ECOLOGICAL ASSESSMENT - OAKDALE CONCEPT PLAN

For:

GOODMAN INTERNATIONAL LIMITED

December 2007

Final Report

Cumberland Ecology
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Report No. 7016RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology

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Executive Summary

PURPOSE

Goodman International Limited (Goodman) is preparing a Concept Plan for the development of a 421 hectare portion of the Western Sydney Employment Hub at Kemps Creek and Horsley Park, NSW. The Concept Plan, referred to as 'Oakdale' (see **Appendix A**), provides for:

- Development of Lots 1 and 2 DP 120673 and Lots 82 nd 87 DP 752041 for employment purposes (comprising approximately 333 hectares);
- Future development of Lot 1 DP 843901 for employment purposes, following the cessation of quarrying and brickmaking on this lot;
- Associated external infrastructure, including upgrade to a section of Old Wallgrove Road and the provision of regional rainwater harvesting infrastructure within the Warragamba-Sydney water pipeline corridor.

Cumberland Ecology has been engaged by Goodman to undertake an ecological assessment for the Oakdale Concept Plan and associated infrastructure. This plan is considered with respect to potential impacts to ecological values of the subject land and the above surrounding areas (hereafter referred to collectively as the "study area").

BACKGROUND

The Oakdale Site has been identified for employment purposes under the Metropolitan Strategy and includes paddocks, various dams distributed over the property, scattered trees, remnant patches of bushland and Ropes Creek riparian corridor. Due to a long history of land use since European settlement the property is largely cleared. Native vegetation occurs along Ropes Creek and its tributaries and in scattered patches mainly in the south and west of the property. Other parts of the subject land have been almost entirely cleared and consist of pasture grasses.

As part of the proposal for development on the Oakdale Site, a section of Old Wallgrove Road is being considered for upgrading and rainwater harvesting pipes will be constructed adjacent to existing Sydney Water infrastructure within the Sydney Water Main Water Supply Pipeline corridor.

METHODS

Ecological assessment methods included a literature review and database search for threatened species known to occur within the locality of the study area. Flora surveys were carried out within the Oakdale Site, the Sydney Water Main Water Supply Pipeline corridor and along the road reserve of Old Wallgrove Road. Flora species identified were recorded and plant communities were described. Fauna surveys were carried out on the Oakdale Site and included targeted searches for Cumberland Plain Land Snails and Green and Golden Bell Frogs. Bird surveys (including owl call playback) were carried out. Surveys for mammals were conducted using hair tubes, spotlighting and Anabat recorders. Habitat assessments were carried out for specific habitat requirements of threatened fauna species known to occur in the locality of the study area based on database search results.

KEY FINDINGS

In addition to exotic and native grassland, the three main plant communities that occur on the subject land are:

- Swamp Oak Floodplain Forest (TSC Act listed);
- Cumberland Plain Woodland (EPBC and TSC Act listed); and
- Wetland vegetation (associated with farm dams on the subject land).

Vegetation in the Sydney Water Pipeline corridor and the existing road reserve of Old Wallgrove Road consists mainly of exotic grass species.

No threatened flora listed under the EPBC and TSC Acts were identified on the subject land or in the pipeline corridor and road reserve during targeted searches.

No threatened fauna species listed under the EPBC and TSC Acts were identified on the subject land except the following bat species:

- Eastern Cave Bat;
- Eastern Bentwing Bat;
- Eastern Freetail Bat; and
- Greater Broad-nosed Bat.

Desktop analysis of the Austral Bricks quarry site indicates that the majority of the site is highly disturbed, but it does contain some vegetation of potential significance, principally in the south eastern areas of the site. This site should be subject to additional investigation and assessment after the cessation of quarrying/brickmaking and prior to subsequent development of the site.

IMPACTS OF THE PROPOSAL

The proposed development involves the removal of a total of approximately 4 ha of vegetation. Approximately 0.5 ha of this comprises Cumberland Plain Woodland, 2.5 ha comprises modified Swamp Oak Floodplain Forest and 1.2 ha comprises degraded woodland. However, as part of the proposal, rehabilitation and revegetation will be carried out in riparian areas. At least 1.72 ha of Cumberland Plain Woodland and 18 ha of Swamp Oak Floodplain Forest will be revegetated. This will result in a net increase of a minimum of 10 ha of vegetated area on the subject land.

Given the current disturbance to vegetation on the subject land by cattle, the proposal will have a positive impact on vegetation communities, the waterways and riparian vegetation communities surrounding them. The revegetation/rehabilitation of endangered ecological communities and re-establishment of riparian vegetated buffers will improve the condition and extent of the vegetation, improve the fauna habitat opportunities and enhance the biodiversity corridor function of Ropes Creek in the area. Thus, the impact on endangered ecological communities as a result of the proposal is expected to be minimal.

No threatened flora species were identified on the subject land and hence no negative impacts are expected as a result of the proposal.

The vegetation in the Sydney Water Pipeline Corridor and in the road reserve is mainly exotic grassland and therefore holds no conservation value. No negative impacts are expected on these areas as a result of the proposal.

The impact on threatened bat species is expected to be minimal as current occurrence is likely to be minimal and habitat extent and condition will improve as a result of the proposal.

RECOMMENDATIONS

The following recommendations have been made for mitigation and offsetting on the Oakdale Site:

- That revegetation/rehabilitation of endangered ecological communities occurs in a ratio of at least 3 hectares for every hectare removed;
- That landscaping of water detention basins with appropriate wetland vegetation is undertaken to make up for the loss of wetland habitat through removal of the existing dams; and
- That a Vegetation Management Plan (VMP) is prepared for the revegetation and management of riparian zones and any areas of revegetation outside this zone. This should include weed removal and management.

For the Austral Bricks quarry site, it is recommended that additional field investigation and assessment be undertaken after the cessation of quarrying and brickmaking, and prior to the subsequent development of the site.

Chapter 1

Introduction

1.1 Purpose

Goodman International Limited (Goodman) is preparing a Concept Plan for the development of a 421 hectare portion of the Western Sydney Employment Hub at Kemps Creek and Horsley Park, NSW. The Concept Plan, referred to as 'Oakdale' (see **Appendix A**), provides for:

- Development of Lots 1 and 2 DP 120673 and Lots 82 and 87 DP 752041 for employment purposes (comprising approximately 333 hectares);
- Future development of Lot 1 DP 843901 for employment purposes, following the cessation of quarrying and brickmaking on this lot; and
- Associated external infrastructure, including upgrade to a section of Old Wallgrove Road and the provision of regional rainwater harvesting infrastructure within the Warragamba-Sydney water pipeline corridor.

Cumberland Ecology has been engaged by Goodman to undertake an ecological assessment for the Oakdale Concept Plan and associated infrastructure. This plan is considered with respect to potential impacts to ecological values of the subject land and the aforementioned surrounding areas (hereafter referred to collectively as the "study area").

The objectives of the assessment include:

- To survey flora species and describe vegetation communities on the currently developable land (ie. Lots 1 and 2 DP 120673 and Lots 82 and 87 DP 752041 – 'the subject land');
- To survey fauna species and describe fauna habitats on the subject land;
- To assess the likelihood that threatened species of flora and fauna could occur on the subject land;
- To carry out a desktop study on the ecological values of the existing Austral Bricks quarry site located to the east of the subject land (ie. Lot 1 DP 843901);

- To describe flora values in the Sydney Water Main Water Supply Pipeline corridor, where rainwater harvesting infrastructure is proposed to be constructed as part of the Oakdale Site project from Mamre Road (west of the Oakdale Site) to Ferrers Road (east of the Oakdale Site);
- To describe flora values in the section of Old Wallgrove Road corridor that runs north east from the Oakdale Site to Wallgrove Road;
- To consider potential impacts of the Oakdale Concept Plan development on flora and fauna; and
- Where relevant, to recommend compensatory and mitigation measures to reduce the impacts of industrial development on flora and fauna.

1.2 Terms and Abbreviations

This report uses the following terminology:

- **Activity** as defined in the EP&A Act;
- **DECC** abbreviates Department of Environment and Climate Change (NSW) (formerly Department of Environment and Conservation);
- **Development** as defined in the EP&A Act;
- **DWE** abbreviates Department of Water and Energy (NSW) (formerly Department of Natural Resources);
- **EP&A Act** abbreviates the *Environmental Planning and Assessment Act 1979*;
- **EPBC Act** abbreviates the *Environment Protection and Biodiversity Conservation Act 1999;*
- **LGA** abbreviates Local Government Area;
- **Locality** is the area within a 10 km radius of the subject land;
- **Proposal** is the development, activity or action proposed;
- **Study area** is the subject land and any additional areas that are likely to be affected by the proposal, either directly or indirectly. This includes the section of Sydney Water Pipeline corridor proposed for construction of additional water pipelines, the area of Old Wallgrove Rd proposed for widening and the existing Austral Bricks quarry to the east of Old Wallgrove Rd;
- **Subject land** means the property of Austral Bricks at Kemps Creek in Lot numbers 1 and 2, DP 120673 and Lots 82 and 87, DP 752041;

- **Subject site** means the area of the Austral Bricks property upon which works are proposed;
- **Threatened species** means those species listed as threatened under the EPBC Act, the TSC Act or the *Fisheries Management Act 1994*; and
- **TSC Act** abbreviates the *Threatened Species Conservation Act 1995.*

1.3 Background

1.3.1 The Subject Land (Oakdale Site)

The subject land is approximately 333 hectares in size and is situated within the Penrith and Fairfield LGAs. It is located adjacent to and directly south of the Sydney Water Main Water Supply Pipeline and west of Old Wallgrove Road (**Figure 1.1**). Private land is situated to the south, east and west of the subject land. This area occurs on a part of the Cumberland Plain in western Sydney. Although the Cumberland Plain has experienced extensive clearance of native vegetation for agriculture, urban and industrial development, remnant and re-growth patches of woodland still occur as mosaics across the landscape. These include threatened vegetation communities that are listed as endangered under the TSC Act and the EPBC Act. Such native woodland vegetation can also potentially support threatened and regionally significant flora and fauna species.

The subject land has been identified for employment purposes under the Metropolitan Strategy and includes paddocks, a house (in Lot 1 DP 120673), two large dams (one on Lot 1 DP 120673, the other on Lot 82 DP 752041), various small dams distributed over the property, and Ropes Creek and two of its tributaries flowing in a south-north direction over the property. A proposal and concept masterplan (**Appendix A**) have been prepared for the future redevelopment of the subject land, and these involve some clearing of native remnant bushland vegetation on the subject land and revegetation/rehabiliation in some areas of the subject land. These are described in more detail within Chapter 4 of this report. In accordance with Section 75D of the EP&A Act, Ministerial Approval will be sought for carrying out the project under Part 3A of the Act.

Due to a long history of land use since European settlement the subject site is largely cleared. Native vegetation occurs along Ropes Creek and its tributaries and in scattered patches mainly in the south and west of the property. Other parts of the subject land have been almost entirely cleared and consist of pasture grasses.

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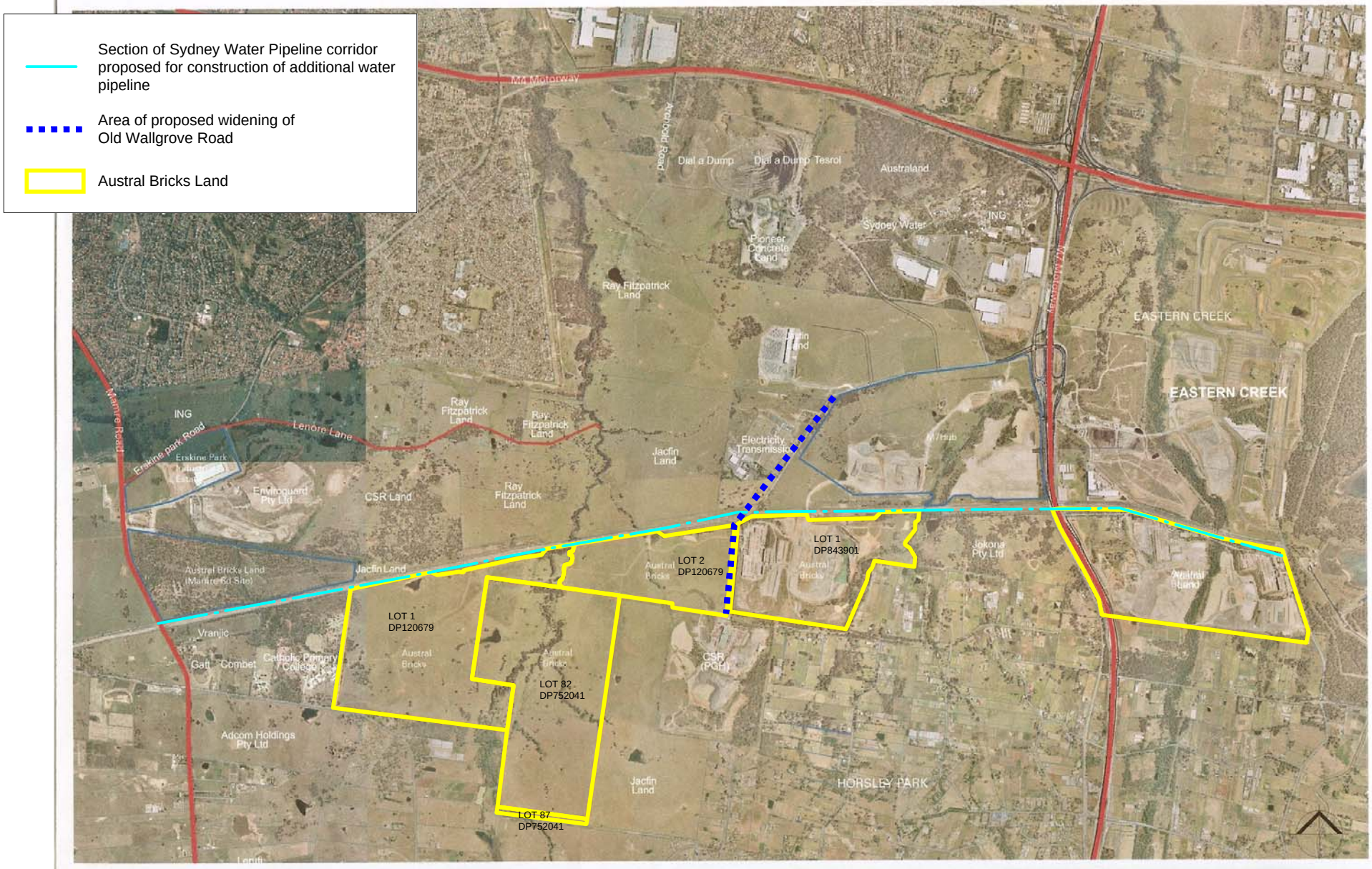

Figure 1.1 Site Context Map

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1.3.2 Sydney Water Pipeline Corridor and Old Wallgrove Road

As part of the Concept Plan for the Oakdale Site, a section of Old Wallgrove Road is being considered for upgrading, and rainwater harvesting pipes will be constructed adjacent to existing Sydney Water infrastructure within the Sydney Water Main Water Supply Pipeline corridor.

1.3.3 Existing Austral Bricks Quarry Site

Austral Bricks plan to fully utilise the site of the existing quarry (Lot 1 843901) for quarrying purposes. This quarry and brickworks has been in operation since 1973 and is planned to continue to operate for the foreseeable future, in accordance with existing development approvals. As such, although included in the Concept Plan area, this lot has not been visited or surveyed, and has only been subject to a desktop assessment. This lot would require further consideration of ecological values following rehabilitation of the quarry and cessation of brickworks and prior to subsequent development of the site.

1.4 Ecological Planning Considerations

Threatened woodland communities, flood extents and the ecological values associated with streams and wetlands form primary constraints when planning future developments in western Sydney. Within this report such values have been considered by:

- Mapping the nature, extent and quality of native vegetation and other fauna habitats across the subject land; and
- Assessing the conservation values of such flora and fauna habitats and the potential for long term conservation on site.

Ecological assessments were made with due reference to:

- Threatened species legislation (the TSC Act and the EPBC Act);
- DWE (formerly Department of Natural Resources) stream categories (DIPNR 2004);
- Local planning documents for Fairfield and Penrith City Councils (Fairfield City Council 2006a, 2006b, and Penrith City Council 2006);
- The *Revised Biodiversity Management Plan Erskine Park Employment Area: 2007* (HLA-Envirosciences 2007); and
- The *Penrith Biodiversity Strategy* (Penrith City Council 2004).

1.4.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act protects the environment, particularly matters of National Environmental Significance. It is managed by the Commonwealth Department of Environment and Water Resources (DEWR). There are eight matters of national environmental significance under the EPBC Act:

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance (Ramsar Wetlands);
- Listed threatened species and ecological communities;
- Listed migratory species;
- The Commonwealth marine area; and
- Nuclear actions, including uranium mining.

Species listed under the EPBC Act are known to occur in the Fairfield and Penrith LGAs, and may occur in the study area.

1.4.2 Threatened Species Conservation Act 1995

The TSC Act outlines the protection of threatened species, communities and critical habitat in New South Wales. Objectives of this Act include:

- To conserve biological diversity and promote ecologically sustainable development; and
- To encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.

The TSC Act also manages priority actions which set out the strategies to be adopted for promoting the recovery of each threatened species, population and ecological community, as well as key threatening processes which threaten native species.

A number of species listed under the TSC Act are known to occur in the Fairfield and Penrith LGAs, and may occur in the study area.

1.4.3 Local Planning Documents

The local planning documents for Fairfield and Penrith City Councils provide for the protection of aquatic vegetation, fauna and ecology and natural water bodies and avoidance of adverse effects on flood-liable land.

1.4.4 DWE (formerly Department of Natural Resources) stream categories (DIPNR 2004)

Goodman has undertaken a Riparian Areas assessment for the Oakdale project (GHD, 2007), to classify streams on the site and determine appropriate riparian areas. The stream categories, and recommended riparian zones for each category, include (after DIPNR 2004):

- Category 1 – Environmental Corridor (provides vegetated linkages between key areas of biodiversity with a 40 m Core Riparian Zone and an additional 10 m vegetated buffer zone);
- Category 2 – Terrestrial and Aquatic Habitat (provides basic habitat and preserves the natural features of a watercourse with a 20 m Core Riparian Zone and an additional 10 m vegetated buffer zone); and
- Category 3 – Bank Stability and Water Quality (has limited habitat value but contributes to the overall basic health of a catchment by preventing soil erosion and enhancing water quality with a 10 m vegetated buffer zone).

