NPWS (2002) vegetation community	Map Unit	Corresponding EEC	TSC Act	EPBC Act
Forest		Act) / Turpentine Ironbark Forest (EPBC Act)		
Mangrove/Saltmarsh Complex	34	Mangroves (FM Act) / Coastal Saltmarsh (TSC Act)	E	Not listed
Freshwater Wetlands	36	Freshwater Wetlands	E	Not listed
Turpentine Ironbark Margin Forest	43	Sydney Turpentine Ironbark Forest (TSC Act) / Turpentine Ironbark Forest (EPBC Act)	E	CE
Shale/Gravel Transition Forest	103	Shale/Gravel Transition Forest (TSC Act) / Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act)	E	CE

Note: E = Endangered Ecological Community, CE = Critically Endangered Ecological Community

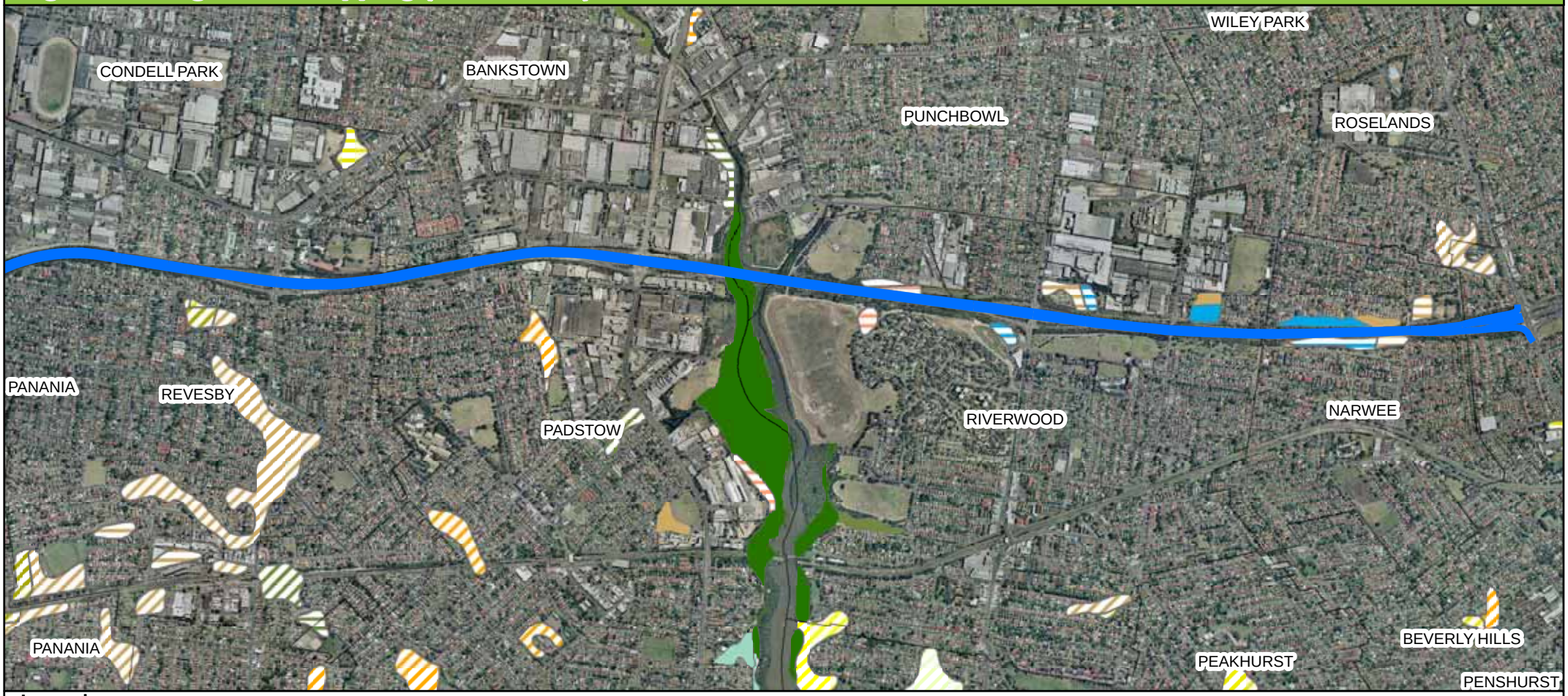
2.1.2 Sydney Metro CMA rapid fauna habitat assessment

The rapid fauna habitat assessment of the Sydney Metropolitan Catchment Management Authority Area (CMA) prepared by the DECC (2008b) identifies fauna species and areas of fauna value in the CMA. Following a review of the rapid habitat assessment and the latest aerial photography three major ecological corridors were identified in close proximity to the Subject Site (Figure 3, Table 3).

Table 3: Ecological Corridors

Corridor	Proximity to Subject Site	Fauna Habitat Value	Area (ha)	Threatened Ecology
Long Point – Casula	The M5 West Motorway crosses the Long Point – Casula corridor at the Georges River between the Hume Highway and Moorebank Avenue	High	375 ha	**Ecological Communities:** River-flat Eucalypt Forest, Swamp Oak Floodplain Forest and Shale/Sandstone Transition Forest. **Threatened Fauna:** Green and Golden Bell Frog, Swift Parrot, Powerful Owl, Grey-headed Flying-fox, East-coast Freetail-bat, Southern Myotis and Greater Broad-nosed Bat.
Hammondville – Pleasure Point	The M5 West Motorway crosses the Hammondville – Pleasure Point corridor at the Georges River in the vicinity of the Toll Plaza at Hammondville	High	618 ha	**Ecological Communities:** Shale Gravel Transition Forest, River-flat Eucalypt Forest, Swamp Oak Floodplain Forest and Sydney Freshwater Wetlands. **Threatened Fauna:** Green and Golden Bell Frog, Black-necked Stork, Square-tailed Kite, Regent Honeyeater, Black-chinned Honeyeater, Koala, Grey-headed Flying-fox and East-coast Freetail-bat.
Salt Pan Creek	The M5 West Motorway crosses the Salt Pan Creek corridor at Salt Pan Creek	Moderate	130 ha	**Ecological Communities:** Coastal Saltmarsh and Mangroves. **Threatened Fauna:** Osprey, Powerful Owl, Regent Honeyeater and Grey-headed Flying-fox.

