *Megathyrsus maximus* (green panic), *Melinus minutiflora* (molasses grass), *Neonotonia wightii* (glycine),, *Ochna serrulata* (ochna), *Paspalum dilatatum* (paspalum), *Passiflora suberosa* (corky passion flower), *Pennisetum purpureum* (elephant grass), *Ricinus communis* (castor oil plant), *Sansevieria trifasciata* (mother-in-law's tongue), *Schefflera actinophyllum* (umbrella tree), *Schinus terebinthifolia* (broadleaf pepper), and *Senna pendula* (Easter cassia).
B	Kenmore Road to Gem Road	Vegetation in this section was park-like in structure with a grassy understorey and scattered mature eucalypt and related tree species	*Araucaria bidwillii* (bunya pine), *A. cunninghamii* (hoop pine), *Corymbia citriodora* (spotted gum), *C. tessellaris* (Moreton Bay ash), *Eucalyptus carnea* (white stringybark), *E. crebra* (narrow-leaved ironbark), *E. major* (grey gum), *E. moluccana* (grey box), *E. tereticornis* (forest red gum), *Grevillea robusta* (silky oak), *Lophostemon confertus* (brushbox).	*Melaleuca linariifolia* (snow-in-summer), *M. quinquenervia* (paperbark teatree), *Lophostemon suaveolens* (swamp mahogany).	Slashed/mown lawn.	*Anredera cordifolia* (lamb's tail vine), bamboo, *Bauhinia variegata* (bauhinia), *Canna x generalis* (canna lily), *Citharexylum spinosum* (fiddlewood tree), *Corymbia torelliana* (cadaghi), *Cyperus involucratus* (umbrella sedge), *Delonix regia* (poinciana), *Hypoestes phyllostachya* (polka dot plant), *Lantana camara* (lantana), *Megathyrsus maximus* (green panic), *Neonotonia wightii* (glycine), *Pennisetum pupureu*m (elephant grass), *Rhaphiolepis indica* (Indian hawthorn), *Ricinus communis* (castor oil plant), *Schefflera actinophylla* (umbrella tree), *Sphagneticola trilobata* (Singapore daisy) , *Tipuana tipu* (tipuana), *Tradescantia zebrina* (purple wandering dew).
C	Gem Road to Moggill Creek	Heavily disturbed riparian vegetation along Moggill Creek	*Aphananthe philippensis* (rough leaved elm), *Casuarina glauca* (swamp oak), *Elaeocarpus obovatus* (hard quandong), *Melaleuca bracteata* (river teatree).	Dominated by weeds.	Little live groundcover due to shading by heavy weed cover.	*Acacia farnesiana* (mimosa bush), *Anredera cordifolia* (lamb's tail vine), *Asclepias curassavica* (red head cotton bush), *Asparagus africanus* (climbing asparagus), *Celtis sinensis* (Chinese elm), *Cestrum parqui* (green cestrum), *Corymbia torelliana* (cadaghi), *Lantana camara* (lantana), *Ligustrum lucidum* (large-leaved privet), *Megathyrsus maximus* (green panic), *Neonotonia wightii* (glycine) *Ochna serrulata* (ochna), *Passiflora suberosa* (corky passion flower), *Rivina humilis* (coral berry), *Schinus terebinthifolia* (broadleaf pepper tree), *Senna pendula* (Easter cassia) , *Solanum seaforthianum* (climbing nightshade).
		Disturbed open eucalypt forest on the ridge and adjacent slopes between Moggill Creek and Gem Road, with rainforest elements in sheltered gullies and south-facing aspects	*Corymbia citriodora* (spotted gum), *C. tessellaris* (Moreton Bay ash), *Eucalytpus crebra* (narrow-leaved ironbark), *E. melanophloia* (silver-leaved ironbark), *E. tereticornis* (forest red gum).	*Acacia disparrima* (hickory wattle), *Acacia maidenii* (maiden's wattle), *Alectryon tomentosus* (hairy bird's eye), *Alphitonia excelsa* (red ash), *Angophora subvelutina* (broadleaf apple), *Aphananthe philippensis* (rough leaved elm), *Alchornea ilicifolius* (native holly), *Lophostemon suaveolens* (swamp mahogany), *Cryptocarya laevigata* (glossy laurel), *Cupaniopsis anacardioides* (tuckeroo), *Cupaniopsis*	*Dianella longifolia* (blue flax lily), *Imperata cylindrica* (blady grass), *Lomandra multiflora* (matrush) , *Oplismenus aemulus* (basket grass), *Themeda triandra* (kangaroo grass).	*Acacia farnesiana* (mimosa bush), *Ageratum houstonianum* (blue billygoat weed), *Asparagus africanus* (climbing asparagus), *Asparagus aethiopicus* (ground asparagus fern), *Bauhinia variegata* (bauhinia), *Bidens pilosa* (cobbler's pegs), *Bryophyllum delagoense* (mother-of millions), *Chloris gayana* (Rhodes grass), *Callisia fragrans* (inch plant), *Celtis sinensis* (Chinese elm), *Corymbia torelliana* (cadaghi), *Delonix regia* (poinciana), *Eriobotrya japonica* (loquat tree), *Jacaranda mimosifolia* (jacaranda), *Lantana camara* (lantana), *Lantana montevidensis* (creeping lantana), *Ligustrum lucidum* and *L. sinense* (large and small -leaved

