APPENDIX 5

Ecological Assessment

Austar Coal Mine Pty Ltd

Austar Ecological Assessment, Stage 3 Mine Area (Longwalls 6 to 17) and Surface Infrastructure Site

September 2008

Umwelt
Environmental Consultants

Austar Ecological Assessment, Stage 3 Mine Area (Longwalls 6 to 17) and Surface Infrastructure Site

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Austar Coal Mine Pty Ltd

Project Director:	Peter Jamieson		
Project Manager:	Catherine Pepper		
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Umwelt
Environmental Consultants

2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

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1.0 Ecological Assessment

Austar Coal Mine (Austar) is an aggregate of the former Ellalong, Pelton, Cessnock No.1 (Kalingo) and Bellbird South Collieries. The current proposed development involves two components, the first being the extension of longwall mining operations to include an additional 12 longwall panels. The second component is the development of associated surface infrastructure. Both components are located in Quorrobolong, approximately 15 kilometres south of Cessnock (**Figure 1.1**). The proposed longwall panels (LW 6 to LW 17) are herein collectively referred to as the Stage 3 Mine Area. They are located in Quorrobolong, to the north of Sandy Creek Road and largely to the east of Quorrobolong Road, with the exception of LW 6 which is west of Quorrobolong Road. The Surface Infrastructure Site comprises a parcel of land owned by Austar and will require access through a small area of the surrounding Werakata State Conservation Area.

A detailed ecological survey and assessment has been undertaken by Umwelt (Australia) Pty Limited (Umwelt) to identify the impacts of the proposed developments described above on any ecological values and to integrate into the proposals measures to avoid or minimise these impacts.

1.1 Definitions

For the purposes of this ecological assessment, the following definitions are used for the different components of the assessment area.

Surface Infrastructure Site: comprises Austar owned land and access route across a small section of Werakata State Conservation Area.

Stage 3 Mine Area: comprises the land above longwall panels LW 6 to LW 17, within the 20 mm subsidence contour line.

Study Area: collectively refers to both the Surface Infrastructure Site and the Stage 3 Mine Area.

Similarly, when referring to the developments, the following definitions are used:

Proposed Stage 3 Mining Development: refers to the underground mining of LW 6 to LW 17.

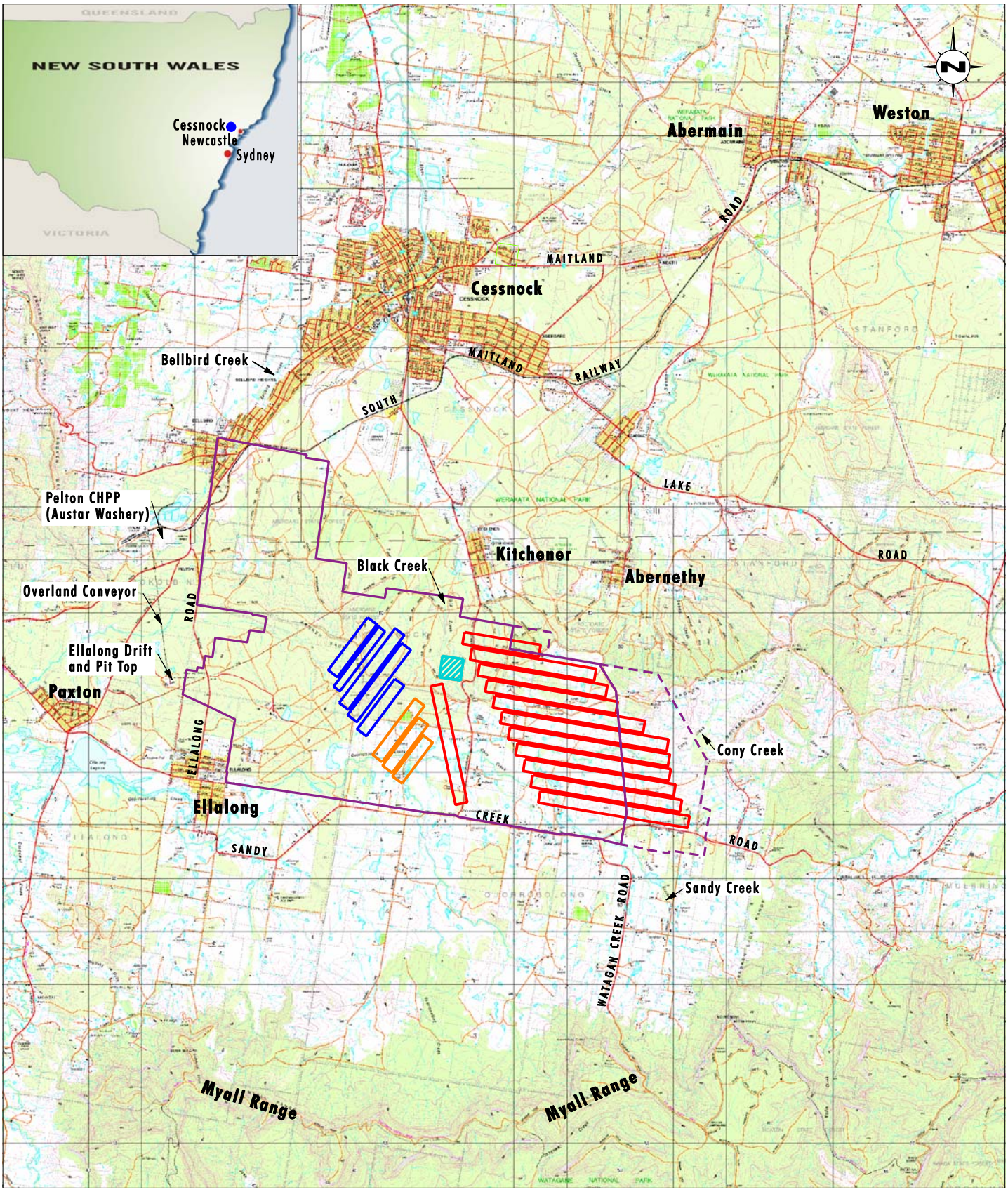
Proposed Surface Infrastructure Development: relates to the construction and operation of the surface infrastructure in accordance with the conceptual layout shown on **Figure 1.2**.

Proposed Developments: collectively refers to the Proposed Stage 3 Mining Development and the Proposed Surface Infrastructure Development.

1.2 Objectives

The objectives of the ecological assessment were to:

- record the flora and fauna species diversity, vegetation communities and fauna habitats occurring within the Study Area;



Source: Topo Maps: LPI NSW, Longwall Layout: Austar Coal Mine

0 1.0 2.0 4km
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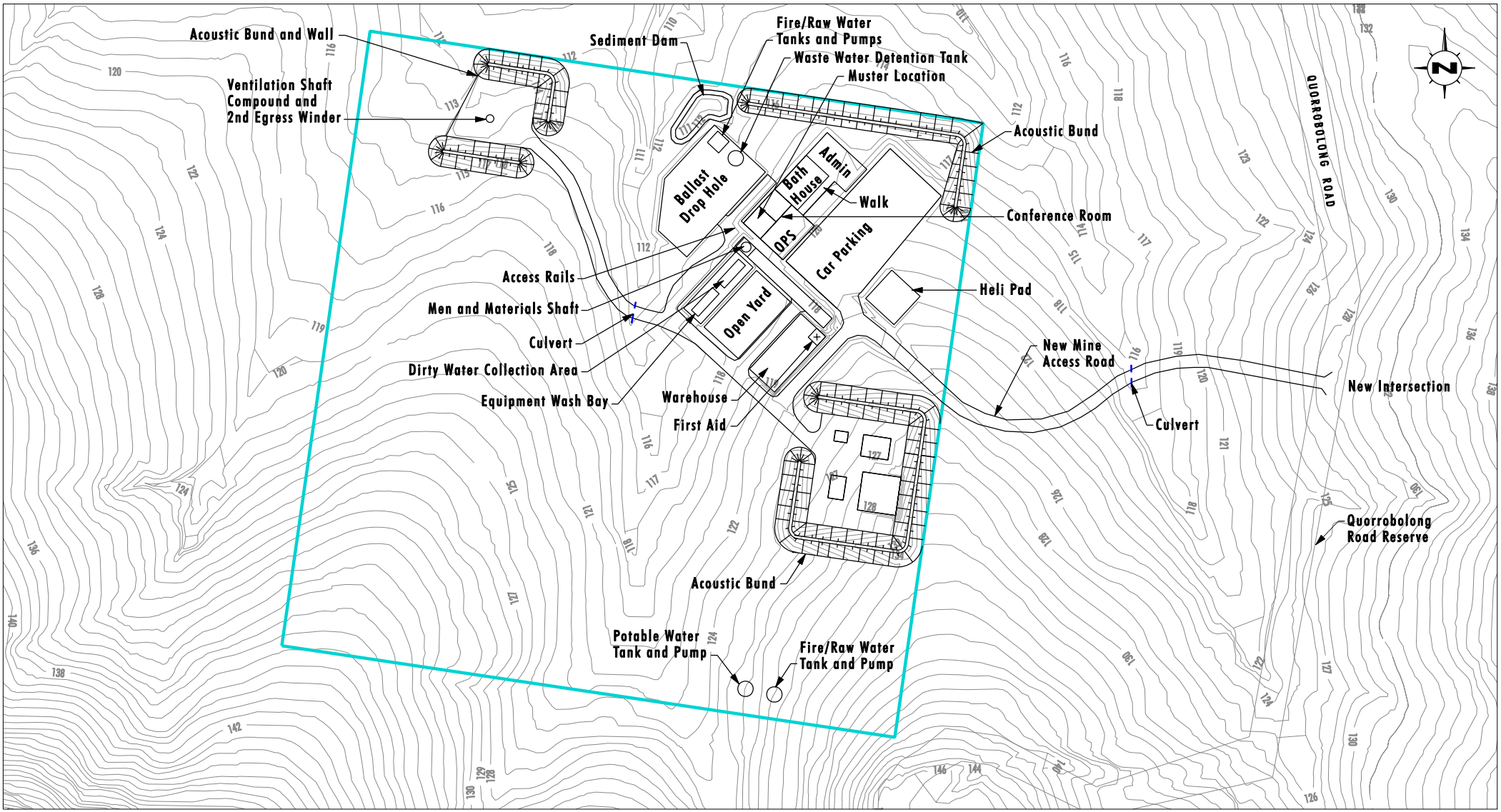
Legend

- Layout for Stage 1 Longwall Panels
- Layout for Stage 2 Longwall Panels
- Conceptual Layout for Stage 3 Longwall Panels
- Surface Infrastructure Site
- Consolidated Mining Lease (CML) 2
- Proposed Stage 3 Extension Boundary

FIGURE 1.1

Locality Plan



Legend

Surface Infrastructure Site

FIGURE 1.2

Conceptual Layout for Proposed Surface Infrastructure Site

Note: Contour Interval 1m

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- identify any threatened species, endangered populations or threatened ecological communities (TECs) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act), the NSW *Fisheries Management Act 1994* (FM Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), that occur or have the potential to occur within the Study Area;

- assess the potential impacts of the proposed development on threatened species, populations and TECs in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the EPBC Act;

- address the requirements of State Environmental Planning Policy (SEPP) 44 - Koala Habitat; and

- develop impact mitigation measures (where necessary) to avoid or reduce any potential significant impacts of the proposed development on the ecological values of the Study Area.

1.3 Environmental Setting

The Study Area is situated in Quorrobolong, 6 to 8 kilometres south of Cessnock in the lower Hunter Valley, NSW. The Study Area lies within the Sydney Basin Bioregion, and the North Coast Botanical Subdivision.

A large proportion of the Study Area comprises cleared agricultural land, however the northern areas contain natural forests which are part of Werakata State Conservation Area (previously Aberdare State Forest). Werakata State Conservation Area was gazetted in mid-2007 and encompasses 2257 hectares of land. The predominantly cleared private lands occupy the lower floodplains, flats and foothills, while the vegetated northern portions are hilly and undulating. The far north-eastern portions of the Study Area encompass a small part of the Broken Back Range.

The Surface Infrastructure Site is located in the upper reaches of Black Creek, a small ephemeral creek which flows north towards Kitchener. The main tributary of the Stage 3 Mine Area is Cony Creek, which traverses the central portion. Sandy Creek flows south from Cony Creek, along the southern boundary of the Stage 3 Mine Area. The Study Area includes a number of ephemeral drainage lines, the majority of which are not well defined and have a very low flow rate. There are some areas of steep bank erosion in the Stage 3 Mine Area, in particular in the northern parts, despite there being a reasonable cover of riparian vegetation.

There are two main soil landscapes within the Study Area, being the Quarrabolong soil landscape and the Aberdare soil landscape (Kovak and Lawrie 1991). The Quarrabolong soil landscape is an alluvial soil, and predominantly occurs around the flats of Cony Creek and Sandy Creek. The Aberdare soil landscape is a yellow podzolic and predominantly occurs on the slopes and ridges.

2.0 Methods

The project included a detailed desktop review of all available literature as well as a comprehensive field program which was spread across multiple seasons. The methods employed for each component of the project are described in the following sections.

2.1 Literature Review

A review of all relevant and available literature was undertaken in order to gain a greater understanding of the ecological values of the Study Area and its locality. Documents reviewed included previous ecological studies relating to sites within proximity to the Study Area, regional vegetation mapping, relevant papers in scientific journals and threatened species information resources such as the Department of Environment and Climate Change (DECC) internet resources. A full list of references cited within this report is provided in **Section 11**.

The literature review also included a search of relevant ecological databases to identify threatened species, endangered populations and endangered ecological communities (EECs) that have been previously recorded or may potentially occur in, or within proximity to, the Study Area.

A summary of the ecological findings of the key literature is provided in the following sections.

2.1.1 Flora and Fauna Survey for the Proposed Ellalong Colliery Extension (HLA 1995)

HLA undertook a flora and fauna survey and assessment for the proposed extension of Ellalong underground colliery, which is situated 10 kilometres to the south-west of Cessnock. The proposal was for underground longwall mining and associated surface infrastructure.

Survey methods included a series of 100 metre vegetation transects, one night of spotlighting and one night of amphibian searches in summer 1994, and one day of diurnal fauna searches including bird and reptile surveys and recognition of secondary traces such as tracks, scats and diggings. All surveys were undertaken in summer 1994.

The vegetation and habitats of the study area for the assessment was reported to be highly modified as a result of past land use practices such as forestry, agriculture and also a recent fire.

Six vegetation types were delineated within the study area, being open forest, woodland, remnant open forest, disturbed open forest, remnant creekline vegetation/wetland and cleared.

A total of 70 flora species and 32 fauna species were recorded, none of which are presently listed as threatened under the TSC Act or the EPBC Act. One rare or threatened Australian plant (ROTAP) was recorded, being *Grevillea montana*, of which only one individual was recorded. This species was regarded likely to have been more widespread prior to the recent fire, from which the vegetation had not yet regenerated at the time of surveys.

2.1.2 Longwall Panels A1 and A2 Flora and Fauna Assessment, Austar Coal Mine (ERM 2006)

ERM undertook an ecological survey and assessment for the proposed mining of Longwalls A1 and A2 and associated infrastructure, on behalf of Austar Coal Mine (ERM 2006). The ecological survey comprised random meander and vehicle based vegetation transects, habitat assessment and opportunistic fauna observations (including observations for secondary traces of fauna such as scats, tracks, scratches and diggings). It is not stated what season the surveys were conducted in.

Three vegetation communities were recorded within the survey area, including the Lower Hunter Spotted Gum – Ironbark Forest and the Hunter Lowland Red Gum Forest, both TSC Act listed EECs. The third community was described as mostly cleared.

No threatened flora or fauna species were recorded within the survey area during the study, however several species were described as having potential to occur. Two ROTAP species were recorded, being *Grevillea montana* and *Macrozamia flexuosa*.

A Seven Part Test of Significance in accordance with the requirements of the EP&A Act was undertaken for the two EECs recorded, and all threatened flora and fauna species found to have potential to occur within the Study Area. This assessment concluded that the proposed Longwall mining development and clearing for associated surface infrastructure would not have a significant impact on any threatened species, populations or EECs.

2.1.3 Vegetation of Werakata National Park, Hunter Valley, NSW (Bell 2004) Cunninghamia 8(3)

A flora survey and vegetation mapping of Werakata National Park (near Cessnock, NSW) was undertaken by Bell (2004) on behalf of the National Parks and Wildlife Service (NPWS, now DECC). The key purpose of the study was to understand the vegetation from a fire management perspective.

Werakata National Park lies within the largest patch of vegetation of the Hunter Valley floor and protects a number of vegetation communities considered to be poorly conserved within the region, as well as populations of a number of threatened flora species.

Six vegetation communities were delineated within the Park, which included Lower Hunter Spotted Gum – Ironbark Forest, Central Hunter Riparian Forest, Hunter Lowlands Red Gum Forest, Kurri Sand Swamp Woodland, Kurri Sand Melaleuca Scrub Forest and Riparian Melaleuca Thicket. Each of these communities correspond with a TSC Act listed EEC, aside from Kurri Sand Melaleuca Scrub Forest and Riparian Melaleuca Thicket.

A total of 190 flora species were recorded within the Park; threatened species recorded were *Callistemon linearifolius, Grevillea parviflora* subsp. *parviflora, Eucalyptus glaucina* and *Eucalyptus parramattensis* subsp. *decadens.* Two ROTAP species were also recorded, being *Grevillea montana* and *Macrozamia flexuosa*.

Callistemon linearifolius was found in two locations within Werakata National Park, which may represent the known northern limit of the species. *Grevillea parviflora* subsp. *parviflora* was found to be common in the southern portion of Werakata National Park near Kitchener. A small population of *Eucalyptus glaucina* was found in the north-west corner of the Bishops Hill portion of Werakata National Park, where it occurs in the Hunter Lowlands Red Gum Forest. In Werakata National Park, *Eucalyptus parramattensis* subsp. *decadens* was found to have a limited distribution, mainly in association with the Neath Soil landscape and the Kurri Sand Swamp Woodland.

2.1.4 Vertebrate Fauna of Werakata National Park (DEC 2005)

A study on the vertebrate fauna of the former Aberdare State Forest (now Werakata State Conservation Area and Werakata National Park) was undertaken to inform the conservation and management of ecological values contained within the Park. The study drew on the findings of a number of previous surveys in the locality, including Ecotone (1995), Hoye (1995), Webster (1995) and Wellington and Wells (1995). In addition to the literature review, a wide range of systematic site-based fauna survey methods were employed for the project. This included diurnal bird and herpetofauna searches, nocturnal spotlighting, harp trapping, Anabat echolocation recording, call playback, Elliott trapping, hair tube sampling, habitat assessment and opportunistic observations.

The compilation of all data from previous and current surveys found that a total of 210 species of vertebrate fauna were found to be present within Werakata National Park, including 18 which are now listed under the NSW TSC Act (four of which are also now listed under the Commonwealth EPBC Act). The following lists all the threatened fauna species that were recorded within Werakata National Park:

- Stephens banded snake (*Hoplocephalus bungaroides*);
- black bittern (*Ixobrychus flavicollis*);
- glossy black-cockatoo (*Calyptorhynchus lathami*);
- swift parrot (*Lathamus discolor*);
- turquoise parrot (*Neophema pulchella*);
- barking owl (*Ninox connivens*);
- powerful owl (*Ninox strenua*);
- masked owl (*Tyto novaehollandiae*);
- brown treecreeper (eastern subsp.) (*Climacteris picumnus victoriae*);
- specked warbler (*Pyrrholaemus sagittatus*);
- black-chinned honeyeater (eastern subsp.) (*Melothreptus gularis gularis*);
- regent honeyeater (*Xanthomyza phrygia*);
- hooded robin (*Melanodryas cucullata*);
- grey-crowned babbler (eastern subsp.) (*Pomatostomus temporalis temporalis*);
- koala (*Phascolarctos cinereus*);
- yellow-bellied glider (*Petaurus australis*);
- squirrel glider (*Petaurus norfolcensis*);
- grey-headed flying-fox (*Pteropus poliocephalus*);
- eastern freetail-bat (*Mormopterus norfolcensis*);
- eastern false pipistrelle (*Falsistrellus tasmaniensis*);

- little bentwing-bat (*Miniopterus australis*); and
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*).

Ten introduced fauna species have been recorded in Werakata National Park, the most common being wild/domestic dog (*Canis lupus familiaris*) and European red fox (*Vulpes vulpes*).

The report identifies two areas of high conservation significance, the Tomalpin Arboreal Zone and the known Swift Parrot Locations. In the Tomalpin Arboreal Zone, the highest density of hollow-bearing trees was recorded. Hollow-bearing trees are an important habitat component for a number of threatened fauna species recorded in the park including the squirrel glider, yellow-bellied glider, masked owl, powerful owl and micro-bat species. There were a number of locations at which the swift parrots have been recorded, in which important foraging resources were present such as spotted gum (*Corymbia maculata*) blossom, nectar and grey box (*Eucalyptus moluccana*) lerp.

Several recovery plan actions were outlined in the document, primarily focusing on the protection of the swift parrot (*Lathamus discolor*), regent honeyeater (*Xanthomyza phrygia*), large forest owls, barking owl (*Ninox connivens*), koala (*Phascolarctos cinereus*) and the yellow-bellied glider (*Petaurus australis*). A number of general recovery actions were outlined, including fire and pest species management and other habitat management practices.

2.1.5 Vegetation of the Cessnock-Kurri Kurri Region, Cessnock LGA, New South Wales: Survey, Classification & Mapping (Bell and Driscoll 2008)

A vegetation survey, classification and mapping project was undertaken for the Cessnock-Kurri region (Bell and Driscoll 2008) on behalf of the Department of Environment and Climate Change (DECC). The area covered by the project included 70,000 hectares of land between the foothills of the Watagan Range in the south, the Corrabare and Broken Back Ranges in the west, North Rothbury in the north and the Wallis Creek floodplain in the east. The principal driver for the project was to clarify the composition and distribution of EECs within the project area, while also providing vegetation community maps and descriptions of extant and pre-1750 vegetation. The conservation significance of each vegetation community described was determined, assisted by comparisons with other proximate regional vegetation classification projects. Recommendations for which communities might meet the criteria for nomination as EECs under the TSC Act were also made.

Extensive surveys within the project area were undertaken, including 93 systematic 0.4 hectare vegetation plots and 17,000 rapid data point assessments. Data from a further 307 plots undertaken within the project area for previous surveys was also used in the analysis. Statistical analysis of the floristic plot data was undertaken using the PATN V3.10 clustering program (Belbin 1995a; 1995b). A number of datasets were analysed to gain a scientific understanding of the relationships of vegetation communities present in the project area to listed EECs and other regionally significant communities. Further analysis of the hierarchy produced through the PATN analysis was undertaken with a Bedward et al. (1992) homogeneity analysis.

Within the project area covered by Bell and Driscoll (2008) close to 800 native plant taxa and 37 vegetation communities were recorded, including 10 threatened flora species and three undiscovered or previously undescribed flora taxa. Seven EECs were found to be present within the Study Area. Between one and six vegetation community variants were described for each of these EECs. This project has delivered extensive data which will be useful for future studies within the project area when going through the process of determining the presence or absence of these EECs.

2.1.6 Ecological Database Searches

In order to identify threatened flora and fauna species which have potential to occur within the Study Area a search of relevant ecological databases was undertaken. These database searches involved:

- a search of the DECC Atlas of NSW Wildlife (August 2007 and May 2008) for threatened flora and fauna species recorded within a 10 kilometre radius of the Study Area; and
- a search of the Department of Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Database (August 2007 and May 2008) for threatened flora and fauna species with potential to occur (based on DEWHA habitat modelling) within a 10 kilometre radius of the Study Area.

The results of these database searches were used to identify threatened species, endangered populations or TECs which may occur within the Study Area, and to gain an understanding of the extent of the distribution of known records of species within the locality.

2.2 Flora Methods

The following sections document the methods employed for the flora components of the project, which includes the flora field surveys and desktop vegetation mapping. Flora field surveys within the Study Area were undertaken over numerous days between November 2006 and December 2007. **Table 2.1** provides a summary of the dates on which flora surveys were undertaken.

Table 2.1 – Flora Survey Dates

Surface Infrastructure Site	Stage 3 Mine Area
8 and 9 Nov 2006	24 and 25 July 2007
17 Nov 2006	27 July 2007
24 and 25 July 2007	31 July 2007
3 August 2007	3 August 2007
29 August 2007	29 August 2007
6 and 7 September 2007	6 and 7 September 2007
26 and 27 September 2007	26 and 27 September 2007
–	18 December 2007

During field surveys of the Stage 3 Mine Area, particular emphasis was placed on investigating riparian areas, as this is where the potential ecological impacts from subsidence were predicted to be concentrated. Notwithstanding this, all habitat areas were surveyed and assessed. Within the Surface Infrastructure Site, all areas were covered by the surveys.

The flora field surveys incorporated both semi-quantitative plot-based methods, as well as non-quantitative methods such as walking transects. Flora surveys were undertaken in accordance with the Department of Environment and Conservation (DEC) Draft Threatened Species Survey and Assessment Guidelines (DEC 2004) where appropriate.