These categories provide a guide as to the appropriate widths of areas to protect and enhance as “Core Riparian Zones” (CRZ) around streams.

Goodman’s riparian assessment identifies Ropes Creek as a Category 1 stream. Four unnamed tributaries of Ropes Creek have been classed as Category 2 streams, and the site contains a number of additional Category 3 streams (as shown on Figure 3.2).

It is understood that Goodman proposes to maintain the recommended CRZ’s to the Category 1 and Category 2 streams (with exception of the farm dams on Category 2 streams, which are proposed to be removed and rehabilitated to reinstate natural stream flows). The Category 3 streams are likely to be disturbed and/or relocated for the project.

Chapter 2

Ecological Assessment Methods

2.1 Literature Review

The Atlas of NSW Wildlife (DEC (NSW) 2006), Bionet (NSW Government 2005) and the EPBC Protected Matters search tool (DEH 2005) were used to provide a list of threatened fauna and flora species in the locality of the study area. As a reference a full list of fauna species recorded in Penrith and Fairfield LGAs is provided in **Table C.4** in **Appendix C**. Relevant reports from previous ecological studies of the area were also reviewed (e.g. GHD 2006 and HLA-Envirosciences 2007).

Development constraints for the existing Austral Bricks quarry/brickworks site were considered based only on this desktop study as no field surveys were carried out. Flora surveys were undertaken on the subject land (the Oakdale Site), the Sydney Water Pipeline corridor and Old Wallgrove Road as described below. Fauna surveys and habitat assessments were carried out only on the Oakdale Site.

2.2 Flora Surveys

Inspections were made of the vegetation on the subject land on 9th and 30th March 2007 using random meander transects within scattered areas of bushland and stands of trees. Details were recorded regarding the main plant species present, general frequency of species, levels of disturbance to native vegetation, plant community structure, and impacts on and likely dynamics of plant communities present.

Further flora inspections were carried out on 30th March 2007 within the section of the Sydney Water Pipeline corridor where the proposed additional water pipe will be located and within the road reserve area of Old Wallgrove Road where the proposed road upgrade will take place (**Figure 1.1**).

Plant communities were described based on the dominant canopy species and community structure, according to Specht (1970). Plant species nomenclature conforms to Harden (1990-93).

Modified indigenous plant community was considered to occur where there was more than 60% native species in the ground cover. Most of the areas identified as bushland also contained native trees; however this was not essential. The definition of 'bushland' was

based on findings of NSW NPWS (2002a) and on the feasibility of restoring such areas to more representative examples of the natural community.

The potential conservation significance of communities and species was based on the TSC Act Schedules and the EPBC Act. The potential significance was also considered within the context of the subject land and study area to obtain a value that more accurately reflects the likely contribution to conservation of the community or species generally.

2.2.1 Targeted Threatened Flora Searches

The results of the database searches (DEC (NSW) 2006) for threatened flora species were reviewed and used to direct targeted searches in the field. The target species included the following:

- *Acacia pubescens* (Downy Wattle);
- *Cynanchum elegans* (White Waxflower);
- *Grevillea juniperina* ssp *juniperina* (Prickly Spiderflower);
- *Grevillea parviflora* var *parviflora;*
- *Hypsela sessiliflora;*
- *Mardsenia viridiflora* ssp *viridiflora;* and
- *Pimelea spicata.*

The likelihood of the above species occurring on the Austral Bricks quarry site was considered with respect to the extent and condition of the available habitat on the quarry site. This is summarised in **Table 3.2** of Chapter 3.

2.3 Fauna Assessment

Opportunistic sightings of fauna species were recorded during visits to the site in March 2007. Targeted searches were carried out for the endangered Green and Golden Bell Frog (*Litoria aurea*) and the endangered Cumberland Land Snail (*Meridolum corneovirens*) as described below in sections 2.3.1 and 2.3.2. General surveys for other fauna species and habitat assessments were carried out as described in sections 2.3.3 to 2.3.5.

2.3.1 Cumberland Land Snail Searches

Targeted searches for the endangered (listed under the TSC Act) Cumberland Land Snail (*Meridolum corneovirens*) were carried out in daylight hours during site visits on the 9th, 23rd and 29th March. These searches were restricted to areas of suitable habitat for the

species, i.e. within leaf litter in remnant patches of woodland representative of Cumberland Plain Woodland ecological community.

2.3.2 Frog Surveys

Frog surveys were carried out on 21st, 22nd and 28th March 2007. Weather conditions on the 21st of March were dry; however there had been rain earlier in the day and heavy rain on the 17th, 19th and 20th of March. Such conditions are favourable for frogs. There was no rain on the 22nd or 28th of March and all three survey nights were warm (approximately 25°C).

The search area included all of the dams on the subject land and all suitable riparian areas (**Figure 2.1**) and surveys were aimed at:

- Determining the range of frog species on the site; and
- Determining whether any threatened or listed frogs may be present.

An assessment of potential habitat for threatened frog species on the site was also carried out.

Tadpole surveys were carried out in daylight. All potential frog sites were dip-netted using a long handled pool net. Tadpoles were identified using keys and descriptions in Anstis (2002). No attempt was made to quantify the number of tadpoles in each pond. During the tadpole survey, fish were also identified using keys and descriptions in McDowall (1996).

All potential frog sites were visited at night. Calling frogs were noted and non-calling frogs were detected using headlamps. Breeding call imitation and sound stimulation was used in each of the potential habitat areas of the Green and Golden Bell Frog to try to evoke calling by sheltering frogs. A listening period of about two minutes followed each calling session.

2.3.3 Bird Surveys

The site was surveyed on the 27th of March 2007 from 6.20 am until 3 pm using an area search method that covered all habitat types occurring on site. All bird species seen or heard were recorded along with their maximum abundance during the survey. The habitat types surveyed were riparian zone, pastureland, dams, woodland and scattered trees, and birds were recorded for each habitat type.

Spot-lighting and call playback for select species (Powerful Owl, Masked Owl and Barking Owl) took place after dusk, between 7.45 and 9.00 pm on 21st, 22nd and 28th March. **Figure 2.1** indicates the locations of owl call playback.

2.3.4 Mammal Surveys

i. Hair Tubes

Hair tube surveys were carried out from 23rd to 29th March 2007. Six hair tubes were placed in trees and 56 hair tubes were placed on the ground within riparian areas and remnant woodland along the lines indicated in **Figure 2.1**. Hair tubes were left in position for 6 nights prior to analysis and identification of mammal species.

ii. Bat Surveys

Two Anabat ZCAIM devices were used on two nights each (21st and 22nd March 2007) to record bat calls in the study area. Water-bodies and remnant woodland patches were identified as the most likely foraging sites for microbats (Microchiroptera) in the area (bat call recording locations are indicated in **Figure 2.1**). Recordings were made overnight on both nights of survey. Analysis of Anabat sequence files was carried out by Greg Ford for Cumberland Ecology. Bat call identification was based on keys and descriptions in Pennay *et al.* (2004).

iii. Spot-lighting

Spot-lighting for nocturnal mammals was carried out on 21st, 22nd and 28th March 2007 between 7.00 pm and 9.00 pm. Observed animals were noted. The estimated distance covered was 1 km on the first and second evenings and 2.5 km on the third evening of spotlighting. The path walked on the first evening was along Ropes Creek on the north of the subject land. The path walked on the second evening was along the tributary to Ropes Creek in the eastern part of the subject land (in Lot 2 DP120673) and in nearby remnant vegetation. The path walked on the third evening covered much of the riparian corridor of Ropes Creek and its tributary in Lot 82 DP752041 and remnant woodland patches near the western boundary of the subject land. The temperature on these evenings was about 25^{o}C, there was minimal wind, low cloud cover, low moonlight and no rain.

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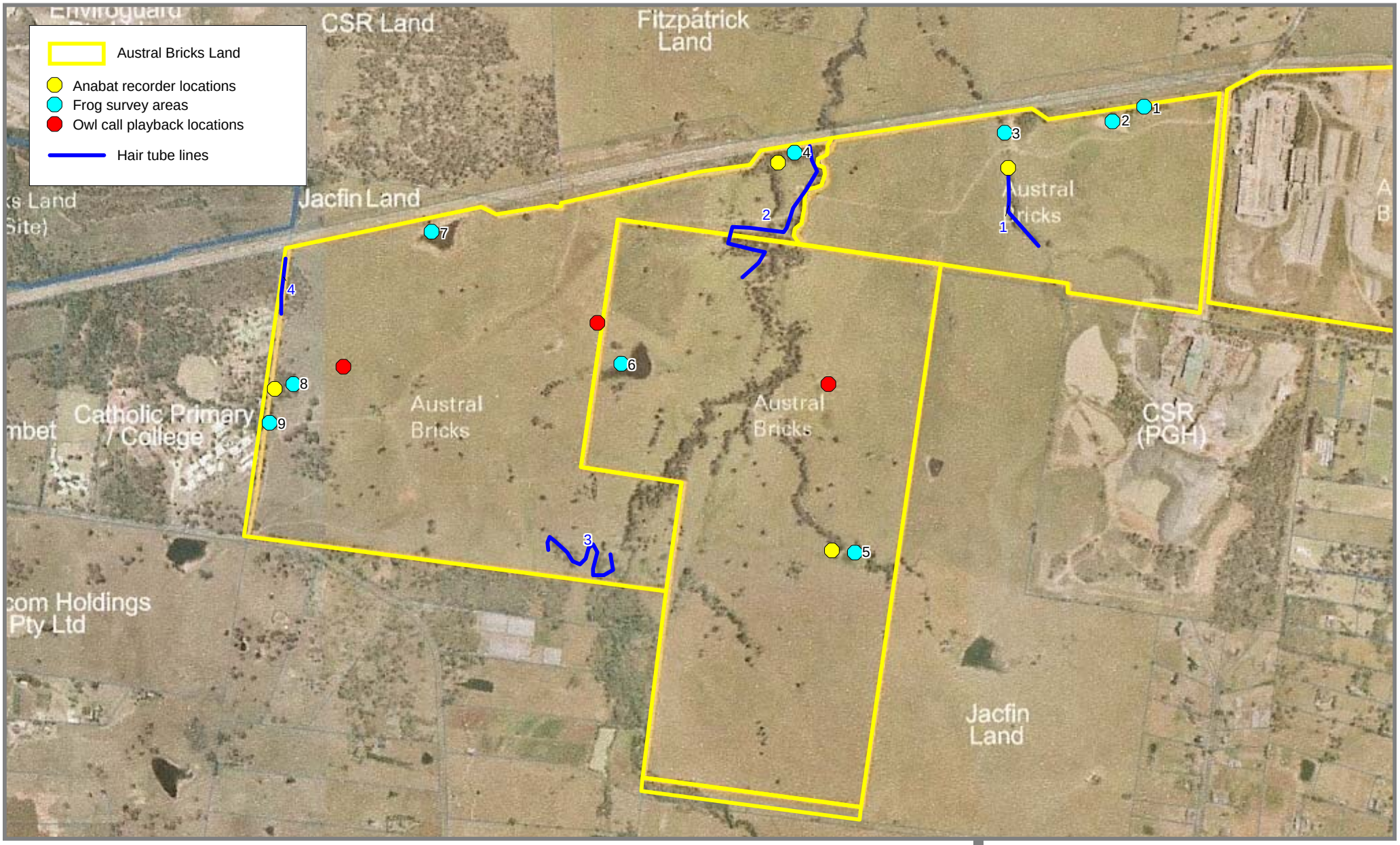

Figure 2.1 Fauna Survey Locations

2.3.5 Habitat Assessment

The nature and extent of fauna habitats on the subject land were assessed and areas where threatened fauna species could reside or forage were identified, including making a note of food tree species. Site assessments included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks. An assessment of the structural complexity of vegetation, the age structure of the forest and the nature and extent of human disturbance throughout the study area was also undertaken and considered. Structural features considered included the nature and extent of the understorey and ground stratum, extent of canopy and flowering characteristics.

Hollows were used as a general indication of habitat quality for arboreal fauna, and hollow-dwelling birds and bats. Hollows observed during surveys were recorded and the general vegetation condition and tree maturity was used to predict whether trees on site were likely to contain hollows.

Indirect indicators of fauna use of the site such as droppings, diggings, footprints, scratches, nests, burrow paths and runways were recorded.

The database results (DEC (NSW) 2006) were used to direct searches for the habitat characteristics of threatened fauna recorded in the locality. The assessment of habitat nature and extent was used to determine the likelihood of occurrence of the threatened species listed below. This is summarised in **Table 3.1** of Chapter 3.

- Green and Golden Bell Frog (*Litoria aurea*);
- Cumberland Land Snail (*Meridolum corneovirens*);
- Spotted-tailed Quoll (*Dasyurus maculatus*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Large-footed Myotis (*Myotis adversus*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Koala (*Phascolarctos cinereus*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Speckled Warbler (*Pyrrholaemus sagittatus*);
- Bush Stone-curlew (*Burhinus grallarius*);

- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Diamond Firetail (*Stagonopleura guttata*);
- Regent Honeyeater (*Xanthomyza phrygia*); and
- Swift Parrot (*Lathamus discolor*).

2.4 Limitations

The assessment of the ecological values of the Austral Bricks existing quarry site is based only on database searches and previously collected information for the area and not on field surveys of the site. As such, it provides an indicative assessment of the potential for endangered ecological communities, threatened species and their habitats to occur.

At the time of the flora survey weather conditions had been dry but sufficiently favourable for plant growth and production of features required for identification of most plant species. Some species, such as the orchid *Pterostylis saxicola*, can only be identified during specific seasons when flowering occurs. In the case of *Pterostylis saxicola*, flowering occurs from October to December (DEC (NSW) 2005). However, given the high level of disturbance to the ground stratum of the site due to grazing, species such as orchids were considered relatively unlikely to occur.

Due to the flora surveys relying on two inspections of the subject land, it was not possible to record all species present. Despite this, it is probable that the vast majority of species have been recorded and that issues including conservation significance of the flora, condition and viability of bushland and likely impact on native vegetation have been satisfactorily assessed.

Although not a part of this survey, detailed additional information will need to be obtained in order to determine what management actions will be required for future management of the bushland to be conserved.

Frog surveys were carried out within a relatively short time frame, over a two week period at the end of March. This is not ideal as frogs are known to move between habitat patches and a longer survey period increases the chances of detecting moving frogs. The timing of the project was such that these surveys could not be commenced earlier in the year. The surveys were carried out during the month of March in order to avoid surveying in autumn months. Weather conditions at the time of the surveys were favourable for frogs, with warm temperatures and recent heavy rainfall.

Chapter 3

Ecological Assessment Results

3.1 Flora Survey

3.1.1 Subject Land (Oakdale Site)

The subject land occurs on undulating terrain in Wianamatta Shale bedrock, mostly on Blacktown Soil Landscape (Hazelton, Bannerman & Tillie, 1989). Ropes Creek riparian zone occurs in South Creek Soil Landscape. A small area in the southeast corner is Luddenham Soil Landscape. Most of the subject land has been cleared of native vegetation for grazing purposes and is thus predominantly grassland (**Photograph 3.1**). This grassland is largely exotic pasture; however, indigenous grassland also occurs in relatively large local patches, generally close to the riparian areas. Native herbaceous species occur variably within exotic grassland. Remnant bushland and scattered groups of trees occur in a few locations over the subject land and small freshwater wetlands occur in several of the farm dams. **Table B.1** in **Appendix B** lists flora species identified on the subject land.

Photograph 3.1 **Grassland and riparian vegetation on the subject land (facing east towards Ropes Creek)**

In addition to exotic and native grassland, the three main plant communities that occur on the subject land are:

- Swamp Oak Floodplain Forest (**Photograph 3.2**);
- Cumberland Plain Woodland (**Photographs 3.3** and **3.4**); and
- Wetland vegetation (associated with farm dams on the subject land).

These are shown in (**Figure 3.1**) and are described below.

i. Swamp Oak Floodplain Forest

This community is located in low-lying zones and appears to have previously formed a continuous band along watercourses (including Ropes Creek) and drainage lines. *Casuarina glauca* is the dominant canopy tree in all remnants of this community. *Eucalyptus tereticornis* (Forest Red Gum), *Angophora floribunda* (Rough-barked Apple) and *Eucalyptus amplifolia* (Cabbage Gum) are present in smaller proportions. There is no small tree stratum except for juvenile canopy trees and shrubs are generally absent.

The ground cover varies from dense moisture-loving species, mainly the exotic *Juncus acutus*, to *Microlaena stipoides* (Weeping Meadow-grass) in more upslope or dry situations, including secondary drainage lines. Most sites inspected were fairly low in species richness, typically containing less than ten species, including exotics. However, the Ropes Creek corridor contains significantly higher species richness.

The condition of Swamp Oak Floodplain open forest on the subject land is generally poor, containing a high percentage of exotics in the ground cover (10-90%). Of the Swamp Oak Floodplain Forest patches offline of Ropes Creek itself, the patch near the western boundary of the subject land is in the best condition (refer to **Figure 3.1**). Note that this is not a reflection of the absolute condition of this patch; although it is of a better quality than other Swamp Oak Floodplain Forest patches offline of Ropes Creek, it is highly modified, having no small tree and shrub strata and a ground stratum that comprises 50% exotic species. The patches in the north-eastern part of the subject land have shrub and ground strata that are almost 100% exotic species. This situation tends to be common in western Sydney as nutrient enrichment of watercourses usually results in weed infestation.

ii. Cumberland Plain Woodland

Most bushland remnants on the subject land comprise Cumberland Plain Woodland. Variants include: woodland with natural understorey, woodland with generally weedy ground cover, individual canopy trees with mainly native ground cover, or largely native ground cover dominated by grasses.

The most intact and weed-free example of this community was observed in the southern section of the subject land between the high voltage power lines (refer to **Figure 3.1**). This

vegetation is proximate to a similar community on the western side of the power line corridor within the subject land. Both of these remnants adjoin a relatively large area of bushland south of the subject property.

Another significant example of Cumberland Plain Woodland occurs near the western boundary of the subject land. This patch has a young tree canopy with a generally native ground cover. Another stand of vegetation occurs south of this patch; this southern stand was originally Cumberland Plain Woodland community but is now degraded to a level that is no longer representative of Cumberland Plain Woodland. Native and exotic grassland occurs between the two stands. Native canopy trees are regenerating in sections of the open zone between the woodland patches. A significantly large area of better-quality similar community occurs contiguously in the adjoining western property and on the northern side of the Sydney Water pipeline corridor.