Figure 2a: Vegetation Mapping (NPWS 2002)



Legend

M5 West Motorway (Subject Site)

NPWS Vegetation Communities

- 1 - Shale Sandstone Transition Forest (Low Sandstone Influence)
- 2 - Shale Sandstone Transition Forest (High Sandstone Influence)
- 3 - Cooks River Castlereagh Ironbark Forest
- 4 - Castlereagh Swamp Woodland
- 6 - Castlereagh Scribbly Gum Woodland
- 9 - Shale Hills Woodland
- 10 - Shale Plains Woodland
- 11 - Alluvial Woodland
- 12 - Riparian Forest
- 14 - Moist Shale Woodland
- 15 - Turpentine-Ironbark Forest
- 31 - Sandstone Ridgetop Woodland
- 32 - Upper Georges River Sandstone Woodland
- 33 - Western Sandstone Gully Forest
- 34 - Mangrove/Saltmarsh Complex
- 36 - Freshwater Wetlands
- 43 - Turpentine-Ironbark Margin Forest
- 61 - Eastern Gully Forest
- 62 - Woodland Heath Complex
- 103 - Shale/Gravel Transition Forest
- 9999 - Unclassified Vegetation

NPWS Canopy Cover

- >10% Canopy Cover
- <10% Canopy Cover
- <10% Canopy Cover (Urban Areas)

0 200 400 800
Metres

Data Sources:
Imagery - 0.10 m pixels (c) SKM Pty Ltd 2007
Vegetation Mapping (NPWS 2002)

Datum/Projection:
GDA 1994 MGA Zone 56

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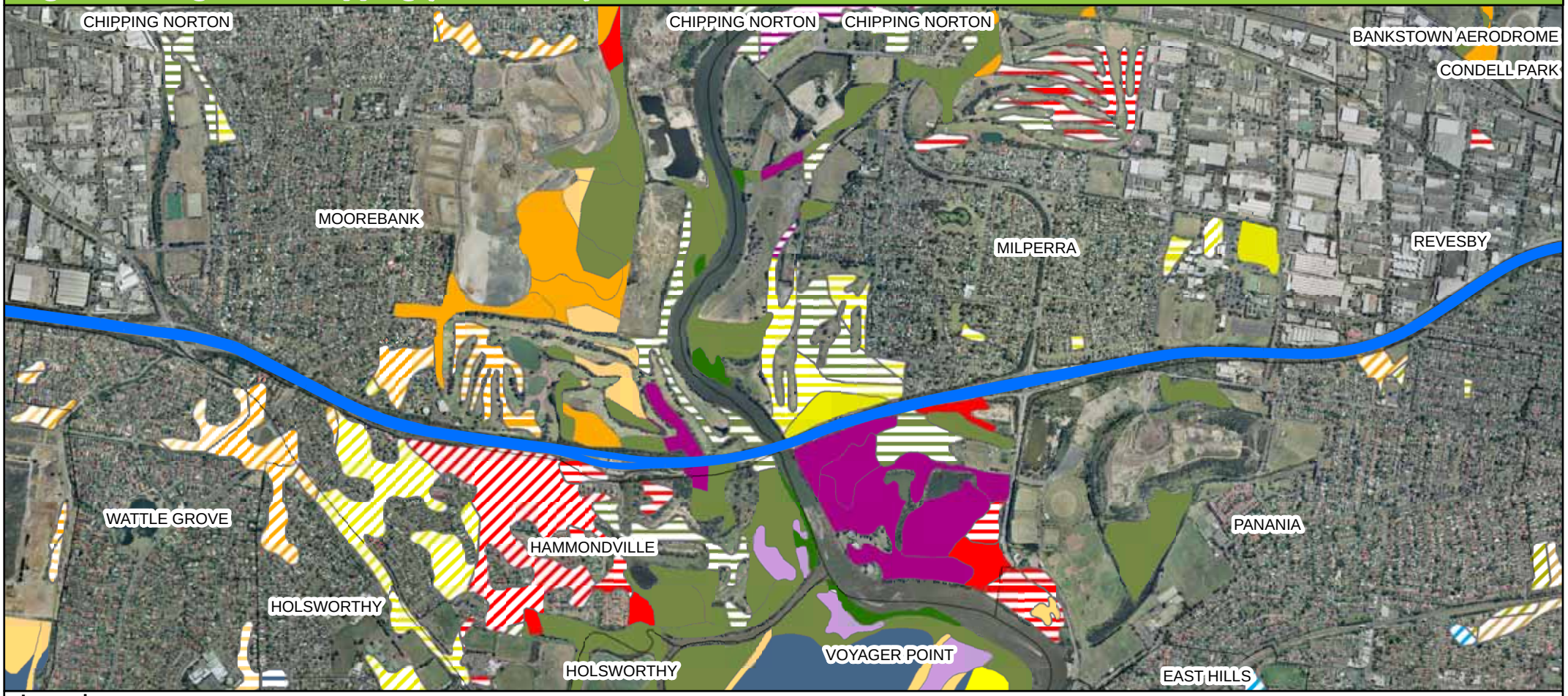
Figure 2b: Vegetation Mapping (NPWS 2002)



Legend

M5 West Motorway (Subject Site)

NPWS Vegetation Communities

- 1 - Shale Sandstone Transition Forest (Low Sandstone Influence)
- 2 - Shale Sandstone Transition Forest (High Sandstone Influence)
- 3 - Cooks River Castlereagh Ironbark Forest
- 4 - Castlereagh Swamp Woodland
- 6 - Castlereagh Scribbly Gum Woodland
- 9 - Shale Hills Woodland
- 10 - Shale Plains Woodland
- 11 - Alluvial Woodland
- 12 - Riparian Forest
- 14 - Moist Shale Woodland
- 15 - Turpentine-Ironbark Forest
- 31 - Sandstone Ridgetop Woodland
- 32 - Upper Georges River Sandstone Woodland
- 33 - Western Sandstone Gully Forest
- 34 - Mangrove/Saltmarsh Complex
- 36 - Freshwater Wetlands
- 43 - Turpentine-Ironbark Margin Forest
- 61 - Eastern Gully Forest
- 62 - Woodland Heath Complex
- 103 - Shale/Gravel Transition Forest
- 9999 - Unclassified Vegetation

NPWS Canopy Cover

- >10% Canopy Cover
- <10% Canopy Cover
- <10% Canopy Cover (Urban Areas)

0 200 400 800
Metres

Data Sources:
Imagery - 0.10 m pixels (c) SKM Pty Ltd 2007
Vegetation Mapping (NPWS 2002)