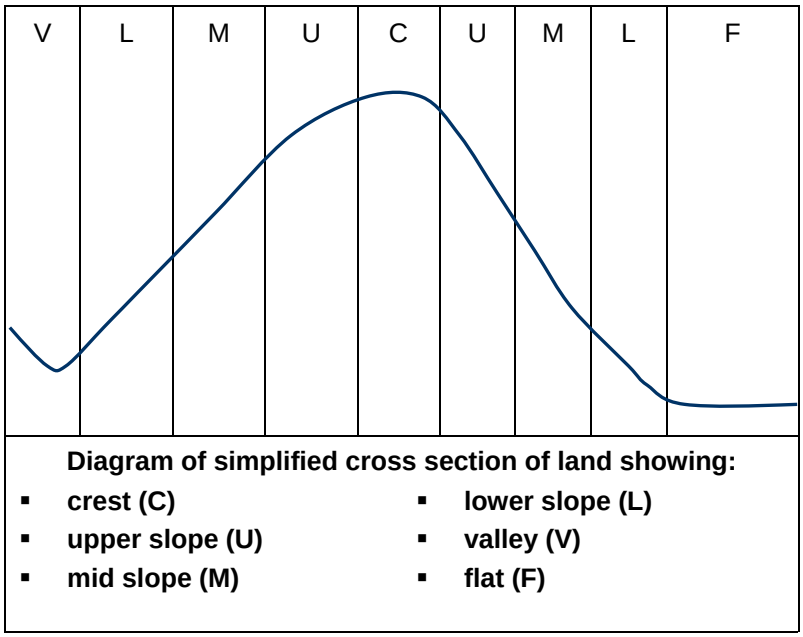
The aims of the flora field surveys were to:

- record the flora species diversity present within the Study Area;

- collect data for the identification, description and mapping of the vegetation communities present within the Study Area;
- describe the general health and condition of the vegetation of the Study Area;
- determine if any threatened flora species, endangered populations or EECs are present or have potential to occur within the Study Area; and to
- gather sufficient information to enable an accurate assessment of the impacts of the proposed development on the ecological values of the Study Area.

2.2.1 Systematic Plot-based Survey

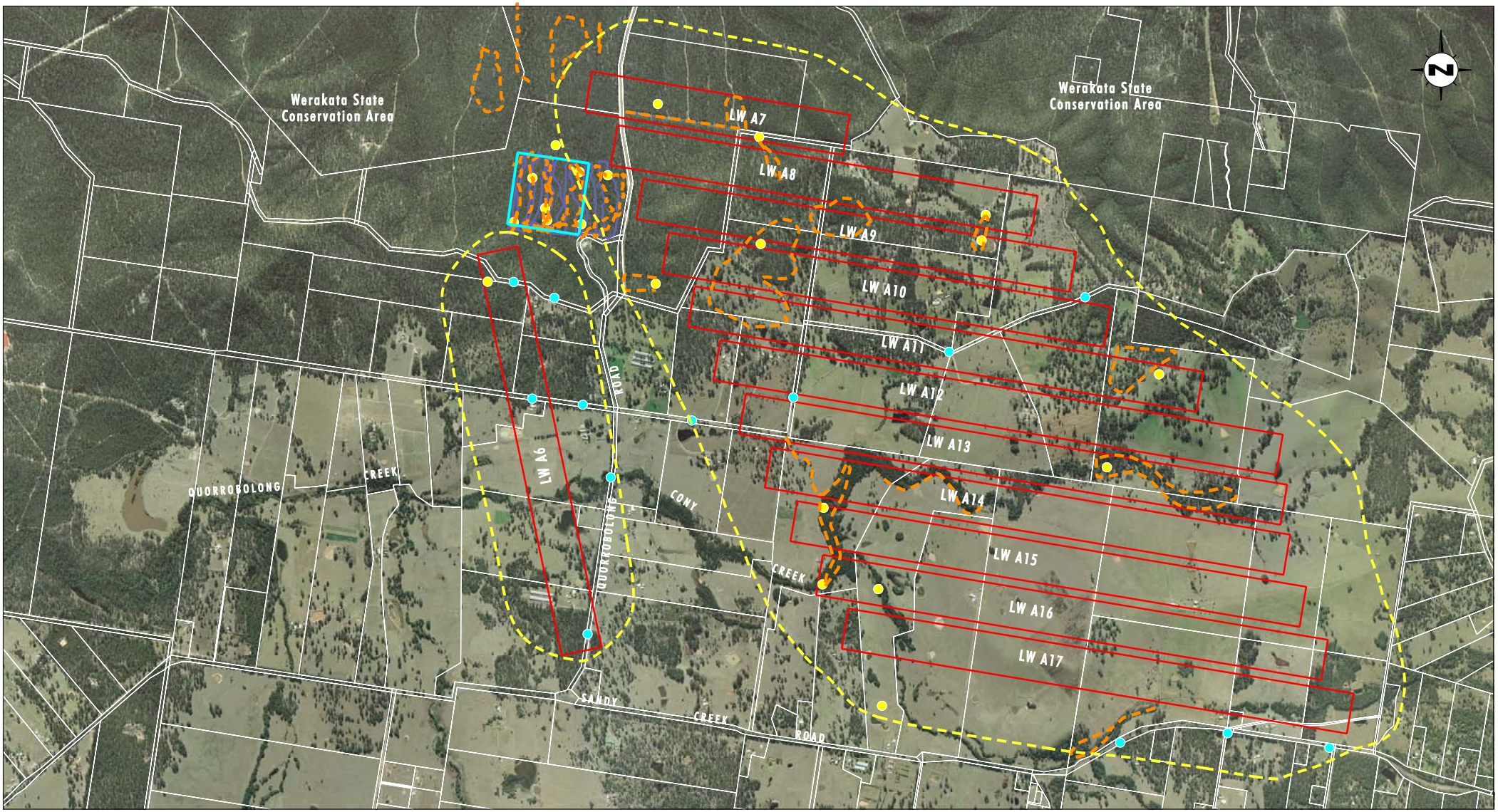
Throughout the Study Area a total of 21 systematic vegetation plots were sampled, of which 8 were in the Surface Infrastructure Site and 13 were in the Proposed Stage 3 Mining Area (**Figure 2.1**). The plots were positioned at sites that were selected by considering a range of attributes that influence or determine the type of vegetation communities present, in particular topographic position (**Schematic 2.1**), slope, aspect and soil type. The selection of plot locations also aimed to achieve effective coverage of the Study Area, in particular areas in which the vegetation was thought to have potential to support EECs or any other vegetation type.



Schematic 2.1 – Illustration of topographic positions sampled

Each flora plot had dimensions of 20 metres by 20 metres (400 m^2), which is a standard size used widely for systematic flora surveys throughout NSW and is recognised by the DECC and the Royal Botanic Gardens Sydney. Within each plot, two ecologists spent approximately 45 minutes to 1 hour searching for species, walking along-side each other in parallel lines throughout the extent of the plot.

All species encountered within the plot were recorded, and a modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with modifications by Poore 1955 and Austin et al. 2000) was used to estimate the cover-abundances of each species (**Table 2.2**).



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

0 0.5 1 1.35km
1:30 000

Legend

- Conceptual Layout for Stage 3 longwall Panels
- 20mm Subsidence Contour
- Surface Infrastructure Site
- Targeted Threatened Flora Searches
- Vegetation Transect
- Quadrat Locations
- Roadside Vegetation Assessment Point

FIGURE 2.1

Flora Survey Locations

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Table 2.2 - Modified Braun-Blanquet Crown Cover-abundance Scale

Class	Cover-abundance*	Notes
1	Few individuals (less than 5% cover)	Forbs, sedges and grasses: < 5 individuals Shrubs and small trees: < 5 individuals
2	Many individuals (less than 5% cover)	Forbs, sedges and grasses: 5 or more individuals Shrubs and small trees: 5 or more individuals Medium-large overhanging tree
3	5 – less than 20% cover	N/A
4	20 – less than 50% cover	N/A
5	50 – less than 75% cover	N/A
6	75 – 100% cover	N/A

Note: * Modified Braun-Blanquet scale (Braun-Blanquet 1927; Poore 1955; Austin et al. 2000).

Information on the structural characteristics of the vegetation in the plot was also recorded, including the height range and canopy cover of each stratum and the dominant species in each stratum. Information on the general health and condition of the vegetation within the plot was also recorded, including presence of weeds, disturbances such as fire and feral animals, and evidence of dieback or insect attack.

2.2.2 Targeted and Meander Transects

Two different types of transects were employed for the field surveys, the methods of which are described in the following sections.

2.2.2.1 Targeted Transects

Extensive targeted threatened species transects were undertaken within the Surface Infrastructure Site on 17 November 2007, the locations of which are shown on **Figure 2.1**. The aim of the targeted transects was to gain an understanding of the abundance and spatial distribution of threatened flora species within the Surface Infrastructure Site.

These transects specifically targeted the two threatened flora species recorded within the Surface Infrastructure Site: heath wrinklewort (*Rutidosis heterogama*) and white spider flower (*Grevillea parviflora* subsp. *parviflora*). The targeted transects traversed a large proportion of the Surface Infrastructure Area. Along the transects, all locations of threatened species were recorded, in addition to any relevant information such as the number of species present and the condition of the habitat.

2.2.2.2 Meander Transects

A total of twelve meander transects were traversed throughout the Study Area, the locations of which are shown on **Figure 2.1**. The objectives of these transects were to:

- search for threatened flora species and their habitats;
- assist in the delineation of vegetation communities;
- enable greater coverage of the Study Area than would be achieved by plot-based sampling alone; and

- contribute to floristic knowledge of the Study Area.

The meander transects were variable in length and location, and were tailored to suit the environment in which they occurred. Their locations were selected to achieve broad coverage of the full range of environments across the Study Area.

2.2.2.3 Roadside Assessment Points

A number of remnants of vegetation were not able to be surveyed due to restricted access to private landholdings. As such, a series of roadside assessment points were surveyed to identify broadly the vegetation communities that may be present in the inaccessible areas. The general locations of the roadside assessment points are shown on **Figure 2.1**.

At each roadside assessment point, the dominant species in each stratum (where readily identifiable from a distance) were recorded along with notes on the structural characteristics such as height and cover of each stratum. Where possible a photograph of the vegetation was also taken.

2.2.3 Plant Identification and Taxonomic Review

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2008), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide common names. Where the identity of a specimen was unknown or uncertain, it was lodged with the National Herbarium of New South Wales at the Royal Botanic Gardens Sydney.

2.2.4 Vegetation Mapping

The vegetation communities of the Study Area were mapped through a combination of aerial photograph interpretation, comparison with regional vegetation mapping and ground-truthing through field surveys.

Preliminary mapping of the vegetation communities within the Study Area was prepared through aerial photograph and topographic map interpretation, review of regional vegetation mapping (House 2003; and Bell and Driscoll 2008.) and expert knowledge of the local area. The field investigations enabled ground-truthing of the preliminary vegetation community mapping.

Subsequent to field surveys, the preliminary vegetation map was revised to incorporate the results of field surveys. Stereographic pairs of aerial photographs of the area were then reviewed to more accurately define the vegetation community boundaries.

2.3 Fauna Survey Methods

The following sections document the methods employed for the fauna components of the project. Fauna surveys were generally undertaken in accordance with the DEC Draft Threatened Species Survey and Assessment Guidelines (DEC 2004).

During field surveys of the Stage 3 Mine Area, particular emphasis was placed on investigating riparian areas, as this is where the potential impacts from subsidence were predicted to be concentrated. Within the Surface Infrastructure Site, all areas were covered by the surveys.

The aims of the fauna field surveys were to:

- record the fauna species diversity present within the Study Area;
- identify and characterise the different habitat types present within the Study Area, and determine the likely fauna assemblage present (given that not all species can be identified);
- determine if any threatened fauna species or endangered populations are present or have potential to occur within the Study Area; and to
- accrue sufficient information to enable an accurate assessment of the impacts of the proposed development on the ecological values of the Study Area.

A total of seven fauna survey sites were the focus of fauna surveys within the Study Area, the locations of which are shown on **Figure 2.2**. Four of these sites were surveyed in winter and three sites were surveyed in spring.

2.3.1 Fauna Trapping Surveys

Fauna trapping was undertaken at each of the seven fauna survey sites described above, four of which were surveyed in winter and three in spring. Following is a summary of the trapping effort for each survey period.

2.3.1.1 Winter Fauna Trapping

In winter, four trap sites were established and set, each for four consecutive nights, with a standard trap site comprising:

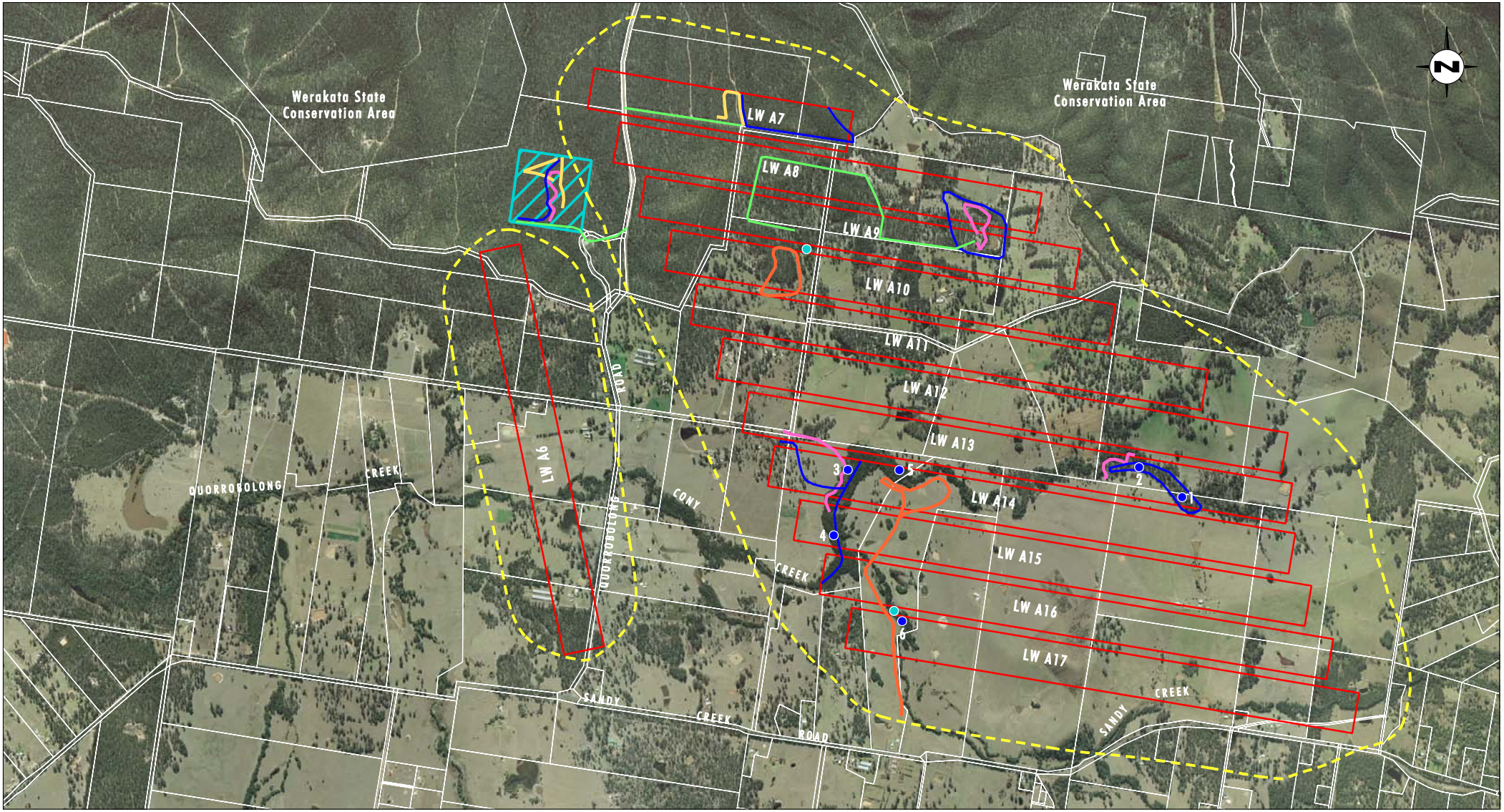
- 10 Elliot B arboreal traps;
- 10 arboreal hair funnels;
- 25 terrestrial hair funnels/tubes; and
- 1 Anabat echolocation recorder.

At two of the winter trap sites, arboreal Elliott B traps were not erected due to access difficulties and lack of appropriately sized canopy trees. The hair tubes were left in-situ for 14 days at each site. Terrestrial traps were not incorporated into the winter survey due to the risk of frost and therefore stress to any trapped animal.

2.3.1.2 Spring Fauna Trapping

In spring, three trap sites were established and set, each for four consecutive nights, with a standard trap site comprising:

- 20 terrestrial Elliott A traps;
- 20 terrestrial Elliott B traps;



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

0 0.5 1 1.35km
1:30 000

Legend

- Conceptual Layout for Stage 3 Longwall Panels
- 20mm Subsidence Contour
- Surface Infrastructure Site
- Winter Fauna Trapline
- Spring Fauna Trapline
- Driving Spotlight Route
- Walking Spotlight Route
- Additional Spotlighting Transect Location (December 2007)
- Additional Amphibian Search Location (December 2007)
- Aquatic Sampling Locations

FIGURE 2.2

Fauna Survey Locations

File Name (A4): R15_V1/2274_123.dgn

- 20 terrestrial hair tubes (10 meat bait, 10 peanut butter, honey and oats);
- 20 terrestrial hair funnels (10 meat bait, 10 peanut butter, honey and oats);
- 10 arboreal Elliott B traps;
- 10 arboreal hair tubes;
- 1 harp trap (at two of the three sites); and
- 4 wire cage traps (baited with chicken necks and a peanut butter, oat and honey mix).

Unless otherwise stated above, all traps were baited with a peanut butter, honey and oat mixture and were sprayed nearby (on the tree trunk in the case of arboreal traps) with a concentrated honey water solution.

2.3.2 Spotlighting Surveys

Spotlighting was conducted on foot using 30 watt Lightforce hand-held spotlights. Spotlighting was undertaken at the seven standard survey sites, as well as two additional sites which are shown on **Figure 2.2**. A total of four person hours of spotlighting over two nights was conducted at each of the seven survey sites, while a total of two person hours of spotlighting was undertaken across the two additional spotlighting sites. Spotlighting was undertaken generally between 6.00 pm and 11 pm. Approximately 3 kilometres of driving spotlight survey was undertaken from a slow-moving vehicle within the Stage 3 Mine Area.

2.3.3 Reptile and Amphibian Surveys

Two diurnal and two nocturnal herpetological surveys, each of one person hour, were conducted in likely habitat areas at each of the seven survey sites on two separate days. Two additional nocturnal amphibian and reptile searches were undertaken on the night of 18 December 2007, at the locations shown on **Figure 2.2**.

During each diurnal search, likely micro-habitats were examined, such as under rocks, logs, tree bark, ground litter and dams. The diurnal searches were typically conducted between 11.00 am and 3.00 pm. Nocturnal herpetological surveys, typically conducted between dusk and midnight, involved spotlight searches of dams, drainage lines and groundcover.

Opportunistic observations of reptile and amphibian species were also recorded during other aspects of the field survey.

2.3.4 Diurnal Bird Surveys

Two diurnal bird surveys, each of one person hour were undertaken at each of the seven survey sites on two different days. Each survey consisted of a slow walking transect. Species were identified from characteristic calls and by observation, using 10 x 50 binoculars.

Opportunistic observations of bird species were also recorded during all other aspects of the field surveys.

2.3.5 Call Playback Surveys

At each of the survey sites the recorded calls of the powerful owl (*Ninox strenua*), masked owl (*Tyto novaehollandiae*), barking owl (*Ninox connivens*), squirrel glider (*Petaurus*

norfolcensis), and koala (*Phascolarctos cinereus*) were played. Each call was played for a minimum of 4 minutes followed by a listening period of 2 minutes before the beginning of the next species call. Calls were broadcast using a 10 watt directional loud hailer. Mammal calls were played before bird calls to prevent the calls of predators (large owls) decreasing the likelihood of prey species (gliders) responding to call playback.

2.3.6 Habitat Assessment

Habitat assessments were undertaken at numerous locations throughout the Study Area. Locations for the habitat assessments were selected intuitively, choosing a range of sites which supported obviously different habitats. The assessment targeted the identification of potential habitat and resources for threatened fauna species. Observations of the following habitat features were made throughout the Study Area:

- tree size class (trunk diameter);
- hollow-bearing trees and stags;
- fallen timber/logs;
- ground cover of rock outcrops;
- presence and condition of wet areas and water bodies;
- type and density of shrub and groundcover; and
- presence of faunal refugia.

In addition to these general habitat features, searches for specific habitat requirements of threatened fauna species considered to potentially occur within the locality were also made, including the presence of winter-flowering eucalypt species, which are important foraging resources for migratory species such as the regent honeyeater (*Xanthomyza phrygia*) and the swift parrot (*Lathamus discolor*).

Habitat features such as tree hollows and fallen logs were observed for any evidence of fauna occupation such as scratches on the trunks of trees, chewed entrances to hollows, scratchings or diggings near logs and scats at the base of trees or near logs.

All habitat features observed were considered when assessing the likely presence or absence of any threatened fauna species within the Study Area. The known habitat requirements of each potentially occurring threatened species were compared with the habitat features recorded within the Study Area.

All fauna species observed opportunistically during field surveys were recorded.

2.3.7 Micro-bat Echolocation Recordings

Bat echolocation recordings were made using an ‘Anabat II Bat Detector‘ and an ‘Anabat CF Storage ZCAIM‘. Hereafter the detector and storage unit will collectively be referred to as the ‘Anabat detector’.

Three all-night micro-bat echolocation recordings were undertaken at each survey site (**Figure 2.2**). At each site the Anabat detector was placed upon a small platform which was attached to a tree trunk at a height of approximately 6 metres. Each detector was positioned within possible bat flyways. The Anabat detector was programmed to start recording 30 minutes before dusk and stop recording 30 minutes after dawn the following morning.

The Anabat detector was contained in a rain-proof housing and all-night recordings were made regardless of weather conditions.

Recorded bat calls were analysed by Ray Williams of Ecotone Ecological Consultants Pty Ltd. The echolocation calls of species were identified to one of three levels of confidence:

- definite;
- probable; and
- possible.

All three levels of identification confidence were treated as positive identifications for the purposes of this assessment.

2.3.8 Opportunistic Records

All fauna observed during other aspects of the field survey, such as travelling between survey sites or during the setting up of equipment, were also recorded.

2.3.9 Indirect Evidence of Faunal Presence

Indirect evidence of faunal presence was recorded for each site when detected. Such evidence included tracks, scats, hairs, scratches, burrows, bones, nests and dreys.

2.3.10 State Environmental Planning Policy 44 - Koala Habitat Assessment

An application for project approval which relates to a site occurring within an Local Government Area (LGA) specified under State Environmental Planning Policy 44 (SEPP 44) – Koala Habitat Protection, affecting an area of one hectare or greater, must be assessed under SEPP 44. Assessment under SEPP 44 is based on an initial determination of whether the land constitutes potential koala (*Phascolarctos cinereus*) habitat. This is determined by assessing whether the eucalypt species present in Schedule 2 of the policy constitute 15 per cent or more of the total number of trees in the upper or lower strata of the tree component. If potential koala habitat is present, the area must be further assessed to determine if the land is core koala habitat.

The species listed in Schedule 2 of the policy are:

Scientific Name	Common Name
Eucalyptus tereticornis	forest red gum
Eucalyptus microcorys	tallowwood
Eucalyptus punctata	grey gum
Eucalyptus viminalis	ribbon or manna gum
Eucalyptus camaldulensis	river red gum
Eucalyptus haemastoma	broad-leaved scribbly gum
Eucalyptus signata	scribbly gum
Eucalyptus albens	white box
Eucalyptus populnea	bimble box or poplar box
Eucalyptus robusta	swamp mahogany

A SEPP 44 assessment was undertaken within each flora quadrat sampled within both the Surface Infrastructure Site and the Stage 3 Mine Area. All SEPP 44 listed canopy species were recorded, along with an estimate of the percentage of the total trees that comprise SEPP 44 species within the 400 m^2 plot.

2.3.11 Summary of Fauna Survey Effort

Table 2.3 provides a summary of the total trapping effort across the seven fauna sites (and the two additional sites described in **Sections 2.3.2** and **2.3.3**). This includes Elliot A and B traps, cage traps, harp traps, hair tubes and hair funnels.

Table 2.3 - Total Trapping Effort (trap nights)

Trap Type		Total Trap Nights						
		Elliot A (ground)	Elliot B (ground)	Elliot B (arboreal)	Hair Funnel (ground)	Hair Funnel (arboreal)	Harp Trap	Cage Trap
Surface Infrastructure Site	Winter	0	0	40	350	140	0	0
	Spring	160	160	80	1120	280	4	32
Stage 3 Mine Area	Winter	0	0	90	1050	420	0	0
	Spring	80	80	40	560	140	4	16
Total Effort		**240**	**240**	**250**	**3080**	**980**	**8**	**48**

Table 2.4 provides a summary of the effort for area searches across the Study Area.

Table 2.4 – Total Area Search Effort

		Total Person Hours				
		Spotlight (Walk)	**Spotlight (Drive)**	**Amphibian & reptile (day)**	**Amphibian & reptile (night)**	**Diurnal Bird**
Surface Infrastructure Site	Winter	2	0	2	2	2
	Spring	4	0	1	4	4
Stage 3 Mine Area	Winter	6	4	6	4	6
	Spring	10	4	6	2	6
Total		**22**	**8**	**15**	**12**	**18**

2.4 Aquatic Survey and Assessment

An assessment of the aquatic habitats within the Study Area consisted of both field surveys and desktop review of previous studies and relevant legislation. The aquatic field surveys were undertaken on 26 September 2007 and 18 December 2007. Six sites within the Stage 3 Mine area were sampled. No aquatic sampling was completed within the Surface Infrastructure Site, due to the absence anywhere of an appropriate depth of standing water to enable sampling.