Relatively large areas of native grassland were observed in numerous locations. They were not mapped owing to the difficulty in readily determining their boundaries with exotic grassland.

iii. Wetland

Wetland species occur in small areas in and around the farm dams on the property. These tend to be dominated by *Typha orientalis* (Cumbungi), *Phragmites australis* (Common Reed) or the exotic *Juncus acutus*. Smaller proportions of other native species occur, including: *Juncus usitatus*, *Paspalum distichum* (Water Couch), *Damasonium minus* (Starfruit), *Persicaria decipiens*, *Elaeocharis sphacelata* and *Triglochin* sp.

Weeds in or adjoining wetlands include *Juncus acutus*, *Cyperus eragrostis*, *Isolepis prolifera*, *Rubus fruticosus* (Blackberry) and introduced grasses. The overall quality of the wetland vegetation around farm dams is low; however, they may have some value for fauna as wetland habitat.

3.1.2 Sydney Water Pipeline Corridor and Old Wallgrove Road

Vegetation in the Sydney Water Pipeline corridor and the existing road reserve of Old Wallgrove Road consists mainly of exotic grass species (**Table B.2** in **Appendix B**).

The species list is not comprehensive but rather the compilation of the various inspection stops made. The search for threatened species was continued between the stops but none were found. Narrow bands of weedy modified bushland occur at creek crossings but are restricted in size to a maximum of 10 metres' wide near the boundaries, reducing to less than a metre in the central zone (vehicular zone).

3.1.3 Threatened Flora Species

No threatened flora listed under the TSC and EPBC Acts were identified on the subject land or in the pipeline corridor and road reserve during targeted searches.

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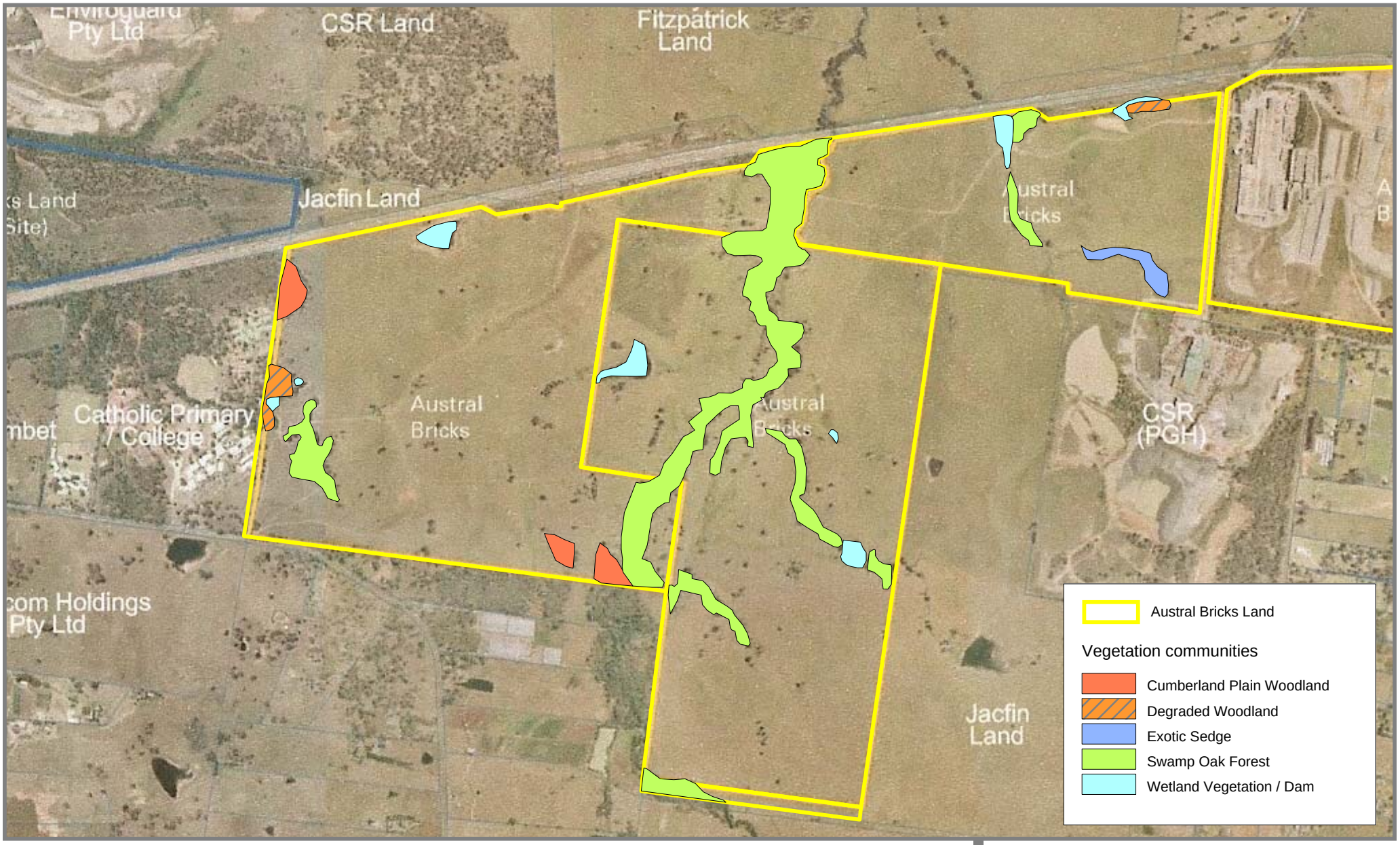

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Figure 3.1 Vegetation Communities on Oakdale Site

3.2 Fauna Survey of the Subject Land

Tables C.1 to **C.3** in **Appendix C** list fauna species identified on the subject land through opportunistic sightings, indirect evidence (e.g. scats) or targeted searches. Four bat species listed as threatened under the TSC Act may occur on the subject land.

3.2.1 Cumberland Land Snail Searches

The endangered Cumberland Land Snail (*Meridolum corneovirens*) was not found in woodland remnants on the subject land; however, suitable habitat for this species does exist.

3.2.2 Frog Surveys

Eight species of frogs were identified on the subject land (**Table C.1** in **Appendix C**). None of these species are listed as threatened. *Crinia signifera* (Brown Froglet) and *Limnodynastes tasmaniensis* (Spotted Marsh Frog) were found to be most widely distributed over the subject land, occurring in all areas surveyed except Area 1 (refer to **Figure 2.1**). *Litoria verreauxii* (Verreaux's Tree Frog), *Uperoleia laevigata* (Smooth Toadlet), *Litoria latopalmata* (Broad-palmed Frog), and *Litoria peronii* (Peron's Tree Frog) are more restricted in their occurrence, being found in no more than three of the areas surveyed. At least 2 frog species were identified at all dams and riparian areas surveyed on the subject land (shown in **Figure 2.1**).

3.2.3 Bird Surveys

A total of 47 bird species were identified on the subject land (**Table C.2** in **Appendix C**). No species identified were listed as threatened species under the TSC and EPBC Acts.

It is acknowledged that seasonality can affect the results of bird surveys, with Spring-Summer periods being the most ideal time to survey for birds. Hence the time of survey has been considered in the assessment of the bird survey results. For example, most migratory species potentially occurring in the study area would have left the locality by late March, and thus migratory species that were not sighted during surveys could still potentially occur on the subject land during part of the year.

Most of the migratory species expected to occur on the subject lands are not listed under any Act as threatened or protected migratory species. One exception is the Dollarbird *Eurystomus orientalis*. The riparian zone and some of the old scattered trees throughout the site would provide ideal habitat for this species. Another bird species expected to occur on the subject land is the Azure Kingfisher (*Alcedo azurea*). This species is likely to be resident and would be expected to occur within the riparian zone with good vegetation cover. Although vegetation in the riparian zone occurs in a very narrow strip, there is

sufficient cover for this species.

Owls were not detected on the subject land with the owl call playback system. The Masked Owl, Powerful Owl and Barking Owl are considered unlikely to forage or nest in the area as there are no records of them in the locality of the subject land and no records in the Fairfield LGA. Masked and Barking Owls are known from Penrith LGA but the subject land does not provide suitable nesting habitat for these species. Living trees on the subject land are too young to have formed suitably large hollows for these species and owl activity was not observed in the form of pellets around stags with large hollows. Cockatoos were observed to be using many of these stags with hollows.

3.2.4 Mammal Surveys

No threatened marsupial species were recorded on the subject land and few native mammal species were identified. Hair tube survey results indicate the presence of cattle and Brushtail Possums (analysis was carried out by Georgeanna Story of Scats About). A Brushtail Possum with young was also observed during a spotlight search. The only other marsupial species recorded on the subject land was the Eastern Grey Kangaroo.

A very low number of recognisable bat calls was present in the data for this survey. Presumably this is due to electrical or environmental interference in the vicinity of the bat call detectors. Of the bat species identified as potentially occurring on the subject land from the recorded calls, four are listed as threatened under the TSC Act:

- Eastern Cave Bat (*Vespadelus troughtoni*)*;*
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)*;*
- Eastern Freetail-bat (*Mormopterus norfolkensis*)*;* and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)*.*

The possible recording of the Eastern Cave Bat was made in the area of dam 8 (refer to **Figure 2.1** for location). The Eastern Bentwing-bat and the Greater Broad-nosed Bat were recorded at dam 5 and the Eastern Freetail-bat potentially was recorded at dam 3.

Possible impacts of development on the subject land on the potential occurrence of any of these bat species are discussed in Chapter 4. A list of mammal species identified on the subject land is shown in **Table C.3** of **Appendix C**.

3.2.5 Habitat Assessment

The majority of the subject land is highly disturbed by activities associated with cattle grazing and forms mostly degraded and unsuitable habitat for many native fauna species. Fauna habitat values on the subject land are greatest in the Ropes Creek corridor and in the largest of the remnant patches of vegetation containing logs and fallen timber, leaf

litter and varying degrees of structural complexity in the vegetation. The Ropes Creek riparian corridor and the remnant Cumberland Plain Woodland patches in the north-west corner and southern part of the subject land form important habitat because these areas are connected to other vegetated areas outside the subject land. In particular, the Ropes Creek riparian corridor forms the only vegetated link through the subject land between habitat areas to the north and to the south of the subject land.

Some regeneration is taking place in remnant patches of woodland and some areas also have a developing shrub layer dominated by *Bursaria spinosa*. The riparian zone is very narrow and some sections are weed infested. The majority of bird species were found in this habitat type. A greater diversity would be expected if this zone was wider and structurally more complex.

The majority of trees on the subject land are young and do not contain hollows. This limits the nesting habitat available to possums, bats and some birds. Several old trees have been retained, mainly near Ropes Creek and its tributaries, and a several stags also occur on site. The hollows of one of these stags were observed to be used by Sulphur-crested Cockatoos which would preclude them being used by any of the other threatened bird species recorded in the locality as roosting/nesting habitat.

Although roosting habitat is not present on the subject land for the Eastern Bentwing-bat and Large-footed Myotis (cave roosting threatened bats species), there is potential roosting habitat under the bark of trees for the Eastern False Pipistrelle, Eastern Freetail-bat and Greater Broad-nosed Bat (threatened bat species known to roost in small tree hollows or under bark). However, the quality of these habitats is low and is expected to preclude these species from the subject land. For example, the Eastern False Pipistrelle prefers to roost in trees within the environs of a moist mature sclerophyll forest; whilst potential roost trees are available on the subject land, there is a lack of mature forest.

No roosting habitat is available for the Grey-headed Flying-fox on or near the subject land. Foraging habitat does occur within the woodland remnants on the subject land - six native tree species were identified that produce blossoms and nectar:

- Rough-barked Apple (*Angophora floribunda*);
- Cabbage Gum (*Eucalyptus amplifolia*);
- Narrow-leaved Ironbark (*Eucalyptus crebra*);
- Broad-leaved Ironbark (*Eucalyptus fibrosa*);
- Grey Box (*Eucalyptus moluccana*); and
- Forest Red Gum (*Eucalyptus tereticornis*).

Other bat species that could potentially forage over the subject land are the Large-footed Myotis and the Greater Broad-nosed Bat (these forage for insects over dams and

creeklines), and the Eastern Bentwing Bat (this species forages for insects over tree canopies).

Very little is known about the foraging habits of the Eastern Cave Bat; however, it is known that these species are cave-dwelling and are most likely found in dry open woodlands near cliffs or rocky overhangs. They have also been recorded in disused mines (Churchill 1998, NSW Scientific Committee 2004b). Thus, it is unlikely that the species occurs over the subject land as these habitat characteristics are not present on the subject land.

The water courses and dams on the subject land also provide habitat for invertebrates, fish species, amphibians, reptiles and water birds.

Potentially suitable habitat for Green and Golden Bell Frogs occurs on the subject land in and around un-shaded dams, particularly in areas containing reeds, bullrushes (*Typha* spp.) or spikerushes (*Elaeocharis* spp.). However, no individuals of this species were found to occur in these areas.

The subject land does not provide suitable habitat for the Spotted-tailed Quoll (*Dasyurus maculates*) and the Koala (*Phascolarctos cinereus*) which have been recorded in the locality. Preferred koala feed trees are absent and remnant vegetation is not dense enough for quolls to traverse the site.

The following table (**Table 3.1**) provides a summary of the likelihood of occurrence of threatened fauna on the subject land and is based on the availability of suitable habitat.

Table 3.1 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DEC (NSW) 2006)

Common Name	Legal Status	LGA	Habitat Requirements	Likelihood of Occurrence on Subject Land
Cumberland Plain Land Snail (*Meridolum corneovirens*)	E1 (TSC Act)	Penrith and Fairfield	Lives in a restricted area in the Cumberland Plain west of Sydney under litter of leaves, bark and logs or in loose soil around grass clumps feeding on fungus. Primarily inhabits Cumberland Plain Woodland (NSW NPWS 2000).	Likely to occur; suitable habitat present.
Green and Golden Bell Frog (*Litoria aurea*)	E1 (TSC Act), V (EPBC Act)	Penrith and Fairfield	Marshes, dams, stream sides, particularly those containing bullrushes or spikerushes; unshaded water bodies free of Gambusia form optimum habitat; vegetation and/or rocks are needed for sheltering (NSW NPWS 1999b).	Low likelihood. Suitable habitat present; no individuals identified during surveys.
Speckled Warbler	V (TSC Act)	Penrith	Inhabits a wide range of Eucalypt dominated communities with grassy understorey, often on rocky ridges or in gullies and typical habitats include scattered native tussock grasses, sparse shrub layer, some eucalypts and an open canopy. Large undisturbed remnants of this habitat are required. Feeds on seeds and insects mostly off the ground and nests are built of dry grass on the ground or on the base of a low dense plant (DEC (NSW) 2006b).	Unlikely. Subject land is very disturbed and successful nesting on the ground is very unlikely due to the presence of cattle.
Bush Stone-curlew	E1 (TSC Act)	Penrith	Inhabits open forest and woodlands with sparse grassy groundlayer and fallen timber, feeds on insects and small vertebrates and nests in a scrape or bare patch on the ground (NSW NPWS 1999a).	Unlikely. Subject land is very disturbed and successful nesting on the ground is very unlikely due to the presence of cattle.
Glossy Black-Cockatoo	V (TSC Act), E1 (EPBC Act)	Penrith	Inhabits Eucalypt forest and woodland, require sheoaks (Casuarinas) for food and large hollows for nesting (DEC (NSW) 2005f).	Low likelihood. Suitable foraging habitat present in riparian areas but no nesting habitat is available.

Table 3.1 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DEC (NSW) 2006)

Common Name	Legal Status	LGA	Habitat Requirements	Likelihood of Occurrence on Subject Land
Diamond Firetail	V (TSC Act)	Penrith	Occurs in grassy eucalypt woodlands, open forest, mallee, Natural Temperate Grassland and in secondary grassland derived from other communities and often in riparian areas or lightly wooded farmland. Feeds on the ground on grass and herb seeds, leaves and insects (DEC (NSW) 2005a).	Low likelihood. Suitable habitat present; no individuals identified during surveys.
Regent Honeyeater	E1 (TSC and EPBC Acts)	Penrith and Fairfield	Inhabits temperate woodlands and open forests, particularly Box-Ironbark Woodland and riparian forests of She-oak, with significantly large numbers of mature trees, high canopy cover and abundance of mistletoe. Feeds mainly on nectar and fruit from eucalypts and mistletoes and occasionally on insects.Requires shrubby understorey for nesting material. Nomadic movement of the species may depend on flowering and other resource patterns (Environment and Conservation NSW 2004).	Low likelihood. Suitable habitat is not present - mistletoe, shrubby understorey and numbers of mature trees not sufficient for the species on subject land.
Swift Parrot	E1 (TSC and EPBC Acts)	Penrith	Migrates between Tasmania and the mainland. Occurs where there are abundant eucalypt flowers or lerp infestations. Favours winter flowering eucalypt species including Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark and White Box (DEC (NSW) 2005k).	Unlikely to occur. Insufficient food trees on subject land.
Spotted-tailed Quoll (*Dasyurus maculatus*)	V (TSC Act), E1 (EPBC Act)	Penrith and Fairfield	Occurs in wide variety of habitats; rainforest, open forest, woodland, coastal heath and riparian forest. Uses hollows in trees, logs and rock crevasses as den sites. Species is nocturnal, carnivorous and has large territories (750-3000 ha)	Unlikely to occur. Subject land is very disturbed and potential den sites are not common.