Datum/Projection:
GDA 1994 MGA Zone 56

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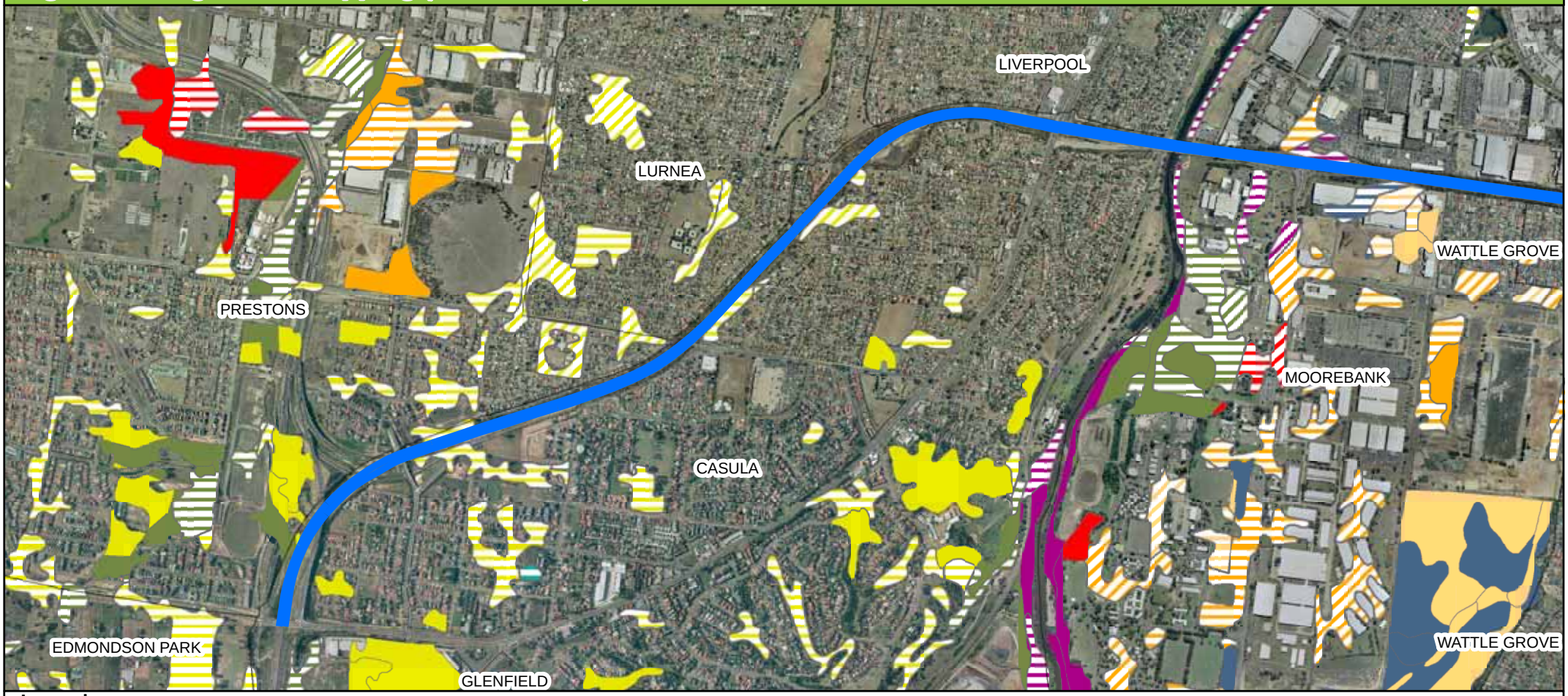
Figure 2c: Vegetation Mapping (NPWS 2002)



Legend

M5 West Motorway (Subject Site)

NPWS Vegetation Communities

- 1 - Shale Sandstone Transition Forest (Low Sandstone Influence)
- 2 - Shale Sandstone Transition Forest (High Sandstone Influence)
- 3 - Cooks River Castlereagh Ironbark Forest
- 4 - Castlereagh Swamp Woodland
- 6 - Castlereagh Scribbly Gum Woodland
- 9 - Shale Hills Woodland
- 10 - Shale Plains Woodland
- 11 - Alluvial Woodland
- 12 - Riparian Forest
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- 43 - Turpentine-Ironbark Margin Forest
- 61 - Eastern Gully Forest
- 62 - Woodland Heath Complex
- 103 - Shale/Gravel Transition Forest
- 9999 - Unclassified Vegetation

NPWS Canopy Cover

- >10% Canopy Cover
- <10% Canopy Cover
- <10% Canopy Cover (Urban Areas)

0 200 400 800
Metres

Data Sources:
Imagery - 0.10 m pixels (c) SKM Pty Ltd 2007
Vegetation Mapping (NPWS 2002)

Datum/Projection:
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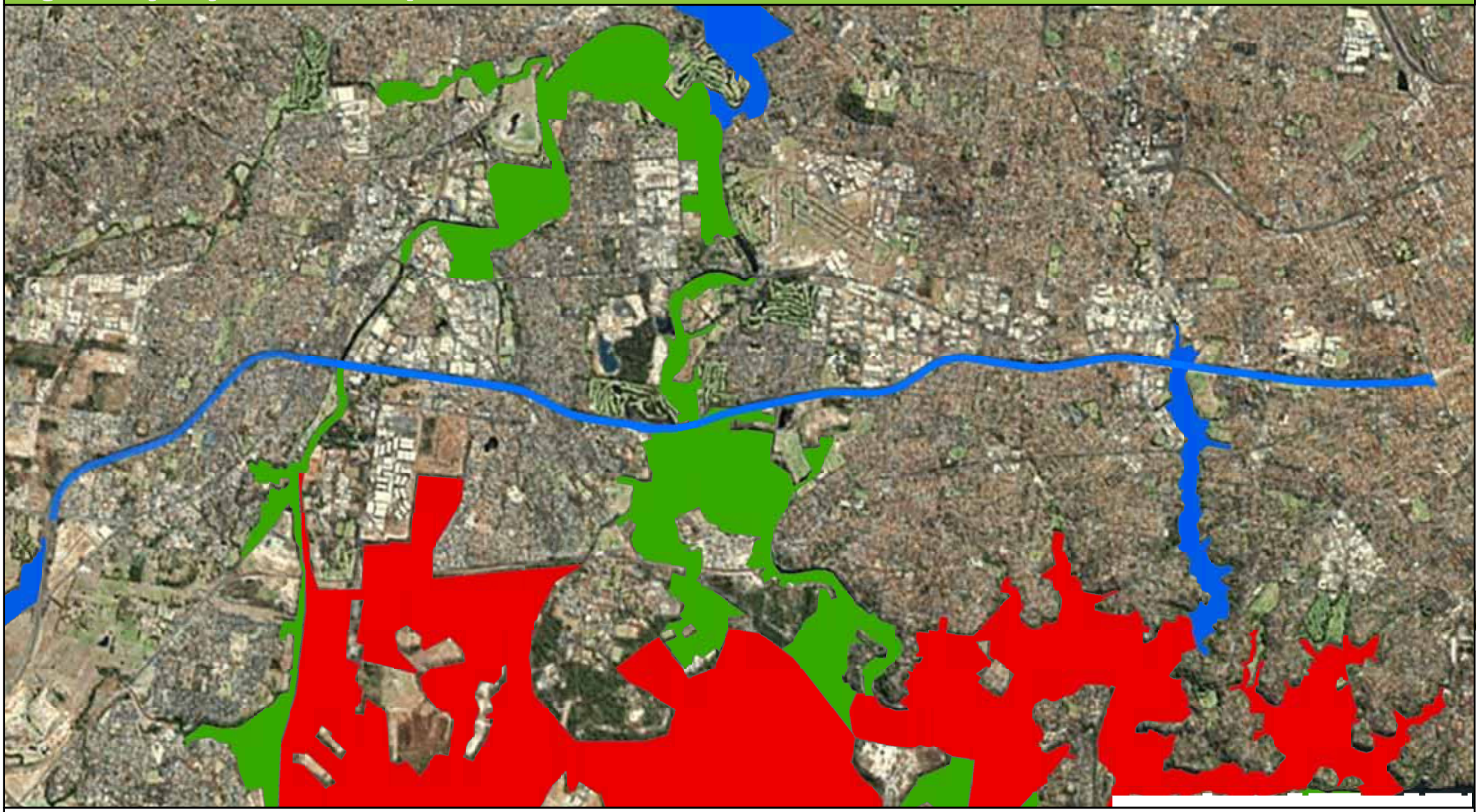
Figure 3. Sydney Metro CMA Rapid Fauna Habitat Assessment



Legend

M5 West Motorway (Subject Site)

Sydney Metro CMA Fauna Habitat Ranking

- Highest
- High
- Moderate

Data Sources:
Imagery - Microsoft Virtual Earth
Rapid Fauna Habitat Assessment (DECC 2008b)

0 0.5 1 2
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 56

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The three identified ecological corridors were categorised as having "Moderate" to "High" fauna values. These categories correspond to moderate-high faunal diversity and a range of habitat types from estuarine to woodland and forest on a range of geological formations.