The aquatic ecology survey and assessment was undertaken in accordance with the legislative requirements of the FM Act, the TSC Act, EPBC Act, the EP&A Act and relevant policies and guidelines including:

- NSW DPI Fisheries Policy and Guidelines – Aquatic Habitat Management and Fish Conservation Guidelines (NSW DPI 1999);
- Guidelines for Aquatic Ecology in EIA (Department of Infrastructure Planning and Natural Resources 1999);
- the NSW Australian Rivers Assessment System (AUSRIVAS) Sampling and Processing Manual (Turak et al. 2004); and
- the ANZECC Water Quality Guidelines for Fresh and Marine Waters (ANZECC 2000).

2.4.1 Objectives

The objectives of the aquatic assessment were to:

- identify the aquatic biodiversity of the Study Area;
- determine if any FM Act or EPBC Act listed aquatic species or EECs occur within the Study Area;
- identify the direct and indirect impacts of the proposed development on aquatic biodiversity; and
- where appropriate, recommend amelioration measures to minimise the disturbance to aquatic biodiversity resulting from the proposed development.

2.4.2 Aquatic Field Survey Methods

The aquatic field survey comprised sampling at six sites (**Figure 2.2**) within the Stage 3 Mine Area, five of which were situated along Cony Creek and two along Sandy Creek. The sites at which aquatic sampling could be undertaken were limited to those areas with sufficient water to enable sampling, and were also restricted by availability of access to private properties. The field survey comprised both macro-invertebrate sampling at each of these six sites and an in-stream and riparian habitat assessment at six sites. More detail on these components is provided below.

Literature Review

A review of relevant and available literature was undertaken in order to obtain information on the aquatic ecology of the Study Area. Environmental assessment reports relevant to the study area and the proposed development were reviewed. Department of Primary Industries (NSW Fisheries) guidelines and relevant published journal articles regarding freshwater fish and invertebrates were also reviewed. The AUSRIVAS Sampling and Processing Manual (Turak et al. 2004) and the ANZECC Water Quality Guidelines (ANZECC 2000) were also reviewed to ensure that the aquatic study followed standard, widely recognised methods.

Current lists of threatened species and key threatening processes were sourced from Department of Primary Industries (NSW Fisheries) and DEWHA internet resources. The current information available on aquatic threatened species, populations and ecological communities was then carefully assessed to determine the potential for any to occur within the Study Area.

Macro-Invertebrate Sampling

Macro-invertebrate sampling was undertaken at four sites along Cony Creek, on 26 September 2007 and two sites on 18 December 2007. At each site, approximately 10 metres of stream reach was sampled using a hand held net with a 250 µm size mesh. All samples were transferred to white trays with a small amount of water and picked (sorted) live in-situ, with picking continuing for a minimum of half an hour and a maximum of one hour. The macro-invertebrates were sorted into a small plastic bottle containing 70% ethanol.

The SIGNAL Biotic Index (Stream Invertebrate Grade Number) was used to obtain a comparative index of the water quality within each of the sampling sites. The SIGNAL index is based on a pollution-sensitivity grading system, which gives a score of between 1 (most tolerant) and 10 (most sensitive) for 210 macro-invertebrate taxa. The SIGNAL score for a macro-invertebrate sample is calculated by averaging these pollution-sensitivity grades of the families present within each sample. A high average grade indicates the presence of many sensitive taxa and infers a high water quality in the stream reach where the sampling was undertaken. A SIGNAL value greater than six indicates clean water quality, a value of five to six indicates water quality is doubtful, four to five indicates probable moderate pollution while a grade of less than four indicates probable severe pollution (Chessman 1995).

The SIGNAL-95 (Chessman 1995) version of the biotic index provides sensitivity grades applicable to eastern Australia while SIGNAL-2 (Chessman 2003) was developed for application Australia-wide. SIGNAL-HU97, developed by Chessman *et al.* 1997, provides sensitivity grades which apply more specifically to the Hunter River system. SIGNAL-HU97 is based on data from spring and autumn surveys in 42 sites in the Hunter River and tributaries. The SIGNAL-HU97 grades were used for this analysis, however for taxa where there were no published HU-97 grades, published SIGNAL-2 grades were used. The results tables provide both the HU97 and SIGNAL-2 grades for comparison.

Habitat Assessment

An aquatic habitat assessment to help determine the likely presence or absence of significant aquatic species, endangered populations or EECs was undertaken at each of the six sampling sites. Opportunistic observations of the characteristics of other aquatic habitats such as dams and small tributaries were also made during other aspects of field work.

Some of the habitat features and stream condition indicators observed included:

- characteristics of bed substrate;
- presence of in-stream woody debris;
- presence of gravel beds;
- presence of drought and flood refuge areas;
- depth of water;
- width of channel;
- presence of pool, riffle and edge habitats;
- height of bank and evidence of erosion;
- channel geomorphology;

- evidence of sediment deposition;
- the presence of natural or artificial barriers to fish passage upstream and downstream;
- colour and clarity of water, and any visual evidence of water quality; and
- characteristics of in-stream, riparian and floodplain vegetation.

The likelihood of aquatic mammals occurring within the Study Area was also considered during the habitat assessment, in particular the water rat (*Hydromys chrysogaster*) and the platypus (*Ornithorhynchus anatinus*). The potential presence of these species was assessed by searching for suitable bank habitat, burrows and also through identification of any scats observed.

2.5 Riparian, Channel and Environmental Inventory (RCE) and Aquatic Habitat Assessment

The Riparian, Channel and Environmental inventory (RCE) developed by Peterson (1992) consists of sixteen characteristics which define the structure of the riparian zone, stream channel morphology, and the biological condition in both habitats to assess the physical and biological condition of small streams in the lowland, agricultural landscape.

Chessman et al. 1997 developed a modified version of Peterson's RCE inventory to suit Australian conditions. The modified RCE (Chessman et al. 1997) was used to record a standardised description of the adjacent land condition of the banks, channel and bed at each of the sample sites. The RCE system scores 13 attributes of the stream relating to the riparian zone, stream channel and surrounding land use on a 1 to 4 scale. The lower the total score, the more heavily degraded the stream reach is, while a higher score indicates a more pristine reach.

An aquatic habitat assessment to inform the assessment of likely presence of significant aquatic species, endangered populations or EECs was undertaken for each of the six sampling sites. The assessment considered geomorphological characteristics, in-stream and riparian vegetation, presence of wetlands, channel substrate, presence of refuge or spawning areas, existing barriers to fish passage, presence of in-stream debris, potential habitat for migratory fish species, shading by vegetation and flow regime.

3.0 Flora Results

The following sections describe the floristic diversity and vegetation communities of the Study Area, in addition to significant ecological values such as threatened flora species, EECs and any records of regional significance.

3.1 Flora Species

A total of 313 species were recorded within the Study Area, of which 272 (87%) are native and 41 (13%) are introduced species. A full list of the flora species recorded during surveys of the Study Area is presented in **Appendix A**, which delineates those species recorded in the Surface Infrastructure Site and those recorded in the Stage 3 Mining Area. Following is a summary of the floristics of each site.

Surface Infrastructure Site

A total of 125 flora species were recorded within the Surface Infrastructure Site. One species was from the Class Cycdopsida (cycads), three species were from the Class Filicopsida (ferns), and 121 from Magnoliopsida (flowering plants) (of which 23 were from sub-class Liliidae (monocots) and 98 from sub-class Magnoliidae (dicots)). Flora species were recorded from 39 plant families, the most speciose being Myrtaceae, Fabaceae, Poaceae and Asteraceae.

Stage 3 Mining Area

A total of 289 flora species were recorded within the Stage 3 Mine Area. Two species were from the Class Cycadopsida (Cycads), eight species were from the Class Filicopsida (ferns), and 279 from Magnoliopsida (flowering plants) (of which 70 were from sub-class Liliidae (monocots) and 209 from sub-class Magnoliidae (dicots)). Flora species were recorded from 86 plant families, the most speciose being Fabaceae, Myrtaceae, Poaceae and Asteraceae.

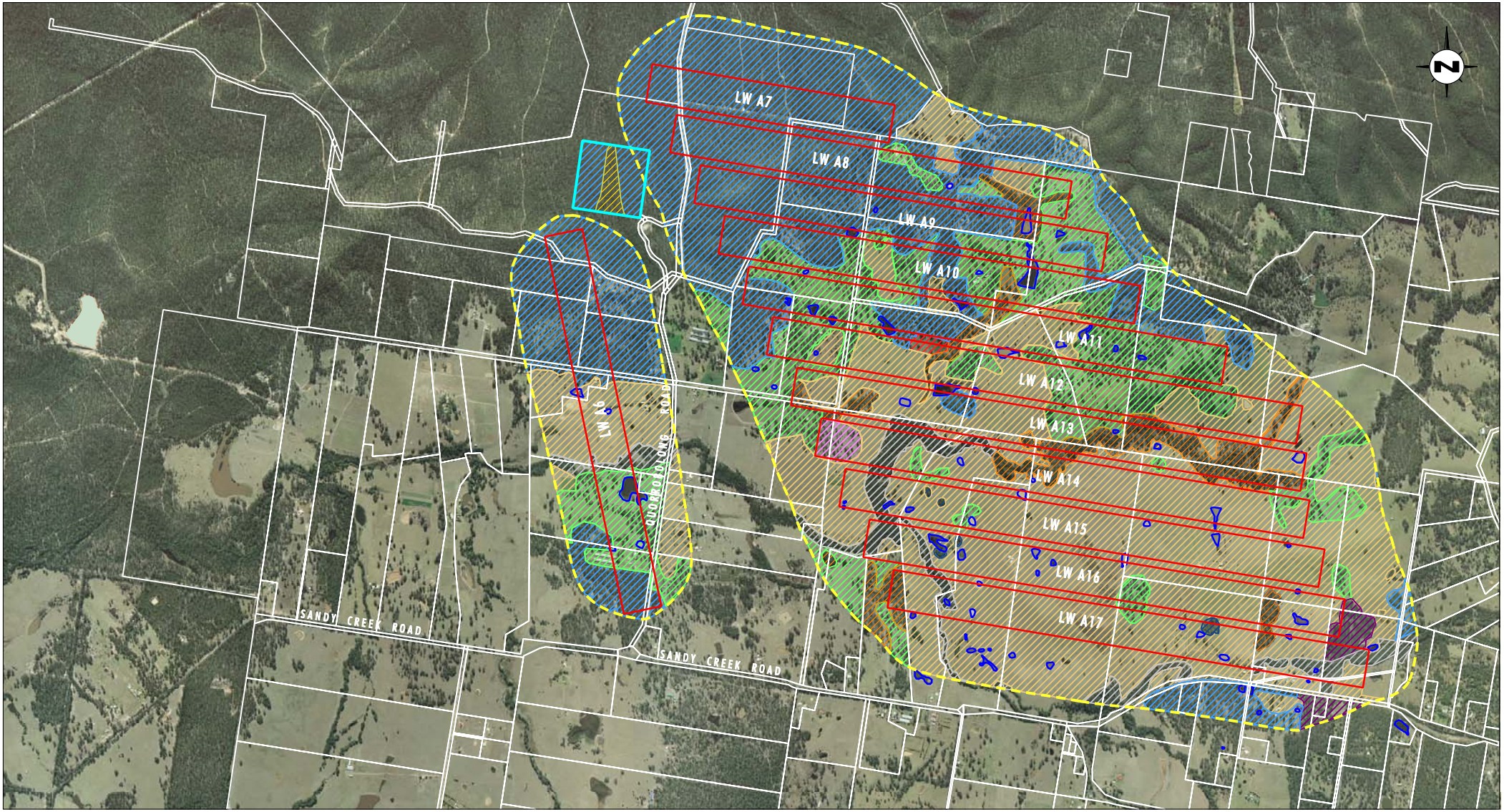
3.2 Vegetation Communities of the Study Area

The Surface Infrastructure Area supports two vegetation communities, while the proposed Stage 3 Mining Area supports seven vegetation communities (**Figure 3.1**). The slopes and ridges of the Study Area support Spotted Gum – Ironbark Forest, which is one of the most widespread communities. Communities of riparian and floodplain environments include Red Gum – Grey Box Forest on Drainage Flats, Riparian Red Gum Forest and Swamp Oak Riparian Forest, the latter occurring in more disturbed situations to the former. Two small restricted communities occur in the Stage 3 Mine Area, Quorrobolong Scribbly Gum Woodland and the Woollybutt Open Forest Remnant. The remaining areas of the Study Area comprise Derived Grassland or Derived Grassland with Scattered Canopy Trees.

Descriptions of the characteristics of each of these communities are provided in the following sections.

3.2.1 Riparian Red Gum Forest

There are several occurrences of Riparian Red Gum Forest within the Study Area (**Figure 3.1**, **Plate 1**), each of which is associated with drainage flats or lower slopes associated with drainage flats. There are 66.7 hectares of this community within the Stage 3 Mine Area.



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

Legend

- Conceptual Layout for Stage 3 Longwall Panels
- 20mm Subsidence Contour
- Surface Infrastructure Site
- Spotted Gum - Ironbark Forest
- Red Gum - Grey Box Forest on Drainage Flats
- Quorrobolong Scribbly Gum Woodland
- Swamp Oak Riparian Forest
- Derived Grassland with Scattered Canopy Trees
- Derived Grassland
- Woolybutt Open Forest
- Riparian Red Gum Forest
- Dam

FIGURE 3.1

Vegetation Communities

PLATE 1
Hunter Lowland Red Gum Forest (Surface Infrastructure Site)

PLATE 2
Lower Hunter Spotted Gum - Ironbark Forest (Stage 3 Mine Area)

The most characteristic dominant canopy species occurring in the Riparian Red Gum Forest community of the Study Area are cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*) and forest red gum (*Eucalyptus tereticornis*), and likely hybrid forms between the two species. Sub-dominant canopy species include grey box (*Eucalyptus moluccana*), large-fruited grey gum (*Eucalyptus canaliculata*) and grey gum (*Eucalyptus punctata*), with the latter two species also often forming a hybrid with each other. Occurring less frequently in this community are turpentine (*Syncarpia glomulifera* subsp*. glomulifera*) and rough-barked apple (*Angophora floribunda*), the latter species only occurring in the remnants of this community occurring on Cony Creek (**Figure 3.1**). At the ecotone between this community and the Spotted Gum – Ironbark Forest (see **Section 3.2.2**), spotted gum (*Corymbia maculata*) and broad-leaved ironbark (*Eucalyptus fibrosa*) are common. The canopy cover of this community is typically 30-40% and has a height range of 12-16 metres (rarely to 22 metres).

As the remnants of the Riparian Red Gum Forest within the Study Area are typically very narrow, the influence of adjoining communities (typically Spotted Gum – Ironbark Forest) is strong.

The Riparian Red Gum Forest generally supports a sub-canopy stratum characterised by ball honeymyrtle (*Melaleuca nodosa*) and, less frequently, black she-oak (*Allocasuarina littoralis*) and prickly-leaved paperbark (*Melaleuca styphelioides*). This sub-canopy has a height of 6 to 10 metres, and a relatively sparse cover of 10% to 20%. In the remnants of this community occurring along Cony Creek, a more established sub-canopy occurs, which comprises grey myrtle (*Backhousia myrtifolia*), hard quandong (*Elaeocarpus obovatus*), hairy clerodendrum (*Clerodendrum tomentosum*) and kurrajong (*Brachychiton populneus* subsp*. populneus*).

The shrub stratum of the Riparian Red Gum Forest is often sparse, with the most common dominant species being blackthorn (*Bursaria spinosa* subsp. *spinosa*), silver-stemmed wattle (*Acacia parvipinnula*) and narrow-leaved bottlebrush (*Callistemon linearis*). The latter species is particularly dominant in disturbed sites (such as those logged or recently subject to fire) where it appears to be a colonising species. The shrub stratum has generally less than 20% cover, however there are some localised patches where it is denser. The height of this stratum ranges between 1 and 5 metres.

The ground stratum of the Riparian Red Gum Forest within the Study Area comprises a diversity of native grasses and other herbs. The composition of the ground stratum is variable across the different remnants of the Study Area. The most commonly recorded species include three-awn speargrass (*Aristida ramosa*), tufted hedgehog grass (*Echinopogon caespitosus* subsp. *caespitosus*), common couch (*Cynodon dactylon*), kangaroo grass (*Themeda australis*), *Goodenia rotundifolia*, poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), dwarf boronia (*Boronia polygalifolia*), two-color panic (*Panicum simile*), many-flowered mat-rush (*Lomandra multiflora* subsp. *multiflora*), weeping grass (*Microlaena stipoides* var. *stipoides*), blue-flax lily (*Dianella* sp.) and white root (*Pratia purpurascens*). The ground stratum is typically moderately dense, with a cover of up to 40%.

A very low number and abundance of introduced species were recorded within this community. Those more commonly recorded in this community included fireweed (*Senecio madagascariensis*), scarlet pimpernel (*Anagallis arvensis*), black nightshade (*Solanum nigrum*), Paddys lucerne (*Sida rhombifolia*), dandelion (*Taraxacum officinale*) and Chilean whitlow wort (*Paronychia brasiliana*). No highly invasive non-native species were observed.

The Riparian Red Gum Forest broadly aligns with the Cabbage Gum Floodplain Woodland (unit 13e) described by Bell and Driscoll (2008) and the Central Hunter Riparian Forest (Unit 13) (House 2003 and NPWS 2000).

Within the Cessnock-Kurri region, 554.78 hectares of the Cabbage Gum Floodplain Woodland was mapped by Bell and Driscoll (2008), which is substantially lower than the estimated pre-1750 distribution of this community of over 14,000 hectares.

The Riparian Red Gum Forest within the Study Area was found to broadly align with the description of the TSC Act listed River-flat Eucalypt Forest EEC. Further discussion of this EEC is provided in **Section 3.4.4**.

3.2.2 Red Gum - Grey Box Forest on Drainage Flats

Within the Surface Infrastructure Site, a remnant of 0.05 hectares of Red Gum – Grey Box Forest on Drainage Flats occurs. This community comprises a narrow riparian band following an upper tributary of Black Creek, which drains to the north of the Surface Infrastructure Site. This community principally differs from the Riparian Red Gum Forest in that it has: a lower abundance of cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*); a greater abundance of grey box (*Eucalyptus moluccana*) and grey gum (*Eucalyptus canaliculata*); and a dominance of prickly-leaved paperbark (*Melaleuca styphelioides*) in the mid-stratum in comparison with the dominance of ball honeymyrtle in the mid-stratum of the Riparian Red Gum Forest. The two communities also occur within different catchments, the Red Gum – Grey Box Forest on Drainage Flats occurring in the Black Creek catchment, and the Riparian Red Gum Forest occurring in the Cony Creek Catchment.

The canopy stratum of this community is characterised by large-fruited grey gum (*Eucalyptus canaliculata*), forest red gum (*Eucalyptus tereticornis*) and grey box (*Eucalyptus moluccana*). The canopy typically has a cover of 20-30%, and has a height range of 16 to 18 metres. Other species occurring less commonly in the canopy (particularly at the ecotone between this and the adjacent spotted gum – ironbark forest) include spotted gum (*Corymbia maculata*) and broad-leaved ironbark (*Eucalyptus fibrosa*).

A tall shrub stratum is present in this community, comprising prickly-leaved tea tree (*Melaleuca styphelioides*) and forest oak (*Allocasuarina torulosa*). The height range of this stratum is 8 to 12 metres, while the cover is approximately 30%.

The dominant species occurring in the dense (40% cover) low shrub stratum of this community include blackthorn (*Bursaria spinosa* subsp. *spinosa*), large-leaf hop bush (*Dodonaea triquetra*), coffee bush (*Breynia oblongifolia*), native indigo (*Indigofera australis*), and large mock olive (*Notelaea longifolia* var. *longifolia*).

The Red Gum – Grey Box Forest within the Study Area broadly aligns with the Grey Gum – Red Gum – Paperbark Forest described for the vegetation mapping of the Cessnock – Kurri Region (Bell and Driscoll). The Grey Gum – Red Gum – Paperbark Forest was mapped by Bell and Driscoll (2008) in only a small number of fragmented locations within the Cessnock – Kurri region. It is estimated that over 60% of the pre-1750 extant of this community within that region has been cleared (Bell and Driscoll (2008). The Grey Gum – Red Gum – Paperbark Forest is regarded to broadly align with the Hunter Lowland Red Gum Forest EEC (Bell and Driscoll 2008).

The Red Gum – Grey Box Forest also shares similar characteristics with the Hunter Lowlands Red Gum Forest Variant (Map Unit 9), described for regional vegetation mapping prepared for the Maitland LGA (Hill 2003) which lies to the north-east of the Study Area. This community described by Hill (2003) was recognised as a variant of the Hunter Lowland Red Gum Forest EEC.

Further discussion of the Hunter Lowland Red Gum Forest EEC in relation to the Red Gum – Grey Box Forest of the Study Area is provided in **Section 3.4.1**.

3.2.3 Spotted Gum – Ironbark Forest

Spotted Gum – Ironbark Forest is the most widespread vegetation community within the Study Area (**Figure 3.1**, **Plates 2** and **3**), occupying approximately 10 hectares of the Surface Infrastructure Site and 428 hectares of the Stage 3 Mine Area. This community occupies the dry slopes and crests of both the Surface Infrastructure Site and the Stage 3 Mine Area, where the soil is relatively infertile. It intergrades with the Hunter Lowland Red Gum Forest on the lower slopes. This community is widespread within the local area, and is also the dominant community within Werakata National Park and Werakata State Conservation Area to the north of the Study Area. Localised variants occur in response to environmental variables such as aspect, topography, geology and disturbance history (including fire and forestry practices). The Spotted Gum – Ironbark Forest within the Study Area is consistent with the TSC Act listed EEC Lower Hunter Spotted Gum – Ironbark Forest. Further discussion of this EEC is provided in **Section 3.4.2**. The community is also equivalent to the Lower Hunter Spotted Gum – Ironbark Forest, Map Unit 17 (NPWS 2000).

The canopy stratum of this community is generally dominated by spotted gum (*Corymbia maculata*), broad-leaved ironbark (*Eucalyptus fibrosa*) and, less commonly, narrow-leaved ironbark (*Eucalyptus crebra*). A number of sub-dominant canopy species occur within this community, some of which may become dominant species in localised patches in response to an environmental gradient such as slope, aspect or soil type. These sub-dominant canopy species include grey box (*Eucalyptus moluccana*), thin-leaved stringybark (*Eucalyptus eugenioides*), turpentine (*Syncarpia glomulifera* subsp*. glomulifera*), grey gum (*Eucalyptus punctata*) and large-fruited grey gum (*Eucalyptus canaliculata*). Forest red gum (*Eucalyptus tereticornis*) and cabbage gum (*Eucalyptus amplifolia* subsp*. amplifolia*) become more dominant on the lower slopes where Hunter Lowland Red Gum Forest intergrades with this community. The canopy stratum generally has a cover ranging between 20 and 30%, and has a height range of 12 to 18 metres.

Spotted Gum – Ironbark Forest has a dry, sparse shrub stratum (approximately 5 – 10% cover), the height of which is 0.5 metres to 4 metres. Commonly recorded species in this stratum include narrow-leaved geebung (*Persoonia linearis*), coffee bush (*Breynia oblongifolia*), peach heath (*Lissanthe strigosa*), broom bitter pea (*Daviesia genistifolia*), blackthorn (*Bursaria spinosa* subsp. *spinosa*), *Leptospermum parvifolium,* pink five corners (*Styphelia triflora*) and *Dillwynia retorta*.

Spotted Gum – Ironbark Forest supports a sparse to dense ground stratum predominantly comprising native grasses, however a number of small forbs, ferns and vines also occur. The more common species recorded include threeawn speargrass (*Aristida vagans*), wiry panic (*Entolasia stricta*), kangaroo grass (*Themeda australis*), blady grass (*Imperata cylindrica* var. *major*), blue flax lily (*Dianella caerulea*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), love creeper (*Glycine tabacina*), many-flowered mat-rush (*Lomandra multiflora* subsp. *multiflora*), *Lepidosperma laterale* and *Goodenia rotundifolia*. The ground stratum has a highly variable cover throughout the Study Area, ranging from 5% to 90%. This is likely to be a reflection of the different disturbance histories relating to this community across the Study Area.

A number of introduced species were recorded in this community, the majority of which are not a threat to the native flora diversity. Some of the more common species recorded include plantain (*Plantago lanceolata*), scarlet pimpernel (*Anagallis arvensis*), balloon cotton bush (*Gomphocarpus fruticosus*), fireweed (*Senecio madagascariensis*) and cobblers pegs (*Bidens pilosa*). A few very small patches of lantana (*Lantana camara*) were observed within this community in the Stage 3 Mine Area.

PLATE 3
Lower Hunter Spotted Gum - Ironbark Forest (Surface Infrastructure Site)

PLATE 4
Swamp Oak Riparian Forest (Stage 3 Mine Area)

The Spotted Gum – Ironbark Forest community recorded within the Study Area is equivalent to the Lower Hunter Spotted Gum – Red Ironbark Forest (Unit 17a) described by Bell and Driscoll (2008), and also with the Lower Hunter Spotted Gum Ironbark Forest (Unit 17) described by House (2003) and mapped by NPWS (2000). Both these communities are regarded to be included in the Lower Hunter Spotted Gum – Ironbark Forest EEC.