Table 3.1 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DEC (NSW) 2006)

Common Name	Legal Status	LGA	Habitat Requirements	Likelihood of Occurrence on Subject Land
			(DEC (NSW) 2005j).	
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V (TSC Act)	Penrith and Fairfield	Occurs in dry sclerophyll forest and woodland and roosts in tree hollows, under bark or in man made structures. Species is solitary and insectivorous (DEC (NSW) 2005e).	Likely to occur; suitable habitat present. Possible recording during Anabat surveys.
Koala (*Phascolarctos cinereus*)	V (TSC Act)	Penrith	Inhabits eucalypt forest and woodland. Specialist feeder on *Eucalyptus tereticornis, E. punctata, E. viminalis, E. microcorys* and *E. robusta*, among others (NSW NPWS 1999c).	Unlikely to occur. Suitable foraging habitat not available.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V (TSC and EPBC Acts)	Penrith and Fairfield	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Forage on nectar and pollen of native trees, especially Eucalyptus, Melaleuca and Banksia. Migrates in search of food (NSW NPWS 2001).	Roosting habitat not available but food resources are available on subject land; likely to occasionally forage on site.
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V (TSC Act)	Penrith and Fairfield	Occurs in moist habitat with trees over 20m in height, hunting insects above or just below the tree canopy. Roosts in eucalypt hollows, under bark and in buildings. Hibernates in winter (DEC (NSW) 2005d).	Unlikely to occur. Trees on subject land are young and canopy is generally not as high as required.
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V (TSC Act)	Penrith and Fairfield	Roosts mainly in caves but also in tunnels, mines or buildings. Non-breeding populations disperse within a 300 km range of maternity caves. Hunting for moths and other insects takes place in forested areas above the canopy (DEC (NSW) 2005c).	Potential to occur. Foraging habitat available; caves for roosting not available on site. Possible recording during Anabat surveys.
Large-footed Myotis (*Myotis adversus*)	V (TSC Act)	Penrith	Found along the coast and roost in caves, mine shafts, tree hollows or dense foliage. Foraging for fish and insects occurs over streams and pools (DEC (NSW) 2005i).	Low likelihood. Suitable foraging habitat available over Ropes Creek and dams.
Greater Broad-nosed Bat	V (TSC Act)	Penrith	Usually roosts in tree hollows and forages for beetles and other	Potential to occur. Suitable foraging

Table 3.1 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DEC (NSW) 2006)

Common Name	Legal Status	LGA	Habitat Requirements	Likelihood of Occurrence on Subject Land
(*Scoteanax rueppellii*)		and Fairfield	insects or microbats along creek and river corridors in open woodland habitat and dry open forests (DEC (NSW) 2005g).	habitat available; roosting opportunities are limited. Possible recording during Anabat surveys.

3.3 Desktop Analysis of Existing Austral Bricks Quarry Site

3.3.1 Vegetation Communities

Aerial photographs of the site indicate the presence of remnant vegetation along the eastern and southern boundaries. Mapping of the native vegetation of the Cumberland Plain (Tozer 2003) indicates that the eastern strip of vegetation is a form of Sydney Coastal River-Flat Forest (Alluvial Woodland), which is listed as an endangered ecological community under the TSC Act. The southern strip is Cumberland Plain Woodland, which is listed as an endangered ecological community under the EPBC and TSC Acts. Field surveys are necessary to ground truth this vegetation and to describe its condition and conservation value.

3.3.2 Flora Species

Table 3.2 lists threatened flora species recorded in the locality of the study area (DEC (NSW) 2006, DEH 2005), their habitat requirements and the likelihood of each species occurring on the Austral Bricks quarry site. Ground-truthing surveys need to be conducted to better determine the likelihood of occurrence of these species.

Table 3.2 THREATENED FLORA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DEC (NSW) 2006, NSW GOVERNMENT 2005) AND THE LIKELIHOOD OF THEIR OCCURRENCE ON THE QUARRY SITE

Family	Scientific Name	Common Name	Legal Status	Habitat Requirements	Likelihood of Occurrence on quarry site
Asclepiadaceae	*Cynanchum elegans*	White-flowered Wax Plant	E1 (TSC and EPBC Acts)	Associated with a variety of vegetation types; flowers between August and May (DEC (NSW) 2005m).	Potential to occur
	Marsdenia viridiflora subsp. *viridiflora*		E2 (TSC Act)	Grows in vine thickets and open shale woodland (NSW Scientific Committee 2003a).	Potential to occur
	Acacia pubescens	Downy Wattle	V (TSC and EPBC Acts)	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland (NSW NPWS 2003a).	Potential to occur
Fabaceae (Faboideae)	*Dillwynia tenuifolia*		V (TSC and EPBC Acts)	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 (DEC (NSW) 2005b).	Unlikely to occur
	Pultenaea parviflora		E1 (TSC and EPBC Acts)	Endemic to the Cumberland Plain. May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel	Unlikely to occur

Table 3.2 THREATENED FLORA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DEC (NSW) 2006, NSW GOVERNMENT 2005) AND THE LIKELIHOOD OF THEIR OCCURRENCE ON THE QUARRY SITE

Family	Scientific Name	Common Name	Legal Status	Habitat Requirements	Likelihood of Occurrence on quarry site
				Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. *Eucalyptus fibrosa* is usually the dominant canopy species. *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*. Often found in association with other threatened species such as *Dillwynia tenuifolia*, *Dodonaea falcata*, *Grevillea juniperina*, *Micromyrtus minutiflora*, *Persoonia nutans* and *Styphelia laeta* (NSW NPWS 2002b).	
Lobeliaceae	*Hypsela sessiflora*		E1 (TSC Act), E4	Known to grow in damp places, on the Cumberland	Potential to occur

Table 3.2 THREATENED FLORA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DEC (NSW) 2006, NSW GOVERNMENT 2005) AND THE LIKELIHOOD OF THEIR OCCURRENCE ON THE QUARRY SITE

Family	Scientific Name	Common Name	Legal Status	Habitat Requirements	Likelihood of Occurrence on quarry site
			(EPBC Act)	Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone. May be an early successional species that benefits from some disturbance. Possibly out competed when overgrown by some species such as Cyndon dactylon (DEC (NSW) 2005h).	around water bodies; however, it is recognized nationally as being extinct despite being recognized statewide as being endangered.
Myrtaceae	*Micromyrtus minutiflora*		E1 (TSC Act), V (EPBC Act)	Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments. Restricted to the general area between Richmond and Penrith, western Sydney (NSW Scientific Committee 2003b).	Unlikely to occur
Orchidaceae	*Pterostylis saxicola*	Sydney Plains Greenhood Orchid	E1 (TSC and EPBC Acts)	Most commonly grows in soil depressions on sandstone rock shelves, within sclerophyll forest or woodland on shale/sandstone transition soils or shale soils; flowers from October to December.	Unlikely to occur
Proteaceae	*Grevillea juniperina* subsp. *juniperina*	Juniper-leaved Grevillea	V (TSC Act)	Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels.	Potential to occur

Table 3.2 THREATENED FLORA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DEC (NSW) 2006, NSW GOVERNMENT 2005) AND THE LIKELIHOOD OF THEIR OCCURRENCE ON THE QUARRY SITE

Family	Scientific Name	Common Name	Legal Status	Habitat Requirements	Likelihood of Occurrence on quarry site
				Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest. Associated canopy species within Cumberland Plain Woodland and Shale/Gravel Transition Forest include *Eucalyptus tereticornis*, *E. moluccana, E. crebra*, *E. fibrosa* and *E. eugenioides*. Understorey species include *Bursaria spinosa*, *Dillwynia sieberi*, *Ozothamnus diosmifolius*, *Daviesia ulicifolia*, *Acacia falcata*, *Acacia parramattensis*, *Themeda australis*, *Aristida ramosa*, *Cymbopogon refractus*, *Eragrostis brownii*, *Cheilanthes sieberi*, *Dianella revoluta* and *Goodenia hederacea*. In Castlereagh Woodland on more sandy soils the dominant canopy species are *Eucalyptus fibrosa*, *E. sclerophylla*, *Angophora bakeri* and *Melaleuca decora*. Understorey species include *Melaleuca nodosa*, *Hakea sericea*, *Cryptandra spinescens*, *Acacia elongata*, *Gonocarpus teucrioides*, *Lomandra longifolia* and the threatened species *Dillwynia tenuifolia*, *Pultenaea parviflora, Micromyrtus minutiflora* and	

Table 3.2 THREATENED FLORA SPECIES KNOWN TO OCCUR IN THE LOCALITY (DEC (NSW) 2006, NSW GOVERNMENT 2005) AND THE LIKELIHOOD OF THEIR OCCURRENCE ON THE QUARRY SITE

Family	Scientific Name	Common Name	Legal Status	Habitat Requirements	Likelihood of Occurrence on quarry site
				Allocasuarina glareicola (NSW Scientific Committee 2000).	
	Persoonia nutans	Nodding Geebung	E1 (TSC and EPBC Acts)	Confined to aeolian and alluvial sediments and occurs in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland (NSW NPWS 2003b).	Potential to occur
Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	E1 (TSC and EPBC Acts)	In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the inland Cumberland Plain sites it is associated with Grey Box and Ironbark (NSW NPWS 2004).	Potential to occur

3.3.3 Fauna Species and Habitats

The following list indicates the threatened fauna species that are likely to have suitable habitat available on the quarry site based on indicative vegetation mapping for the area:

- Green and Golden Bell Frog (*Litoria aurea*);
- Cumberland Land Snail (*Meridolum corneovirens*);
- Spotted-tailed Quoll (*Dasyurus maculatus*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Large-footed Myotis (*Myotis adversus*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Koala (*Phascolarctos cinereus*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Speckled Warbler (*Pyrrholaemus sagittatus*);
- Bush Stone-curlew (*Burhinus grallarius*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Diamond Firetail (*Stagonopleura guttata*);
- Regent Honeyeater (*Xanthomyza phrygia*); and
- Swift Parrot (*Lathamus discolor*).

As the majority of the area of this quarry site appears (in aerial photographs) to be clear of vegetation, the areas considered most likely to form suitable habitat for fauna species are the vegetation remnants located on the periphery of the site and, in particular, the large remnant on the south eastern side of the site.

The Spotted-tailed Quoll and Koala are not considered likely to occur on this site due to a lack of continuity between vegetation patches in the surrounding area (although this is not conclusive without site inspections and field surveys). All other threatened mammalian species listed above are bats and birds, capable of dispersing between isolated patches of vegetation. These bats and the threatened bird species listed above are considered to have a potential to occur on the quarry site. It is possible that Cumberland Land Snails

may occur in remnant patches of Cumberland Plain Woodland. It is difficult to comment on the likelihood of occurrence of Green and Golden Bell Frogs without a survey of the water bodies on the site.

To summarise, the above analysis indicates that the majority of the quarry site is highly disturbed, but it does contain some vegetation of potential significance, principally in the south eastern areas of the site. This site should be subject to additional investigation and assessment after the cessation of quarrying/brickmaking and prior to subsequent development of the site.

3.4 Conservation Significance of the Ecological Values of the Study Area

3.4.1 Vegetation Communities

i. Subject Land

All native plant communities on the subject land are listed as endangered ecological communities under the EP&A Act and TSC Act. Swamp Oak Floodplain open forest is a variant of Swamp Oak Floodplain Forest of the North Coast, Sydney Basin and South East Corner Bioregions. Grey Box-Forest Red Gum woodland is a variant of Cumberland Plain Woodland. Native grassland is a highly modified form of Cumberland Plain Woodland. Cumberland Plain Woodland is also listed under the Commonwealth EPBC Act as an endangered ecological community.

Despite the high nominal conservation significance of remnant indigenous plant communities, their actual conservation significance is considered to be low for most occurrences on the subject land. The majority cover very small areas (a couple of hundred square metres up to approximately 3000 square metres), are isolated from other bushland, are highly modified structurally and have a predominantly exotic ground cover.

Freshwater wetlands occur around the dams on the subject lands but are very restricted in distribution and are highly degraded. These occurrences are not considered to be of conservation value. Exotic grassland is also present on the subject land has no conservation significance.

Three remnants were considered to have a conservation value that is locally significant for the relevant communities (location of these remnants shown in **Figure 3.2**) and for native fauna use:

- Swamp Oak Floodplain Forest in Ropes Creek corridor (**Photograph 3.2**);
- The Cumberland Plain Woodland, west of and proximate to the Ropes Creek corridor near the southern boundary of the subject site (**Photograph 3.3**); and

- The small area of modified Cumberland Plain Woodland in the northwest corner of the subject land, adjoining the larger area of Cumberland Plain Woodland in the properties to the west and north of the water supply pipeline (**Photograph 3.4**).

All three areas are part of a corridor or an extension of a larger area of endangered ecological community in adjoining properties. As such, their conservation significance is greater than their onsite occurrence alone.

Photograph 3.2 **Ropes Creek riparian area, near northern boundary of subject land**

Photograph 3.3 **Cumberland Plain Woodland, near southern boundary of subject land**

Photograph 3.4 **Cumberland Plain Woodland in north-western corner of subject land**

ii. Sydney Water Pipeline corridor and Old Wallgrove Road

Vegetation in the Sydney Water Pipeline corridor consists mainly of exotic grass species and holds no conservation value. Vegetation within the existing road reserve of Old Wallgrove also comprises exotic species and holds no conservation value.

3.4.2 Flora Species

i. Subject Land

No plant species recorded on the subject land is listed under the TSC Act or EPBC Act as threatened.

ii. Sydney Water Pipeline corridor and Old Wallgrove Road

Exotic grasslands with scattered native species occur in these areas. No threatened species listed under the TSC Act or EPBC Act were identified.

3.4.3 Fauna Species on the Subject Land

No threatened fauna species listed under State and Commonwealth legislation were identified on the subject land except the following bat species:

- Eastern Cave Bat;
- Eastern Bentwing Bat;
- Eastern Freetail Bat; and
- Greater Broad-nosed Bat.

As the Anabat recordings, which identified these species were bad in quality, possibly due to background noise interference on the recordings, their presence on the subject land cannot be conclusively determined. Despite this, potential impacts to these species from the proposal will be considered in Chapter 4. These bat species are all listed as Vulnerable under the TSC Act.

3.5 Constraints

There are no flora constraints in the Sydney Water Main Water Supply Pipeline corridor or in the road reserve area of Old Wallgrove Road.

The site of the existing Austral Bricks quarry is primarily highly disturbed, although the site may contain some vegetation of potential significance, principally in the south eastern

areas of the site. This site would require additional field investigation and assessment after the cessation of quarrying and brickmaking, and prior to the subsequent development of the site.

Figure 3.2 shows the main ecological constraints affecting the subject land. It is noted that constraints arising from one in one hundred year flood levels associated with Ropes Creek overlap with constraints imposed by riparian zone requirements for Ropes Creek.

Remnant woodland patches with conservation value include three areas of Cumberland Plain Woodland and the Swamp Oak Floodplain Forest adjoining Ropes Creek, as indicated in **Figure 3.2.**

C:\GIS\Cumberland Ecology\7016 Ropes Creek.wor GV 15 Dec 2007

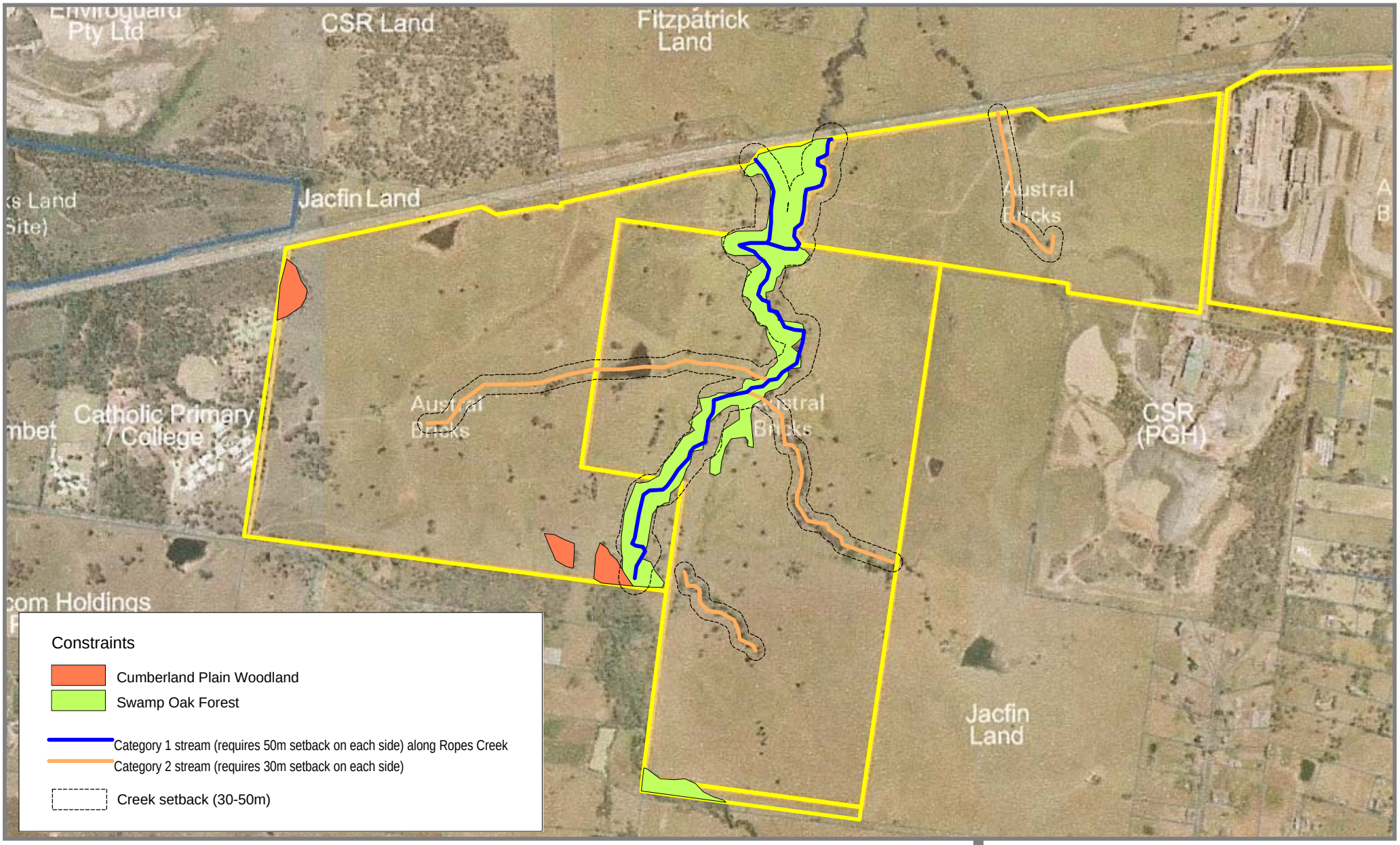

Figure 3.2 Constraints map showing riparian zones and remnant woodland of conservation significance

Chapter 4

Impacts of the Proposal

This Chapter addresses potential impacts of the proposed development on vegetation communities, flora and fauna, and fauna habitats in the study area. As part of a risk assessment of the proposal, Assessments of Significance, though not required for a Part 3A project application, have been included in **Appendix D** of this report.