Section	Location	General Description	Predominant canopy species	Shrub and small tree species	Groundcover species	Weed species
				parvifolia (small-leaved tuckeroo), *Dodonaea viscosa* (sticky hopbush), *Eustrephus latifolius* (wombat berry), *Geitonoplesium cymosum* (scrambling lily), *Jagera pseudorhus* (foambark), *Maclura cochinchinensis* (cockspur thorn), *Mallotus philippensis* (red kamala), *Niemeyera antiloga* (brown pearwood), *Pandorea pandorana* (wonga vine), *Parsonsia straminea* (silkpod), *Trophis scandens* (burny vine).		privet), *Macfadyena unguis-cati* (cat's claw creeper), *Megathyrsus maximus* (green panic), *Melinus repens* (red Natal grass), *Murraya paniculata cv. exotica* (mock orange), *Neonotonia wightii* (glycine), *Ochna serrulata* (ochna), *Passiflora suberosa* (corky passion flower), *Pellaea viridis* (exotic sickle fern), *Pinus elliottii* (slash pine), *Prunus persica* (peach), *Punica granatum* (pomegranate), *Raphiolepis indica* (Indian hawthorn), *Schinus terebinthifolia* (broadleaf pepper), *Schleffera actinophylla* (umbrella tree), *Senna floribunda* (Easter cassia), *Syagrus romanzoffiana* (queen palm), *Synedrella nodiflora* (Cinderella weed), *Urochloa decumbens* (signal grass.
D	Moggill Creek and tributary	Tidal vegetation on the east and west banks of Moggill Creek and along the small tributary of Moggill Creek	*Aegiceras corniculatum* (river mangrove), *Avicennia marina* (grey mangrove), *Casuarina glauca* (swamp oak), *Excoecaria agallocha* (milky mangrove), *Melaleuca bracteata* (river teatree).	Crinum pedunculatum (crinum lily).	*Lilaeopsis brisbanica* (endangered herb under the *NC Act*), *Phragmites australis* (common reed).	*Schinus terebinthifolia* (broadleaf pepper tree).
E	Moggill Creek to Moggill Road	Disturbed riparian rainforest	*Araucaria cunninghamii* (hoop pine), *Aphananthe philippinensis* (rough leaved elm), *Cryptocarya laevigata* (glossy laurel), *Cryptocarya triplinervis* (three-veined laurel), *Mallotus philippensis* (red kamala), *Podocarpus elatus* (brown pine).	*Benthamina alyxifolia* (mistletoe), *Ficus coronata* (sandpaper fig), *Maclura cochinchinensis* (cockspur thorn), *Trophis scandens* (burny vine).	*Adiantum aethiopicum* (maidenhair fern), *Adiantum hispidulum* (rough maidenhair fern) and *Pellaea paradoxa* (paradoxical sickle fern).	*Asparagus africanus* (climbing asparagus), *Celtis sinensis* (Chinese elm), *Crotalaria pallida* (streaked rattlepod), *Lantana camara* (lantana), *Ligustrum sinense* (small-leaved privet), *Murraya paniculata cv. exotica* (mock orange), *Neonotonia wightii* (glycine), *Nephrolepis cordifolia* (fishbone fern), *Ochna serrulata* (ochna), *Schinus terebinthifolia* (broadleaf pepper tree) , *Senna pendula* (Easter cassia).
		Freshwater to brackish wetland	*Acacia melanoxylon* (black wattle), *Casuarina glauca* (swamp oak), *Eucalyptus tereticornis* (forest red gum), *Melaleuca bracteata* (river tea tree).	*Ficus coronata* (sandpaper fig), *Mallotus philippensis* (red kamala), *Pandorea pandorana* (wonga vine), *Parsonsia straminea* (monkey rope) and *Platycerium superbum* (staghorn).	*Typha* sp. (bulrushes).	*Ageratum houstonianum* (blue billygoat weed), *Asclepias curassavica* (red-head cotton bush), *Asparagus africanus* (climbing asparagus), *Baccharis halimifolia* (groundsel bush), *Celtis sinensis* (Chinese elm), *Cestrum parqui* (green cestrum), *Chloris gayana* (Rhodes grass), *Ipomoea cairica* (coast morning glory), *Lantana camara* (lantana), *Ligustrum sinense* (small-leaved privet), *Macroptilium atropurpureum* (siratro), *Megathyrsus maximus* (green panic), *Morus* sp. (mulberry), *Neonotonia wightii* (glycine), *Ochna serrulata* (ochna), *Passiflora suberosa* (corky passion flower), *Pinus caribaea* (Caribbean pine), *Salix babylonica* (weeping willow), *Salix chilensis* (pencil willow), *Schinus terebinthifolius* (broadleaf pepper tree) *Solanum mauritianum* (wild tobacco), *Solanum seaforthianum* (climbing nightshade).