A number of variants of spotted gum – ironbark forest community were mapped by Bell and Driscoll (2008) within the Study Area, including:

- Coastal Foothills Spotted Gum – Ironbark Forest;
- Lower Hunter Spotted Gum – Ironbark Forest (*Eucalyptus placita* variant); and
- Coastal Foothills Transition Forest (stringybark variant).

The Coastal Foothills Spotted Gum – Ironbark Forest and the Lower Hunter Spotted Gum – Ironbark Forest (*Eucalyptus placita*) variant were mapped by Bell and Driscoll (2008) in only isolated pockets within the Stage 3 Mine Area and the latter in the eastern portion of the Surface Infrastructure Site.

The Coastal Foothills Transition Forest occurs towards the eastern end of the Broken Back Range where the Coastal Foothills Spotted Gum – Ironbark Forest merges with the Lower Hunter Spotted Gum – Red Ironbark Forest and Sandstone Hills Bloodwood Forest (Bell and Driscoll 2008). This transition forest is mapped by Bell and Driscoll (2008) within the northern parts of the Stage 3 Mine Area only.

The current study does not delineate these variants in the vegetation community mapping. It is recognised that the Lower Hunter Spotted Gum – Ironbark Forest encompasses a range of variants across the Study Area, however these were not able to be readily separated.

3.2.4 Swamp Oak Riparian Forest

Swamp Oak Riparian Forest is found in the heavily disturbed areas of Cony Creek and Sandy Creek (**Figure 3.1**, **Plate 4**). The community typically occurs along a very narrow band of riparian vegetation which is adjoined by Derived Grassland on the floodplain.

The canopy of this community is characterised by a dense (40 to 50%) cover of swamp oak (*Casuarina glauca*), which grows to a height of 12 to 20 metres. The presence of this species in such high density indicates the riparian vegetation has been heavily modified (directly and indirectly through factors such as changes to hydrology and soil chemistry) as a result of past agricultural practices. The dense swamp oak (*Casuarina glauca*) has resulted in the exclusion of virtually all other tree species. There are a small number of mature rough-barked apple (*Angophora floribunda*) trees within this community in isolated occurrences.

The shrub stratum in this community is virtually absent, however where present, is characterised by juvenile swamp oak (*Casuarina glauca*) and the introduced African boxthorn (*Lycium ferocissimum*). Where present, this stratum typically has a cover of less than 5% and a maximum height of 5 metres.

The ground stratum in this community is dense (up to 90% cover recorded in some locations), however it has a low species diversity. The dominant species recorded in the ground stratum of this community include weeping grass (*Microlaena stipoides* var. *stipoides*), slender bamboo grass (*Austrostipa verticillata*), common couch (*Cynodon dactylon*), kidney weed (*Dichondra repens*), tufted hedgehog grass (*Echinopogon caespitosus*), white root (*Pratia purpurascens*), spiny-headed mat-rush (*Lomandra longifolia*) and common chickweed (*Stellaria media*).

Introduced species of potential threat to this community that were recorded include blackberry (*Rubus fruticosus* spp. agg.) and sharp rush (*Juncus acutus* subsp*. acutus*). Introduced species frequently recorded and of lesser concern to the community were scarlet pimpernel (*Anagallis arvensis*), sow thistle (*Sonchus oleraceus*), Scotch thistle (*Onopordum acanthium*) and red-flowered mallow (*Modiola caroliana*).

As indicated previously, the condition of this community is highly modified from its natural state as a result of anthropogenic activities. The presence of mature rough-barked apple (*Angophora floribunda*) trees in some locations indicates the riparian vegetation may have previously comprised a more eucalypt-dominated community, and is likely to have had a more structurally and floristically diverse understorey. In response to past disturbances, swamp oak (*Casuarina glauca*) has become dominant in the canopy, and its allelopathic nature suppresses the germination of other species, therefore inhibiting the return of the original community.

The Swamp Oak Riparian Forest of the Study Area is consistent with the Central Hunter Swamp Oak Forest (Unit 13a), as described and mapped by Bell and Driscoll (2008) and the Central Hunter Riparian Forest (Unit 13; House 2003 and NPWS 2000). Both these regional vegetation mapping studies describe this community to be consistent with the River-flat Eucalypt Forest on Coastal Floodplains EEC. Further discussion of this EEC is provided in **Section 3.4.4**.

3.2.5 Quorrobolong Scribbly Gum Woodland

Two small remnants of Quorrobolong Scribbly Gum Woodland occur in the south-east corner of the Stage 3 Mine Area (**Figure 3.1**), collectively covering an area of 11.2 hectares. This community is listed as an EEC under the TSC Act, and is known only to occur in a small area which extends to the south of the Stage 3 Mine Area and continues to the east for a short distance. This community is restricted to a residual sand deposit overlying the Permian clay sediments in the Hunter Valley. Survey of this community was limited to a roadside assessment due to access constraints, therefore the following description of the community is supplemented with the description provided in the NSW Scientific Committee's Final Determination for this EEC (NSW Scientific Committee 2005a).

The characteristic canopy species of this community is narrow-leaved scribbly gum (*Eucalyptus racemosa*), however several sub-dominant canopy species occur in association. These species include red mahogany (*Eucalyptus resinifera* subsp. *resinifera*), Sydney peppermint (*Eucalyptus piperita*) and turpentine (*Syncarpia glomulifera* subsp*. glomulifera*). The community supports a sub-canopy stratum of black she-oak (*Allocasuarina littoralis*), and Siebers paperbark (*Melaleuca sieberi*).

The shrub stratum of the Quorrobolong Scribbly Gum Woodland comprises paperbark tea tree (*Leptospermum trinervium*), lemon-scented tea tree (*Leptospermum polygalifolium* subsp. *cismontanum*), dogwood (*Jacksonia scoparia*), native cherry (*Exocarpos cupressiformis*), needlebush (*Hakea sericea*), prickly Moses wattle (*Acacia ulicifolia*), crinkle bush (*Lomatia silaifolia*) and veined mock olive (*Notelaea venosa*).

Species characteristic of the ground stratum of this community include wiry panic (*Entolasia* stricta), kangaroo grass (*Themeda australis*), two-color panic (*Panicum simile*), blady grass (*Imperata cylindrica* var*. major*), fishbones (*Lomandra obliqua*), *Goodenia rotundifolia* and false sarsaparilla (*Hardenbergia violacea*).

Bell and Driscoll (2008) recognise this vegetation community as Quorrobolong Scribbly Gum Forest however a corresponding community is not defined in the regional vegetation study of House (2003) and NPWS (2000).

3.2.6 Woollybutt Open Forest

A small, remnant of what may have previously comprised an open forest dominated or sub-dominated by woollybutt (*Eucalyptus longifolia*) occurs in the Stage 3 Mine Area (**Figure 3.1**, **Plate 5**). The regional significance of this community is described further in **Section 3.6**.

This remnant is situated within a paddock currently utilised for cattle grazing, and as such the understorey is highly modified, comprising heavily grazed native and introduced grasses and other herbs. There is a sparse cover (approximately 10%) of mature canopy trees, including woollybutt (*Eucalyptus longifolia*), grey box (*Eucalyptus moluccana*) and narrow-leaved ironbark (*Eucalyptus crebra*). There does not appear to be any recruitment of juvenile trees in this remnant. This is likely to be due to the grazing impacts on the remnant.

There are no known vegetation communities from regional vegetation studies that are equivalent to the Woollybutt Open Forest. Further study needs to be undertaken on remnant stands supporting woollybutt (*Eucalyptus longifolia*) to determine whether they should be separated into an individual community or a variant of another similar vegetation community.

3.2.7 Derived Grassland and Derived Grassland with Scattered Canopy Trees

A large proportion of the Stage 3 Mine Area comprises Derived Grassland (**Figure 3.1**), while the Surface Infrastructure Site does not support any areas of this community. The areas in which Derived Grassland currently occurs are likely to have previously supported woodland vegetation similar to that of surrounding vegetation remnants, however they have been cleared of tree and shrub species and now support only a highly modified ground stratum. Within the Study Area, the Derived Grassland is present largely as a result of clearing for agricultural purposes, in particular cattle grazing, and most properties still currently support livestock (cattle and horses).

The ground stratum of the Derived Grassland comprises a range of native and introduced grasses and other herbs. The dominant native species recorded included kangaroo grass (*Themeda australis*), common couch (*Cynodon dactylon*), yellow buttons (*Chrysocephalum apiculatum*), slender rats tail grass (*Sporobolus creber*), fishweed (*Einadia trigonos* subsp. *trigonos*), carrot weed (*Cotula australis*) and *Oxalis chnoodes*. Introduced species commonly recorded in the derived grassland include scarlet pimpernel (*Anagallis arvensis*), fireweed (*Senecio madagascariensis*), onion weed (*Romulea rosea*) and Scotch thistle (*Onopordum acanthium*).

The floristic composition of the Derived Grassland varies strongly between the various private landholdings throughout the Study Area, which is the result of land management practices differing between landholdings.

A variant of Derived Grassland occurs within the Stage 3 Mine Area, being Derived Grassland with Scattered Mature Trees (**Figure 3.1**). This occurs where there is predominantly grassland with sparse canopy trees, typically with less than 10% cover. The canopy trees present are dependent on the topographic position. On the lower slopes and flats the dominant trees are typically forest red gum (*Eucalyptus tereticornis*), cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*), grey box (*Eucalyptus molucanna*) and, in one location, woollybutt (*Eucalyptus longifolia*). On the slopes and ridges, trees that are often present in the derived grassland include spotted gum (*Corymbia maculata*), broad-leaved ironbark (*Eucalyptus fibrosa*) and grey box (*Eucalyptus moluccana*).

PLATE 5
Woollybutt Open Forest Remnant (Stage 3 Mine Area)

3.3 Threatened Flora Species, Endangered Flora Populations and EECs

The following sections outline the threatened flora species, endangered flora populations and EECs recorded within the Study Area and those with potential to occur. **Appendices B** and **C** provide a full list of threatened flora species, populations and EECs (derived from literature review and expert knowledge) that were assessed for their potential to occur within the Study Area. **Appendix B** relates to the Surface Infrastructure Site and **Appendix C** relates to the Stage 3 Mine Area.

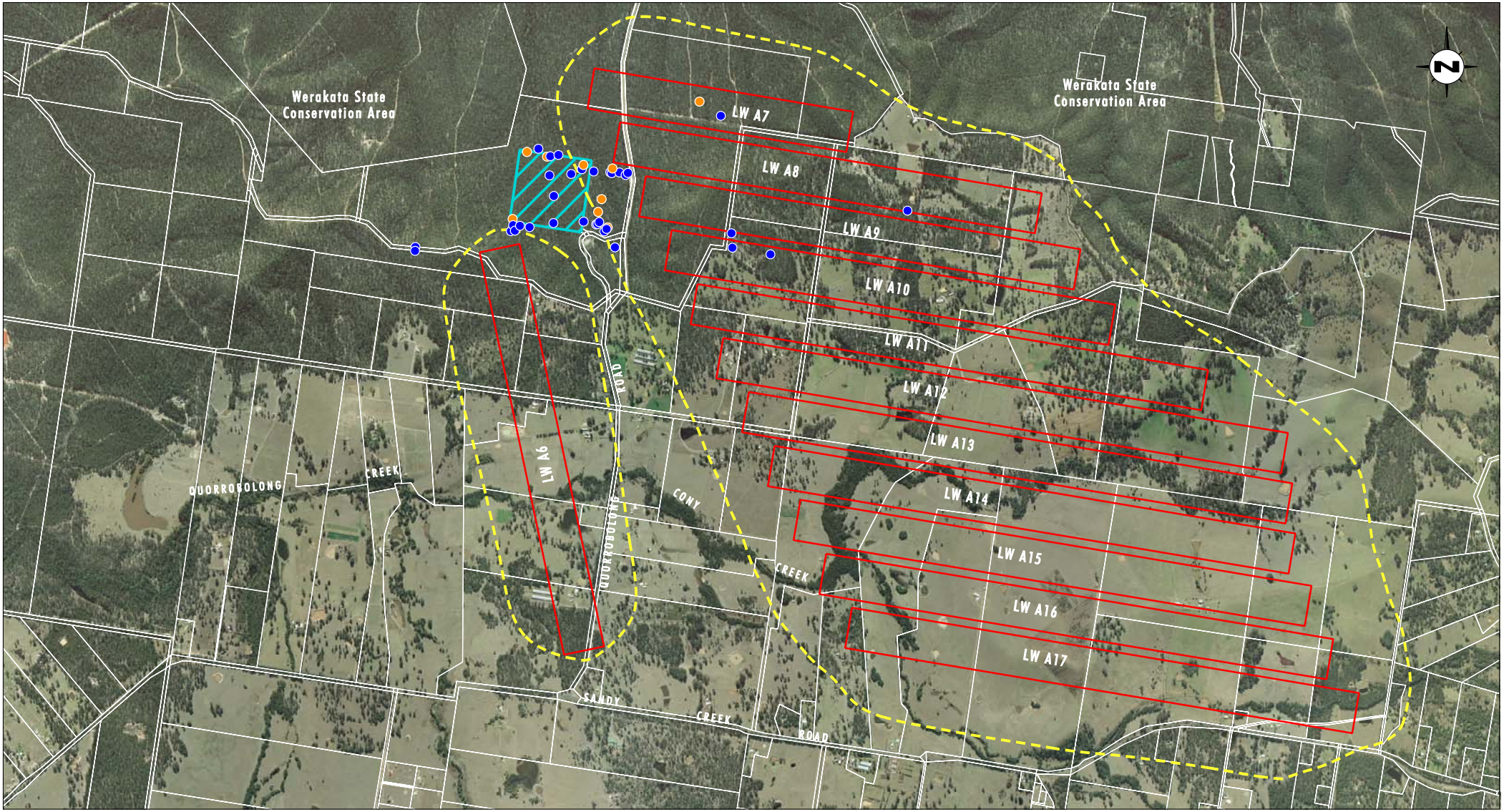
3.3.1 Recorded Threatened Flora Species

Two threatened flora species were recorded within the Study Area during the field surveys, being heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). Both species were recorded extensively in the Surface Infrastructure Site and less commonly in the northern portions of the Stage 3 Mine Area. The recorded locations of these species are shown on **Figure 3.2**, however the actual extent of occurrence of each species is expected to be greater, in particular within the Stage 3 Mine Area which was not as intensively traversed as the Surface Infrastructure Site (**Figure 2.1**). Heath wrinklewort (*Rutidosis heterogama*) was found at 15 locations within the Surface Infrastructure Site, at which one to over 20 individuals were observed in each case. Approximately 70 individuals of heath wrinklewort were recorded in total within in the Surface Infrastructure Site. Small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) was recorded at four locations within the Surface Infrastructure Site, across which approximately 30 individuals were counted in total.

In order to provide context to the distribution of heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) within the locality, a map showing all records from the DECC Atlas of NSW Wildlife for the Cessnock 1:100,000 topographic map sheet is provided on **Figure 3.3**. This shows that potential habitat for the two species is relatively widespread within the locality, particularly to the north-east of the Study Area.

3.3.2 Threatened Flora Species with Potential to Occur

Lists of all threatened flora species compiled from the two ecological database searches described in **Section 2.1.5** are provided in **Appendices B** and **C**, relating to the Surface Infrastructure Site and the Stage 3 Mine Area respectively. EPBC Act listed threatened flora species are considered in **Appendices D** and **E** for the Surface Infrastructure Site and the Stage 3 Mine Area respectively. Each appendix provides an assessment of the likelihood of the occurrence of each of the listed species within the Surface Infrastructure Site and the Stage 3 Mine Area. In addition to those threatened flora species recorded (see **Section 3.3.1**), both the Surface Infrastructure Site and the Stage 3 Mine Area were found to have potential habitat for three threatened flora species. These threatened flora species with potential to occur are listed in **Table 3.1**.



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

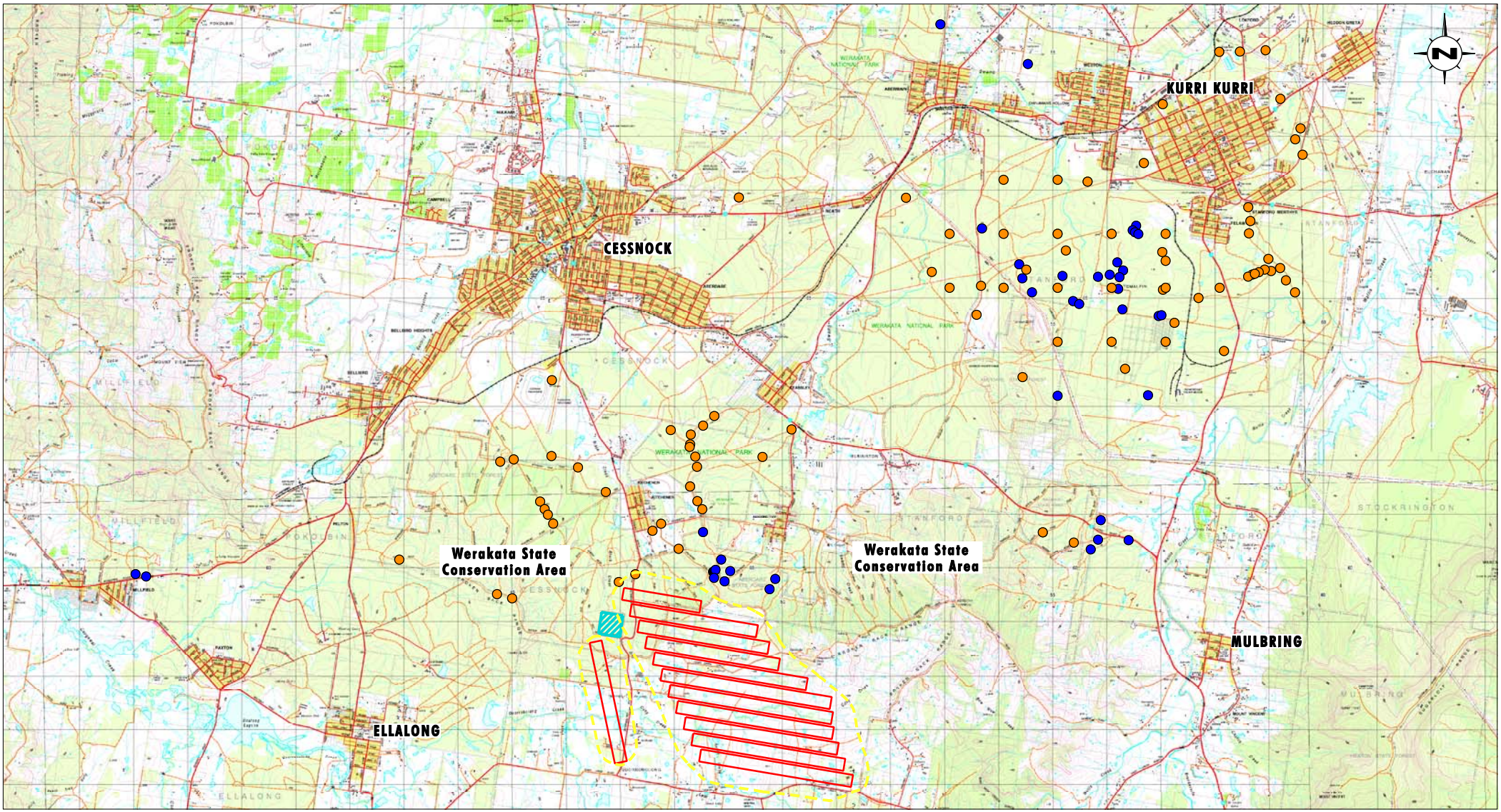
Legend

- Conceptual Layout for Stage 3 Longwall Panels
- 20mm Subsidence Contour
- Surface Infrastructure Site
- *Rutidosis heterogama*
- *Grevillea parviflora* subsp. *parviflora*

FIGURE 3.2

Threatened Flora Locations

File Name (A4): R15_V1/2274_141.dgn



Base Source: Topo Maps: LPI NSW, Longwall Layout: Austar Coal Mine

0 1 2.5 5km
1:100 000

Legend

- Conceptual Layout for Stage 3 Longwall Panels
- 20mm Subsidence Contour
- Surface Infrastructure Site
- *Rutidosis heterogama*
- *Grevillea parviflora* subsp. *parviflora*

FIGURE 3.3

Threatened Flora Locations (DECC Atlas of NSW Wildlife Cessnock 1:100 000 map)

File Name (A4): R15_V1/2274_126.dgn

Table 3.1 - Threatened Flora Species not recorded but with Potential to Occur within the Study Area

Species	Status	Potential to Occur in Surface Infrastructure Site	Potential to Occur in Stage 3 Mine Area
Callistemon linearifolius	V (TSC)	Yes	Yes
Bynoes wattle *Acacia bynoeana*	V (EPBC) E (TSC)	Yes	Yes
leafless tongue orchid *Cryptostylis hunteriana*	V (EPBC) V (TSC)	Yes	Yes
Groves paperbark *Melaleuca groveana*	V (TSC)	Yes	Yes

Key:

TSC = *Threatened Species Conservation Act* 1995

EPBC = *Environment Protection and Biodiversity Conservation Act* 1999

E = Endangered

V = Vulnerable

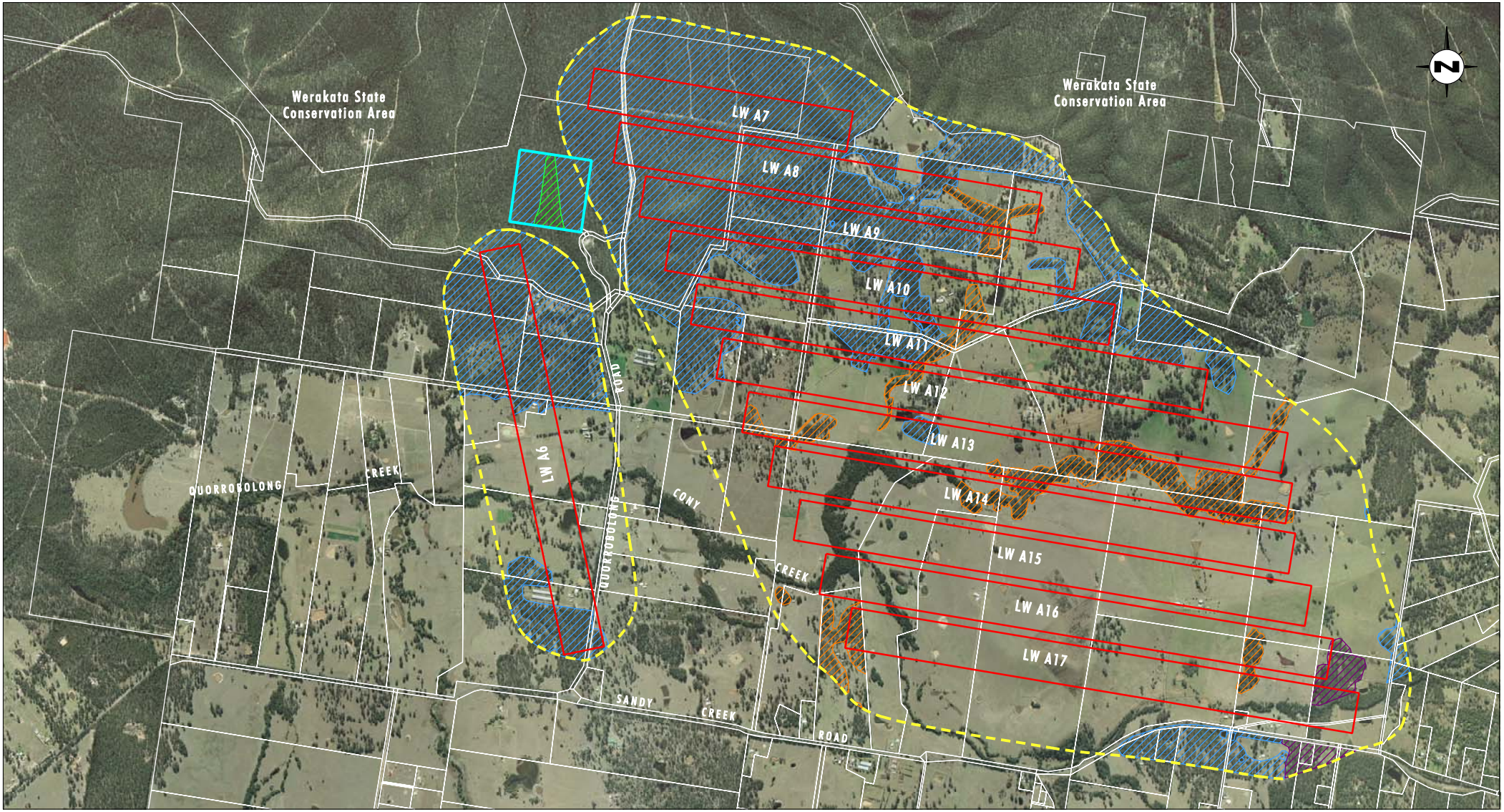
3.4 Endangered Ecological Communities

An initial constraints analysis (which was based on literature review and expert knowledge) undertaken prior to field surveys identified the following six EECs as having potential to occur within the Study Area:

- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin, and South-east Corner Bioregions;
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South-east Corner Bioregions;
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner Bioregions;
- Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion;
- Hunter Lowland Red Gum Forest in the Sydney Basin and NSW North Coast Bioregions; and
- Freshwater Wetlands on Coastal Floodplains of the North Coast, Sydney Basin and South-east Corner Bioregions.