4.1 The Proposed Development

The following sections describe those works pertaining to the flora and fauna of the subject land that will occur as a part of the development proposal.

4.1.1 Vegetation Removal on the Subject Land

- Scattered trees that are of no conservation value and have minimal habitat value will be removed, and the degraded woodland patches on the western boundary and the north-eastern boundary will be removed (refer to **Figure 3.1** of Chapter 3);
- Some Cumberland Plain Woodland will be removed. This includes parts of the patches on the southern boundary near the powerlines (refer to **Figure 3.1** of Chapter 3). However, the patch in the north-western corner will be retained and a detention basin will be constructed around the patch. This patch has a moderately high conservation value as it is relatively weed-free and is contiguous with a larger area of bushland in the adjacent property;
- The entire area of exotic sedge vegetation will be removed in the north eastern portion of the subject land. This vegetation holds no conservation value.
- A small patch of Swamp Oak Floodplain Forest will be removed on the western boundary of the subject land. The vegetation in this patch is in poor condition with 50% of the ground cover being comprised of exotic species and the small tree and shrub strata being absent; and
- A number of dams will be drained and the associated wetland vegetation will be removed.

A summary of the vegetation removal that will occur as part of the proposal is shown in **Table 4.1**.

4.1.2 Revegetation / Rehabilitation of Vegetation Communities on the Subject Land

As part of the proposal, riparian corridors will be protected and enhanced through revegetation and rehabilitation works, and active management of weeds within the CRZ and buffer zones. Ropes Creek has been classified as a Category 1 stream, the unnamed tributary to the south-east (on Lot 82 DP 752041) as a Category 2 stream and the smaller tributary of Ropes Creek on the north-eastern part of the subject land (on Lot 2 DP 120673) as a Category 2 stream in its northern reaches. Therefore, the following buffer widths apply to the length of the riparian corridors on the subject land:

- Category 1 – Environmental Corridor (provides vegetated linkages between key areas of biodiversity and requires a 40 m Core Riparian Zone and an additional 10 m vegetated buffer zone); and

- Category 2 – Terrestrial and Aquatic Habitat (provides basic habitat and preserves the natural features of a watercourse and requires a 20 m Core Riparian Zone and an additional 10 m vegetated buffer zone).

In addition to this, Cumberland Plain Woodland will be revegetated/rehabilitated within the 1–100 year flood zone. Swamp Oak Forest will also be revegetated in the flood zone outside the riparian areas to strengthen riparian planting corridors and within the riparian corridor as part of the buffer zone.

Wetland vegetation will be provided outside the riparian zone and flood zone around detention basins.

Table 4.1 indicates the sizes of the areas to be revegetated and rehabilitated on the subject land.

Table 4.1 VEGETATION AREAS TO BE REMOVED, RETAINED AND REVEGETATED ON THE SUBJECT LANDS AS PART OF THE PROPOSED OAKDALE CONCEPT PLAN.

Vegetation Community	Existing Area (ha)	Area to be Removed (ha)	Area to be Retained (ha)	Area to be Revegetated (ha)
Cumberland Plain Woodland	2.47	0.57	1.89	1.72
Degraded Woodland	1.22	1.22	0	0
Exotic Sedge	1.50	1.50	0	0
Swamp Oak Floodplain Forest	22.02	2.48	19.54	18 (as a minimum)
Wetland Vegetation / Dam	3.54	3.54	0	To be provided around detention basins outside 1 in 100 year flood zone
Total (ha)	**30.74**	**9.31**	**21.43**	**19.7 (not including wetland vegetation)**
Total (%)	**100**	**30.29**	**69.71**	**64.09**

4.2 Impacts on Vegetation Communities on the Subject Land

Table 4.1 shows that the total area of vegetation to be removed as a result of the proposal will be less than half of the existing vegetation (~ 30%). Of these, less than a quarter of the existing Cumberland Plain Woodland will be removed (~ 23%) and less than a quarter of the existing Swamp Oak Forest will be removed (~ 11%). Furthermore, a relative good quality patch of Cumberland Plain Woodland will be retained in the north-western corner of the subject land and a low quality patch of Swamp Oak Forest will be removed from the western boundary as part of this proposal.

As part of the revegetation and rehabilitation work on the endangered ecological communities, at least 1.72 hectares of Cumberland Plain Woodland and 18 hectares (minimum) of Swamp Oak Floodplain Forest will be improved or replaced on the subject land. Thus, the proposal will result in a net increase in Cumberland Plain Woodland and Swamp Oak Floodplain Forest. In addition to this wetland vegetation will be provided around detention basins as habitat for wetland fauna species despite its low conservation value.

The corridor function is likely to be the most important aspect of habitat issues for fauna. The revegetation and maintenance of a riparian buffer zone along Ropes Creek and its tributaries will provide for the re-establishment of corridor connectivity between biodiversity areas, including closure of significant canopy gaps within the existing corridor. It will also protect features of the natural watercourse and provide terrestrial and aquatic habitat for fauna. Furthermore, the boundaries of a proposed biodiversity corridor, as indicated by HLA-Envirosciences (2007) for the Erskine Park Employment Area directly north of the subject land, includes a large portion of Ropes Creek. Maintenance and enhancement of the riparian zone of Ropes Creek on Oakdale would significantly extend the functions and values of this corridor further south.

Given the current disturbance to vegetation on the subject land by cattle, the proposal will have a positive impact on vegetation communities, the waterways and riparian vegetation communities surrounding them. The proposal will improve the condition and extent of the vegetation, improve the fauna habitat opportunities and enhance the biodiversity corridor function of Ropes Creek in the area.

Thus, the impact on endangered ecological communities as a result of the proposal is expected to be minimal. Assessments of significance for Cumberland Plain Woodland and Swamp Oak Floodplain Forest, though not required for a Part 3A application, have been provided in **Appendix D** and these confirm that there will be no significant impact on these communities as a result of the proposal.

4.3 Impacts on Flora Species on the Subject Land

No threatened flora species were identified on the subject land and hence no negative impacts is expected as a result of the proposal.

4.4 Impacts on Fauna Species on the Subject Land

4.4.1 Cumberland Land Snail

Suitable habitat for this species exists; however, no Cumberland Land Snail was identified on the subject land during surveys. Also, less than half the area of existing habitat will be removed and three times this area will be revegetated. Thus, there will be a net increase in suitable habitat for this species and no significant impact is expected as a result of the proposal.

4.4.2 Frogs

No threatened amphibian species were identified on the subject land during targeted surveys and hence no significant impact is expected as a result of the proposal. Wetlands will be provided within the proposed landscaped area in the flood zone of Ropes Creek around water detention basins. Aquatic habitats occur along Ropes Creek and its tributaries and these will be protected by riparian buffer zones.

4.4.3 Birds

No threatened bird species were identified or considered likely to occur on the subject land and hence no significant impact is expected as a result of the proposal.

4.4.4 Bats

Although not required for a Part 3A application, an Assessment of Significance for bat species potentially recorded during recent surveys has been included in **Appendix D**; this assessment shows that there will be no significant impact on bat species potentially occurring on the subject land as a result of the proposal. The bat species relevant are discussed below:

i. *Eastern Cave Bat (*Vespadelus troughtoni*)*

The likelihood of occurrence of this cave-roosting species on the subject land is very low as there is little suitable habitat for roosting (i.e. caves, disused mines, cliff and / or rocky overhangs). No records in the locality exist for this species, and as the quality of the Anabat recording from recent surveys is very poor and thus inconclusive, it is probable

that this species does not use the subject land for roosting or foraging. Therefore, no significant impact is expected as a result of this proposal.

ii. *Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)*

It is unlikely that roosting colonies of this species occur on the subject land; however, non-breeding populations have a 300km range and may potentially forage over the canopy of existing vegetation. As there will be a net increase in vegetation cover and riparian corridors will be improved, thus improving the foraging habitat for this species, no significant impact is expected as a result of this proposal.

iii. *Eastern Freetail-bat (*Mormopterus norfolkensis*)*

There is potential roosting and foraging habitat for the species on the subject land in wooded areas. As there will be a net increase in vegetation cover and riparian corridors will be improved, thus improving the habitat for this species, no significant impact is expected as a result of this proposal.

iv. *Greater Broad-nosed Bat (*Scoteanax rueppellii*)*

There is little roosting habitat for this species but potential foraging habitat along the creek corridors exist. It is possible that this species forages over the creeks on the subject site; as the riparian corridor will be improved and the waterways protected, thus improving foraging habitat, no significant impact is expected as a result of this proposal.

4.4.5 Other Mammals

No threatened marsupials were identified or considered likely to occur on the subject land and hence no significant impact is expected as a result of this proposal.

4.5 Water Pipeline Corridor and Old Wallgrove Road

The vegetation in the Sydney Water Pipeline Corridor and in the road reserve is mainly exotic grassland and therefore holds no conservation value. No negative impacts are expected on these areas as a result of the proposal.

4.6 Existing Austral Bricks Quarry Site

No impact on the Austral Bricks existing quarry site is expected as a result of the proposed development. In addition to this, a development proposal has not been prepared for the site and only a preliminary constraints analysis was required as a part of this report.

Chapter 5

Recommended Mitigation Measures and Offsets

5.1 Introduction

The proposal will result in the removal of approximately 30% of the existing site vegetation, a third of which are endangered ecological communities, and another third of which is not an endangered ecological community but has some value as wetland habitat for fauna. The proposal also includes the revegetation/rehabilitation of these endangered ecological communities such that there will be a net increase in vegetation, and provision of wetland vegetation around detention basins as habitat for wetland fauna. In addition to this, vegetated linkages and waterways will be improved along Ropes Creek and its tributaries through the establishment of corridor buffer zones of widths as specified by DWE Stream Category requirements.

5.2 Recommendations

To ensure the effectiveness of the revegetation/rehabilitation works summarised above, the following measures are recommended:

- That revegetation/rehabilitation of endangered ecological communities occurs in a ratio of at least 3 hectares for every hectare removed;
- That landscaping of water detention basins with appropriate wetland vegetation is recommended to make up for the loss of wetland habitat through removal of the existing dams; and
- That a Vegetation Management Plan (VMP) is prepared for the revegetation and management of riparian zones and any areas of revegetation outside this zone. This should include weed removal and management. This is discussed in more detail below.

5.3 Vegetation Management Plan

A Vegetation Management Plan (VMP) is a site-specific document that provides a guideline for the management and rehabilitation of vegetation communities. The document will describe each task necessary for the implementation of the plan, the duration and priority. Maps, diagrams and plant species lists will describe existing vegetation, constraints, vegetation and natural features to be retained, proposed vegetation, sediment and erosion control and stabilisation works.

This plan will outline how vegetation is to be protected during both the construction and operation phases of the development, and will include the following:

- Vegetation and fauna habitat management strategies and methods to ensure the long-term viability of native vegetation communities to be retained within the site;
- Vegetation restoration strategies and methods for native bushland and fauna habitats in degraded areas within the site;
- Management strategies and methods to prevent or mitigate impacts on native vegetation and fauna habitats that may occur as a result of the proposed subdivision, infrastructure construction or bushfire protection measures;
- An implementation schedule and monitoring schedule; and
- An indication of a number of performance criteria which will be reviewed annually.

5.4 Austral Bricks Quarry Site

A development proposal has not been prepared for the site and only a preliminary constraints analysis was required as a part of this report. It is recommended that additional investigation and assessment after the cessation of quarrying and brickmaking, and prior to the subsequent development of the site.

Chapter 6

Conclusions

The following endangered ecological communities have been identified on the subject land:

- Cumberland Plain Woodland; and
- Swamp Oak Floodplain Forest.

The proposal will result in the removal of a small percentage of these communities. A patch of Cumberland Plain Woodland in the north-western corner of the subject land that is in relatively good condition will be retained and a low quality patch of Swamp Oak Floodplain Forest on the western boundary will be removed. Revegetation of these communities in a ratio of at least 3:1 will occur as part of the proposal, so that there will be a net increase in the area of Cumbeland Plain Woodland and Swamp Oak Floodplain Forest. No significant impact on these communities is expected as a result of the proposal.

Freshwater wetlands will also be removed as a result of the proposal and this has some value as wetland habitat for fauna; however, wetland habitats will be provided around detention basins to compensate for this loss. Therefore, no significant impact on wetland habitat is expected as a result of the proposal.

A positive impact on the riparian corridor is expected as a result of the proposal. Revegetation and re-establishment of a riparian buffer zone along Ropes Creek and its tributaries will protect the features of the natural waterways, provide a vegetated link between key biodiversity areas, and provide terrestrial and aquatic habitat for fauna.

No threatened flora species were identified on the subject land, in the Sydney Water Pipeline Corridor, or in the road reserve along Old Wallgrove Road, and hence will not be impacted by the proposal.

No threatened fauna species were identified on the subject land except for the following bat species:

- Eastern Cave Bat;
- Eastern Bentwing Bat;
- Eastern Freetail Bat; and

- Greater Broad-nosed Bat.

Due to the quality and extent of existing roosting and foraging habitat on the subject land, it is unlikely that any roosting populations occur on the subject land and foraging is expected to be minimal. As revegetation / rehabilitation actions will result in the increase in available habitat, and in the improvement of the riparian zone for foraging, no negative impact on the above bat species is expected as a result of the proposal.

No impact on the Austral Bricks existing quarry site is expected as a result of the proposed development. The site of the existing Austral Bricks quarry is primarily highly disturbed, although the site does contain some vegetation of potential significance, principally in the south eastern areas of the site. This site would require additional investigation and assessment after the cessation of quarrying and brickmaking, and prior to the subsequent development of the site.

To ensure the effectiveness of the mitigation measures that will take place as a result of the proposal, it is recommended that:

- Revegetation occurs in a ratio of 1 hectare of endangered ecological community removed to 3 hectares revegetated;

- Landscaping of water detention basins with appropriate wetland vegetation is recommended to make up for the loss of wetland habitat through removal of the existing dams; and

- A vegetation management plan be prepared and implemented to identify the boundaries of bushland to be retained, and assist in maintenance of endangered ecological communities and re-establishment of corridor connectivity, including closure of significant canopy gaps within the existing corridor.

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Appendix A

Oakdale Concept Masterplan (Goodman, 20 June 2007)

Warehouse 6
20,000 sqm

Warehouse 5
20,000 sqm

Warehouse 1
30,000 sqm

Office
4,000 sqm

Warehouse 7
20,000 sqm

Warehouse 4
20,000 sqm

Warehouse 3
20,000 sqm

Warehouse 2
20,000 sqm

Legend

- Riparian Zone
- 1 in 100 Flood Zone
- Detention Basins
- Estate Park/ Amenities
- Services Zone
- Substation

PRELIMINARY

Macquarie Goodman
inspired customer solutions

Oakdale Industrial Estate

DOP Site 8

Masterplan

0 100 500

1: 5000 @ A1
1:10000 @ A3

20 June 07 JC

SP SK35 (A)

Appendix B

Flora Species Identified in the Study Area

Table B.1 FLORA SPECIES RECORDED ON THE SUBJECT LAND (SURVEYS IN MARCH 2007)

QUADRATS 1 AND 2 – FOREST RED GUM-GREY BOX WOODLAND; QUADRATS 3 AND 4 – SWAMP OAK FOREST

KEY: *=INTRODUCED; ADJ=ADJACENT TO QUADRAT; 1=RARE IN QUADRAT; 2=OCCASIONAL; 3=COMMON; 4=COMMON BUT <5%; 5=5-25%; 6=26-50%; 7=51-75%

			Quadrat			
Family	**Scientific Name**	**Common Name**	**1**	**2**	**3**	**4**
Trees						
Casuarinaceae	*Casuarina glauca*	Swamp Oak			7	7
Fabaceae	*Acacia decurrens*	Green Wattle		1		
Myrtaceae	*Angophora floribunda*	Rough-barked Apple			1	adj
	Eucalyptus amplifolia	Cabbage Gum				adj
	E. crebra	Narrow-leaved Ironbark		adj	adj	
	E. eugenioides	Thin-leaved Stringybark		5		
	E. fibrosa	Broad-leaved Ironbark				
	E. moluccana	Grey Box	adj	adj	1	1
	E. tereticornis	Forest Red Gum	6	5	1	1
	Melaleuca decora	Feather Honey-myrtle		adj		
	M. linariifolia	Snow-in-summer				
	M. styphelioides	Prickly Paperbark			2	5
Shrubs						
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood	1			
	**Senecio pterophorus*				1	

Table B.1 FLORA SPECIES RECORDED ON THE SUBJECT LAND (SURVEYS IN MARCH 2007)

QUADRATS 1 AND 2 – FOREST RED GUM-GREY BOX WOODLAND; QUADRATS 3 AND 4 – SWAMP OAK FOREST

KEY: *=INTRODUCED; ADJ=ADJACENT TO QUADRAT; 1=RARE IN QUADRAT; 2=OCCASIONAL; 3=COMMON; 4=COMMON BUT <5%; 5=5-25%; 6=26-50%; 7=51-75%

			Quadrat			
Family	**Scientific Name**	**Common Name**	**1**	**2**	**3**	**4**
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea	adj			
	Dillwinia sieberi	Prickly Parrot Pea	1			
	Acacia falcata	Sickle Wattle	adj			
Pittosporaceae	*Bursaria spinosa*	Blackthorn	2	6	3	1
Herbs - Ferns						
Azollaceae	*Azolla filiculoides*	Azolla				2
Sinopteridaceae	*Cheilanthes distans*			adj		
	C. sieberi	Rock Fern			1	
Herbs - Dicots						
Acanthaceae	*Brunoniella australis*		2	2	2	
Aizoaceae	*Tetragonia tetragonioides*	Warragul Greens			2	
Amaranthaceae						
Apiaceae	*Centella asiatica*	Pennywort			1	
Asteraceae	**Bidens pilosa*	Farmers Friends		1		
	**B. subalternans*			1		
	**Cirsium vulgare*	Spear Thistle		1	2	2
	**Conyza sp*	a Fleabane	adj		3	4

Table B.1 FLORA SPECIES RECORDED ON THE SUBJECT LAND (SURVEYS IN MARCH 2007)