7.3.2 Significant Species and Specimens

Two small populations of the *NC Act* protected endangered herb, *Lileopsis brisbanica,* were located growing in the muddy substrate beneath the mangroves along the small tributary of Moggill Creek (27° 31' 22.14" S, 152° 55' 17.18" E and 27° 31' 22.25" S, 152° 55' 8.67" E). No specimens of this species were observed on the nearby banks of Moggill Creek.

A single specimen of a *Macadamia* species (Queensland nut) was located in the disturbed open eucalypt forest of Section A (27° 31' 16.6" S, 152° 56' 43.5" E). No fertile material (flowers or fruit) was present on the specimen to enable positive identification to species level. All *Macadamia* species endemic to the Moreton Region including *M. integrifolia, M. ternifolia* and *M. tetraphylla*; are classified as vulnerable under the *NC Act*. This individual may have been a cultivated rather than a naturally occurring specimen given its proximity to an existing residence and the absence of any area of natural habitat (rainforest).

A large specimen of *Corymbia citriodora* (spotted gum) (over 40 metres tall and 103 cm diameter at breast height (dbh)) was located at the western edge of the open forest between Gem Road and Moggill Creek in Section C (27° 31' 17.2" S, 152° 55' 34.6" E). This was one of the largest trees observed along the KBP alignment. A large specimen of *Eucalyptus tereticornis* (forest red gum) (28 metres tall and 123 cm dbh) was located in Section E, west of Moggill Creek (27° 31' 21.3" S, 152° 55' 8.4" E). Also in Section E was a mature *Araucaria cunninghamii* (hoop pine) (approximately 26 metres tall and 69 cm dbh) adjacent to the tributary of Moggill Creek (27° 31' 21.9" S, 152° 55' 16.2804" E) and a large *A. bidwillii* (bunya pine) (approximately 24 metres tall and 84 cm dbh) adjacent to Moggill Road (27° 31' 20" S, 152° 55' 16.1" E).

7.3.3 Pest Plant Species

Several plant species categorised as declared pests under the *Land Protection (Pest and Stock Route Management) Act 2002* were located within the KBP corridor as detailed below in Table 7.4.

Table 7.4: Declared Pest Plants Recorded within the Project Area

Class 2	Class 3
Subject to coordinated management & programs led by local government, community or landowners. Landowners must take reasonable steps to keep land free of Class 2 pests.	Listing is to prevent sale, preventing the spread of these pests into new areas. Landholders are not required to control unless their land is adjacent to an environmentally significant area.
Baccharis halimifolia (groundsel bush)	*Anredera cordifolia* (madeira vine)
Bryophyllum delagoense (mother of millions)	*Asparagus aethiopicus* (basket asparagus)
Opuntia stricta (prickly pear)	*Asparagus africanus* (climbing asparagus)
Salix chilensis (pencil willow)	*Celtis sinensis* (Chinese elm)
Schinus terebinthifolia (broadleaf pepper tree)	*Cinnamomum camphora* (camphor laurel)
Sphagneticola trilobata (Singapore daisy)	*Lantana camara, L. montevidensis* (lantanas)
Spathodea campanulata (African tulip tree)	*Ligustrum lucidum, L. sinense* (privets)
	Macfadyena unguis-cati (cat's claw creeper)
	Tecoma stans (yellow bells)
	Thevetia peruviana (Captain Cook tree)

Seven (7) declared Class 2 pest plants and 12 declared Class 3 pest plants were recorded within the KBP corridor, reflecting the high degree of disturbance and modification of the local environment.