A summary of the assessment of the potential to occur for each of these EECs (as a result of field survey outcomes) is presented in Table 1 of **Appendices B** and **C** (for the Surface Infrastructure Area and Stage 3 Mine Area respectively).

The four EECs that were found to be present within the Study Area are the Hunter Lowland Red Gum Forest, Lower Hunter Spotted Gum – Ironbark Forest, River-flat Eucalypt Forest and the Quorrobolong Scribbly Gum Woodland (refer to **Figure 3.4**). A summary of the extent of the four EECs within the Surface Infrastructure Site and the Stage 3 Mine Area is provided in **Table 3.2**. Further descriptions of the four EECs recorded are provided in **Sections 3.4.1** to **3.4.3**.



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

0 0.5 1 1.5km
1:30 000

Legend

- Conceptual Layout for Stage 3 Longwall Panels
- 20mm Subsidence Contour
- Surface Infrastructure Site
- Lower Hunter Spotted Gum - Ironbark Forest
- River-flat Eucalypt Forest
- Hunter Lowland Red Gum Forest
- Quorrobolong Scribbly Gum Woodland

FIGURE 3.4

Endangered Ecological Communities

File Name (A4): R15_V1/2274_171.dgn

Table 3.2 – EECs Recorded within the Study Area and their Extent

Endangered Ecological Communities	Area (ha)	
	Surface Infrastructure Site	Stage 3 Mine Area
Lower Hunter Spotted Gum – Ironbark Forest	10	428.6
Quorrobolong Scribbly Gum Woodland	-	11.2
Hunter Lowland Red Gum Forest	0.05	0
River-flat Eucalypt Forest	0	66.7

There are no aquatic EECs listed under the FM Act occurring within or with potential to occur within the Study Area.

3.4.1 Hunter Lowland Red Gum Forest EEC

The 0.05 hectare Red Gum – Grey Box Forest on Drainage Flats recorded within the Surface Infrastructure Site was found to broadly align with the Hunter Lowland Red Gum Forest EEC, as described by the NSW Scientific Committee (2005b). The occurrence of this EEC within the Study Area is shown on **Figure 3.4**.

The reasonably poorly defined nature of the Hunter Lowland Red Gum Forest EEC, the lack of detail included in the diagnostic description provided in the Final Determination (NSW Scientific Committee 2005b) and the range of variants within its distribution, make it difficult to strongly conclude the presence or absence of the Hunter Lowland Red Gum Forest EEC. For these reasons, a precautionary approach is taken for the purposes of this assessment, whereby the Red Gum – Grey Box Forest on Drainage Flats of the Study Area is regarded to comprise the Hunter Lowland Red Gum Forest EEC. A description of the general characteristics of the EEC and the characteristics of the EEC within the Study Area are provided below.

The following description of the Hunter Lowland Red Gum Forest EEC is summarised from the final determination for the EEC (NSW Scientific Committee 2005b).

Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions is found on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley floor. This EEC has been recorded from the Maitland, Cessnock, Port Stephens, Muswellbrook and Singleton LGAs.

The Hunter Lowland Redgum Forest EEC is generally an open forest, the most common canopy tree species being forest red gum (*Eucalyptus tereticornis*) and grey gum (*Eucalyptus punctata*) although other frequently occurring canopy species are smooth-barked apple (*Angophora costata*), spotted gum (*Corymbia maculata*), narrow-leaved ironbark (*Eucalyptus crebra*) and grey box (*Eucalyptus moluccana*), with a number of other eucalypts being less frequently recorded. The mid stratum is characterised as open with sparse shrubs of coffee bush (*Breynia oblongifolia*), prickly beard heath (*Leucopogon juniperinus*), gorse bitter pea (*Daviesia ulicifolia*) and dogwood (*Jacksonia scoparia*). There is consistently a ground layer of grasses and herbs, characterised by weeping grass (*Microlaena stipoides* var. *stipoides*), barbed wire grass (*Cymbopogon refractus*), tufted hedgehog grass (*Echinopogon caespitosus* var. *caespitosus*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*) and white root (*Pratia purpurascens*).

It is estimated that only 27% of the pre-1750 extent of this community remains un-cleared. Currently, less than 2% of the remaining area of the EEC is included in conservation reserves (Werakata National Park and Werakata State Conservation Area).

The Red Gum – Grey Box Forest on Drainage Flats of the Study Area (as described in **Section 3.2.1**) supports some characteristics that are consistent with the TSC Act listed Hunter Lowland Red Gum Forest EEC. The particular features of the EEC shared by the community in the Study Area include its topographic position within the landscape, the substrate it occurs on and the floristic composition of the canopy stratum. There is, however, some dissimilarity in the understorey floristic composition between the Study Area community and the EEC, if considering only the description provided in the Final Determination for the EEC (NSW Scientific Committee 2005b) (which has limited diagnostic details characterising the community). However, when also taking into consideration the description provided in NPWS (2000) for Map Unit 19 - Hunter Lowlands Red Gum Forest (described in the Final Determination as being consistent with the EEC) and other treatments of the EEC in regional vegetation mapping such as Hill (2003), Peake (2006) and Bell and Driscoll (2008), the community within the Study Area supports characteristics consistent with recognised variants of the EEC which occur in other locations throughout its distribution.

The potential for the proposed Surface Infrastructure Development to have an impact on this EEC is assessed in Table 1 of **Appendix B**. The assessment concludes that the proposed Surface Infrastructure Development will not have a significant impact on the Hunter Lowland Red Gum Forest EEC.

3.4.2 Lower Hunter Spotted Gum – Ironbark Forest EEC

The Spotted Gum – Ironbark Forest recorded within the Study Area was found to be consistent with the Lower Hunter Spotted Gum – Ironbark Forest EEC, as described by the NSW Scientific Committee (2005c). A description of the general characteristics of the EEC and the characteristics of the EEC within the Study Area are provided below.

The following description of this EEC is summarised from the final determination for the Lower Hunter Spotted Gum – Ironbark Forest EEC (NSW Scientific Committee 2005c).

The Lower Hunter Spotted Gum – Ironbark Forest EEC occurs in the central to lower Hunter Valley, principally on Permian geology. The EEC is restricted to a range of approximately 65 kilometres by 35 kilometres centred on the Cessnock – Beresfield area and corresponds to the Lower Hunter Spotted Gum – Ironbark Forest as described by NSW NPWS (2000) for the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS). The dominant canopy species of this community are spotted gum (*Corymbia maculata*) and broad-leaved ironbark (*Eucalyptus fibrosa*), with grey gum (*Eucalyptus puncata*) and narrow-leaved ironbark (*Eucalyptus crebra*) present occasionally in lower frequency. An understorey comprising the following shrub species is present: silver-stemmed wattle (*Acacia parvipinnula*), gorse bitter pea (*Daviesia ulicifolia*), black thorn (*Bursaria spinosa* subsp. *spinosa*), ball honeymyrtle (*Melaleuca nodosa*) and peach heath (*Lissanthe strigosa*). The ground layer is diverse, comprising poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), barbed-wire grass (*Cymbopogon refractus*), blue-flax lily (*Dianella revoluta*), wiry panic (*Entolasia stricta*), love creeper (*Glycine clandestina*), *Lepidosperma laterale*, many-flowered mat-rush (*Lomandra multiflora*), weeping grass (*Microlaena stipoides* var. *stipoides*), *Pomax umbellata,* kangaroo grass (*Themeda australis*) and white root (*Pratia purpurascens*).

A comparison between the floristic and structural composition of the Lower Hunter Spotted Gum – Ironbark Forest EEC (described above) and the Spotted Gum – Ironbark Forest occurring within the Study Area (described in **Section 3.2.2**) showed that the latter is consistent with the characteristics of the Lower Hunter Spotted Gum – Ironbark Forest, as

described in the final determination for this EEC (NSW Scientific Committee 2005c). The Lower Hunter Spotted Gum – Ironbark Forest EEC occurs widely in both the Surface Infrastructure Site and the Stage 3 Mine Area (**Figure 3.4**).

The potential for the proposed Surface Infrastructure Development and the proposed Stage 3 Mining Development to have a significant impact on this EEC is assessed in Table 1 of **Appendices B** and **C** respectively. The assessments conclude that the proposed Surface Infrastructure Development or the proposed Stage 3 Mining Development will not have a significant impact on the Lower Hunter Spotted Gum – Ironbark Forest EEC.

3.4.3 Quorrobolong Scribbly Gum Woodland EEC

A small occurrence (approximately 11.2 hectares) of Quorrobolong Scribbly Gum Woodland EEC (NSW Scientific Committee 2005a) is situated in the south-east corner of the Stage 3 Mining Area (**Figure 3.4**). This EEC is known only to occur in the Quorrobolong district. A description of this EEC within the Study Area is provided in **Section 3.2.5**, which is consistent with the description provided in the final determination for this EEC (NSW Scientific Committee 2005a).

3.4.4 River-flat Eucalypt Forest EEC

Based on an assessment of the structural and floristic composition of the riparian communities within the Study Area, it was concluded that 66.7 hectares of the River-flat Eucalypt Forest EEC occurs within the Stage 3 Mine Area, along Cony Creek and its tributaries (**Figure 3.4**).

The following description of this EEC is summarised from the final determination for the *River-flat Eucalypt Forest on Coastal Floodplains EEC* (NSW Scientific Committee 2005a).

The *River-Flat Eucalypt Forest* is associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces *associated* with coastal floodplains. The community generally occurs below 50 metres above sea level (ASL), however it may occur on localised river flats up to 250 metres ASL. The EEC ranges in structure from tall open forest to woodland, with a canopy dominated by forest red gum (*Eucalyptus tereticornis*), cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*), rough-barked apple (*Angophora floribunda*) and broad-leaved apple (*Eucalyptus subvelutina*). A small tree layer often is present, which may comprise *Melaleuca decora*, prickly-leaved tea tree (*Melaleuca styphelioides*), grey myrtle (*Backhousia myrtifolia*), white cedar (*Melia azedarach*), river oak (*Casuarina cunninghamiana*) and swamp oak (*Casuarina glauca*). The mid-stratum is often absent, but where present may comprise species such as black thorn (*Bursaria spinosa*), forest nightshade (*Solanum prinophyllum*), native raspberry (*Rubus parvifolius*), coffee bush (*Breynia oblongifolia*) and *Ozothamnus diosmifolius*. The ground cover consists of a number of forbs, scramblers and grasses.

There is a strong floristic similarity between the vegetation of the Riparian Red Gum Forest and the River-flat Eucalypt Forest EEC. The geomorphology of the areas in which this community is mapped is also consistent with that in which the River-flat Eucalypt Forest EEC is documented to occur. The final determination for the River-flat Eucalypt Forest EEC states that it occurs on 'periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains' (NSW Scientific Committee 2005d). A floodplain is defined as 'a level landform pattern on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990)'. Coastal floodplains include those up to 250 metres above sea level (ASL) (NSW Scientific Committee 2005d). The Riparian Red Gum Forest of the Study Area occurs on 'alluvial flats' and 'drainage lines' and is associated with a coastal

floodplain in that it drains into a coastal floodplain (i.e. has a direct hydrological connection), being that of Cony Creek further downstream and also of Quorrobolong Creek (into which Cony Creek flows). The 1 in 100 year flood levels illustrated on **Figure 3.5** shows those areas of these catchments which comprise a floodplain under the flood-frequency component of the definition by the NSW Scientific Committee (2005d). All areas of the Stage 3 Mine Area occur below 250 metres ASL, typically between 140 metres and 155 metres ASL.

Bell and Driscoll (2008) map the riparian vegetation of Cony Creek within the Study Area as comprising the Central Hunter Swamp Oak Forest (Unit 13a) in the western extent and the Cabbage Gum Floodplain Woodland (Unit 13e) in the eastern extent. Bell and Driscoll (2008) state that both these vegetation communities are broadly included under the River-flat Eucalypt Forest EEC. The vegetation in the western extent of Cony Creek where Bell and Driscoll (2008) mapped Central Hunter Swamp Oak Forest (and mapped under the current study as Swamp Oak Riparian Forest, **Figure 3.1**) was highly modified and generally characterised by a mono-specific canopy of swamp oak (*Casuarina glauca*) with a very low presence of any other *Eucalyptus* spp. or *Angophora* spp. As stated in the final determination (NSW Scientific Committee 2005d), some of the important features that characterise this community from other EECs on floodplains include: a) its dominance by either a mixed eucalypt canopy or by a single species of eucalypt belonging to either the genus *Angophora* or the sections *Exsertaria* or *Transversaria* of the genus *Eucalyptus*; and b) the relatively low abundance or sub-dominance of *Casuarina* and *Melaleuca* species. From this it is concluded that, inconsistent with Bell and Driscoll (2008), this western extent of Cony Creek within the Study Area does not support the River-flat Eucalypt Forest EEC. There is currently no evidence from this vegetation to suggest that this riparian vegetation would have previously been dominated by *Eucalyptus* spp. and *Angophora* spp.

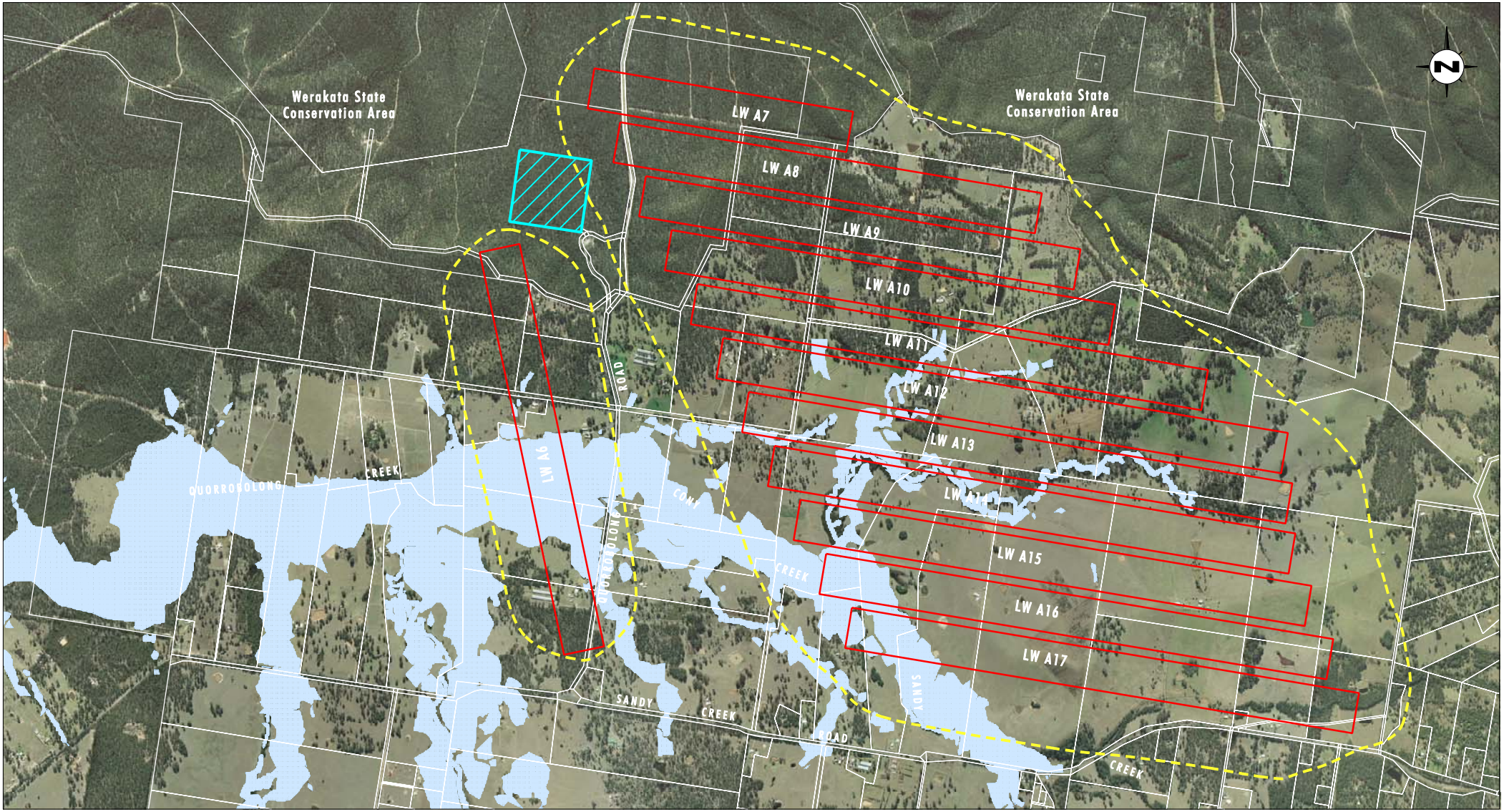
The potential for the proposed Stage 3 underground mining to have an impact on this EEC is preliminarily assessed in Table 1 of **Appendix C**. A seven part test of significance (in accordance with the EP&A Act) was undertaken to determine if the proposed Stage 3 underground mining would have a significant impact on this EEC. This assessment, provided in **Appendix C**, concluded that the impacts of the proposed Stage 3 underground mining on the River-flat Eucalypt Forest EEC would be minimal, and would not result in the modification or loss of any areas of this EEC. As such, the proposed Stage 3 underground mining will not have a significant impact on any areas of the River-flat Eucalypt Forest EEC.

3.5 Endangered Flora Populations

No endangered flora species were identified within the Study Area. Four endangered flora populations are relevant to the Hunter Valley catchment (in which the Study Area occurs):

- weeping myall (*Acacia pendula*) population in the Hunter Valley;
- river red gum (*Eucalyptus camaldulensis*) population in the Hunter Valley;
- tiger orchid (*Cymbidium canaliculatum*) population in the Hunter Valley; and
- *Leionema lamprophyllum* subsp. *obovatus* population in the Hunter Valley.

The potential for each of these endangered flora populations is assessed in Table 1 of **Appendices B** and **C** (relating to the Surface Infrastructure Site and the Stage 3 Mine Area respectively). The assessment concludes that no endangered flora populations have potential to occur within the Study Area.



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

0 0.5 1 1.5km
1:30 000

Legend

- Conceptual Layout for Stage 3 Longwall Panels
- 20mm Subsidence Contour
- Surface Infrastructure Site
- 1 in 100 Year Flood Level

FIGURE 3.5

Existing 1 in 100 Year Flood Level for Cony Creek and Sandy Creek

3.6 Regionally Significant Flora Species

Briggs and Leigh (1996) list species in Australia regarded to be a 'Rare or Threatened Australian Plant' (ROTAP). From this list, one species was recorded within the Surface Infrastructure Site, being *Macrozamia flexuosa*, of which several individuals were recorded. Within the Stage 3 Mine Area, three ROTAP species were recorded: *Grevillea montana*, *Macrozamia flexuosa* and *Eucalyptus fergusonii* subsp. *fergusonii*. Several individuals of each of the three species were observed throughout the Stage 3 Mine Area. Both *Grevillea montana* and *Macrozamia flexuosa* are reported to be widespread within the Cessnock area (Bell and Driscoll 2008).

The Study Area occurs within the Hunter Region, within which there are numerous flora species considered to have conservation significance (Peake et al. 2003). The criteria used to list regionally significant species include:

- endemic taxa – known distribution restricted to this region;
- uncommon taxa – less than 50 known populations;
- records close to the limit of the species' geographical range; and
- significant reductions in population size or area occupied.

The Hunter Rare Plants Database (Peake et. al. 2003) provides an extensive list of flora species within the Hunter Region that are considered to be regionally significant. From this database, there are 36 regionally significant flora species which were recorded within the Study Area (**Table 3.3**).

Table 3.3 - Regionally Significant Species Recorded within the Study Area

Species	Criteria	Recorded in Surface Infrastructure Site	Recorded in Stage 3 Mine Area
Acacia longissima	D U W	Yes	Yes
Acacia parvipinnula	N W	Yes	Yes
Angophora bakeri	N D	Yes	Yes
Astroloma humifusum	N	-	Yes
Bossiaea obcordata	?U	-	Yes
Caladenia catenata	W	-	Yes
Corymbia maculata	W	Yes	Yes
Diuris aurea	N	-	Yes
Eleocharis gracilis	W	-	Yes
Eucalyptus amplifolia subsp. *amplifolia*	T	Yes	Yes
Eucalyptus canaliculata	D	Yes	Yes
Eucalyptus eugenoides	?W	-	Yes
Eucalyptus fergusonii subsp. *fergusonii*		-	Yes
Eucalyptus globboidea	W	Yes	Yes
Eucalyptus longifolia	N D	-	Yes
Eucalyptus punctata	N A	Yes	Yes
Eustrephus latifolius	W	Yes	Yes

Table 3.3 - Regionally Significant Species Recorded within the Study Area (cont)

Species	Criteria	Recorded in Surface Infrastructure Site	Recorded in Stage 3 Mine Area
Glossodia major	-	-	Yes
Glossodia minor	U	-	Yes
Gompholobium minus	N	-	Yes
Goodenia rotundifolia	S	Yes	Yes
Grevillea sericea subsp. *sericea*	R V (TSC) V (EPBC)	Yes	Yes
Hovea linearis	N	-	Yes
Imperata cylindrica var. *major*	?W	Yes	Yes
Jasminum volubile	S	-	Yes
Leptospermum trinervium	W	Yes	Yes
Lissanthe strigosa	?U	Yes	Yes
Lyperanthus suaveolans	-	-	Yes
Macrozamia flexuosa	L S	Yes	Yes
Maytenus silvestris	U	Yes	Yes
Melaleuca styphelioides	W	Yes	Yes
Oxylobium pulteneae	L	-	Yes
Parsonsia straminea	?W	Yes	Yes
Podolobium ilicifolium	?W	Yes	Yes
Pterostylis nutans	-	-	Yes
Rutidosis heterogama	U	Yes	Yes

Key to Criteria:

U = everywhere uncommon

N, S or W = northern, southern or western distributional limit in Hunter Region

R = rare in the Hunter Valley

T = not the above but may be threatened

? = code is uncertain

- = code not specified

D = disjunct in the Hunter Region

L = endemic to the Hunter Region

V (TSC) = vulnerable under the TSC Act

V (EPBC) = vulnerable under the EPBC Act

These 36 regionally significant flora species emphasise the ecological values of the Study Area, however as they are not legislatively protected, do not propose a constraint to the proposed development. Many of these species are relatively widespread throughout the region, being significant due to the Hunter Valley being the limit of their distribution.

3.7 Regionally Significant Ecological Communities

Two ecological communities which are regarded to be regionally significant are known to occur within proximity to the Study Area, and therefore have been considered in this ecological assessment. A description of each of these ecological communities is provided below.

Abernethy, which is located to the north of the Study Area, is close to the north-eastern limit of distribution for yellow bloodwood (*Corymbia eximia*). *Corymbia eximia* appears to occur as the key dominant tree species in the community here. Preliminary analysis by Bell and Driscoll (in prep.) suggests that it is a distinct community that is highly restricted and may meet criteria for listing as an EEC. This species or the community which it comprises was not recorded within the Surface Infrastructure Site or the Stage 3 Mine Area; however it was recorded approximately three kilometres west of the Surface Infrastructure Site. No remnants of this ecological community were recorded during surveys of the Study Area.

A relictual population of woollybutt (*Eucalyptus longifolia*) occurs in the Quorrobolong area, which forms the northern limit to the species' known distribution. The significance of this population is currently being investigated by Bell and Driscoll (in prep.). The community may meet criteria for listing as an EEC, or, it may form a population that should be listed as an endangered population under the TSC Act. This species was found in a small remnant in low numbers within the Stage 3 Mine Area (**Figure 3.1**). This remnant is described in **Section 3.2.5**.

4.0 Fauna Results

Following are the results of fauna field surveys of winter and spring 2007. Included is a description of the fauna species recorded, fauna habitats of the Study Area, and significant findings such as threatened fauna species.

4.1 Fauna Species Recorded

Sections 4.1.1 to **4.1.4** provide a summary of the fauna species recorded within the Study Area during field surveys. A full list of the fauna species recorded in both the Surface Infrastructure Site and the Stage 3 Mine Area is provided in **Appendix F**.

A total of 56 fauna species were recorded within the Surface Infrastructure Site, of which 36 were birds, 2 amphibians, 2 reptiles and 16 were mammals. Within the Stage 3 Mine Area a total of 97 fauna species were recorded, including 62 birds, 9 amphibians, 4 reptiles and 22 mammals.

4.1.1 Birds

Surface Infrastructure Site

A total of 36 bird species were recorded within the Surface Infrastructure Site during the winter and spring 2007 surveys. The species recorded are typical of those associated with woodland habitats, such as the superb fairy wren (*Malurus cyaneus*), spotted pardalote (*Pardalotus punctatus*), striated pardalote (*Pardalotus striatus*), white-plumed honeyeater (*Lichenostomus penicillatus*) and eastern rosella (*Platycercus eximius*).

One threatened bird species was recorded in the Surface Infrastructure Site, the grey-crowned babbler (*Pomatostomus temporalis temporalis*).

Stage 3 Mine Area

A total of 62 bird species were recorded within the Stage 3 Mine Area during the winter and spring 2007 surveys. The species recorded are typical of those associated with open woodland and grassland habitats, such as the Australian magpie (*Gymnorhina tibicen*), noisy miner (*Manorina melanocephala*), masked lapwing (*Vanellus miles*) and Australian magpie-lark (*Grallina cyanoleuca*).