The M5 West Motorway crosses each of these significant ecological corridors via a series of elevated bridges which allows for vegetation connectivity and for the north-south movement of fauna across the Study Area. The majority of the fauna habitat in these corridors occurs to the south of the M5 motorway, with limited connectivity to the north, except for the Hammondville – Pleasure Point corridor which extends northwards along the Georges River. These corridors are important linkages for the transfer of genetic material (both flora and fauna) between adjoining populations and provide known habitat for a number of threatened species and ecological communities. Suitable habitat for a range of other threatened species is also likely to occur within these corridors. The proposed upgrade to the M5 Motorway is not likely to impact on the connectivity of these corridor.

2.1.3 Native vegetation of the Sydney Metropolitan CMA

The NSW Department of Environment, Climate Change and Water conducted a recent vegetation mapping project for the Sydney Metropolitan CMA in order to develop a consistent, fine scale map of all native vegetation communities present within the area bounded by the CMA (DECCW 2009). This dataset is currently in 'draft' format and is currently being reviewed. As such, the draft mapping is not intended to be used for planning or decision making purposes.

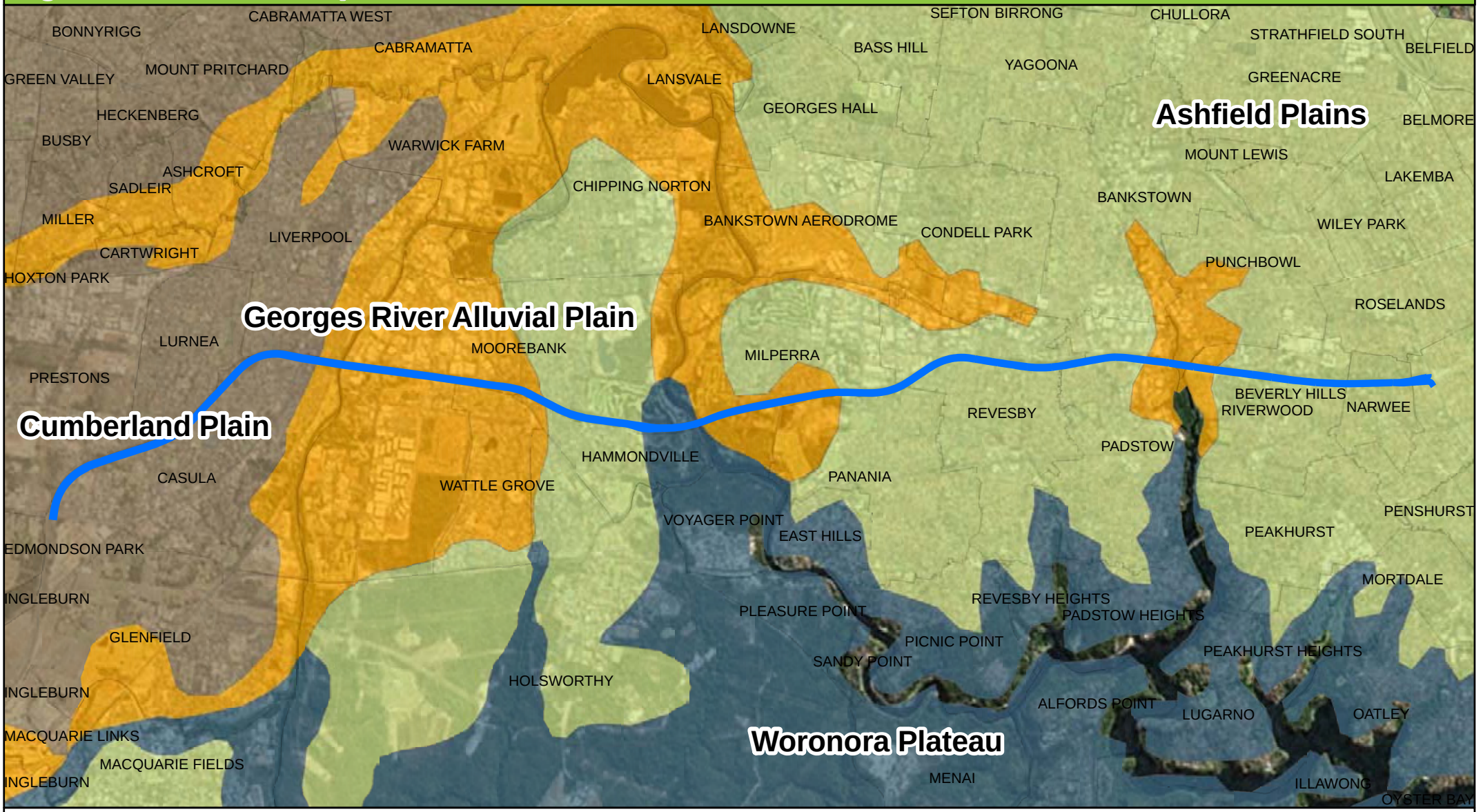
DECCW (2009) mapped twelve vegetation communities close to the Subject Site. While some areas of these vegetation communities have been mapped adjoining the Subject Site, the vast majority of vegetation within the Subject Site has been mapped as either "Weeds" or "Urban Exotic/Native". These areas correspond to the landscaped areas of the M5 West Motorway. Where mapped native vegetation appears close to the carriageway, it is generally contained behind noise barriers.

2.1.4 Mitchell landscapes

Mitchell Landscapes are a system of ecosystem classification mapped at the 1:250,000 scale, based on a combination of soils, topography and vegetation (DECC 2008a). Four Mitchell Landscapes have been mapped within the Study Area (Figure 4). The majority of the Subject Site has been mapped as occurring on the "Ashfield Plains" landscape, with the western section (Hume Highway to Camden Valley Way) mapped as occurring on the "Cumberland Plain" landscape. Several large areas associated with the Georges River and Salt Pan Creek have been mapped as "Georges River Alluvial Plain". One small area of the Subject Site in the vicinity of the Hammondville has been mapped as "Woronora Plateau" landscape. Descriptions of these landscapes are provided in Appendix A.

While these landscapes are generally indicative of the landform, soils and vegetation associations in the Study Area, the Subject Site has been highly modified throughout the development of the original M5 West Motorway. The typical 'cut' and 'fill' motorway construction has completely altered the soil profile within the Subject Site to the extent that only small isolated disturbed remnants of native vegetation occur.

Figure 4. Mitchell Landscapes



Legend

M5 West Motorway (Subject Site)

Mitchell Landscapes

- Ashfield Plains
- Cumberland Plain
- Georges River Alluvial Plain
- Woronora Plateau

Data Sources:
Imagery - Microsoft Virtual Earth
Mitchell Landscapes (DECC 2008a)

Datum/Projection:
GDA 1994 MGA Zone 56

0 0.5 1 2
Kilometres

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2.2 PREVIOUS INVESTIGATIONS

2.2.1 M5 West Motorway widening

Eco Logical Australia (ELA) previously conducted a flora and fauna impact assessment for a proposed upgrade of the M5 West Motorway for Kellogg Brown and Root Pty Ltd (ELA 2009).