7.4 Potential Impacts and Mitigation Measures

As the design of the proposed KBP is only in a planning stage, it is not possible to precisely quantify the impacts on the existing vegetation. The mitigation measures as noted are therefore at this stage general in nature.

7.4.1 Threatened Vegetation Communities

No RE was mapped within the corridor. The nearest mapped RE was the 'Not-of-Concern' RE 12.11.5, which occurs approximately 130 metres south of the proposed alignment.

The critically endangered White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community highlighted in the *EPBC Act* search did not occur within or near the project area.

Accordingly, no mitigation measures are required for these vegetation communities.

7.4.2 Threatened Flora Species

Lilaeopsis brisbanica is listed as endangered under the *NC Act*. The alignment currently proposed would directly impact upon the habitat for this species. Two small populations of *L. brisbanica* occurred on the banks of a small tidal tributary of Moggill Creek, in the vicinity of a proposed bridging structure across Moggill Creek. If the locations of these populations are not directly affected by excavation or fill, it is likely they may be impacted by shading.

L. brisbanica is only known from an 11 kilometre stretch of the Brisbane River between Moggill and Oxley Creeks. Further, it is apparently extinct at some localities where it was previously recorded, including Breakfast Creek and Caboolture (Bean 1997). It is therefore important to ensure that all possible measures are taken to ensure the survival of this population. To ensure this can be achieved, the following mitigation strategies and alternatives are suggested:

- consideration of alignment and options for the western end of the KBP should consider the preservation of this small population;
- where possible the bridge design should have sufficient clearance to allow sunlight penetration underneath the deck structure to continue the preservation of this population; and/or
- if the populations of *L. brisbanica* cannot be retained in their current locations then transplanting should be trialled. *L. brisbanica* is amenable to cultivation in pots and it flowers and fruits readily (Bean 1997). Further, although the species grows naturally in grey saline mud, fresh water appears to be quite satisfactory for its growth and plantlets transplanted from the wild retain their general morphological characters in pot culture (Bean 1997). Transplanting trials should be conducted well ahead of construction works to determine whether they will be successful. A suitable, tidal site for transplanting will also need to be found in consultation with the Department of Primary Industries and Fisheries (DPIF), as the Queensland government department responsible for the management and protection of all marine plants and the EPA, and as the administering authority for the *NC Act*.

As discussed in Section 7.3.2, a specimen of *Macadamia tetraphylla* was tentatively identified based on vegetative characters. *Macadamia tetraphylla* is listed as vulnerable under the *NC Act*. However, positive identification of the species, requiring flowers and/or fruit, and confirmation of whether it is a cultivated or a naturally occurring specimen is required in subsequent phases of the KBP planning study.

7.4.3 Marine Plants

The proposed bridging structure across Moggill Creek will impact upon tidal lands that support marine plants, shown as of State Significance in BPA mapping. Marine plants include mangroves, seagrass, saltcouch, algae, samphire (succulent) vegetation and adjacent plants such as *Casuarina* (coastal she-oaks) and *Melaleuca* spp. (paper barks). Marine plants potentially impacted by the proposed works include *Aegiceras corniculatum* (river mangrove), *Avicennia marina* (grey mangrove), *Casuarina glauca* (swamp oak) and *Excoecaria agallocha* (milky mangrove). All marine plants are protected through the provisions of the *Fisheries Act 1994*.

The precise extent of tidal vegetation affected along Moggill Creek and its small tributary cannot be quantified at this stage; however, clearing of marine plants, including plants in tidal areas requires a Fisheries Development Approval. The DPIF has a policy that sets out specific mitigation and compensation measures for works or activities causing marine fish habitat loss (Dixon & Beumer 2002). This policy is one of several specific issue offset policies that indicate where environmental

offsets are needed. The DPIF is the regulating agency for the *Marine Fish Habitat — Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss* (Dixon & Beumer 2002). It will be necessary to negotiate with DPIF to determine a suitable location and area for any compensatory works.