Three threatened bird species were recorded within the Stage 3 Mine Area, being the grey-crowned babbler (*Pomatostomus temporalis temporalis*), the speckled warbler (*Pyrrholaemus sagittatus*) and the powerful owl (*Ninox strenua*).

All bird species recorded within the Study Area during the winter and spring 2007 surveys are listed in **Appendix F**.

4.1.2 Amphibians

Surface Infrastructure Site

Two frogs were recorded calling within the Surface Infrastructure Site during the winter and spring 2007 surveys, being the brown froglet (*Crinia signifera*) and Vereauxs tree frog (*Litoria vereauxii*).

Stage 3 Mine Area

Nine frog species were recorded within the Stage 3 Mine Area during the winter and spring 2007 surveys. This primarily included locally common species such as the common eastern froglet (*Crinia signifera*), striped marsh-frog (*Limnodynastes peroni*) and the spotted marsh-frog (*Limnodynastes tasmaniensis*).

No threatened amphibian species were recorded within the Study Area during the winter or spring 2007 surveys. All amphibian species recorded within the Study Area during the winter and spring 2007 surveys are listed in **Appendix F**.

4.1.3 Reptiles

Surface Infrastructure Site

Two reptile species, Jacky lizard (*Amphibolurus muricatus*) and the eastern bearded dragon (*Pogona barbata*), were recorded within the Surface Infrastructure Site during the surveys.

No threatened reptile species were recorded at within the Surface Infrastructure Site during the winter or spring 2007 surveys. No threatened amphibian species were recorded at within the Study Area during the winter or spring 2007 surveys.

Stage 3 Mine Area

Four reptile species, were recorded within the proposed Stage 3 Mine Area during the surveys.

No threatened reptile species were recorded at within the Stage 3 Mine Area during the winter or spring 2007 surveys.

All reptile species recorded within the Study Area during the winter and spring 2007 surveys are listed in **Appendix F**.

4.1.4 Mammals

Surface Infrastructure Site

A total of 16 mammal species were recorded within the Surface Infrastructure Site during the winter and spring 2007 surveys.

Four threatened mammal species, the little bentwing-bat (*Miniopterus australis*), the grey-headed flying-fox (*Pteropus poliocephalus*), the large-footed myotis (*Myotis adversus*) and the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), were recorded within the Surface Infrastructure Site during the winter and spring 2007 surveys.

Stage 3 Mine Area

A total of 22 mammal species were recorded within the proposed Stage 3 Mine Area during the winter and spring 2007 surveys.

Six threatened mammal species, the squirrel glider (*Petaurus norfolcensis*), the eastern freetail-bat (*Mormopterus norfolkensis*), the large-footed myotis (*Myotis adversus*), the little bentwing-bat (*Miniopterus australis*), eastern false pipistrelle (*Falsistrellus tasmaniensis*) and the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) were recorded within the Stage 3 Mine Area during the winter and spring 2007 surveys.

All mammal species recorded within the proposed development areas during the winter and spring 2007 surveys are listed in **Appendix F**.

4.2 Habitat Assessment

The Study Area provides foraging, roosting and nesting habitats for a variety of native fauna. Five broad habitat types occur within the Study Area. A description of the specific habitats within each of these broad habitat types is provided below. Only two of these habitat types are relevant to the Surface Infrastructure Site, being the Riparian Habitat and the Open Forest Habitat. A discussion of local and regional habitat connectivity is also provided below.

4.2.1 Riparian Habitat

Riparian habitats occur within the Surface Infrastructure Site and the Stage 3 Mine Area. The vegetation found in the riparian habitats within the proposed Surface Infrastructure Site is dominated by Hunter Lowland Red Gum Forest. Canopy trees in these areas are relatively young and contain very few hollows greater than 100mm in diameter. Scattered stands of *Melaleuca styphelioides* and *Melaleuca nodosa* occur along the stream channel. The creekline is extensively eroded in some areas and ponding occurs in a number of places along the channel. Riparian habitats within the Surface Infrastructure Site may provide foraging habitat for small reptiles and frogs and foraging and nesting habitat for small woodland birds. These habitats may also provide a drinking and foraging resource for micro-bats and large terrestrial mammals. The vegetation within these areas contains a number of nectar-producing plant species and may provide foraging habitat for smaller terrestrial mammals and foraging and roosting habitat for arboreal mammals.

Riparian habitats within the Stage 3 Mine Area are generally eroded and poorly vegetated. Some of the heavily disturbed areas of Cony Creek and Sandy Creek are vegetated with dense stands of swamp oak (*Casuarina glauca*). These areas provide some foraging and nesting habitat for small woodland birds. They generally lack large hollow-bearing trees and therefore contain little potential habitat for arboreal mammals. The understorey in these areas is very poorly developed and therefore is not likely to provide high quality habitat for terrestrial mammals or reptiles. Despite the poor quality of the aquatic habitats associated with riparian habitats within the Stage 3 Mine Area, potential habitat for amphibians exists in these areas. Aquatic habitats in these areas also provide a drinking and foraging resource for micro-bats and large terrestrial mammals.

In some situations within the Stage 3 Mine Area a number of large, hollow-bearing eucalypts occur along the stream channel. These trees may provide denning and foraging habitat for arboreal mammals and micro-bats, as well as nesting habitat for a number of bird species. These eucalypts may also provide seasonal foraging habitat for nectarivorous birds and arboreal mammals. There are a number of winter-flowering canopy tree species within these habitats, including spotted gum (*Corymbia maculata*), grey box (*Eucalyptus moluccana*) and forest red gum (*Eucalyptus tereticornis*).

Although Cony and Sandy Creeks do not provide high quality habitat for many native species, the riparian areas comprise important native corridors across the Stage 3 Mine Area. Within much of the Study Area these riparian habitats represent the largest refuge for native species and may form important seasonal foraging sites for many species of fauna.

4.2.2 Open Forest Habitat

Open forest habitats occur on the drier slopes and crests in the north of the Study Area. The canopy in the open forest habitats is dominated by *Eucalyptus* and *Corymbia* spp. and may provide foraging resources for nectarivorous bird and mammal species. The open forest habitat would also provide foraging and roosting habitat for small woodland birds and micro-bats. Although the canopy trees are relatively young, a few larger, hollow-bearing trees occur within the open forest habitats of both the Surface Infrastructure Site and the Stage 3 Mine Area and some limited nesting habitat for hollow-dependent fauna is present. The understorey of the open forest habitats is generally composed of low, prickly shrubs which provide refuge for small birds, mammals and reptiles. The grassy ground stratum provides foraging resources for granivorous bird species and macropods.

The winter-flowering canopy species occurring within this habitat may provide important foraging resources for a range of fauna species, including the migratory threatened bird species, regent honeyeater (*Xanthomyza phrygia*) and swift parrot (*Lathamus discolor*).

4.2.3 Woodland Habitat

A small remnant of Quorrobolong Scribbly Gum Woodland occurs in the south-east corner of the Stage 3 Mine Area. The upper stratum in this remnant is composed of generally mature *Eucalyptus* and *Corymbia* spp. with a shrub stratum of *Melaleuca*, *Leptospermum* and *Acacia* species. The nectar-producing species within this remnant may provide a foraging resource for nectarivorous birds and mammals. The mature trees contain some small hollows and may provide roosting habitat for micro-bats. The mid- and ground strata in this remnant may provide some refuge and foraging habitat for reptiles, small woodland birds and small terrestrial mammals.

4.2.4 Derived Grassland Habitat

Much of the Stage 3 Mine Area is vegetated with open grassland habitats. These areas have been heavily cleared and grazed and now support a ground stratum dominated by pasture grass species. Although these areas provide foraging habitat for some micro-bats, macropods and some bird species (for example Australian magpies (*Gymnorhina tibicen*), masked lapwings (*Vannellus miles*), magpie-larks (*Grallina cyanoleuca*) and noisy miners (*Manorina melanocephala*)), they contain minimal foraging habitat for reptiles, amphibians, smaller terrestrial or arboreal mammals.

4.2.5 Constructed Dam Habitat

A number of constructed dams are present across the proposed Stage 3 Mine Area. All of these provide habitat for amphibians and also represent a freshwater resource for native birds and mammals. Many of the dams within the proposed Stage 3 Mine Area continue to be regularly grazed and therefore contain minimal emergent vegetation. Notwithstanding this, a number of these dams provide refuge and foraging habitat for a diversity of water-birds and foraging habitat for micro-bats.

4.2.6 Local Habitat Connectivity

Historically, much of the vegetation within the Surface Infrastructure Site has been logged and is now predominantly composed of relatively young native vegetation (estimated to be younger than fifty years old). The proposed Surface Infrastructure Site is situated within a much larger remnant of regrowth native vegetation (now comprising Werakata State Conservation Area and previously the Aberdare State Forest) and therefore habitats within the Study Area are well connected to others in the north and west of the site. However,

habitat connectivity to the east of the site is limited by the presence of Quorrobolong Road and to the south by Pelton Road. The presence of these roads should not impede the migrational movements of birds, bats and medium to large-sized terrestrial mammals, however smaller reptiles, arboreal and terrestrial mammals and amphibians may not be capable of successfully crossing these habitat gaps.

The vegetation within the Stage 3 Mine Area is dominated by grassland and pastures. Much of the area has been logged and grazed and continues to be used for agricultural purposes. This is with the exception of the densely vegetated areas to the north of the Stage 3 Mine Area which are integrated with the Werakata State Conservation Area. Consequently, the existing native habitats within the Stage 3 Mine Area are highly fragmented and isolated. The vegetation and associated habitats along Cony Creek, crossing the site in a general east-west direction, represent the most sizable and significant habitat corridor across the Stage 3 Mine Area. Habitat connectivity in a north-south direction across the site is generally poor. Although, a number of remnants of native vegetation occur across the Stage 3 Mine Area, links between habitats within these and other, more extensive areas of habitat to the north and south of the Study Area are limited.

4.2.7 Regional Habitat Connectivity

Section 4.2.6 provides a description of the local habitat connectivity in relation to the Surface Infrastructure Site and the Stage 3 Mine Area. This section discusses habitat connectivity on a more regional scale.

The proposed Surface Infrastructure Site and the northern part of the Stage 3 Mining Area lie within a bushland remnant which is part of the Broken Back Range and has recently been gazetted as Werakata State Conservation Area. On a regional scale, this large remnant ultimately links with larger bushland areas to the south including Pokolbin State Forest, Corrabare State Forest, Watagan National Park and Yengo National Park.

The NPWS Key Habitats and Corridors (Scotts 2003) project does not identify any fauna movement corridors or key habitats for threatened species within the Study Area or nearby locality.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of habitat from a parcel of land owned by Austar that lies within Werakata State Conservation Area (the Surface Infrastructure Site). Relative to the broader habitat remnant, the removal of this small extent of vegetation will not lead to the fragmentation of habitats on either a local or regional scale.

Given that the proposed Stage 3 Mining Development will involve negligible surface disturbances, there will be no fragmentation of currently connected habitats.

4.3 SEPP 44 (Koala Habitat) Assessment Results

Two SEPP 44 listed tree species, forest red gum (*Eucalyptus tereticornis*) and grey gum (*Eucalyptus punctata*), were recorded within vegetation communities of the Study Area.

Forest red gum (*Eucalyptus tereticornis*) is likely to be hybridising with cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*) which also occurs within the Study Area. Also, the grey gum (*Eucalyptus punctata*) is likely to be forming hybrids with the large-fruited grey gum (*Eucalyptus canaliculata*).

Due to the hybridisation of both species, the exact number of each species occurring in any one location was difficult to assess. Broadly, however, the results of the SEPP 44 assessment revealed that both forest red gum (*Eucalyptus tereticornis*) and grey gum (*Eucalyptus punctata*) comprise greater than 15% of the total trees present in some locations. In addition to the SEPP 44 listed tree species, there are several tree species present within the Study Area which are likely to be koala foraging resources. As such, the Study Area is regarded to comprise potential habitat for the koala. Given the connectivity with large tracts of bushland to the north and south of the Study Area, there is potential for the koala to utilise the resources of the Study Area when travelling between habitats within this larger remnant.

4.4 Threatened Fauna Species

The following sections outline the threatened fauna species recorded within the Surface Infrastructure Site and the Stage 3 Mine Area, and those with potential to occur. **Appendices B** and **C** provide a full list of threatened fauna species (derived from literature review and expert knowledge) that were assessed for their potential to occur within the Study Area. **Appendix B** relates to the Surface Infrastructure Site and **Appendix C** relates to the Stage 3 Mine Area. EPBC Act listed threatened fauna species are considered in **Appendices D** and **E** for the Surface Infrastructure Site and the Stage 3 Mine Area respectively.

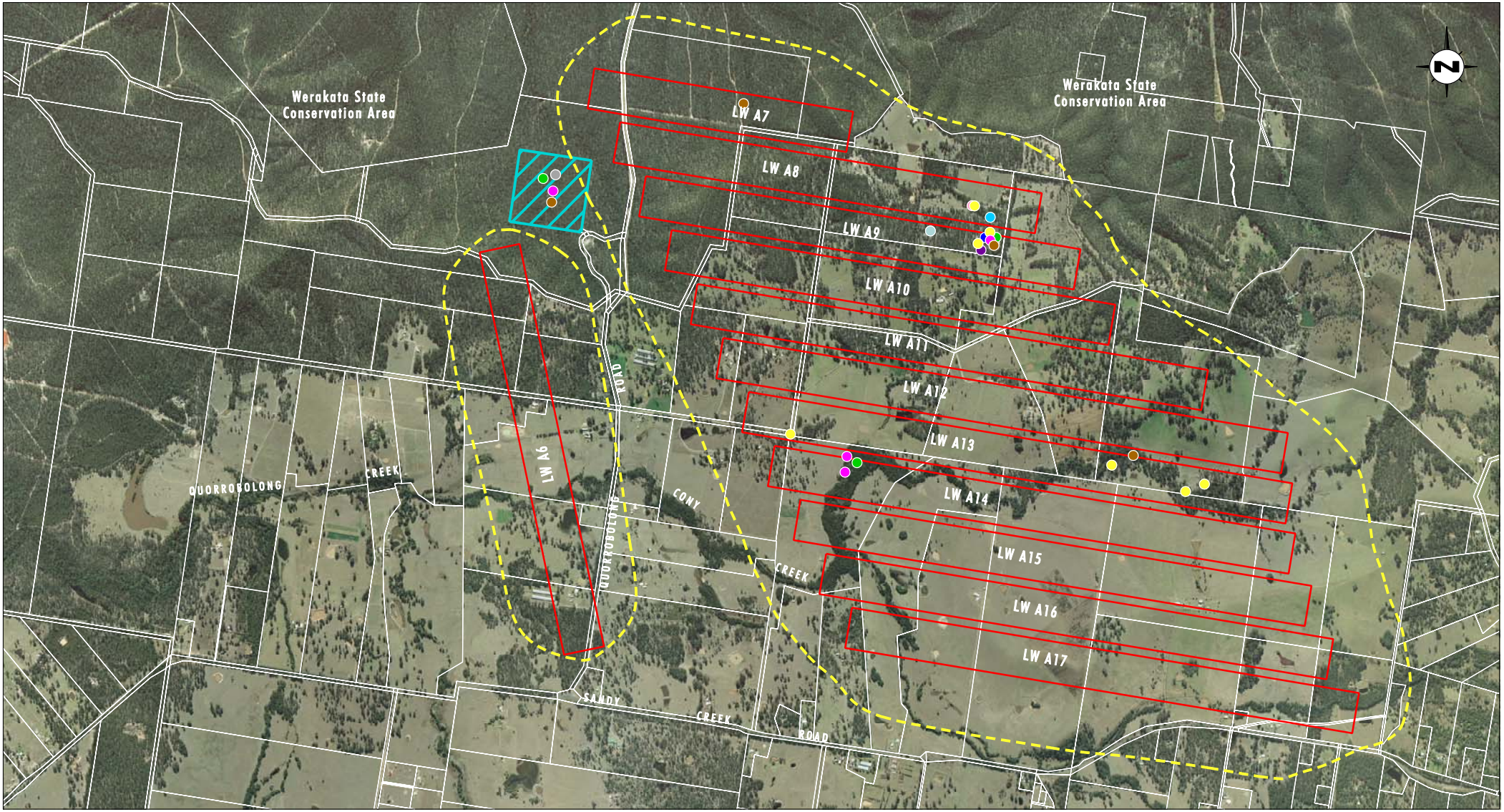
4.4.1 Recorded Threatened Fauna Species

Three threatened fauna species, the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), large-footed myotis (*Myotis adversus*) and the little bentwing-bat (*Miniopterus australis*) were recorded within the Surface Infrastructure Site (**Table 4.1**, **Figure 4.1**). These species were recorded via the Anabat echolocation detector. No other threatened fauna species were recorded within the Surface Infrastructure Site.

The nine threatened fauna species recorded within the Stage 3 Mine Area are listed in **Table 4.1**, along with the survey method by which the species was recorded. **Figure 4.1** shows the location where these species were recorded.

Table 4.1 – Threatened Fauna recorded in the Stage 3 Mine Area

Species	Status	Site Recorded	Method of Record
gang-gang cockatoo *Callocephalon fimbriatum*	V (TSC)	Stage 3 Mine Area	sighted and heard
grey-crowned babbler *Pomatostomus temporalis temporalis*	V (TSC)	Stage 3 Mine Area	sighted and heard
speckled warbler *Pyrrholaemus saggitata*	V (TSC)	Stage 3 Mine Area	sighted
powerful owl *Ninox strenua*	V (TSC)	Stage 3 Mine Area	identification of call during call-playback survey
squirrel glider *Petaurus norfolcensis*	V (TSC)	Stage 3 Mine Area	hair analysis and trap capture
little bentwing-bat *Miniopterus australis*	V (TSC)	Surface Infrastructure Site Stage 3 Mine Area	Anabat echolocation analysis



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

0 0.5 1 1.35km
1:30 000

Legend

- Conceptual Layout for Stage 3 longwall Panels
- 20mm Subsidence Contour
- Surface Infrastructure Site
- speckled warbler
- powerful owl
- little bentwing-bat
- eastern freetail-bat
- large-footed myotis
- eastern bentwing-bat
- gang-gang cockatoo
- squirrel glider
- eastern false pipistrelle
- grey-crowned babbler

FIGURE 4.1

Location of Recorded Threatened Fauna Species

File Name (A4): R15_V1/2274_127.dgn

Table 4.1 – Threatened Fauna recorded in the Stage 3 Mine Area (cont)

Species	Status	Site Recorded	Method of Record
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V (TSC)	Surface Infrastructure Site Stage 3 Mine Area	Anabat echolocation analysis
large-footed myotis *Myotis adversus*	V (TSC)	Surface Infrastructure Site Stage 3 Mine Area	Anabat echolocation analysis
eastern freetail-bat *Mormopterus norfolkensis*	V (TSC)	Stage 3 Mine Area	Anabat echolocation analysis

Notes:

V=vulnerable

TSC = *Threatened Species Conservation Act 1995*

4.4.2 Threatened Fauna Species with Potential to Occur

A search of the DECC and DEWHA ecological databases (described in **Section 2.1.6** above) was undertaken in order to identify threatened fauna species which have potential to occur within the Surface Infrastructure Site, and their distribution within the locality.

Table 2 of **Appendices B** and **C** lists the threatened fauna species recorded from these two database searches, and assesses the likelihood of their occurrence within the Surface Infrastructure Site and the Stage 3 Mine Area respectively. A total of 21 threatened fauna species were found to have potential habitat within the Surface Infrastructure Site, while 19 were found to have potential habitat in the Stage 3 Mine Area. All species with potential to occur within the Study Area are listed in **Table 4.2** below.

Table 4.2 - Threatened Fauna Species with Potential to Occur within the Study Area

Species	Status	Potential to Occur in Surface Infrastructure Site	Potential to Occur in Stage 3 Mine Area
green-thighed tree frog *Litoria brevipalmata*	V (TSC)	No	Yes
painted snipe *Rostratula benghalensis australis*	E (TSC) V (EPBC)	No	Yes
freckled duck *Stictonetta naevosa*	V (TSC)	No	Yes
square-tailed kite *Loiphoctinia isura*	V (TSC)	Yes	Yes
red goshawk *Erythrotriorchis radiatus*	E (TSC) V (EPBC)	Yes	Yes
glossy black-cockatoo *Calyptorhynchus lathami*	V (TSC)	Yes	Yes
gang-gang cockatoo *Callocephalon fimbriatum*	V (TSC)	Yes	Recorded
swift parrot *Lathamus discolor*	E (TSC) E (EPBC)	Yes	Yes
regent honeyeater *Xanthomyza phrygia*	E (TSC) E (EPBC)	Yes	Yes

Table 4.2 - Threatened Fauna Species with Potential to Occur within the Study Area (cont)

Species	Status	Potential to Occur in Surface Infrastructure Site	Potential to Occur in Stage 3 Mine Area
turquoise parrot *Neophema pulchella*	V (TSC)	Yes	Yes
powerful owl *Ninox strenua*	V (TSC)	Yes	Recorded
barking owl *Ninox connivens*	V (TSC)	Yes	Yes
masked owl *Tyto novaehollandiae*	V (TSC)	Yes	Yes
brown treecreeper *Climacteris picumnus victoriae*	V (TSC)	Yes	Yes
black-chinned honeyeater *Melithreptus gularis gularis*	V (TSC)	Yes	Yes
speckled warbler *Pyrrholaemus saggitata*	V (TSC)	Yes	Recorded
grey-crowned babbler *Pomatostomus temporalis temporalis*	V (TSC)	Yes	Recorded
diamond firetail *Stagonopleura guttata*	V (TSC)	Yes	Yes
spotted-tailed quoll *Dasyurus maculatus*	V (TSC) E (EPBC)	Yes	Yes
koala *Phascolarctos cinereus*	V (TSC)	Yes	Yes
squirrel glider *Petaurus norfolcensis*	V (TSC)	Yes	Recorded
grey-headed flying-fox *Pteropus poliocephalus*	V (TSC) V (EPBC)	Yes	Yes
eastern freetail-bat *Mormopterus norfolcensis*	V (TSC)	Yes	Recorded
little bentwing-bat *Miniopterus australis*	V (TSC)	Yes	Recorded
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V (TSC)	Yes	Recorded
large-eared pied bat *Chalinolobus dwyeri*	V (TSC)	Yes	Yes
eastern false pipistrelle *Falsistrellus tasmaniensis*	V (TSC)	Yes	Yes
large-footed myotis *Myotis adversus*	V (TSC)	Yes	Recorded
greater broad-nosed bat *Scoteanax rueppellii*	V (TSC)	Yes	Yes

Key:

* Records from DECC Wildlife Atlas Database

Records from DEWHA Protected Matters Search

TSC = *Threatened Species Conservation Act* 1995

EPBC = *Environment Protection and Biodiversity Conservation Act* 1999

E = Endangered

V = Vulnerable

4.5 Endangered Fauna Populations

There are no endangered fauna populations known to occur within the Surface Infrastructure Site or the Stage 3 Mine Area. There are no endangered fauna populations with potential to occur within the Study Area.

4.6 Critical Habitat

There are no areas of critical habitat occurring within or in proximity to the Surface Infrastructure Site or the Stage 3 Mine Area.

4.7 EPBC – Listed Migratory Species

A search of the DEWHA Protected Matters Database was undertaken in order to identify any EPBC Act listed threatened, migratory or listed marine species which could potentially occur within a 10 kilometre radius of the centre of the Study Area (based on DEWHA habitat modelling).

Threatened flora and fauna species identified from the DEWHA database search are presented in Tables 1 and 2 of **Appendices B** and **C** (for the Surface Infrastructure Site and the Stage 3 Mine Area respectively), while the EPBC Act-listed migratory and marine species are listed in **Table 4.3** below.

Table 4.3 - Migratory and listed marine species potentially occurring within a 10 kilometre radius of the Study Area (DEWHA Protected Matters Database)

Species	Status	Potential to Occur in Surface Infrastructure Site	Potential to Occur in Stage 3 Mine Area
white-bellied sea-eagle *Haliaeetus leucogaster*	Migratory Marine	Moderate	Recorded
white-throated needletail *Hirundapus caudacutus*	Migratory Marine	Moderate	Moderate
rainbow bee-eater *Merops ornatus*	Migratory Marine	Moderate	Moderate
black-faced monarch *Monarcha melanopsis*	Migratory Marine	Moderate	Moderate
satin flycatcher *Myiagra cyanoleuca*	Migratory Marine	Moderate	Moderate
rufous fantail *Rhipidura ruffifrons*	Migratory Marine	High	High
regent honeyeater *Xanthomyza phrygia*	Migratory	High	High
great egret *Ardea alba*	Migratory Marine	None	High
cattle egret *Ardea ibis*	Migratory Marine	None	High
Lathams snipe *Gallinago hardwickii*	Migratory Marine	Low	Low

Table 4.3 - Migratory and listed marine species potentially occurring within a 10 kilometre radius of the Study Area (DEWHA Protected Matters Database) (cont)

Species	Status	Potential to Occur in Surface Infrastructure Site	Potential to Occur in Stage 3 Mine Area
painted snipe *Rostratula benghalensis*	Migratory Marine	Low	Low
fork-tailed swift *Apus pacificus*	Migratory Marine	Moderate	Moderate
swift parrot *Lathamus discolor*	Marine	High	High

Of the 13 EPBC-listed migratory and marine species shown in **Table 4.3** above, only one was recorded during surveys of the Study Area, being the white-bellied sea-eagle (*Haliaeetus leucogaster*), which was observed in the Stage 3 Mine Area. An assessment of significance has been undertaken for the migratory and marine species listed in **Table 4.3** that have moderate or high potential to occur in the Study Area, and is provided in **Appendices D** and **E** (for the Surface Infrastructure Site and the Stage 3 Mine Area respectively).