QUADRATS 1 AND 2 – FOREST RED GUM-GREY BOX WOODLAND; QUADRATS 3 AND 4 – SWAMP OAK FOREST

KEY: *=INTRODUCED; ADJ=ADJACENT TO QUADRAT; 1=RARE IN QUADRAT; 2=OCCASIONAL; 3=COMMON; 4=COMMON BUT <5%; 5=5-25%; 6=26-50%; 7=51-75%

			Quadrat			
Family	**Scientific Name**	**Common Name**	**1**	**2**	**3**	**4**
	Euchiton sphaericum				1	
	**Hypochaeris microcephala*		1			1
	**H. radicata*	Flatweed			1	
	**Senecio madagascariensis*	Fireweed	3		3	2
	**Sonchus oleraceus*	Sow Thistle		2		2
	Solenogyne bellioides		1			
	Tagetes minuta	Stinking Roger			1	
Brassicaceae	**Lepidium sp*			2	2	
Campanulaceae	*Wahlenbergia gracilis*	a Native Bluebell		adj	1	
Chenopodiaceae	*Chenopodium sp*			3		
	Einadia nutans ssp nutans			3		
	E. polygonoides		3			
Convolvulaceae	*Dichondra repens*	Kidney Plant	4	4	4	
Crassulaceae	**Bryophyllum delagoense*	Mother-of-millions			1	
Euphorbiaceae	*Chamaesyce sp*	Caustic Weed				
	Phyllanthus virgata		2	1		
Fabaceae	*Desmodium varians*	Tick Trefoil	2			

Table B.1 FLORA SPECIES RECORDED ON THE SUBJECT LAND (SURVEYS IN MARCH 2007)

QUADRATS 1 AND 2 – FOREST RED GUM-GREY BOX WOODLAND; QUADRATS 3 AND 4 – SWAMP OAK FOREST

KEY: *=INTRODUCED; ADJ=ADJACENT TO QUADRAT; 1=RARE IN QUADRAT; 2=OCCASIONAL; 3=COMMON; 4=COMMON BUT <5%; 5=5-25%; 6=26-50%; 7=51-75%

			Quadrat			
Family	**Scientific Name**	**Common Name**	**1**	**2**	**3**	**4**
Lamiaceae	*Ajuga australis*	Australian Bugle		adj		
Lobeliaceae	*Pratia purpurascens*	Whiteroot		1	2	1
Malvaceae	**Modiola caroliniana*				1	
	**Sida rhombifolia*	Paddys Lucerne	3	3	3	
Myoporaceae	*Eremophila debile*	Winter Apple		1		
Oxalidaceae	*Oxalis ?perennans*			2	2	
Plantaginaceae	**Plantago lanceolata*	Lambs Tongue	2	2	2	
Polygonaceae	*Rumex brownii*					1
	**R. crispus*	Curled Dock			2	
Rubiaceae	*Asperula conferta*	Common Bedstraw				1
	Galium propinquum				1	
	**Richardia stellaria*		1			
Solanaceae	**Solanum chenopodioides*			2		
	**S. nigrum*	Blacjberry Nightshade		1	1	1
	S. prinophyllum			1	2	
	**S. pseudocapsicum*	Jerusalem Cherry		1		
Herbs - Monocots						

Table B.1 FLORA SPECIES RECORDED ON THE SUBJECT LAND (SURVEYS IN MARCH 2007)

QUADRATS 1 AND 2 – FOREST RED GUM-GREY BOX WOODLAND; QUADRATS 3 AND 4 – SWAMP OAK FOREST

KEY: *=INTRODUCED; ADJ=ADJACENT TO QUADRAT; 1=RARE IN QUADRAT; 2=OCCASIONAL; 3=COMMON; 4=COMMON BUT <5%; 5=5-25%; 6=26-50%; 7=51-75%

			Quadrat			
Family	**Scientific Name**	**Common Name**	**1**	**2**	**3**	**4**
Anthericacaeae	*Arthropodium sp*				1	
Cyperaceae	*Cyperus gracilis*		4	3	4	
	Fimbristylis dichotoma		2	2		
	Tricoryne elatior			1		
Juncaceae	**Juncus acutus*					1
	J. usitatus					1
Phormiaceae	*Dianella longifolia*			1		
Poaceae	*Aristida ramosa*	a Three-awned Grass	4	2		
	A. vagans	a Three-awned Grass		4		
	**Axonopus affinis*	Carpet Grass				
	Bothriochloa sp	Red Leg Grass	4	4	4	
	**Chloris gayana*	Rhodes Grass				
	C. ventricosa	Windmill Grass	5	5	3	2
	Cymbopogon refracta	Barb-wire Grass	1	2		
	**Cynodon dactylon*	Couch Grass				6
	Danthonia sp	a Wallaby Grass	2			2
	Eragrostis leptostachya	Paddock Love-grass		3	3	2

Table B.1 FLORA SPECIES RECORDED ON THE SUBJECT LAND (SURVEYS IN MARCH 2007)

QUADRATS 1 AND 2 – FOREST RED GUM-GREY BOX WOODLAND; QUADRATS 3 AND 4 – SWAMP OAK FOREST

KEY: *=INTRODUCED; ADJ=ADJACENT TO QUADRAT; 1=RARE IN QUADRAT; 2=OCCASIONAL; 3=COMMON; 4=COMMON BUT <5%; 5=5-25%; 6=26-50%; 7=51-75%

Family	Scientific Name	Common Name	Quadrat			
			1	2	3	4
	Microlaena stipoides	Weeping Meadow-grass	5	5	6	5
	Panicum effusum			1		
	Paspalidium sp		3	2		
	**Paspalum dilatatum*	Paspalum	2	2	3	4
	**Setaria gracilis*	Slender Pigeon Grass	2	3	2	2
	Sporobolus creber	Rats Tail Grass	2			
	**S. indica var capensis*	Parramatta Grass				1
Vines						
Fabaceae	*Glycine clandestina*				1	
	G. tabacina		3	3	1	
Ranunculaceae	*Clematis glyciphylla*	Travellors Joy			3	
Rosaceae	**Rubus fruticosus*	Blackberry			2	
	R. parvifolia	Small-leaved Bramble			2	

Table B.2 PLANT SPECIES RECORDED IN SYDNEY WATER PIPELINE CORRIDOR

KEY: *=INTRODUCED SPECIES

Family	Species Name	Common Name
Trees		
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Fabaceae	*Acacia parramattensis*	Parramatta Wattle
Myrtaceae	*Angophora floribunda*	Rough-barked Apple
	Eucalyptus moluccana	Grey Box
	E. tereticornis	Forest Red Gum
Shrubs		
Euphorbiaceae	**Ricinus communis*	Castor Oil Plant
Herbs - Dicots		
Amaranthaceae	*Alternanthera nodiflora*	
Apiaceae	*Centella asiatica*	Pennywort
Asteraceae	**Senecio madagascariensis*	Fireweed
Euphorbiaceae	*Chamaesyce sp*	
Geraniaceae	*Geranium ?solanderi*	
Lamiaceae	*Plectranthus parviflorus*	Cockspur Flower
Polygonaceae	*Persicaria decipiens*	
	**Rumex crispus*	Curled Dock
Herbs - Monocots		
Alismataceae	*Damasonium minus*	Starfruit
Commelinaceae	*Commelina cyanea*	Blue Wandering Jew
Juncaceae	**Juncus acutus*	
Poaceae	*Bothriochloa sp*	Red Leg Grass
	**Choris gayana*	Rhodes Grass
	**Cynodon dactylon*	Couch Grass
	**Eragrostis curvula*	African Love-grass
	**Paspalum dilatatum*	Papalum
	**Pennisetum clandestinum*	Kikiuyu
	Phragmites australis	Common Reed
Typhaceae	*Typha orientalis*	Cumbungi
Vines		
Rosaceae	**Rubus fruticosus*	Blackberry
Sapindaceae	**Cardiospermum grandiflorum*	Balloon Vine

Appendix C

Fauna Species Recorded on the Subject Land and Fauna Records for the Penrith and Fairfield Local Government Areas

Table C.1 FROG SPECIES RECORDED ON THE SUBJECT LAND

Family	Scientific Name	Common Name	Dam Number (refer to Figure 2.1 for dam locations)
Hylidae	*Litoria fallax*	Eastern Dwarf Tree Frog	3, 5, 6, 8
	Litoria latopalmata	Broad-palmed Frog	1, 7, 9
	Litoria peronii	Peron's Tree Frog	1, 5, 8
	Litoria verreauxii	Verreaux's Tree Frog	5, 7, 8
Myobatrachidae	*Crinia signifera*	Brown Froglet	2, 3, 4, 5, 6, 7, 8, 9
	Limnodynastes peronii	Striped Marsh Frog	1, 2, 3, 5
	Limnodynastes tasmaniensis	Spotted Marsh Frog	3, 4, 5, 6, 7, 8, 9
	Uperoleia laevigata	Smooth Toadlet	5, 8

Table C.2 BIRD SPECIES RECORDED ON THE SUBJECT LAND

KEY: A=1-5 INDIVIDUALS; B=6-20 INDIVIDUALS

Common Name	Scientific Name	Riparian Zone	Pastureland	Dams	Woodland	Scattered Trees
Australian Wood Duck	*Chenonetta jubata*	B		B		
Pacific Black Duck	*Anas superciliosa*	B		A		
Chestnut Teal	*Anas castanea*			A		
Australasian Grebe	*Tachybaptus novaehollandiae*			A		
Little Pied Cormorant	*Phalacrocorax melanoleucos*	A		A		
White-faced Heron	*Egretta novaehollandiae*	A	A	A		
Brown Falcon	*Falco berigora*	A				A
Nankeen Kestrel	*Falco cenchroides*		A	A		A
Purple Swamphen	*Porphyrio porphyrio*			A		
Dusky Moorhen	*Gallinula tenebrosa*	A				
Black-fronted Dotterel	*Elseyornis melanops*			A		
Masked Lapwing	*Vanellus miles*			A		
Spotted Turtle-Dove	*Streptopelia chinensis*	A				
Crested Pigeon	*Ocyphaps lophotes*	B	B		B	B
Galah	*Cacatua roseicapilla*				A	A
Long-billed Corella	*Cacatua tenuirostris*				A	A
Little Corella	*Cacatua sanguinea*					A

Table C.2 BIRD SPECIES RECORDED ON THE SUBJECT LAND

KEY: A=1-5 INDIVIDUALS; B=6-20 INDIVIDUALS

Common Name	Scientific Name	Riparian Zone	Pastureland	Dams	Woodland	Scattered Trees
Sulphur-crested Cockatoo	*Cacatua galerita*	A			A	
Rainbow Lorikeet	*Trichoglossus haematodus*	A				
Musk Lorikeet	*Glossopsitta concinna*				A	
Eastern Rosella	*Platycercus eximius*	B	B		B	B
Red-rumped Parrot	*Psephotus haematonotus*	B	A	A	B	B
Laughing Kookaburra	*Dacelo novaeguineae*				A	
Superb Fairy-wren	*Malurus cyaneus*	A	A			
Spotted Pardalote	*Pardalotus punctatus*				A	
Striated Pardalote	*Pardalotus striatus*					A
Weebill	*Smicrornis brevirostris*				A	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*				A	
Red Wattlebird	*Anthochaera carunculata*	A				
Noisy Friarbird	*Philemon corniculatus*				A	B
Noisy Miner	*Manorina melanocephala*	B			B	B
Magpie-lark	*Grallina cyanoleuca*		A	A		
Grey Fantail	*Rhipidura fuliginosa*	A			A	
Willie Wagtail	*Rhipidura leucophrys*	B	B	A	A	A
Spangled Drongo	*Dicrurus bracteatus*	A				

Table C.2 BIRD SPECIES RECORDED ON THE SUBJECT LAND

KEY: A=1-5 INDIVIDUALS; B=6-20 INDIVIDUALS

Common Name	Scientific Name	Riparian Zone	Pastureland	Dams	Woodland	Scattered Trees
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	B			B	B
Grey Butcherbird	*Cracticus torquatus*	A			A	A
Australian Magpie	*Gymnorhina tibicen*		A		A	A
Pied Currawong	*Strepera graculina*	A				
Australian Raven	*Corvus coronoides*	A	A		A	A
White-winged Chough	*Corcorax melanorhamphos*	B				
Richard's Pipit	*Anthus novaeseelandiae*		B			
Red-browed Finch	*Neochmia temporalis*	B				
Welcome Swallow	*Hirundo neoxena*		B	A		
Silvereye	*Zosterops lateralis*	A				
Common Starling	*Sturnus vulgaris*	A	A	A	A	A
Common Myna	*Acridotheres tristis*	A	A		A	

Table C.3 MAMMAL AND REPTILE SPECIES RECORDED ON THE SUBJECT LAND

KEY: ?=UNCERTAIN RECORD; A=ANABAT; C=CALL; H=HAIR; O=SIGHTING; P=SCAT; SP=SPOTLIGHTING; T=TRACKS

Group	Scientific name	Common Name	Evidence
Introduced Mammals	*Bos taurus*	European Cattle	O, H
	Canis familiaris	Domestic Dog	P
	Equus caballus	Horse	O
	Oryctolagus cuniculus	Rabbit	O
	Vulpes vulpes	Fox	T
Marsupials	*Macropus giganteus*	Eastern Grey Kangaroo	O
	Trichosurus sp.	Brush-tail Possum	H; Sp
Bats	*?Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	A
	?Mormopterus norfolkensis	Eastern Freetail-bat	A
	?Scoteanax rueppellii	Greater Broad-nosed Bat	A
	?Vespadelus troughtoni	Eastern Cave Bat	A
Reptiles	*Amphibolurus muricatus*	Jacky Lizard	O
	Physignathus lesueurii	Water Dragon	O
	Pseudechis porphyriacus	Red-bellied Red Snake	O

Table C.4 FAUNA SPECIES RECORDED IN THE PENRITH AND FAIRFIELD LGAS (DEC (NSW) 2006, NSW GOVERNMENT 2005)

KEY: *=RECORDS OF THREATENED SPECIES FROM BIONET DATABASE (NSW GOVERNMENT 2005); E1=ENDANGERED SPECIES; V=VULNERABLE SPECIES; P=PROTECTED SPECIES; U=UNPROTECTED SPECIES

Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
Amphibia					
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E1	9	Penrith&Fairfield
	Litoria caerulea	Green Tree Frog	P	23	Penrith
	Litoria dentata	Keferstein's Tree Frog	P	12	Penrith&Fairfield
	Litoria fallax	Eastern Dwarf Tree Frog	P	37	Penrith&Fairfield
	Litoria latopalmata	Broad-palmed Frog	P	16	Penrith
	Litoria lesueuri	Lesueur's Frog	P	1	Penrith
	Litoria peronii	Peron's Tree Frog	P	30	Penrith&Fairfield
	Litoria phyllochroa	Green Stream Frog	P	3	Fairfield
	Litoria tyleri	Tyler's Tree Frog	P	1	Penrith&Fairfield
	Litoria verreauxii	Verreaux's Tree Frog	P	47	Penrith&Fairfield
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	P	142	Penrith&Fairfield
	Limnodynastes dumerilii	Bullfrog	P	3	Penrith&Fairfield
	Limnodynastes ornatus	Ornate Burrowing Frog	P	1	Penrith
	Limnodynastes peronii	Striped Marsh Frog	P	33	Penrith&Fairfield
	Limnodynastes tasmaniensis	Spotted Marsh Frog	P	37	Penrith&Fairfield
	Pseudophryne bibronii	Bibron's Toadlet	P	3	Fairfield

Table C.4 FAUNA SPECIES RECORDED IN THE PENRITH AND FAIRFIELD LGAS (DEC (NSW) 2006, NSW GOVERNMENT 2005)

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Uperoleia laevigata	Smooth Toadlet	P	11	Penrith&Fairfield
Aves					
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	P	30	Penrith&Fairfield
	Acanthiza lineata	Striated Thornbill	P	54	Penrith&Fairfield
	Acanthiza nana	Yellow Thornbill	P	111	Penrith&Fairfield
	Acanthiza pusilla	Brown Thornbill	P	50	Penrith&Fairfield
	Acanthiza reguloides	Buff-rumped Thornbill	P	49	Penrith&Fairfield
	Gerygone fusca	Western Gerygone	P	1	Penrith
	Gerygone mouki	Brown Gerygone	P	11	Penrith
	Gerygone olivacea	White-throated Gerygone	P	31	Penrith&Fairfield
	Origma solitaria	Rockwarbler	P	3	Penrith
	Pyrrholaemus sagittatus	Speckled Warbler	V	12	Penrith
	Sericornis frontalis	White-browed Scrubwren	P	27	Penrith&Fairfield
	Sericornis magnirostris	Large-billed Scrubwren	P	1	Penrith
	Smicrornis brevirostris	Weebill	P	106	Penrith&Fairfield
Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk	P	2	Penrith
	Accipiter fasciatus	Brown Goshawk	P	17	Penrith
	Accipiter novaehollandiae	Grey Goshawk	P	3	Penrith&Fairfield

Table C.4 FAUNA SPECIES RECORDED IN THE PENRITH AND FAIRFIELD LGAS (DEC (NSW) 2006, NSW GOVERNMENT 2005)

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Aquila audax	Wedge-tailed Eagle	P	8	Penrith&Fairfield
	Circus approximans	Swamp Harrier	P	3	Penrith&Fairfield
	Circus assimilis	Spotted Harrier	P	1	Penrith
	Elanus axillaris	Black-shouldered Kite	P	11	Penrith&Fairfield
	Haliaeetus leucogaster	White-bellied Sea-Eagle	P	5	Penrith&Fairfield
	Haliastur sphenurus	Whistling Kite	P	1	Penrith&Fairfield
	Hieraaetus morphnoides	Little Eagle	P	2	Penrith&Fairfield
	Lophoictinia isura	Square-tailed Kite	V	3	Penrith
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar	P	16	Penrith
Alaudidae	*Alauda arvensis*	Eurasian Skylark	U	1	Fairfield
	Mirafra javanica	Horsfield's Bushlark	P	2	Penrith
Alcedinidae	*Alcedo azurea*	Azure Kingfisher	P	7	Penrith&Fairfield
Anatidae	*Anas castanea*	Chestnut Teal	P	4	Penrith&Fairfield
	Anas gracilis	Grey Teal	P	9	Penrith&Fairfield
	Anas platyrhynchos	Mallard	U	1	Penrith
	Anas rhynchotis	Australasian Shoveler	P	1	Penrith
	Anas superciliosa	Pacific Black Duck	P	47	Penrith&Fairfield
	Aythya australis	Hardhead	P	3	Penrith&Fairfield