7.4.4 Forest vegetation

None of the forest vegetation along the alignment was mapped as remnant RE and all of it was disturbed to varying degrees. However, most of it still retains sufficient structural and compositional integrity to be recognised as native forest. The areas of forest potentially impacted by the KBP cannot be quantified prior to the detailed design stage. However, some general principles of mitigation are provided.

All of the forest vegetation potentially affected by the KBP was moderately to heavily disturbed. In spite of this, it still provides significant flora habitat values within an otherwise urbanised environment. There are limited options for reducing this impact within the physical constraints of the available corridor. The following general mitigation measures are suggested to compensate for this direct impact:

- Rehabilitation of wooded areas with native species that are compatible with road operation to replace weed and pest species;
- Revegetation – significant areas devoid of forest vegetation occur adjacent to the alignment in Section C and Section E. These areas may offer the opportunity for revegetation with locally occurring native species;
- Collection of seeds from the impacted site(s) for use in site rehabilitation;
- Salvage of tree hollows for use by native fauna; and
- Cooperation with local conservation initiatives should be considered by way of compensation.

Where feasible, seeds of native species should be collected locally for use in both revegetation and rehabilitation. Where possible there should be a preference to plant *Gossia gonoclada* as part of these initiatives, as it is an EVR species and this will increase its local population and improve its survival.

7.4.5 Locally Significant Species

Two locally significant species, under the BCC Natural Assets Planning Scheme Policy, were identified in the project area: *Abrus precatorius* (crab's eye) and *L. brisbanica*.

Abrus precatorius was observed in the forest vegetation of Section A, south of the drainage line and approximately 30 metres west of the Centenary Motorway (27° 31' 15.08" S 152° 56' 53.10 E). The specimen observed appears to be directly affected by the proposed alignment. Mitigation measures could include collecting and propagating the seed of this species for use in rehabilitation and revegetation.

L. brisbanica was observed in a small tributary of Moggill Creek in two small populations with the coordinates 27° 31' 22.14" S, 152° 55' 17.18" E and 27° 31' 22.25" S, 152° 55' 8.67" E. This species is endangered under the *NC Act*. Impacts and mitigation measures for this species are described above (Section 7.4.2).

Table 7.5: Potential Impacts and Mitigation Measures

Reference Code	Project Phase	Potential Impact	Potential Mitigation Measures
FL 01	Design	Loss of threatened flora species	The alignment, where possible, to avoid directly impacting the identified populations of *L. brisbanica* on the banks of a small tidal tributary of Moggill Creek. Positive identification to species level of the *Macadamia* species located in Section A and confirmation of a cultivated or naturally occurring specimen.
FL 02			Minimise the construction footprint by using a bridging structure rather than fill to cross the Moggill Creek flood plane, thereby avoiding excessive shading.
FL 03			Transplanting trials, to determine rates of successful cultivation, should be conducted prior to construction where populations of *L. brisbanica* cannot be retained in their current locations. A suitable, tidal site for transplanting will also need to be found in consultation with the DPIF as the lead state government agency responsible for the management and protection of all marine plants and the EPA, as the administering authority for the NCA.
FL 04	Design	Clearing of marine plants.	All marine plants are protected through the provisions of the *Fisheries Act* 1994. Clearing of marine plants, including plants in tidal areas, requires a Fisheries Development Approval from DPIF. It will be necessary to negotiate with DPIF to determine a suitable location and area for any compensatory works.
FL 05	Construction	Loss of threatened flora species (*L. brisbanica).*	Implement appropriate erosion and sediment control measures to ensure the area of habitat for *L. brisbanica* is not adversely impacted by erosive runoff and/or pollutants.
FL 06	Construction	Loss of forest vegetation.	Rehabilitation of wooded areas with native species that are compatible with road operation to replace weed species.
FL 07			Revegetation – significant areas devoid of forest vegetation occur adjacent to the alignment in Section E and Section C. These areas may offer the opportunity for revegetation with locally occurring native species.
FL 08			Cooperation with local conservation initiatives should be considered by way of compensation.
FL 09			Where feasible, seed of native species should be collected locally for use in both revegetation and rehabilitation.

Reference Code	Project Phase	Potential Impact	Potential Mitigation Measures
FL 10			Collecting and propagating the seed of *A. precatorius* for use in rehabilitation and revegetation.
FL 11	Operation	Loss of threatened flora species (*L. brisbanica).*	Implement appropriate pollution control measures to ensure the area of habitat for *L. brisbanica* is not adversely impacted by erosive runoff and/or pollutants.