The major findings of (ELA 2009) included:

- The central median of the M5 West Motorway is comprised of four basic elements: concrete, grass, planted shrubs and planted trees;
- The verges and batters have been planted with locally native species and due to significant alterations to the soil profile no threatened vegetation communities were recorded within the Study Area.
- *Acacia pubescens* (Downy Wattle) a vulnerable species listed on the TSC Act and EPBC Act has been planted at numerous locations along the M5 West Motorway median.
- Two small areas adjacent to the M5 West Motorway were identified as potential habitat for *Litoria aurea* (Green and Golden Bell Frog). The proposed works were determined unlikely to significantly affect this habitat.
- *Nassella neesiana* (Chilean Needle Grass), an aggressive noxious weed species was identified at one location within the central median.

As the previous study completely encompasses the sections of the current proposal between King Georges Road and Moorebank Avenue and was conducted recently, it has been utilised in the preparation of this current study. All of the findings of the previous study have been incorporated into this Biodiversity Working Paper.

2.3 REVIEW OF THREATENED SPECIES, POPULATIONS AND ECOLOGICAL COMMUNITIES

Data sources used in this review included the:

- DECCW Atlas of NSW Wildlife (DECCW 2010a);
- DECCW Profile Database (DECCW 2010b);
- DPI Fisheries Threatened Species (DPI 2010a);
- Database of the Royal Botanic Gardens PlantNET (Botanic Gardens Trust 2010);
- Department of the Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Search Tool for nationally threatened species and ecological communities listed on the EPBC Act (DEWHA 2010);
- DPI Noxious Weeds Database (DPI 2010b); and
- Birds Australia

2.3.1 Threatened flora

Thirty-five threatened flora species have been recorded or are predicted to occur within the Study Area. The conservation significance, associated habitat, and likelihood of occurrence for each species has

been included in Appendix B (Figure 5, Table 15). In addition, two threatened plant populations have been recorded or are predicted in proximity to the Study Area. While these species have the potential to occur within the Study Area, the majority of these species are considered unlikely to occur on the Subject Site.

2.3.2 Threatened fauna

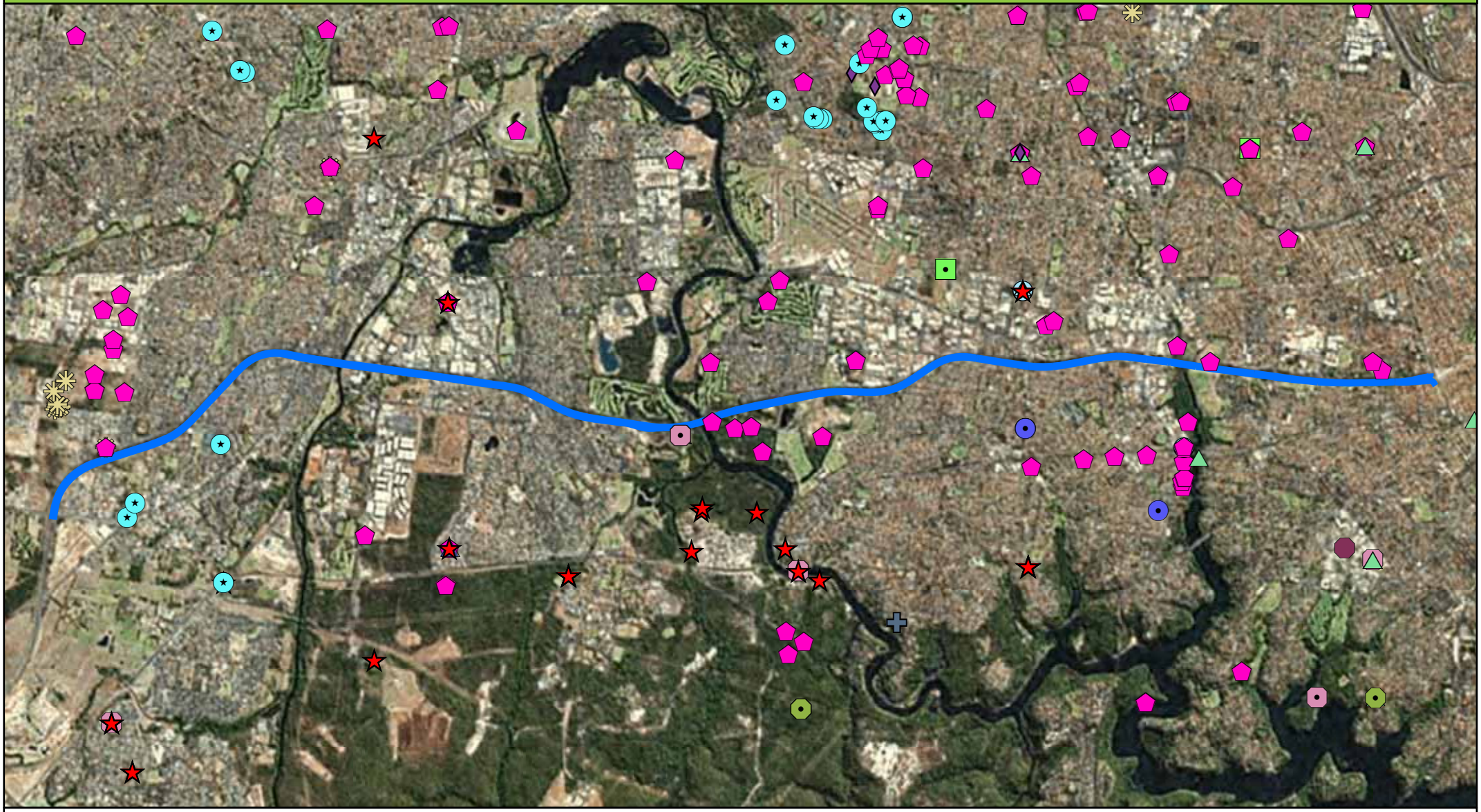
Fifty-three threatened fauna species have been recorded or are predicted to occur within the Study Area. The conservation significance, associated habitat, and likelihood of occurrence for each species are included in Appendix B (Figure 6, Table 16).

This list includes 27 birds, 6 frogs, 14 mammals, 3 invertebrates, 2 fish and 1 reptile. Of these species, four are considered likely to potentially forage on the Subject Site on occasion.

2.3.3 Threatened ecological communities

13 Endangered Ecological Communities (EECs) have been recorded or are predicted to occur within the Study Area. The conservation significance, associated habitat, and likelihood of occurrence for each EEC are included in Appendix B (Table 17). Due to significant alterations to the soil profile no EECs are expected to occur on the M5 Motorway Subject Site.