5.0 Aquatic Results

The results of the aquatic assessment are provided in the following sections. The results include data obtained from field surveys, as well as information from a desk-top literature review.

5.1 Macroinvertebrate Sampling

The macroinvertebrate taxa collected from the four sites within the Stage 3 Mine Area are listed in **Table 5.1** below, which also indicates the SIGNAL-2 sensitivity grade for each taxa where available.

Table 5.1 – Macroinvertebrate Taxa Recorded within the Stage 3 Mine Area

Taxa	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	SIGNAL -2 Grade	SIGNAL HU97 Grade
Acarina	freshwater mites	2	0	2	2	5		-	-
Amphipod sp. 1	side swimmers	2	1	4			6	-	-
Araneae	true spiders				1			-	-
Atyidae	freshwater shrimp	1	1	1	1	3	6	3	8
Baetidae	baetids		1			8	4	5	8
Belostomatidae						4		1	-
Brentidae	straight-snouted weevils	1	1					3	-
Carabidae	ground beetles				1			3	-
Chaoboridae							1	2	-
Chironomidae	non-biting midges	14	10		2	7	12	3	1
Cladocera	water fleas	7	16	15	10	43	14	-	-
Coenagrionidae	damselflies	1		1	4	11	1	2	3
Copepoda							2		-
Corixidae						7	7	2	5
Culicidae	mosquitoes	9	10	1			1	1	6
Cyclopoida	crustaceans		5	1	2			-	-
Dixidae	‘u’ bent larvae				1			7	8
Dytiscidae	diving beetles	7	3	3	6	6	13	2	4
Glossiphoniidae						1	2	1	4
Hydrophilidae	water scavenger beetles	3	1	2		2	8	2	5
Leptoceridae	stick caddis	1		1	1	5	3	6	9
Leptophlebiidae	leptoflebs	1	2					8	10
Lestidae						2	6	9	-
Libellulidae	dragonflies		1		1			4	5
Mesoveliidae	water treaders	1						2	3
Notonectidae							11	1	6
Ostracoda							3	-	-

Table 5.1 – Macroinvertebrate Taxa Recorded within the Stage 3 Mine Area (cont)

Taxa	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	SIGNAL -2 Grade	SIGNAL HU97 Grade
Physidae	freshwater snails	2	1	1	1	5	7	1	3
Planorbidae						1		2	6
Pleidae	pygmy back-swimmers			1		1		2	-
Richardsonianidae	leeches			1				4	-
Scirtidae	marsh beetles	3	4	1	5	12	9	6	5
Staphylinidae	rove beetles			1				3	-
Stratiomyidae	soldier flies	1						2	4
Synthemistidae	dragonflies	1						2	-
Tricladida	planarians			1		1		-	-
Veliidae	small water striders	1			6	1	1	3	-
Diptera pupae	flies		3		1			-	-
Diptera adult	flies	1					1	-	-
TOTAL No. Species		**19**	**15**	**16**	**16**	19	21	-	

A total of 39 taxa of macroinvertebrates were recorded across the six sampling sites. Of these, Site 6 had the highest diversity of taxa at 21. A total of 19 taxa were recorded at Sites 1 and 5 while 3 and 4 had 16 taxa each and Site 2 had 15 taxa.

The macroinvertebrate taxa recorded in higher abundances were generally those with a low SIGNAL score (refer to **Section 2.4.2** for a description of the SIGNAL grades). Taxa with a SIGNAL score greater than five (indicating sensitive species) were typically found in low abundance across all sites. Site 6 was found to have a higher abundance of the sensitive taxa than the other five sites. The low abundance of sensitive species reflect the observed condition of the riparian habitats at all sites, which was generally low. The riparian habitats have been heavily disturbed as a result of forestry and agricultural practices in the catchment.

5.2 Freshwater Vertebrates

No freshwater vertebrates were recorded within the Stage 3 Mine Area during sampling. There are a number of freshwater vertebrates that have potential to occur, including the introduced species mosquito fish (*Gambusia holbroki*).

5.3 Aquatic Habitat Assessment

The characteristics of the major aquatic habitats of the Study Area are described in the following sections.

5.3.1 Cony Creek

Cony Creek runs in an east-west direction throughout the centre of the Stage 3 Mine Area, and ultimately feeds into Quorrobolong Creek further to the west. Cony Creek is

characterised by a narrow band of riparian vegetation (approximately 10 to 20 metres wide) with cleared floodplains, predominantly utilised for cattle grazing. The riparian vegetation varies in condition, with the remnants of higher condition being in the east of the Study Area and those of more disturbed condition in the west. In locations where the vegetation condition is higher, the canopy is dominated by mixed Eucalypts, including forest red gum (*Eucalyptus tereticornis*), cabbage gum (*Eucalyptus amplifolia* subsp*. amplifolia*) and rough-barked apple (*Angophora floribunda*). The understorey comprises a diversity of species, predominantly grey myrtle (*Backhousia myrtifolia*) and other wet sclerophyll species. The more disturbed remnants of riparian vegetation along Cony Creek are characterised by a dense canopy of swamp oak (*Casuarina glauca*), with no shrub stratum and very low native diversity in the ground stratum.

The channel of Cony Creek is approximately 2 metres wide, with steep banks up to 2 metres in height. Where the understorey vegetation is sparse, there is considerable erosion of the banks. Where grazing is not excluded from the riparian zone, the extent of erosion is higher. There is generally very low flow within Cony Creek, however several small to moderate-sized pools of standing water are present. Due to the ephemeral nature of the creekline, there is limited opportunity for freshwater fish species to occur, however a diversity of macroinvertebrate species are present. There is generally a good cover of riparian vegetation providing shade to the channel.

5.3.2 Sandy Creek

Sandy Creek runs through the south-west corner and along the southern boundary of the Stage 3 Mine Area. Sandy Creek flows in an east to west direction, and is a tributary of Cony Creek. The riparian vegetation of Sandy Creek is heavily modified, due to a history of clearing for agricultural practices, and subsequent weed invasion. There is very little native diversity, particularly in the understorey, and a large proportion of introduced species. The canopy is characterised by dense stands of swamp oak (*Casuarina glauca*), with occasional emergent trees such as rough-barked apple (*Angophora floribunda*) and forest red gum (*Eucalyptus tereticornis*). Although the vegetation is heavily modified, the riparian and bank vegetation is dense and provides good shading of the channel.

The channel of Sandy Creek is typically 2 to 3 metres wide with steep banks 1 to 2 metres high. At the time of surveys there was a moderate flow of water within Sandy Creek, with water depth up to 1 metre in some locations. Sandy Creek may support a moderate diversity of fish species and macroinvertebrate taxa.

5.3.3 Black Creek

A south-north flowing tributary of Black Creek traverses the Surface Infrastructure Site. This is an ephemeral creekline which is well vegetated in the riparian and channel zones. The vegetation is regrowth, having been previously logged. There was very little water in the channel of this tributary at the time of surveys, however there is evidence of high flows in the past. There is a small amount of exposed bedrock, and rocky ledges along the creekline. There are often several small pools of standing water. Very few strictly aquatic species were recorded along this tributary, a reflection of its generally dry, ephemeral nature. It is unlikely that any fish species would occur within this tributary, however a diversity of macroinvertebrates would be present, particularly when higher volumes of water are present. The small pools remaining in the channel during drier times would be a refuge for macroinvertebrate taxa. The tributary is generally well shaded with overhanging bank vegetation.

5.3.4 Dam Habitats

There are a number of constructed dams within the Stage 3 Mine Area, the majority of which have little or no fringing vegetation. There is one large dam in the north-east of the Stage 3 Mine Area that supports a moderate diversity of emergent sedges and rushes and some aquatic species. This dam is regularly used by waterbirds, and would be an important water resource for native fauna, in particular macropods such as the eastern grey kangaroo (*Macropus giganteus*) and red-necked wallaby (*Macropus rufrogriseus*).

5.4 RCE Habitat Condition Assessment

An RCE inventory score (modified Chessman et al. 1997 score) was calculated for each of the six sampling sites within the study area. The average RCE score for the riparian habitats of the Stage 3 Mine Area was 35. The total possible score that can be obtained is 52, which indicates a stream in near-pristine condition, while a lower score indicate a more disturbed condition. The score for the Study Area indicate that the stream has a moderate condition, and is greatly modified from its natural state. This is consistent with the observations of the habitat assessment, provided in **Section 5.3**.

5.5 Fisheries Management Act 1994 Listed Species

No FM Act listed threatened species or endangered populations were recorded within the Study Area during surveys, and there is no record of any having been previously recorded within the locality. There is no potential for any FM Act listed threatened species or endangered populations to occur in the aquatic habitats of the Study Area.

6.0 Key Threatening Processes

A number of Key Threatening Processes (KTPs) listed under the Schedules of the TSC Act, the EPBC Act and the FM Act, are relevant to the proposed development. A discussion of the implications of the relevant KTPS under each Act is detailed below. Further assessment of the impacts of the proposed development on specific ecological values of the study area is provided in **Section 8**.

6.1 Threatened Species Conservation Act Listed KTPs

- **Alterations due to subsidence associated with longwall mining**

This is the most relevant KTP associated with the proposed development. As discussed in **Section 8**, the extent of subsidence is not predicted to be significant. Appropriate management measures will be implemented in the event that the underground mining results in unforeseen threats to the ecological values of the Study Area.

- **Clearing of native vegetation**

The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. Given that the proposed Stage 3 Mine Development will involve underground mining, there will be no clearing of native vegetation in that area. The implications of this KTP will be limited to the proposed Surface Infrastructure Development. The proposed Surface Infrastructure Site will require the clearing of approximately 10 hectares of native vegetation. A biodiversity offsets area is proposed to provide compensation for this loss (refer to **Section 9**).

- **Invasion of native plant communities by exotic perennial grasses**

There is very limited potential that operations associated with the proposed Stage 3 Mining Development or the proposed Surface Infrastructure Development would introduce exotic perennial grasses into native plant communities. Should monitoring of the proposed Stage 3 mining area or the Surface Infrastructure Site detect exotic perennial grasses becoming invasive within native plant communities (particularly within any EECs), appropriate management measures will be implemented.

- **High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition**

There is very limited potential that the proposed Stage 3 Mining Development or the proposed Surface Infrastructure Development would cause an increase in the frequency of fire in areas of native vegetation. In the event that the vegetation of the Study Area becomes exposed to high frequency fire, appropriate management measures will need to be implemented.

- **Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands**

Based on the predicted subsidence expected as a result of the proposed Stage 3 Mining Development, there is potential for minor alterations to the natural flow regime of the underlying waterways. In particular, there are predicted to be flow changes at the confluence of Cony Creek and Sandy Creek, with the potential for a slight increase in in-channel ponding for a period of up to 24 hours. However, appropriate mitigation measures will need to be

implemented in the event that monitoring reveals any significant alteration to the natural flow regimes of the Study Area.

6.2 Environment Protection and Biodiversity Conservation Act

- **Land clearance**

The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. Given that the proposed Stage 3 Mine Development will involve underground mining, there will be no clearing of native vegetation in that area. The implications of this KTP will be limited to the proposed Surface Infrastructure Development. The proposed Surface Infrastructure Site will require the clearing of approximately 10 hectares of native vegetation. A biodiversity offset area (refer to **Section 9**) is proposed to provide compensation for this loss.

6.3 Fisheries Management Act

- **The removal of large woody debris**

The proposed development is very unlikely to require the removal of large woody debris from watercourses.

- **The degradation of native riparian vegetation along New South Wales water courses**

The proposed underground mining has negligible potential to cause degradation of riparian vegetation as a result of subsidence. The predicted levels of subsidence for the proposed Stage 3 Mining Development are very unlikely to result in the degradation of native riparian vegetation. If, however, unforeseen impacts are identified, appropriate mitigation measures will be implemented to minimise these impacts. An ecological monitoring program will be established to detect any changes in the condition of riparian vegetation.

7.0 EPBC Matters of National Environmental Significance

If the actions of a proposed development trigger the EPBC Act, approval from the Minister for Environment and Water Resources must be sought, in addition to any state or local government approvals. The EPBC Act is triggered if the proposed development is likely to have a significant impact on any matters of national environmental significance (MNES), as listed under the EPBC Act. The seven MNES are listed in **Table 7.1**, which also provides a discussion of the potential for the proposed development to have a significant impact on any of these MNES.

Table 7.1 - Assessment of EPBC Act Matters of National Environmental Significance (MNES)

MNES	Potential to Occur within the Study Area	Potential for Significant Impact
The world heritage values of declared World Heritage properties.	There are no World Heritage properties within or in proximity to the Study Area.	No World Heritage properties will be impacted upon as a result of the proposed developments.
The national heritage values of places on the National Heritage List.	There are no National Heritage Listed places within the Study Area. Nearby Natural Heritage listed places include Bow Wow Creek Gorge and Mulbring Road-Fill Quarry. These areas will not be affected as a result of the proposed developments.	No National Heritage Listed places will be impacted upon as a result of the proposed developments.
The ecological character of declared Ramsar wetlands.	The Study Area lies within the same catchment as the Hunter Estuary Wetlands Ramsar site, however it is a considerable distance upstream of this. The proposed developments will not impact on the ecological character of this Ramsar wetland site.	The proposed developments will not have a significant impact on any Ramsar wetlands.
Threatened species (other than extinct and conservation-dependent species) and ecological communities (other than vulnerable ecological communities) listed under the EPBC Act.	Three EPBC Act listed threatened species were recorded within the Study Area. A number of EPBC Act listed threatened species have potential to occur within the Study Area. An assessment of the significance of the impacts of the proposed Surface Infrastructure Development and the Stage 3 Mining Development on these species is provided in **Appendix D**. The Stage 3 Mining Development has potential to impact only one EPBC Act listed threatened species, for which an assessment under that Act is provided in **Appendix E**. The impact on this species, should it occur, would not be significant.	The proposed developments will not have a significant impact on any EPBC Act listed threatened species or ecological communities.

Table 7.1 - Assessment of EPBC Act Matters of National Environmental Significance (MNES) (cont)

MNES	Potential to Occur within the Study Area	Potential for Significant Impact
Migratory species listed under the EPBC Act.	A number of EPBC Act listed migratory bird species have potential to occur within the Study Area. An assessment of the significance of the impacts of the proposed Surface Infrastructure Development on potentially occurring migratory species is provided in **Appendix D**. The Stage 3 Mining Development does not have potential to impact on any EPBC Act listed migratory species, therefore an assessment of significance under that Act is not required.	The proposed developments will not have a significant impact on any EPBC Act listed migratory species.
Nuclear actions that are likely to have a significant impact on the environment.	The proposed development does not involve any nuclear actions.	The proposed developments do not involve any nuclear actions that may have a significant impact on the environment.
The Commonwealth marine environment.	The Study Area is not within the Commonwealth marine environment.	The proposed developments do not have a significant impact on any areas of the Commonwealth marine environment.

In summary, from **Table 7.1** the proposed developments will not have a significant impact on any EPBC Act listed MNES, and therefore referral to the Minister for Environment and Water Resources will not be required.

8.0 Assessment of Impacts

Due to the very different nature of the proposed Surface Infrastructure Development and the Stage 3 Mining Development, the impacts of each proposal are discussed in separate sections below.

8.1 Impacts of Proposed Surface Infrastructure Development

The proposed Surface Infrastructure Development requires the clearing of vegetation within the 8 to 10 hectare footprint shown on **Figure 1.2**.

The vegetation to be removed largely comprises the Lower Hunter Spotted Gum – Ironbark EEC (10 hectares), while a small area of Hunter Lowland Red Gum Forest EEC (0.2 hectares) will also be disturbed. The proposed Surface Infrastructure Development will also disturb known habitat for heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), as well as potential habitat for a number of threatened fauna species. The impacts of the proposed development on these significant ecological values are discussed in the following sections.

8.1.1 Impacts on Threatened Flora Species

Two threatened flora species were recorded within the Surface Infrastructure Site, being heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). Specimens of both threatened flora species were identified positively by expert botanists at the NSW National Herbarium. A number of additional threatened flora species were found to have potential to occur within the Surface Infrastructure Site. An assessment of the significance of the impacts of the proposed Surface Infrastructure Development on recorded or potentially occurring threatened flora species is assessed in **Appendix B**. Although seven part tests of significance are not required for developments assessed under Part 3A, seven part tests are nevertheless used as the means of determining the likely level of significance of impacts. An assessment in accordance with the EPBC Act for all recorded and potentially occurring threatened flora species listed under that Act is provided in **Appendix D** in relation to the Surface Infrastructure Site.

Heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) were recorded widely throughout the Surface Infrastructure Site, and therefore a number of individuals of these threatened flora species will be disturbed as a result of the proposed Surface Infrastructure Development. Both species are known to have a moderately widespread occurrence within the locality, particularly to the north-east of the Surface Infrastructure Site. Known individuals and habitat of both species are now protected within the adjacent Werakata State Conservation Area and the nearby Werakata National Park.

Although the proposed development was not found to have a significant impact on any threatened flora species, a biodiversity offsets area is proposed to compensate for the loss of threatened flora species resulting from the proposed Surface Infrastructure Development (**Section 9.1**). One small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) was recorded within the proposed biodiversity offset area during a site inspection. No individuals of heath wrinklewort (*Rutidosis heterogama*) were recorded, however the habitats are similar to those of the Surface Infrastructure Site, and therefore this species is regarded likely to occur.

The assessment of the impacts of the proposed Surface Infrastructure Development on these two threatened flora species (**Appendix B**) takes into consideration their distribution and abundance within the locality, their protection within conservation reserves, and the proposed protection of 17 hectares of known and potential habitat within the biodiversity offset area. This considered, it is concluded that the proposed Surface Infrastructure Development will not have a significant impact on the heath wrinklewort (*Rutidosis heterogama*) or small-flowered grevillea (*Grevillea parviflora* subsp. *parviflora*) such that their local population would be placed at risk of extinction.

The seven part test in **Appendix B** finds that the project will not have a significant impact on any other threatened flora species.

8.1.2 Impacts on EECs

Two EECs were recorded in the Surface Infrastructure Site, Hunter Lowland Red Gum Forest and Lower Hunter Spotted Gum – Ironbark Forest. The proposed Surface Infrastructure Development will have an impact on 0.05 hectares of the Hunter Lowland Red Gum Forest EEC, and 10 hectares of the Lower Hunter Spotted Gum – Ironbark Forest, the significance of which is assessed through a seven part test which is provided in **Appendix B**. Although seven part tests of significance are not required for developments assessed under Part 3A, seven part tests are nevertheless used as the means of determining the likely level of significance of impacts. This assessment of significance also takes into consideration the proposed biodiversity offsets and impact mitigation measures described in **Section 9.1**.

The proposed Surface Infrastructure Development will require a relatively small area of disturbance of the two EECs, both of which are conserved within the adjacent Werakata State Conservation Area and Werakata National Park. Approximately 7871 hectares of the Lower Hunter Spotted Gum – Ironbark Forest EEC was found to be present in the Cessnock-Kurri region (Bell and Driscoll 2008), while only 127.03 hectares of the Hunter Lowland Red Gum Forest EEC was identified.

A 17 hectare area supporting vegetation of similar characteristics is proposed to be protected within a biodiversity offsets area nearby to the proposed Surface Infrastructure Site (refer to **Section 9**). These 17 hectares will be conserved which may include incorporation into the adjacent Werakata State Conservation Area. Given the small area of each EEC to be disturbed relative to the regional extent, and taking into consideration the proposed offset area, the impacts on the regional conservation of the EECs will not be significant.

The assessment of significance in relation to the Hunter Lowland Red Gum Forest and the Lower Hunter Spotted Gum – Ironbark Forest EECs (**Appendix B**) concludes that the EECs will not be significantly impacted by the proposed Surface Infrastructure Development such that their occurrence within the locality will be placed at risk of extinction.

8.1.3 Impacts on Threatened Fauna Species

Three threatened fauna species, the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), large-footed myotis (*Myotis adversus*) and the little bentwing-bat (*Miniopterus australis*) were recorded within the Surface Infrastructure Site. No other threatened fauna species were recorded within the Surface Infrastructure Site, however 21 species were found to have potential to occur.

An assessment of the significance of the impacts of the proposed Surface Infrastructure Development on recorded or potentially occurring threatened fauna species is assessed in **Appendix B**. Although seven part tests of significance are not required for developments assessed under Part 3A, seven part tests are nevertheless used as the means of

determining the likely level of significance of impacts. An assessment in accordance with the EPBC Act for all recorded and potentially occurring threatened fauna species listed under that Act is provided in **Appendix D**.

The three threatened fauna species recorded are all micro-bat species, and therefore are highly mobile and likely to utilise the resources of the Surface Infrastructure Site as part of a wider foraging range. As such, the habitats of the Surface Infrastructure Site are not likely to be significant for the persistence of any local populations of these micro-bat species. While there is not likely to be a significant impact as a result of the development, a biodiversity offsets area is proposed (**Section 9.1**), which will lead to the dedication of approximately 17 hectares of currently privately owned land to the Werakata State Conservation Area. The proposed biodiversity offsets area contains similar habitat values to those proposed to be disturbed within the Surface Infrastructure Site.

The outcome of the assessment of recorded and potentially occurring threatened fauna species concludes that the proposed Surface Infrastructure Site will not have a significant impact on the long-term conservation of any threatened fauna species within the locality.

8.1.4 Impacts on Endangered Populations

There are no endangered flora or fauna populations present within the Surface Infrastructure Site, therefore there will be no impacts on endangered populations.

8.1.5 Impacts on Corridor Function

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares from a parcel of land which is currently privately owned however is surrounded by Werakata State Conservation Area on the west, north and south edges. The east edge adjoins Quorrobolong Road, which dissects Werakata State Conservation Area. Due to the very small area of vegetation to be disturbed for the proposed Surface Infrastructure Development, and considering the large expanse of Werakata State Conservation Area, there will be very limited impact on current corridor functions, including fauna movement and plant propagule dispersal. The impacts on fauna movement corridors will be localised and not likely to result in the decline of any locally occurring population.

8.1.6 Summary of Impacts on Threatened Species and EECs and Recommendations

The proposed Surface Infrastructure Development will impact on two threatened flora species and two EECs and known and potential habitat for a number of threatened fauna species, however detailed assessments have found that the impact will not be significant for any threatened species or EECs.

Although the impact on threatened species and EECs will not be significant, a biodiversity offsets area has been designated in order to compensate for the loss of habitat for known and potentially occurring threatened species and EECs. The proposed biodiversity offsets area is discussed in further detail in **Section 9.1.2**.

8.2 Impacts of Proposed Stage 3 Mining Development

Detailed modelling and assessment of the potential impacts that may result from the Longwall mining of panels LW6 to LW17 was undertaken by MSEC (2008). This assessment has considered the potential maximum extent of subsidence and any secondary impacts that may occur as a result of that subsidence.

In general terms, the principal surface impact resulting from Longwall mining is subsidence, the extent of which is dependent on a number of factors including the depth of the coal seam worked, the design and location of the mine, the topography of the landscape, the nature of the overlying rock stratum, the width of the chain pillars and the ratio of the depth of overburden to the Longwall panel width (NSW Scientific Committee 2005e). Subsidence relating to Longwall mining may result in secondary impacts, which typically impact greatest on riparian ecosystems. Broadly, potential changes to riparian environments that may be expected to occur as a result of Longwall mining include:

- changes to runoff and flow volumes through subsidence induced changes to catchment boundaries;
- changes to bank stability and channel alignment;
- changes to in-channel and out of channel ponding through changes to the bed profile of the creeks which may result in drying or waterlogging of root systems; and
- loss of water to near-surface groundwater flows due to subsidence-induced cracks occurring beneath a stream or other surface water body (valley closure).

Due to the geology of the area, the mine layout and the depth to the coal seam (i.e. 450 to 740 metres), within the Stage 3 Mine Area, the subsidence predicted to occur as a result of the proposed Longwall mining is not expected to significantly impact on runoff regimes, bank stability, channel alignment, in-channel and out of channel ponding or groundwater availability. Subsidence predictions indicate that subsidence will occur reasonably consistently over the breadth of the Stage 3 mining area. As a result the subsidence impacts are not expected to have a significant impact on the ecology of the area. In addition, due to the depth of cover and relative predicted uniformity of subsidence over the Stage 3 area, it is predicted that surface mitigation works along creeks and drainage channels will not be required and hence disturbance of these areas is not likely to be necessary. Drainage line analysis of the predicted subsided landform indicates that all creek systems will remain free draining without mitigation works.

Given that there will be negligible subsidence impacts on the surface landform, or consequent secondary impacts relating to subsidence as a result of the proposed Stage 3 Mining Development, the impacts on the overlying natural ecosystems will be negligible.

The following sections provide a discussion of the potential for the proposed Stage 3 Mine Development to impact on any threatened species or EECs recorded or with potential to occur in the Stage 3 Mine Area. **Section 7.2.4** provides discussion of the KTP, 'alteration of habitats due to subsidence relating from longwall mining'.