Table C.4 FAUNA SPECIES RECORDED IN THE PENRITH AND FAIRFIELD LGAS (DEC (NSW) 2006, NSW GOVERNMENT 2005)

KEY: *=RECORDS OF THREATENED SPECIES FROM BIONET DATABASE (NSW GOVERNMENT 2005); E1=ENDANGERED SPECIES; V=VULNERABLE SPECIES; P=PROTECTED SPECIES; U=UNPROTECTED SPECIES

Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Chenonetta jubata	Australian Wood Duck	P	42	Penrith&Fairfield
	Cygnus atratus	Black Swan	P	5	Penrith&Fairfield
	Stictonetta naevosa	Freckled Duck	V	2	Penrith
Anhingidae	*Anhinga melanogaster*	Darter	P	5	Penrith&Fairfield
Apodidae	*Apus pacificus*	Fork-tailed Swift	P	3	Penrith
	Hirundapus caudacutus	White-throated Needletail	P	3	Penrith
Ardeidae	*Ardea alba*	Great Egret	P	4	Penrith
	Ardea ibis	Cattle Egret	P	16	Penrith&Fairfield
	Ardea intermedia	Intermediate Egret	P	3	Penrith&Fairfield
	Ardea pacifica	White-necked Heron	P	6	Penrith&Fairfield
	Botaurus poiciloptilus	Australasian Bittern	V	1	Penrith
	Butorides striatus	Striated Heron	P	1	Fairfield
	Egretta garzetta	Little Egret	P	4	Penrith&Fairfield
	Egretta novaehollandiae	White-faced Heron	P	31	Penrith&Fairfield
	Ixobrychus flavicollis	Black Bittern	V	1	Penrith
	Ixobrychus minutus	Little Bittern	P	2	Penrith
	Nycticorax caledonicus	Nankeen Night Heron	P	3	Penrith&Fairfield
Artamidae	*Artamus cyanopterus*	Dusky Woodswallow	P	16	Penrith&Fairfield

Table C.4 FAUNA SPECIES RECORDED IN THE PENRITH AND FAIRFIELD LGAS (DEC (NSW) 2006, NSW GOVERNMENT 2005)

KEY: *=RECORDS OF THREATENED SPECIES FROM BIONET DATABASE (NSW GOVERNMENT 2005); E1=ENDANGERED SPECIES; V=VULNERABLE SPECIES; P=PROTECTED SPECIES; U=UNPROTECTED SPECIES

Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Artamus personatus	Masked Woodswallow	P	2	Penrith
	Artamus superciliosus	White-browed Woodswallow	P	6	Penrith
	Cracticus nigrogularis	Pied Butcherbird	P	3	Penrith
	Cracticus torquatus	Grey Butcherbird	P	118	Penrith&Fairfield
	Gymnorhina tibicen	Australian Magpie	P	110	Penrith&Fairfield
	Strepera graculina	Pied Currawong	P	76	Penrith&Fairfield
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E1	2	Penrith
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	P	63	Penrith&Fairfield
	Cacatua sanguinea	Little Corella	P	5	Penrith
	Cacatua tenuirostris	Long-billed Corella	P	4	Penrith&Fairfield
	Callocephalon fimbriatum	Gang-gang Cockatoo	V	4	Penrith
	Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	P	32	Penrith&Fairfield
	Calyptorhynchus lathami	Glossy Black-Cockatoo	V	6	Penrith
	Eolophus roseicapillus	Galah	P	43	Penrith&Fairfield
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	P	98	Penrith&Fairfield
	Coracina papuensis	White-bellied Cuckoo-shrike	P	2	Penrith
	Coracina tenuirostris	Cicadabird	P	3	Penrith
	Lalage tricolor	White-winged Triller	P	4	Penrith

Table C.4 FAUNA SPECIES RECORDED IN THE PENRITH AND FAIRFIELD LGAS (DEC (NSW) 2006, NSW GOVERNMENT 2005)

KEY: *=RECORDS OF THREATENED SPECIES FROM BIONET DATABASE (NSW GOVERNMENT 2005); E1=ENDANGERED SPECIES; V=VULNERABLE SPECIES; P=PROTECTED SPECIES; U=UNPROTECTED SPECIES

Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
Casuariidae	*Dromaius novaehollandiae*	Emu	P	1	Penrith
Centropodidae	*Centropus phasianinus*	Pheasant Coucal	P	3	Penrith
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel	P	8	Penrith&Fairfield
	Erythrogonys cinctus	Red-kneed Dotterel	P	1	Penrith
	Vanellus miles	Masked Lapwing	P	45	Penrith&Fairfield
	Vanellus tricolor	Banded Lapwing	P	3	Penrith
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1	4	Penrith
Climacteridae	*Cormobates leucophaeus*	White-throated Treecreeper	P	45	Penrith&Fairfield
Columbidae	*Columba livia*	Rock Dove	U	8	Penrith&Fairfield
	Geopelia humeralis	Bar-shouldered Dove	P	8	Penrith
	Geopelia placida	Peaceful Dove	P	36	Penrith
	Leucosarcia melanoleuca	Wonga Pigeon	P	4	Penrith
	Ocyphaps lophotes	Crested Pigeon	P	38	Penrith&Fairfield
	Phaps chalcoptera	Common Bronzewing	P	17	Penrith
	Streptopelia chinensis	Spotted Turtle-Dove	U	63	Penrith&Fairfield
Coraciidae	*Eurystomus orientalis*	Dollarbird	P	9	Penrith&Fairfield
Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough	P	34	Penrith
Corvidae	*Corvus coronoides*	Australian Raven	P	174	Penrith&Fairfield

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	P	11	Penrith&Fairfield
	Chalcites basalis	Horsfield's Bronze-Cuckoo	P	11	Penrith&Fairfield
	Chalcites lucidus	Shining Bronze-Cuckoo	P	17	Penrith&Fairfield
	Cuculus pallidus	Pallid Cuckoo	P	11	Penrith&Fairfield
	Eudynamys orientalis	Pacific Koel	P	1	Penrith&Fairfield
	Scythrops novaehollandiae	Channel-billed Cuckoo	P	3	Penrith&Fairfield
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird	P	28	Penrith&Fairfield
Dicruridae	*Dicrurus bracteatus*	Spangled Drongo	P	1	Fairfield
	Grallina cyanoleuca	Magpie-lark	P	137	Penrith&Fairfield
	Myiagra cyanoleuca	Satin Flycatcher	P	3	Penrith
	Myiagra inquieta	Restless Flycatcher	P	16	Penrith
	Myiagra rubecula	Leaden Flycatcher	P	5	Penrith&Fairfield
	Rhipidura albiscapa	Grey Fantail	P	142	Penrith&Fairfield
	Rhipidura leucophrys	Willie Wagtail	P	80	Penrith&Fairfield
	Rhipidura rufifrons	Rufous Fantail	P	7	Penrith&Fairfield
Estrildidae	*Lonchura castaneothorax*	Chestnut-breasted Mannikin	P	3	Penrith&Fairfield
	Lonchura punctulata	Nutmeg Mannikin	U	3	Fairfield
	Neochmia modesta	Plum-headed Finch	P	1	Penrith

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Neochmia temporalis	Red-browed Finch	P	99	Penrith&Fairfield
	Stagonopleura guttata	Diamond Firetail	V	2	Penrith
	Taeniopygia bichenovii	Double-barred Finch	P	47	Penrith&Fairfield
	Taeniopygia guttata	Zebra Finch	P	3	Penrith&Fairfield
Eupetidae	*Cinclosoma punctatum*	Spotted Quail-thrush	P	1	Penrith
	Psophodes olivaceus	Eastern Whipbird	P	46	Penrith&Fairfield
Falconidae	*Falco berigora*	Brown Falcon	P	7	Penrith&Fairfield
	Falco cenchroides	Nankeen Kestrel	P	10	Penrith&Fairfield
	Falco longipennis	Australian Hobby	P	7	Penrith&Fairfield
	Falco peregrinus	Peregrine Falcon	P	1	Penrith&Fairfield
Fringillidae	*Carduelis carduelis*	European Goldfinch	U	1	Penrith&Fairfield
	Carduelis chloris	European Greenfinch	U	1	Fairfield
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra	P	77	Penrith&Fairfield
	Todiramphus sanctus	Sacred Kingfisher	P	21	Penrith&Fairfield
Hirundinidae	*Cheramoeca leucosternus*	White-backed Swallow	P	6	Penrith&Fairfield
	Hirundo neoxena	Welcome Swallow	P	51	Penrith&Fairfield
	Petrochelidon ariel	Fairy Martin	P	1	Penrith&Fairfield
	Petrochelidon nigricans	Tree Martin	P	10	Penrith&Fairfield

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
Laridae	*Larus novaehollandiae*	Silver Gull	P	1	Penrith&Fairfield
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	P	152	Penrith&Fairfield
	Malurus lamberti	Variegated Fairy-wren	P	18	Penrith&Fairfield
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill	P	67	Penrith&Fairfield
	Anthochaera carunculata	Red Wattlebird	P	40	Penrith&Fairfield
	Anthochaera chrysoptera	Little Wattlebird	P	21	Penrith&Fairfield
	Entomyzon cyanotis	Blue-faced Honeyeater	P	1	Penrith
	Grantiella picta	Painted Honeyeater	V	1	Penrith
	Lichenostomus chrysops	Yellow-faced Honeyeater	P	96	Penrith&Fairfield
	Lichenostomus fuscus	Fuscous Honeyeater	P	20	Penrith
	Lichenostomus leucotis	White-eared Honeyeater	P	56	Penrith&Fairfield
	Lichenostomus melanops	Yellow-tufted Honeyeater	P	5	Penrith
	Lichenostomus penicillatus	White-plumed Honeyeater	P	35	Penrith&Fairfield
	Manorina melanocephala	Noisy Miner	P	167	Penrith&Fairfield
	Manorina melanophrys	Bell Miner	P	62	Penrith&Fairfield
	Meliphaga lewinii	Lewin's Honeyeater	P	14	Penrith
	Melithreptus brevirostris	Brown-headed Honeyeater	P	29	Penrith&Fairfield
	Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	3	Penrith

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Melithreptus lunatus	White-naped Honeyeater	P	24	Penrith
	Myzomela sanguinolenta	Scarlet Honeyeater	P	9	Penrith&Fairfield
	Philemon citreogularis	Little Friarbird	P	1	Penrith
	Philemon corniculatus	Noisy Friarbird	P	36	Penrith&Fairfield
	Phylidonyris nigra	White-cheeked Honeyeater	P	29	Penrith
	Phylidonyris novaehollandiae	New Holland Honeyeater	P	7	Penrith&Fairfield
	Plectorhyncha lanceolata	Striped Honeyeater	P	1	Penrith
	Xanthomyza phrygia	Regent Honeyeater	E1	5	Penrith&Fairfield
Menuridae	*Menura novaehollandiae*	Superb Lyrebird	P	3	Penrith
Meropidae	*Merops ornatus*	Rainbow Bee-eater	P	5	Penrith
Motacillidae	*Anthus australis*	Australian Pipit	P	6	Penrith&Fairfield
Muscicapidae	*Turdus merula*	Eurasian Blackbird	U	10	Penrith&Fairfield
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	P	34	Penrith&Fairfield
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole	P	38	Penrith&Fairfield
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	P	120	Penrith&Fairfield
	Falcunculus frontatus	Eastern Shrike-tit	P	30	Penrith&Fairfield
	Pachycephala pectoralis	Golden Whistler	P	107	Penrith&Fairfield
	Pachycephala rufiventris	Rufous Whistler	P	74	Penrith&Fairfield

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	P	140	Penrith&Fairfield
	Pardalotus striatus	Striated Pardalote	P	74	Penrith&Fairfield
Passeridae	*Passer domesticus*	House Sparrow	U	14	Penrith&Fairfield
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	P	7	Penrith&Fairfield
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	P	84	Penrith&Fairfield
	Melanodryas cucullata	Hooded Robin	V	1	Penrith
	Microeca fascinans	Jacky Winter	P	13	Penrith
	Petroica boodang	Scarlet Robin	P	12	Penrith
	Petroica goodenovii	Red-capped Robin	P	4	Penrith
	Petroica phoenicea	Flame Robin	P	5	Penrith
	Petroica rosea	Rose Robin	P	27	Penrith
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant	P	3	Penrith&Fairfield
	Phalacrocorax melanoleucos	Little Pied Cormorant	P	16	Penrith&Fairfield
	Phalacrocorax sulcirostris	Little Black Cormorant	P	9	Penrith&Fairfield
	Phalacrocorax varius	Pied Cormorant	P	8	Penrith&Fairfield
Phasianidae	*Coturnix pectoralis*	Stubble Quail	P	2	Penrith&Fairfield
	Coturnix sp.	Unidentified Quail	P	1	Penrith
	Coturnix ypsilophora	Brown Quail	P	11	Penrith&Fairfield

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
Podargidae	*Podargus strigoides*	Tawny Frogmouth	P	44	Penrith&Fairfield
Podicipedidae	*Podiceps cristatus*	Great Crested Grebe	P	6	Penrith&Fairfield
	Poliocephalus poliocephalus	Hoary-headed Grebe	P	5	Penrith
	Tachybaptus novaehollandiae	Australasian Grebe	P	12	Penrith&Fairfield
Psittacidae	*Alisterus scapularis*	Australian King-Parrot	P	21	Penrith
	Barnardius zonarius semitorquatus	Twenty Eight Parrot	P	1	Fairfield
	Glossopsitta concinna	Musk Lorikeet	P	1	Penrith
	Glossopsitta pusilla	Little Lorikeet	P	3	Penrith
	Lathamus discolor	Swift Parrot	E1	27	Penrith
	Platycercus adscitus eximius	Eastern Rosella	P	89	Penrith&Fairfield
	Platycercus elegans	Crimson Rosella	P	38	Penrith&Fairfield
	Psephotus haematonotus	Red-rumped Parrot	P	51	Penrith&Fairfield
	Trichoglossus haematodus	Rainbow Lorikeet	P	43	Penrith&Fairfield
Ptilonorhynchidae	*Chlamydera maculata*	Spotted Bowerbird	P	1	Fairfield
	Ptilonorhynchus violaceus	Satin Bowerbird	P	16	Penrith
Pycnonotidae	*Pycnonotus jocosus*	Red-whiskered Bulbul	U	35	Penrith&Fairfield
Rallidae	*Fulica atra*	Eurasian Coot	P	7	Penrith&Fairfield
	Gallinula tenebrosa	Dusky Moorhen	P	25	Penrith&Fairfield

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Gallirallus philippensis	Buff-banded Rail	P	2	Penrith&Fairfield
	Porphyrio porphyrio	Purple Swamphen	P	20	Penrith&Fairfield
	Porzana pusilla	Baillon's Crake	P	2	Penrith&Fairfield
	Porzana tabuensis	Spotless Crake	P	1	Fairfield
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	P	3	Penrith
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	P	2	Penrith&Fairfield
	Gallinago hardwickii	Latham's Snipe	P	1	Penrith&Fairfield
	Limosa limosa	Black-tailed Godwit	V	1	Penrith
	Tringa glareola	Wood Sandpiper	P	2	Penrith
	Tringa nebularia	Common Greenshank	P	1	Penrith
Strigidae	*Ninox boobook*	Southern Boobook	P	13	Penrith&Fairfield
	Ninox connivens	Barking Owl	V	3	Penrith
Sturnidae	*Acridotheres tristis*	Common Myna	U	95	Penrith&Fairfield
	Sturnus vulgaris	Common Starling	U	57	Penrith&Fairfield
Sylviidae	*Acrocephalus australis*	Australian Reed-Warbler	P	3	Penrith&Fairfield
	Cisticola exilis	Golden-headed Cisticola	P	10	Penrith&Fairfield
	Megalurus gramineus	Little Grassbird	P	5	Penrith&Fairfield
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill	P	4	Penrith

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Platalea regia	Royal Spoonbill	P	5	Penrith&Fairfield
	Plegadis falcinellus	Glossy Ibis	P	1	Penrith
	Threskiornis molucca	Australian White Ibis	P	8	Penrith&Fairfield
	Threskiornis spinicollis	Straw-necked Ibis	P	5	Penrith&Fairfield
Turnicidae	*Turnix varia*	Painted Button-quail	P	9	Penrith
Tytonidae	*Tyto alba*	Barn Owl	P	8	Penrith&Fairfield
	Tyto novaehollandiae	Masked Owl	V	13	Penrith
Zosteropidae	*Zosterops lateralis*	Silvereye	P	88	Penrith&Fairfield
Gastropoda					
Camaenidae	*Meridolum corneovirens*	Cumberland Plain Land Snail	E1	118	Penrith&Fairfield
Helicidae	*Helix aspersa*	Brown gardensnail	U	5	Penrith&Fairfield
Mammalia					
Bovidae	*Bos taurus*	European cattle	U	11	Penrith&Fairfield
	Capra hircus	Goat	U	7	Penrith&Fairfield
	Ovis aries	Sheep	U	1	Fairfield
Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	V	1	Fairfield
Canidae	*Canis lupus*	Dingo, domestic dog	U	34	Penrith&Fairfield
	Canis lupus familiaris	Dog	U	47	Penrith&Fairfield

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Vulpes vulpes	Fox	U	146	Penrith&Fairfield
Dasyuridae	*Antechinus stuartii*	Brown Antechinus	P	2	Penrith
	Dasyurus maculatus	Spotted-tailed Quoll	V	3	Penrith&Fairfield
	**Dasyurus viverrinus*	Eastern Quoll	E1		Penrith&Fairfield
	**Phascogale tapoatafa*	Brush-tailed Phascogale	V		Penrith
	Sminthopsis murina	Common Dunnart	P	1	Penrith
Equidae	*Equus caballus*	Horse	U	13	Penrith
Felidae	*Felis catus*	Cat	U	27	Penrith&Fairfield
Leporidae	*Lepus capensis*	Brown Hare	U	22	Penrith&Fairfield
	Oryctolagus cuniculus	Rabbit	U	144	Penrith&Fairfield
Macropodidae	*Macropod sp.*	unidentified macropod	P	5	Penrith
	Macropus giganteus	Eastern Grey Kangaroo	P	102	Penrith
	Macropus robustus	Common Wallaroo	P	18	Penrith
	**Petrogale penicillata*	Brush-tailed Rock-wallaby	E1		Penrith&Fairfield
	Wallabia bicolor	Swamp Wallaby	P	84	Penrith&Fairfield
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	17	Penrith&Fairfield
	Mormopterus planiceps	Little Mastiff-bat	P	2	Penrith&Fairfield
	Mormopterus sp 1	undescribed mastiff-bat	P	40	Penrith&Fairfield