Figure 5. Threatened Flora



Legend

M5 West Motorway (Subject Site)

Threatened Flora

- Acacia bynoeana
- Acacia prominens
- Acacia pubescens
- Acacia terminalis subsp. terminalis
- Caladenia tessellata
- Callistemon linearifolius
- Deyeuxia appressa
- Epacris purpurascens var. purpurascens
- Grevillea parviflora subsp. parviflora
- Gyrostemon thesioides
- Maundia triglochinoides
- Melaleuca deanei
- Persoonia hirsuta
- Persoonia nutans
- Pimelea spicata
- Pomaderris prunifolia
- Pterostylis saxicola
- Pultenaea pedunculata
- Syzygium paniculatum
- Tetratheca juncea
- Wahlenbergia multicaulis
- Wilsonia backhousei

Data Sources:
Imagery - Microsoft Virtual Earth
DECCW (2010)

Datum/Projection:
GDA 1994 MGA Zone 56

0 0.5 1 2
Kilometres

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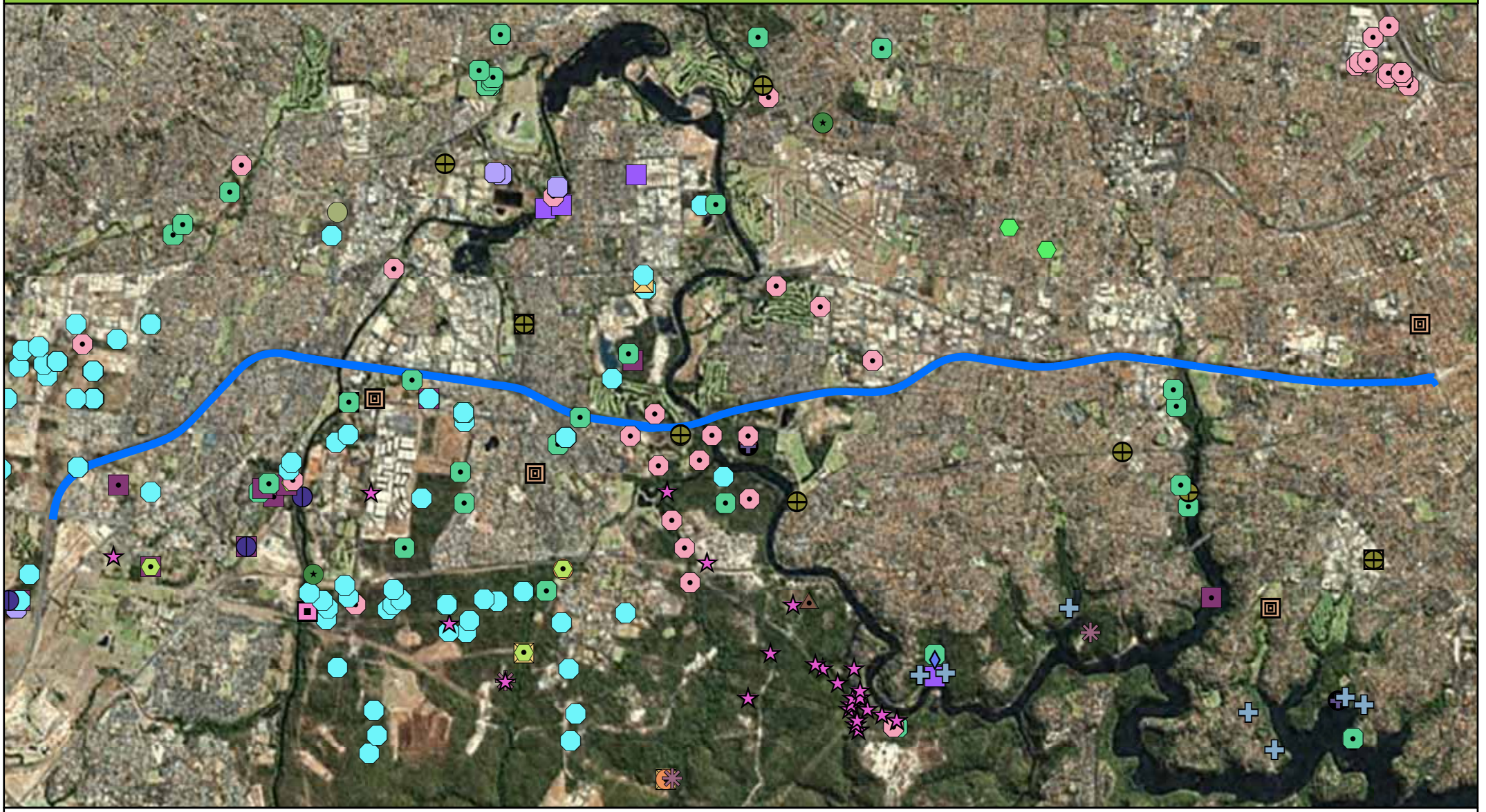
Figure 6. Threatened Fauna



Legend

M5 West Motorway (Subject Site)

Threatened Fauna

- Barking Owl
- Black-chinned Honeyeater (eastern subspecies)
- Black-necked Stork
- Brush-tailed Rock-wallaby
- Bush Stone-curlew
- Cumberland Plain Land Snail
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Eastern Pygmy-possum
- Gang-gang Cockatoo
- Greater Broad-nosed Bat
- Green and Golden Bell Frog
- Grey-headed Flying-fox
- Koala
- Little Lorikeet
- Pink Robin
- Powerful Owl
- Red-crowned Toadlet
- Regent Honeyeater
- Southern Myotis
- Speckled Warbler
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Swift Parrot
- Yellow-bellied Sheathtail-bat

Data Sources:
Imagery - Microsoft Virtual Earth
DECCW (2010)

0 0.5 1 2
Kilometres

Datum/Projection:
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3 Ecological Assessment

3.1 METHODOLOGY

This ecological assessment has been prepared with reference to the *Draft Guidelines for Threatened Species Assessment* (DEC & DPI 2005); *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004); *Guidelines for Aquatic Habitat Management and Fish Conservation* (DPI 1999); and *Principles for the use of biodiversity offsets in NSW (*DECC 2008).

3.1.1 Desktop GIS habitat assessment and mapping

A desktop geographic information system (GIS) assessment was undertaken to identify potential habitat for *Litoria aurea* (Green and Golden Bell Frog) and to map vegetation communities in the Study Area. Utilising the mapping of DECCW (2009) and high resolution aerial photography, all vegetation patches (polygons) within the corridor were visually inspected and assigned a vegetation community. Vegetation present on the aerial photographs which was not mapped by DECCW (2009) was added and assigned a vegetation community. Polygons were trimmed where the edges extended outside of the Study Area and where vegetation had been mapped over the existing pavement (for example where tree canopies overhang the motorway). Where polygons clearly included two separate vegetation communities (e.g. landscaping and remnant), these polygons were split. This was particularly evident where vegetation behind noise walls had been retained and vegetation in front had been landscaped.

Each vegetation polygon was assigned a code ranging from 'low' (not confident) to 'high' (confident) in relation to the observable accuracy of the assigned vegetation community. Examples of this include areas mapped as Endangered Ecological Communities (EECs) which appeared to be revegetation from the aerial photography. Those polygons coded 'low' or 'moderate' were to be the primary target of the site inspection and mapping validation.

3.1.2 M5 Motorway survey

An initial ecological survey of the M5 West Motorway from Camden Valley Way to the Hume Highway was undertaken by two ecologists over 8 hours on 12 February 2010. This initial survey consisted of driving along the motorway and observing the median strip where vegetation was proposed to be cleared and surrounding batters and road verges. Regular stops were made where practicable and safe to do so (generally in breakdown bays) where more thorough assessment of the vegetation within the Subject Site could be made. Observations were aided by the use of binoculars and digital photography. Remnant vegetation outside of the road easement was also visited to develop an understanding of surrounding vegetation communities and biodiversity values. Lieutenant Cantello Reserve and Salt Pan Creek Reserve were included in these inspections.