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Tadarida australis	White-striped Freetail-bat	P	28	Penrith&Fairfield
Muridae	*Mus musculus*	House Mouse	U	228	Penrith&Fairfield
	Rattus fuscipes	Bush Rat	P	3	Penrith
	Rattus rattus	Black Rat	U	42	Penrith&Fairfield
	Rattus sp.	rat	P	13	Penrith&Fairfield
Ornithorhynchidae	*Ornithorhynchus anatinus*	Platypus	P	3	Penrith&Fairfield
Peramelidae	*Isoodon/Perameles sp.*	unidentified Bandicoot	P	3	Penrith
	Perameles nasuta	Long-nosed Bandicoot	P	5	Penrith
Petauridae	*Petaurus australis*	Yellow-bellied Glider	V	1	Penrith
	Petaurus breviceps	Sugar Glider	P	54	Penrith&Fairfield
	Petaurus norfolcensis	Squirrel Glider	V	3	Penrith
Phalangeridae	*Trichosurus sp.*	brushtail possum	P	55	Penrith&Fairfield
	Trichosurus vulpecula	Common Brushtail Possum	P	84	Penrith&Fairfield
Phascolarctidae	*Phascolarctos cinereus*	Koala	V	5	Penrith
Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum	P	37	Penrith&Fairfield
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	33	Penrith&Fairfield
Suidae	*Sus scrofa*	Pig	U	5	Penrith
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna	P	15	Penrith

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	4	Penrith
	Chalinolobus gouldii	Gould's Wattled Bat	P	80	Penrith&Fairfield
	Chalinolobus morio	Chocolate Wattled Bat	P	71	Penrith&Fairfield
	Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	4	Penrith&Fairfield
	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	13	Penrith&Fairfield
	Myotis adversus	Large-footed Myotis	V	10	Penrith
	Nyctophilus geoffroyi	Lesser Long-eared Bat	P	80	Penrith&Fairfield
	Nyctophilus gouldi	Gould's Long-eared Bat	P	14	Penrith&Fairfield
	Nyctophilus sp.	long-eared bat	P	6	Penrith&Fairfield
	Scoteanax rueppellii	Greater Broad-nosed Bat	V	11	Penrith&Fairfield
	Scotorepens orion	Eastern Broad-nosed Bat	P	51	Penrith&Fairfield
	Vespadelus darlingtoni	Large Forest Bat	P	9	Penrith
	Vespadelus regulus	Southern Forest Bat	P	18	Penrith&Fairfield
	Vespadelus vulturnus	Little Forest Bat	P	125	Penrith&Fairfield
Vombatidae	*Vombatus ursinus*	Common Wombat	P	10	Penrith
Reptilia					
Agamidae	*Amphibolurus muricatus*	Jacky Lashtail	P	23	Penrith&Fairfield

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Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Physignathus lesueurii	Eastern Water Dragon	P	10	Penrith&Fairfield
	Pogona barbata	Eastern Bearded Dragon	P	11	Penrith
Chelidae	*Chelodina longicollis*	Eastern Snake-necked Turtle	P	14	Penrith&Fairfield
Colubridae	*Dendrelaphis punctulatus*	Green Tree Snake	P	2	Penrith
Elapidae	*Demansia psammophis*	Yellow-faced Whipsnake	P	5	Penrith
	Furina diadema	Red-naped Snake	P	10	Penrith&Fairfield
	Parasuta dwyeri	Variable Black-naped Snake	P	1	Penrith
	Parasuta spectabilis	Spectacled Hooded Snake	P	1	Penrith
	Pseudechis porphyriacus	Red-bellied Black Snake	P	33	Penrith&Fairfield
	Pseudonaja textilis	Eastern Brown Snake	P	11	Penrith&Fairfield
Gekkonidae	*Diplodactylus vittatus*	Eastern Stone Gecko	P	13	Penrith&Fairfield
Pygopodidae	*Pygopus lepidopodus*	Southern Scaly-foot	P	6	Penrith&Fairfield
Scincidae	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink	P	17	Penrith&Fairfield
	Ctenotus robustus	Robust Ctenotus	P	28	Penrith&Fairfield
	Ctenotus taeniolatus	Copper-tailed Ctenotus	P	21	Penrith
	Egernia whitii	White's Rock-skink	P	3	Penrith
	Eulamprus quoyii	Eastern Water-skink	P	28	Penrith&Fairfield
	Eulamprus tenuis	Bar-sided Forest-skink	P	1	Penrith&Fairfield

Table C.4 FAUNA SPECIES RECORDED IN THE PENRITH AND FAIRFIELD LGAS (DEC (NSW) 2006, NSW GOVERNMENT 2005)

KEY: *=RECORDS OF THREATENED SPECIES FROM BIONET DATABASE (NSW GOVERNMENT 2005); E1=ENDANGERED SPECIES; V=VULNERABLE SPECIES; P=PROTECTED SPECIES; U=UNPROTECTED SPECIES

Group	Scientific Name	Common Name	Legal Status	Count (Penrith)	LGA
	Lampropholis delicata	Dark-flecked Garden Sunskink	P	80	Penrith&Fairfield
	Lampropholis guichenoti	Pale-flecked Garden Sunskink	P	76	Penrith&Fairfield
	Lampropholis sp.	unidentified grass skink	P	10	Penrith&Fairfield
	Lygisaurus foliorum	Tree-base Litter-skink	P	3	Penrith&Fairfield
	Saproscincus mustelinus	Weasel Shadeskink	P	3	Penrith
	Tiliqua scincoides	Common Bluetongue	P	31	Penrith&Fairfield
Typhlopidae	*Ramphotyphlops nigrescens*	Blackish Blind Snake	P	4	Penrith
Varanidae	*Varanus sp.*	Unidentified Goanna	P	1	Penrith
	Varanus varius	Lace Monitor	P	13	Penrith&Fairfield

Appendix D

7-Part Assessments of Significance

This appendix provides formal assessments of impacts of a proposed development or activity upon threatened species or communities. The assessments are completed in accordance with the procedure identified in Section 5a of the Environmental Planning and Assessment Act 1979 (i.e the "Assessment of Significance" test).

Threatened species and ecological communities listed under the TSC Act 1995 and EPBC Act 1999 for which this procedure was carried out include:

- Eastern Cave Bat (*Vespadelus troughtoni*)*;*
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)*;*
- Eastern Freetail-bat (*Mormopterus norfolkensis*)*;*
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)*;*
- Swamp Oak Forest on the Floodplains of the North Coast, Sydney Basin and South East Corner Bioregions; and
- Cumberland Plain Woodland.

D.1.1 Bats

The following bat species (all listed as Vulnerable under the TSC Act) may occur on the subject land and have therefore been assessed:

- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Eastern Cave Bat (*Vespadelus troughtoni*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*); and
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*).

All of these species except the Eastern Cave Bat have been recorded in the locality of the Oakdale Site and all four species have the potential to forage over woodland remnants and riparian areas on the subject land.

The Eastern Bent-wing Bat hunts in forested areas and roosts primarily in caves (DEC (NSW) 2005c).This species also can potentially roost in rock crevices and overhangs and possibly drainage channels (DEC (NSW) 2005c). The Eastern Cave Bat also predominantly roosts in caves and forages in dry open forest/woodland areas (NSW Scientific Committee 2004b).

The Eastern Freetail-bat and the Greater Broad-nosed Bat usually roost in tree hollows and sometimes in buildings (DEC (NSW) 2005c, g). The Eastern Freetail-bat may also roost under the bark of trees (Churchill 1998). Greater Broad-nosed Bats are known to

forage along creek and river corridors (DEC (NSW) 2005g) and Eastern Freetail-bats inhabit dry eucalypt forest and woodland (Churchill 1998).

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

No caves and very few man-made structures occur on the subject land, therefore, it is considered unlikely that the Eastern Cave Bat or the Eastern Bent-wing Bat roost on the subject land.

Remnant woodland on the subject land potentially provides roosting opportunities for the Greater Broad-nosed Bat and the Eastern Freetail-bat within tree hollows or under bark. However, such roosting opportunities would be very limited considering the age of the woodland remnants. Most of the vegetation to be removed is in poor condition with very little or no understorey and mainly comprising young trees which would not contain hollows.

The proposed development will result in the clearance of approximately 4 ha of woodland. This does not represent a large area of potential foraging habitat for these species. Furthermore, the proposal provides for offsets with the revegetation of riparian corridors and planting of Cumberland Plain Woodland which will result in a net increase in foraging habitat for these bats. Also, revegetation and management of riparian corridors will result in improved habitat quality for the Greater Broad-nosed Bat which forages along creek and river corridors.

The proposed development is not likely to have an adverse effect on the life cycle of these species such that a viable local population is likely to be placed at risk of extinction.

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

No endangered populations of these species are currently listed on Schedule 1 of the TSC Act.

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

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Approximately 4ha of vegetation will be removed which consists of a combination of disturbed woodland with an exotic understorey, scattered trees, modified Swamp Oak Forest with a poor understorey and a small patch of Cumberland Plain Woodland. Approximately 4 ha of wetland vegetation and dams will also be removed. This is not considered to be a significant area of habitat on a regional scale for these highly mobile species.

Removal of the small area of potential foraging habitat at the site would not isolate known areas of habitat for these species from currently interconnecting or proximate areas of habitat. These species are highly mobile, capable of flying over cleared areas. The proposed development will have a positive impact on habitat connectivity in the area due to the requirement to revegetate riparian zones.

Potential foraging habitat to be removed from the subject land is not considered to be very important to the long-term survival of these species and will be compensated for by replanting and revegetation within riparian zones and in the flood zone. Revegetation of Swamp Oak Forest and Cumberland Plain Woodland will result in a net increase in the potential habitat for these species of approximately 10 ha in total. Additionally, wetland vegetation will be provided outside the riparian zone but within the flood zone around detention basins.

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

No critical habitat for these species has been identified.

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

No threat abatement plan is relevant to these bat species. No recovery plans have been prepared, however the DECC recommends a number of priority actions to assist in recovery, which are consistent for these 4 bat species.

The priority actions for these species include retention of large hollow bearing trees, including dead trees and paddock trees, and maintaining a diversity of age groups, species diversity, and structural diversity in vegetation.

The proposed clearance of vegetation is consistent with these priority actions since the subject land contains mostly very young trees with no hollows. Furthermore, a large area of Swamp Oak Forest will be retained, revegetated and managed. This will provide improved foraging and roosting opportunities for these bat species.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Vegetation clearance that results in habitat loss is a listed key threatening process under the TSC Act (NSW Scientific Committee 2004a). The proposed development will involve the clearing of approximately 4 ha of vegetation. However, this will be offset by replanting a minimum of 10 ha in total of Cumberland Plain Woodland and Swamp Oak Forest and additional wetland vegetation. Additionally, about 20 ha of existing Swamp Oak Forest will be regenerated and managed for weeds. The proposal will result in a net increase in woodland on the Oakdale Site and therefore, does not constitute a key threatening process.

Invasion, establishment and spread of Lantana (*Lantana camara*) is also listed as a key threatening process under the TSC Act (NSW Scientific Committee 2005). Lantana was not found to occur on the subject land.

Conclusion

The proposal is not likely to have a significant impact on the viability of local populations of these species as:

- It is not likely that cave-dwelling species roost on the subject land. The species that roost in tree hollows are considered unlikely to be roosting in the vegetation to be removed due to its age. The proposal is not likely to affect the life cycle of these species; and

- A large proportion of the potential foraging habitat for the species will be retained on the subject land and additional foraging habitat will be provided through revegetation in riparian areas and replanting of Cumberland Plain Woodland in the flood zone.

D.1.2 Endangered Ecological Communities

The following endangered ecological communities occur on the subject land and have been assessed below:

- Cumberland Plain Woodland; and

- Swamp Oak Forest on the Floodplains of the North Coast, Sydney Basin and South East Corner Bioregions.

Cumberland Plain Woodland (CPW), listed as an endangered ecological community under the EPBC Act and the TSC Act, occurs in 2 forms; Shale Hills Woodland and Shale Plains Woodland. Shale Hills Woodland occurs in the south of the Cumberland Plain in more elevated areas. Shale Plains Woodland (SPW) is more widely distributed, occurring throughout the drier areas of the Cumberland Plain (NSW NPWS 2001a). Dominant canopy species include Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*E. tereticornis*), Narrow-leaved Ironbark (*E. creba*), Spotted Gum (*Corymbia maculata*) and Thin-leaved Stringybark (*E. eugenoides*). The shrub layer is dominated by Blackthorn (*Bursaria spinosa*). Grasses dominate the ground layer (NSW NPWS 2001a). The community is well adapted to fire and drought but is now under threat from disturbance triggering weed invasion, increasing soil nutrients, rubbish dumping and altered fire regimes (NSW NPWS 2001a).

Swamp Oak Forest on the Floodplains of the North Coast, Sydney Basin and South East Corner Bioregions (Swamp Oak Forest), listed as an endangered ecological community under the TSC Act, occurs where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains (DEC (NSW) 2005n). The dominant canopy species is *Casuarina glauca* (Swamp Oak) and the understorey is characterised by frequent occurrences of vines, *Parsonsia straminea, Geitonoplesium cymosum* and *Stephania japonica* var. *discolor*, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter (DEC (NSW) 2005n). The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees (DEC (NSW) 2005n). This community is under threat from a number of activities, including grazing and trampling by stock and feral animals.

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

Not applicable

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

Not applicable.

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

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Cumberland Plain Woodland occurs as small remnant patches on the subject site. The patch on the north western boundary of the subject land (approximately 2 ha) will be retained. Two patches (on the southern boundary) will be removed, amounting to a total of approximately 0.5 ha of this community to be cleared. Areas of the floodplain zone (amounting to approximately 1.7 ha) will be revegetated with Cumberland Plain Woodland species as part of the proposal. This will result in a net increase of approximately 1 ha of Cumberland Plain Woodland on the subject land. The proposed activity is therefore unlikely to adversely affect the extent of the ecological community and place it at risk of extinction. The proposed development will not affect the composition of the Cumberland Plain Woodland on site.

A patch of Swamp Oak Forest, approximately 2.5 ha in area, will be removed as part of the proposal. This patch occurs near the western boundary of the subject land and its condition is poor with 50% of the ground cover being comprised of exotic species and the small tree and shrub strata being absent. As part of the proposal, riparian corridors will be protected through revegetation and rehabilitation works, and active management of weeds within the CRZ and buffer zones. Approximately 19.5 ha of the existing Swamp Oak Forest will be retained on the subject land and an additional 18 ha will be replanted within riparian corridors. This will result in a net increase of 15 ha of this endangered ecological community on the subject land. The proposed activity is therefore unlikely to adversely affect the extent of the ecological community and place it at risk of extinction. The proposed development will not have adverse effects on the composition of the Swamp Oak Forest on the subject land but will result in improved condition of this community through weed management and revegetation works.

d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Approximately 0.5 ha of the remnant Cumberland Plain Woodland patches on site will be removed as part of the proposal. This loss will be offset by the proposed planting of 1.7 ha of this community within the flood zone on the subject land. The result will be an increase in the extent of this community on the subject land. The areas to be removed are connected to other, more extensive remnants of Cumberland Plain Woodland outside the boundary of the subject land. However, the patches of this community to be removed on the subject land form the northern tips of these more extensive areas and their removal will not result in fragmentation and isolation of the larger patches off-site. The proposed development will not result in the loss or modification of a significant area of Cumberland Plain Woodland and will in fact result in a net increase in the occurrence of this community on the subject land. Thus the proposed development will not affect the long-term survival of this ecological community in the locality.

Approximately 2.5 ha of Swamp Oak Forest will be removed as part of the proposal. This patch of Swamp Oak Forest is considered to be in poor condition. The removal of this vegetation will be offset by revegetation, regeneration and weed management of existing Swamp Oak Forest in the riparian zone of Ropes Creek (approximately 20 ha in total) which is currently in a very disturbed state due to the presence of cattle. Additional offsets will be provided through the replanting of Swamp Oak Forest in riparian corridors that are not currently vegetated. A total of 18 ha will be replanted resulting in a net increase of 15 ha of Swamp Oak Forest on the subject land. Revegetation will occur along the riparian corridors of Ropes Creek and its tributaries. This will result in improved habitat connectivity in the general area. HLA-Envirosciences (2007) indicate the boundaries of a proposed biodiversity corridor in the Erskine Park Employment Area directly north of the subject land. This proposed corridor includes a large portion of Ropes Creek. Maintenance and enhancement of the riparian zone of Ropes Creek on the Oakdale Site would significantly extend the functions and values of this corridor further south.

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

No critical habitat for this species has been identified.

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

No recovery plan has been prepared for Cumberland Plain Woodland ecological community, although a recovery plan for the endangered communities of the Cumberland Plain is currently being prepared by the DECC (NSW).

16 priority actions have been identified for Cumberland Plain Woodland and 11 priority actions have been identified for Swamp Oak Forest. Recovery strategies for these communities include protecting habitat by controlling run-off entering the site (if it would change water nutrient or sediment levels), minimising grazing, weed control, and restoration or revegetation.

The proposal is not inconsistent with these strategies as it involves revegetation of both communities that will result in a net increase in the area of the communities on the subject land, weed management, and the removal of cattle.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Vegetation clearance that results in habitat loss is a listed key threatening process under the TSC Act (NSW Scientific Committee 2004a). The proposed development will involve the clearing of approximately 4 ha of vegetation. However, this will be offset by replanting 19.5 ha in total of Cumberland Plain Woodland and Swamp Oak Forest and additional wetland vegetation. Additionally, about 20 ha of existing Swamp Oak Forest will be regenerated and managed for weeds. The proposal will result in a net increase in woodland on the Oakdale Site and therefore, does not constitute a key threatening process.

Conclusion

The proposal is not likely to adversely affect the extent or composition of these endangered ecological communities. In fact, the proposal will result in an increase in the extent of these communities on the subject land and in improvement of their condition. Furthermore, maintenance and enhancement of the riparian zone of Ropes Creek on the Oakdale Site would significantly extend the functions and values of this area as a biodiversity corridor.