Surveys of the mapped potential habitat for the Green and Golden Bell Frog and EECs (refer section 3.1.1 above) were conducted by two ecologists over 10 hours on 21 May 2010. Each area of potential Green and Golden Bell Frog habitat was visited and an assessment of the habitat value, condition and likely utilisation of the habitat by the Green and Golden Bell Frog was undertaken. Photographs of each area of potential habitat were taken (refer Appendix C). The areas visited included:

- Landscape setbacks;

- Constructed drainage lines with earthen and artificial linings;
- Sedimentation basins (both earthen and concrete lined); and
- Natural wetlands and sedimentation basins.

During the survey, the majority of areas mapped as EECs in the desktop assessment were visited. Where these areas could be identified as an EEC to a reasonable degree of certainty, they were coded 'high'. A number of areas consisted of both remnant vegetation and landscaping and were coded 'moderate' and may require additional assessment to determine the true status of the vegetation.

3.1.3 Construction compounds

Eight potential construction compounds were identified for use. They included:

- Bansgrove Road: Bransgrove Road, Panania;
- Henry Lawson Drive: Near 450 Henry Lawson Drive, Milperra;
- Moorebank Avenue: Near 175–209 Moorebank Avenue, Moorebank;
- M5/Graham Avenue (1): Near 59–79 Graham Avenue, Casula;
- M5/Graham Avenue (2) & (3): Near 81 and 85A Graham Avenue, Casula;
- Beaconsfield Road: Near 68 Marigold Street, Milperra; and
- Northern side of Heathcote Road: Corner M5 on ramp and Heathcote Road, Moorebank.

A desktop assessment of the construction compounds was undertaken to determine if any ecological survey would be required. Resources utilised during the desktop assessment included recent aerial photography (SKM 2007), NPWS (2002) mapping, DECCW (2009) mapping and NPWS Atlas Records (DECCW 2010a). From the desktop assessment it was concluded that six of the potential construction compound sites did not require further assessment due to a combination of factors including: absence of vegetation of conservation significance, existing land use (such as developed industrial sites) and proposed land use (such as no vegetation clearing required). These six sites were either predominantly cleared or currently developed and were not considered likely to be impacted by temporary infrastructure, however should the proposed land use change, further assessment may be required.

Four of the eight construction compound sites were identified for further assessment, including:

- Moorebank Avenue: Near 175–209 Moorebank Avenue, Moorebank.
- M5/Graham Avenue (2) & (3): Two sites, one located near 81 and another near 85A Graham Avenue, Casula.
- Northern side of Heathcote Road: Corner M5 on ramp and Heathcote Road, Moorebank.

Each of these potential construction compound sites were inspected by two ecologists over 8 hours on 10 May 2010. The ecological inspections included incidental observations of all flora and fauna within the sites and random meander surveys for threatened plant species in areas of remnant vegetation. During the inspections, potential ecological constraints were identified and mapped in situ using a hand-held geographic mapping unit loaded with ArcPad® software and the latest hi-resolution aerial photograph (SKM 2007).

3.1.4 Limitations

Due to safety regulations and access limitations it was not possible to perform detailed survey within the median of the M5 Motorway, however, given the highly disturbed nature of the proposal area and paucity of important habitat, particularly in regard to threatened species, more detailed study was deemed unnecessary.

Irrespective of the access constraints, there is a high level of confidence regarding the assessment of potential impacts of the proposal due to knowledge of past disturbance within the median areas and previous access to the median (ELA 2009) which aided in the identification of planted species.

Should additional works be required outside of those originally assessed (refer Figure 1 – Study Area), then additional impacts may occur and will require further assessment.

3.2 RESULTS

3.2.1 Site characterisation and context

The M5 West Motorway is characterised by the typical 'cut' and 'fill' motorway construction which has completely altered the soil profile with the majority of the vegetation within the M5 Motorway having been planted. Several small patches of remnant native vegetation occur behind noise walls and barriers where the original soil profiles remain. The vegetation of the Subject Site is now characterised by landscaped batters and regularly maintained grass medians with occasional shrub and tree planting (most noticeably around bridge abutments).

3.2.2 Flora species richness

A total of 222 species (107 native, 105 exotic and 10 non-local natives) from 48 plant families were recorded across the Subject Site and at the construction compound sites (Appendix C).

Two threatened plant species were recorded on the Subject Site, namely *Acacia pubescens* (Downy Wattle) and *Doryanthes palmeri* (Giant Spear Lily). *Wilsonia backhousei* (Narrow-leafed Wilsonia) was recorded in Coastal Saltmarsh (TSC Act EEC) in Salt Pan Creek, which adjoins the Subject Site. *Eucalyptus nicholii* (Narrow-leaved Black Peppermint) was recorded at the Moorebank Ave compound site.

Downy Wattle and the Narrow-leaved Black Peppermint are listed as vulnerable under the TSC Act and EBPC Act, whilst the Giant Spear Lily and Narrow-leafed Wilsonia are listed as vulnerable under the TSC Act. The Giant Spear Lily is native in northern NSW in the Northern Rivers bioregion and has been included as part of the landscaping adjoining bridge abutments in the west of the Subject Site. The Narrow-leaved Black Peppermint is a commonly planted street and garden tree (DECCW 2010b) and would have been planted as part of the original landscaping of the site.

While the Downy Wattle is native to the Study Area, it was planted as part of the original landscaping of the M5 West Motorway and is generally located in the central median around bridge abutments east of Moorebank Road. Several other populations of Downy Wattle have been identified both within and

adjoining the M5 Motorway corridor, however these populations occur behind the noise walls and are unlikely to be directly affected by the proposal.

Considering the modification to the soil profile which was originally undertaken for the construction of the M5 West Motorway, no naturally occurring threatened flora species are deemed likely to occur within the Subject Site.

3.2.3 Fauna species richness

Four species of listed threatened fauna were deemed to have the potential to occur within the Subject Site, namely the *Chalinolobus dwyeri* (Large-eared Pied Bat), *Mormopterus norfolkensis* (Eastern Freetail Bat), *Miniopterus orianae oceanensis* (Eastern Bent-wing Bat) and *Litoria aurea* (Green and Golden Bell Frog). The first three species are insectivorous bats that tolerate relatively high levels of disturbance (having been recorded via ANABAT detection and trapping within environments with frequent traffic-generated noise). Lighting from the M5 West Motorway could potentially attract prey for these species, providing potential foraging habitat for the species in the Subject Site.

Areas of potential Green and Golden Bell Frog habitat were identified where a suitable combination of habitat elements were present (including macrophytes such as *Typha orientalis* and *Eleocharis* spp., adjoining grassy areas for foraging, unshaded open water, suitable overwintering habitat and free of predatory fish such as *Gambusia holbrooki* (Plague Minnow). The majority of potential Green and Golden Bell Frog habitat identified in the desktop assessment was considered to be unlikely to support populations of the Green and Golden Bell Frog during site inspections. This was due to a number of factors influenced by the type of structure (e.g. concrete or artificially lined), absence of vegetation, lack of connectivity to adjoining areas (e.g. extensive concrete stormwater channels) and absence of previous Green and Golden Bell Frog records in the locality.

Two areas of potential Green and Golden Bell Frog habitat were identified during the site inspection; one is within close proximity to the Georges River on the southern side of the M5 Motorway at Panania (Figures 8c and 8d, Photo 10 in Appendix C) and the other is located on either side of the M5 Motorway along Anzac Creek at Heathcote Road (Figure 8e, Photo 16 in Appendix C). The Panania location includes an extensive wetland area dominated by *Typha orientalis* and *Casuarina glauca* adjoining a tip site is connected to the Georges River by a series of wetland and vegetated areas. *Gambusia holbrooki* (Plague Minnow) was observed at the later location which is likely to reduce the ability of the Green and Golden Bell Frog to breed and have successful recruitment in this location. Although targeted surveys for the Green and Golden Bell Frog were not undertaken as part of this project, a conservative habitat assessment approach which focused on assessing potential habitat and assuming presence where habitat features were appropriate for this species was undertaken. Targeted surveys for this species would provide no greater certainty at this stage of the project.

A small number of common native fauna species were also observed during the field investigations (Appendix C). Considering the degraded nature of the vegetation within the M5 Motorway corridor and the current disturbance regimes, the habitat within the corridor is of limited value to fauna in general and would provide only minor foraging habitat for disturbance tolerant species such as *Manorina melanocephala* (Noisy Miner). Large contiguous areas of vegetation occur outside of the M5 Motorway corridor which would support a more diverse fauna assemblage. The exotic invasive fish *Gambusia holbrooki* (Plague Minnow) was recorded in a number of sedimentation basins along the M5 Motorway corridor and in Anzac Creek at the Moorebank Ave construction compound site. Predation by the Plague Minnow is listed as a Key Threatening Process under the *TSC Act*. The presence of this species in the sediment basins within the study area is likely to reduce the ability of the Green and Golden Bell Frog to breed in these habitats and have successful recruitment.

3.2.4 Vegetation of the central median

The central median of the M5 West Motorway is comprised of four basic elements: concrete, exotic grass, planted shrubs and planted trees. The median between King Georges Road and Fairford Road is currently paved as is the median between the Hume Highway and Moorebank Road. The remaining areas of median consist predominantly of mown exotic grasses with occasional plantings and concentrated landscape plantings around bridge abutments (Plate 1, Plate 2 and Plate 3). The species recorded along the central median have been planted (or hydro-mulched) as part of landscaping of the M5 West Motorway, and no remnant vegetation is present within the median. The soil profile has been highly modified, consisting predominantly of cut and fill batters. Whilst the species planted are native, they do not entirely represent species that would have naturally occurred in the area. Such species include *Melaleuca armillaris* (Bracelet Honey-myrtle), *Westringea fruiticosa* (Coastal Rosemary), *Acacia saligna* (Cooba), *Doryanthes palmeri* (Giant Spear Lily) and various Grevillea cultivars. The ground cover in all areas of the median consists predominately of introduced grasses including *Eragrostis curvula* (African Lovegrass), *Pennisetum clandestinum* (Kikuyu) and *Chloris gayana* (Rhodes Grass).

Plate 1: Mown Grass Median

Plate 2: Typical Median Planting

Plate 3: Typical Bridge Abutment Planting

One locally native threatened species, *Acacia pubescens* (Downy Acacia), was observed to have been included within landscaped areas of the Subject Site (Plate 4). Approximately 33 plants were observed within the median close to the overpasses for River Road, Fairford Road and Heathcote Road. Downy Acacia is listed as vulnerable under both state and federal legislation (TSC Act 1995 and EPBC Act

1999). The individuals found within the median exist due to hydro-mulching and landscaping activities associated with the original construction of the M5 West Motorway, with seed stock sourced from plants that are thought to have naturally occurred within the M5 corridor area (NPWS 2003). The location of Downy Wattle is presented via mapping in Figure 7.

Plate 4: Downy Wattle (*Acacia pubescens*) in central median

A number of individuals of the *Doryanthes palmeri* (Giant Spear Lily) were observed in the concentrated landscape planting around the bridge abutments between the Hume Highway and Camden Valley Way. Giant Spear Lily is listed as vulnerable under state legislation (TSC Act 1995). This species is a relatively commonly planted landscape species and is easily confused with *Doryanthes excelsa* (Gymea Lily) with which it is closely related. There is likely to be a mixture of Gymea Lily and Giant Spear Lily in these landscaped areas. As the Giant Spear Lily is native to northern NSW and has clearly been planted as part of the M5 West Motorway landscaping, it is of little consequence to the proposal.

The landscaping within the central median includes flowering native plants that potentially offer foraging resources for various native fauna, including threatened species. Given the high level of disturbance and the amount of noise along the motorway; it is unlikely that the motorway would be utilised by most species. No other habitat features, such as tree hollows, aquatic areas, roost sites and rock piles that have conservation significance or ecological value were observed.

3.2.5 Vegetation of the verge and batters

The landscaping along the verge and batters of the M5 West Motorway varies with the width of setback, ranging from areas with no landscaping, to narrowly landscaped areas in front of noise walls and large landscaped areas setback from the pavement (Plate 5).

The majority of vegetation within batters and setback areas along the M5 has been planted, with a consistent suite of species used throughout the Subject Site. Commonly recorded species included *Eucalyptus moluccana* (Grey Box), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Casuarina glauca* (Swamp Oak) and *Acacia parramattensis* (Parramatta Wattle).

Figure 7a. Downy Wattle (Acacia pubescens) locations

Legend

Acacia pubescens locations

- Median
- Verge
- Beyond Noise Walls

Data Sources:
Imagery - 0.10 m pixels (c) SKM Pty Ltd 2007
ELA Survey (2009)

0 25 50 100
Metres

Datum/Projection:
GDA 1994 MGA Zone 56

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Figure 7b. Downy Wattle (Acacia pubescens) locations

Legend

Acacia pubescens locations

- Median
- Verge
- Beyond Noise Walls

Data Sources:
Imagery - 0.10 m pixels (c) SKM Pty Ltd 2007
ELA Survey (2009)

0 25 50 100
Metres

Datum/Projection:
GDA 1994 MGA Zone 56

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Figure 8f. Vegetation Communities and Green and Golden Bell Frog Habitat

Legend

- M5 Motorway Corridor
- Photo Point

Green and Golden Bell Frog Habitat

- Potential
- Unlikely

Vegetation Community, Mapping Confidence

- Artificial Wetland
- Landscaping
- Castlereagh Scribbly Gum Woodland (non EEC), Moderate
- Coastal Mangrove Swamp (non EEC)
- Coastal Saltmarsh (EEC), High
- Coastal Saltmarsh (EEC), Moderate
- Cooks River/ Castlereagh Ironbark Forest (EEC), High
- Cooks River/ Castlereagh Ironbark Forest (EEC), Moderate
- Cumberland Plain Woodland (EEC), High
- Cumberland Plain Woodland (EEC), Moderate
- River Flat Eucalypt Forest (EEC)
- Shale Gravel Transition Forest (EEC), High
- Shale Gravel Transition Forest (EEC), Moderate
- Swamp Oak Floodplain Forest (EEC)

0 0.1 0.2 0.4
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 56

Data Sources:
Imagery - 0.10 m pixels (c) SKM Pty Ltd 2007
ELA (2010)
DECCW (2009)

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