8.2.1 Impacts on Threatened Flora Species

Two threatened flora species were recorded within the Stage 3 Mine Area, heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*).

Table 1 of **Appendix C** includes an assessment as to whether the proposed Stage 3 Mining Development would have an impact on any recorded or potentially occurring threatened flora species. Given that the surface disturbances associated with the proposed Stage 3 Mining Development will be negligible, there is no requirement to undertake an assessment of significance for any threatened flora species recorded or with potential to occur within the Stage 3 Mine Area.

There are no EPBC Act listed threatened flora species with potential to be impacted by the proposed Stage 3 Mining Development and therefore further assessment under that Act is not required.

8.2.2 Impacts on EECs

Three EECs were recorded within the Stage 3 Mine Area, the Lower Hunter Spotted Gum – Ironbark Forest EEC, the Quorrobolong Scribbly Gum Woodland EEC and the River-flat Eucalypt Forest EEC.

Given the negligible subsidence impacts on habitat characteristics predicted for the proposed Stage 3 Mining Development, it is not expected to have any impact on the Lower Hunter Spotted Gum Ironbark Forest EEC and the Quorrobolong Scribbly Gum Woodland EEC. However, there is some potential (albeit very low), that the proposed Stage 3 Mine Development may impact on the River-flat Eucalypt Forest, as it occurs in riparian situations, where any impacts of longwall mining would be expected to be concentrated.

The significance of any potential impacts on the River-flat Eucalypt Forest EEC is assessed through a seven part test in accordance with the requirements of the EP&A Act. Although seven part tests of significance are not required for developments assessed under Part 3A, seven part tests are nevertheless used as the means of determining the likely level of significance of impacts. This assessment, provided in **Appendix B**, concludes that the proposed Stage 3 Mine Development will not have a significant impact on the River-flat Eucalypt Forest EEC such that it would place the local occurrence of the EEC at risk of extinction.

No EPBC Act listed EECs were found within the Stage 3 Mine Area, and therefore an assessment of significance under that Act is not required for any EECs.

8.2.3 Impacts on Threatened Fauna Species

Nine threatened fauna species were recorded within the Stage 3 Mine Area, while 19 were found to have potential to occur.

Table 1 of **Appendix C** includes an assessment as to whether the proposed Stage 3 Mining Development would have an impact on any of these recorded or potentially occurring threatened fauna species. Given that the surface disturbances associated with the proposed Stage 3 Mining Development will be negligible, there is no requirement to undertake an assessment of significance for all species recorded or with potential to occur within the Stage 3 Mine Area. As such, a seven part test of significance, in accordance with the requirements of the EP&A Act, has been prepared only for the three threatened fauna species which have potential to be impacted upon by the proposed Stage 3 Mining Development (**Appendix C**). These species are the green-thighed frog (*Litoria brevipalmata*), grey-headed flying-fox (*Pteropus poliocephalus*) and large-footed myotis (*Myotis adversus*). Although seven part tests of significance are not required for developments assessed under Part 3A, seven part tests are nevertheless used as the means of determining the likely level of significance of impacts.

The outcome of the assessment provided in **Appendix C** concludes that the proposed Stage 3 Mine Development will not have a significant impact on any recorded or potentially occurring threatened fauna species.

One EPBC Act listed threatened fauna species has potential to be impacted by the proposed Stage 3 Mining Development, the grey-headed flying-fox (*Pteropus poliocephalus*). An

assessment in accordance with the requirements of the EPBC Act is provided for this species in **Appendix E**.

8.2.4 Impacts on Endangered Populations

There are no endangered flora or fauna populations present within the Stage 3 Mine Area, therefore there will be no impacts on endangered populations.

8.2.5 Key Threatening Processes

Subsidence due to longwall mining has been recognised as causing habitat alteration, with species and ecological communities that depend on aquatic and semi-aquatic habitats being particularly susceptible to the impacts of subsidence. Consequently, alteration of habitat following subsidence due to longwall mining has been determined by the NSW Scientific Committee to constitute a Key Threatening Process (NSW Scientific Committee 2005e).

A list of threatened species, populations and EECs potentially impacted by longwall mining is provided in the NSW Scientific Committee Final Determination for this KTP (NSW Scientific Committee, 2005e). Of those species listed, one was recorded within the Stage 3 Mine Area, the large-footed myotis (*Myotis adversus*). One species was found to have potential to occur, the grey-headed flying-fox (*Pteropus poliocephalus*).

The large-footed myotis is a micro-bat species which forages over streams and pools catching insects and small fish by raking their feet across the water surface. Any changes in surface water ponding may have an impact on foraging resources for this species, specifically, the drying of any water bodies. The grey-headed flying-fox is a fruit bat, which feeds on resources such as fruit, blossom and insects. This species has potential to be impacted by longwall mining through the loss of foraging resources, for instance if there is a change in hydrology that causes dieback of food trees of this species.

Given the negligible subsidence expected to occur as a result of the Stage 3 Mine Development, and the very low potential for any increase or decrease in surface water ponding (within riparian areas or elsewhere), there will be no impact on any threatened fauna species.

8.2.6 Summary of Impacts on Threatened Species and EECs and Recommendations

The surface disturbances associated with the proposed Stage 3 Mining Development are expected to have a negligible impact on habitat characteristics, and will not result in any changes to topography or the surface or groundwater patterns within the Stage 3 Mine Area. As such, there will be no significant impact on any recorded or potentially occurring threatened species, populations or EECs as a result of the proposed Stage 3 Mine Area. As a precautionary measure, a seven part test of significance in accordance with the requirements of the EP&A Act was undertaken for the River-flat Eucalypt Forest EEC (recorded within the Stage 3 Mine Area), green-thighed frog (*Litoria brevipalmata*) (potentially occurring), grey-headed flying-fox (*Pteropus poliocephalus*) (potentially occurring) and the large-footed myotis (*Myotis adversus*) (recorded). This EEC and the threatened fauna species rely on riparian habitats, and therefore are at slightly greater risk of being impacted by the proposed Stage 3 Mining Development than any other record. The outcome of the seven part test of significance concluded that there would not be a significant impact on the River-flat Eucalypt Forest, the green-thighed frog (*Litoria brevipalmata*), the grey-headed flying-fox (*Pteropus poliocephalus*) or the large-footed myotis (*Myotis adversus*) as a result of the proposed Stage 3 Mining Development.

There is one threatened fauna species also listed under the EPBC Act that has potential to be impacted by the proposed Stage 3 Mining Development, and therefore requires an assessment of significance in accordance with that Act. An assessment of significance under the EPBC Act for the grey-headed flying-fox (*Pteropus poliocephalus*) is provided in **Appendix E**.

Although the predicted disturbances suggest that there will be no significant impact on any recorded or potentially occurring threatened species, populations or EECs as a result of the Stage 3 Mine Development, ongoing monitoring will be undertaken as mining proceeds to ensure that these predictions are consistent with the actual impacts encountered. In the event that monitoring does reveal impacts which are inconsistent with those predicted (and therefore used as the basis for this assessment), a review of the potential impacts on threatened species, populations and EECs will be undertaken. Modifications to the project and mitigation measures where appropriate will be implemented accordingly.

9.0 Impact Mitigation Measures

In order to minimise the impacts on the ecological values of the Surface Infrastructure Site and the Stage 3 Mine Area, the following mitigation measures are incorporated into the proposed developments.

9.1 Surface Infrastructure Site

Due to the presence of a number of features of ecological importance within the Surface Infrastructure Site (including threatened species and EECs), it is necessary to put in place mitigation measures to ensure that the impacts of the construction and operation of the Surface Infrastructure Site are minimised. Due to the proposed development being adjacent to a State Conservation Area, a number of the impact mitigation measures listed below relate to ensuring that impacts (such as invasion of exotic species) of the proposed development of the Surface Infrastructure Site do not extend into the reserve. The measures include the following:

- Clearing of vegetation will be restricted to the minimum area necessary to construct the proposed infrastructure and will be undertaken in accordance with the tree felling procedure outlined in **Section 9.1.1**.

- An appropriate speed limit on access roads will be implemented to minimise the risk of vehicle collision with ground-dwelling fauna dispersing between adjacent habitats.

- An appropriately designed nest box will be erected (either within remaining bushland areas or within the Biodiversity Offsets Area) for the compensation of each tree hollow removed as a result of clearing required for construction of the proposed Surface Infrastructure Site.

- Any outbreaks of invasive weeds observed on the property boundary will be appropriately controlled to avoid their escape into the surrounding Werakata State Conservation Area and subsequently competing with threatened flora species. Early detection will ensure the management required is not extensively onerous. Particular weeds of concern within the area that have potential to invade the disturbed edges include lantana (*Lantana camara*), prickly pear (*Opuntia stricta* var. *stricta*), asparagus fern (*Asparagus aethiopicus*) and blackberry (*Rubus fruticosus* sp. agg.).

- Any landscaping undertaken around infrastructure areas will use only locally occurring native plant species to reduce the risk of invasive plant species escaping into the adjacent reserve and competing with threatened flora species. Particular care will be taken to avoid planting species which are known to escape and naturalise into native bushland.

9.1.1 Tree Clearing Procedure

The following tree clearing procedure will be used whenever woody native vegetation is required to be cleared within the Surface Infrastructure Site. Based on observations during field surveys, the density of hollow-bearing tress within the Surface Infrastructure Site is relatively low. The procedure focuses on the identification of hollow-bearing trees, active nests, possum dreys or other important habitat features prior to clearing, and aims to minimise injury to native fauna species (particularly hollow-dependent species) that may be occupying vegetation to be cleared. The following sections provide detail on the recommended timing of clearing activities, pre-clearing surveys, recommended clearing procedures, requirements for compensatory habitat (nest boxes) and associated monitoring

activities. Hollow-bearing trees refer to those trees containing identified hollows, while habitat trees refer to those trees that do not contain hollows but contain other habitat features such as active nests and possum dreys.

Timing of Clearing

The most appropriate timing for the clearing of woody vegetation is in the period between February and June, as this is outside of the breeding time for many native fauna species, particularly threatened species. It will be necessary for the clearing program to include some flexibility in the event that significant ecological values (such as breeding threatened species) are detected during the pre-clearance surveys (see below). In such cases, it may be necessary to delay clearing activities in order to avoid creating a significant impact on that species.

In the event that project planning schedules prevent the clearing procedure to be implemented in the ideal period between February and June, additional measures may need to be incorporated. Undertaking clearing activities within spring or summer greatly increases the likelihood of nesting fauna occupying the tree hollows, and therefore presents a much greater risk of injury to residing fauna. As such, if clearing activities cannot be avoided during these seasons, extra vigilance should be incorporated into the monitoring procedure. Additional steps may need to be implemented, which should be at the discretion of the appropriately trained and qualified ecologist who is overseeing for the clearing procedure. If tree-felling activities do need to occur in spring or summer, additional flexibility in the clearing program should be incorporated to allow for any additional steps that may need to be undertaken.

Pre-Clearing Requirements

Pre-clearing requirements involve the completion of adequate pre-clearing surveys by a suitably qualified, experienced and licenced person and the erection of nest boxes as compensatory habitat for tree hollows to be removed. The requirements for the pre-clearing surveys are provided below:

- The area to be cleared must be appropriately identified in the field, prior to the pre-clearing surveys.
- A pre-clearance inspection will be undertaken no more than two weeks prior to the scheduled clearing by a suitably qualified, experienced and licenced person. All hollow-bearing trees and habitat trees within the area to be cleared will be identified and marked using spray paint.
- The number of hollows present in each tree will be recorded, as will the size class of each hollow. Tree hollows will be classified into the following size classes:
  - Very small - <25 mm;
  - Small -26-50 mm;
  - Medium – 51-100 mm;
  - Large – 101-300 mm; and
  - Very large - >301 mm.
- A suitably qualified, experienced and licenced person will recommend any specific activities that are deemed necessary as a result of any findings of the pre-clearance survey. Such actions may include delaying clearing if an identified threatened species is

breeding, or completion of discouraging activities (such as branch removal) to encourage native species to vacate the area.

- The total number of hollows in each tree to be cleared will define the number of nest boxes that are required to compensate for the clearing. One nest box per tree hollow removed will be erected in nearby secure habitats (which may include the Biodiversity Offsets Area). The nest boxes will be of the same size classes that were removed, and the design will be appropriate for native fauna species known from the area.

- All nest boxes will be erected prior to clearing, and will be mounted using an appropriate method, such as the 'HabisureTM' system. This system allows for growth of the trunk without damage to the tree, or nest box.

- All nest boxes will be subject to regular monitoring for their condition and usage by target native species.

Clearing Procedure

The clearing of vegetation will follow the steps outlined below:

- Prior to clearing, the site Environmental Officer will contact the local wildlife rescue organisation and have them on standby should the need arise to recover any fauna from the felled habitat trees.

- All non-habitat trees will be cleared first, taking care to avoid all marked habitat trees. Providing that pre-clearing surveys have been completed, it is not necessary for an ecologist to be present while clearing non-habitat trees.

- Within one to two days following the clearing of non-habitat trees, habitat trees will be cleared in the presence of a suitably qualified, experienced and licenced person. Before clearing, the trunk of the hollow-bearing tree will be shaken vigorously with heavy machinery. Any fauna observed should be encouraged to vacate the tree, using relevant techniques under the advice of a suitably qualified, experienced and licenced person. The machinery operator will then push the tree over as slowly as possible, so as to minimise the intensity of impact when hitting the ground. This will minimise potential harm to fauna remaining within the hollows.

- Once the tree has been felled, a suitably qualified, experienced and licenced person will inspect the tree (particularly tree hollows) for signs of any trapped or injured fauna. Where necessary, a spotlight will be used to inspect deep hollows.

- Any injured fauna will be carefully captured and taken to a wildlife carer or veterinary clinic.

In the event that clearing activities have to be undertaken in spring or summer, additional steps may need to be incorporated into this procedure. This may include such things as increased vigilance during the pre-clearance inspection and gradual felling of trees limb by limb to avoid harm to any residing fauna.

Nest Box Monitoring

Nest box monitoring will be undertaken by a suitably qualified, experienced and licenced person to record their effectiveness and suitability. In particular, the monitoring should identify the degree of usage of nest boxes and look for signs of occupation by feral species such as European honeybees or Indian mynahs. This monitoring should be undertaken biennially after the first phase of nest box installation for the duration of the mine operations

(to ensure no loss of nest boxes through deterioration over time). In the event that this monitoring shows limited or declining use of nest boxes at any time, the types, locations and need for the nest boxes will be reviewed. The monitoring should be scheduled for spring when nesting bird species are most likely to be detected. Subsequent to the monitoring, a brief report will be prepared documenting the findings, and detailing recommendations regarding maintenance activities as required.

In addition to the monitoring by a qualified ecologist, annual inspections of the nest boxes should be undertaken by mine personnel over the life of the mine. The aim of this monitoring is to assess the condition of the boxes and replace any fallen or damaged boxes.

The need and frequency of the nest box monitoring program will be assessed periodically.

9.1.2 Biodiversity Offsets

In order to compensate for the loss of vegetation and habitats as a result of the development of the proposed Surface Infrastructure Site, an area suitable to establish a biodiversity offset was sought. A number of land parcels owned by Austar were investigated to determine if they support similar or comparable ecological values to those identified within the Surface Infrastructure Site, and therefore their potential to compensate for the disturbances associated with its development.

The following criteria were considered when investigating the suitability of each land parcel as a biodiversity offset area:

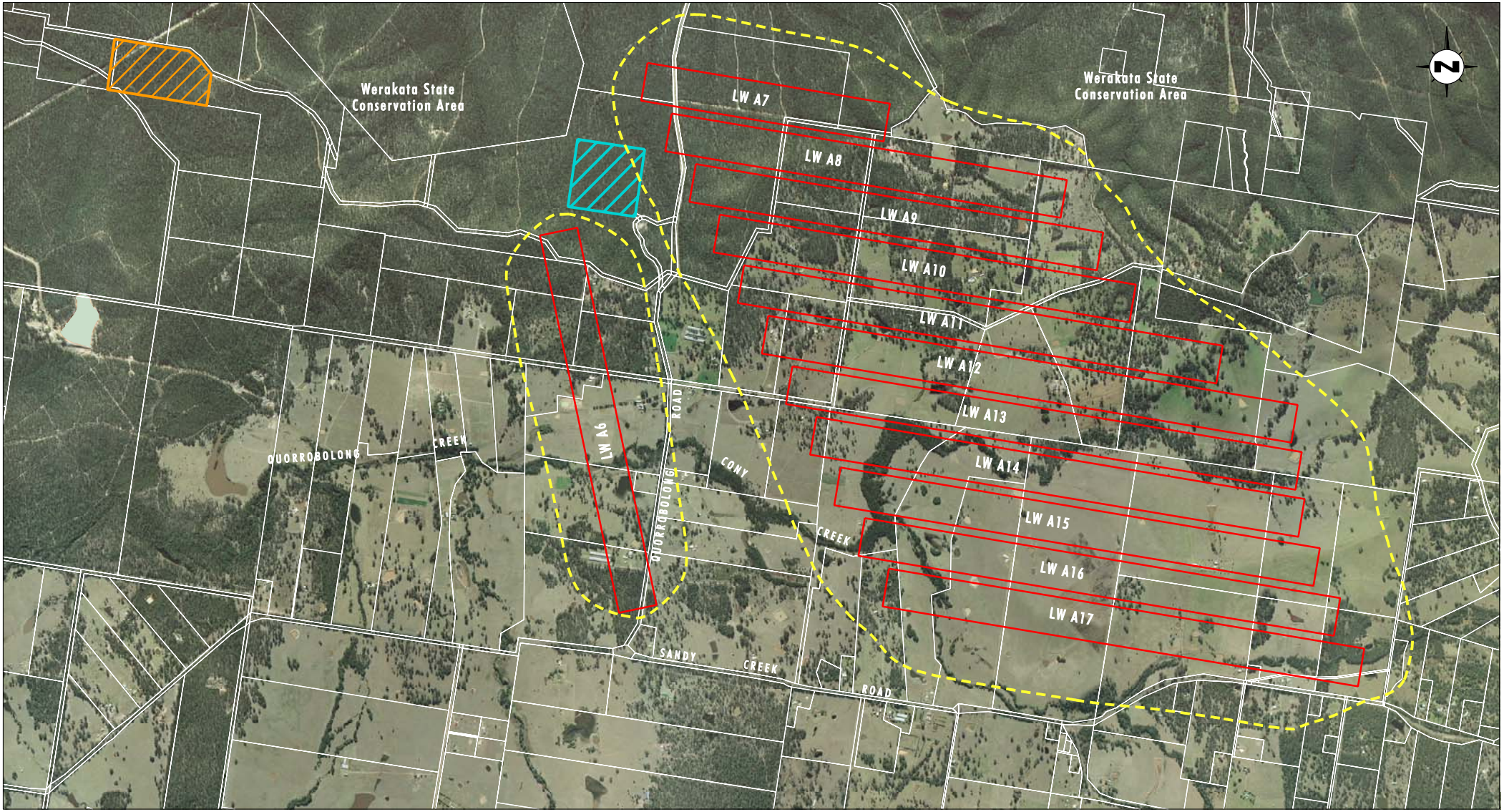
- the length of edge adjacent to Werakata State Conservation Area (and therefore the influence of edge effects) and connectivity between habitats (where possible taking into consideration the potential for any future land developments);
- the presence of similar vegetation communities of similar or better condition to those occurring in the Surface Infrastructure Site;
- identification of areas of potential future development and how this may influence the integrity of the biodiversity offsets area; and
- the presence of any ecological values additional to those present within the Surface Infrastructure Site.

Through this process a parcel of land approximately 17 hectares in size was found to comprise similar characteristics to those to be disturbed for the proposed Surface Infrastructure Development. This area was found suitable for the proposed biodiversity offsets, and is herein referred to as the proposed Biodiversity Offsets Area. The location of the proposed Biodiversity Offsets Area is shown in **Figure 9.1**.

The proposed Biodiversity Offsets Area, were found to support the following three vegetation communities, one of which is a known EEC, one of which is a potential EECs and one of which is of regional significance:

- Lower Hunter Spotted Gum – Ironbark Forest (known EEC);
- Hunter Lowland Red Gum Forest (potential EEC); and
- Yellow Bloodwood Low Open Forest (regionally significant ecological community).

The Lower Hunter Spotted Gum – Ironbark Forest EEC and the Hunter Lowland Red Gum Forest EEC were both recorded within the Surface Infrastructure Site, however the Yellow



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

0 0.5 1 1.5km
1:32 000

Legend

- Conceptual Layout for Stage 3 Longwall Panels
- 20mm Subsidence Contour
- Surface Infrastructure Site
- Proposed Biodiversity Offset Area

FIGURE 9.1

Proposed Biodiversity Offset Area

File Name (A4): R15_V1/2274_142.dgn

Bloodwood Low Open Forest was not. The potential presence of the Hunter Lowland Red Gum Forest EEC is based largely on a broad assessment of the structure and floristic composition of the riparian community, rather than a systematic and quantitative assessment. Due to the strong similarities with the EEC, the riparian community in the proposed Biodiversity Offsets Area is regarded as being highly likely to be consistent with the EEC.

As discussed in **Section 3.7**, the Yellow Bloodwood Low Open Forest is a community thought to have a highly restricted distribution in the Hunter Valley and may meet criteria for listing as an EEC.

The proposed Biodiversity Offsets Area contains potential habitat for the two threatened flora species that were recorded within the Surface Infrastructure Site: heath wrinklewort (*Rutidosis heterogama*) and the small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). The latter species was recorded in low numbers in the proposed Biodiversity Offsets Area. The relevant components of the habitats of the Surface Infrastructure Site which are important for these threatened flora species are regarded to be consistent with those of the proposed Biodiversity Offsets Area.

The habitat characteristics of the proposed Biodiversity Offsets Area are similar to those of the Surface Infrastructure Site, and for some characteristics support values of slightly higher significance. For example, there is a greater density of mature trees in the canopy stratum comparative to the Surface Infrastructure Site which generally supports canopy trees of a younger age class. The greater density of mature trees improves the fauna habitat vales, in particular for hollow-dependent and other arboreal species. Additionally, the understorey of the proposed Biodiversity Offsets Area is more developed than that of the Surface Infrastructure Site. This understorey complexity is important for a range of fauna species, particularly for ground-dwelling mammals, reptiles and birds.

Given the similarity in habitats, the proposed Biodiversity Offsets Area is expected to have potential habitat for a similar suite of fauna species, including the threatened fauna species which were recorded or have potential to occur within the Surface Infrastructure Site.

9.2 Stage 3 Mine Area

No specific ecological impact mitigation measures are necessary for the Stage 3 Mine Development, as the subsidence predictions indicate no impact on ecological entities. However, as mining progresses in Stage 2 (which is the first application of the top coal caving method in Australia), if it is found that the resulting subsidence is exceeding that predicted, a review of the impacts of the Stage 3 Development on any significant ecological values will be undertaken. This review of the ecological assessment may lead to the modification of the proposed development as reported herein, or the establishment of an ecological monitoring program and implementation of impact mitigation measures. Provided that the subsidence impacts are as predicted, no specific ecological monitoring or mitigation measures are deemed to be necessary. Again, this will be reviewed in light of the outcomes of the monitoring within the Stage 2 Mining Area.

10.0 Conclusion

A detailed analysis of the predicted subsidence impacts and associated changes to hydrology resulting from the proposed Stage 3 Mining Area has identified that the surface impacts on the existing ecological values are likely to be negligible. As subsidence will be relatively negligible and consistent across the proposed Stage 3 Mine Area, the predicted subsidence will not result in any significant, detectable changes to the surface landscape or hydrology. The proposed development is not expected to have a significant impact on any threatened species, populations or EECs recorded or with potential to occur within the Stage 3 Mining Area. Ongoing monitoring of the subsidence impacts as mining progresses will be undertaken to ensure that this continues to be the case. In the event that the subsidence impacts are not consistent with those predicted (and which have been used as the basis for this assessment), a review of the ecological assessment will be made to adequately determine the impact on any significant ecological values.

The impacts of the proposed development of the Surface Infrastructure Site will be greater than those resulting from the proposed Stage 3 Mining Area, due to the required clearing of native vegetation and associated habitats. The proposed Surface Infrastructure Site will require the disturbance to two threatened flora species, two EECs and habitat for a number of known and potentially occurring threatened fauna species. In recognition of the ecological values of the Surface Infrastructure Site, a 17 hectare Biodiversity Offsets Area will be established to compensate for the impacts on these entities in the proposed Surface Infrastructure Site. This area supports areas of higher ecological values than contained within the Surface Infrastructure Site.

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APPENDIX A

Flora Species List

Appendix A – Flora Species List

The following list was developed from surveys of the Study Area detailed in **Section 2** of the main report. It includes all species of vascular plants observed on both the Surface Infrastructure Site and the Stage 3 Mine Area during fieldwork. Not all species are readily detected at any one time of the year, therefore the list will not necessarily include all plant species likely to occur in the Study Area. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp.	specimens that are identified to genus level only;
?	specimens for which identification was uncertain;
prob.	specimens for which identification was considered highly likely but not definite;
poss.	specimens for which identification was considered likely but not definite;

The following abbreviations or symbols are used in the list:

asterisk (*)	denotes species not indigenous to the study area;
subsp.	subspecies;
var.	variety;
f.	forma; and
X	hybrid.

Those species highlighted in bold are threatened species.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2008), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Family/Sub Family	Scientific Name	Common Name	Surface Infrastructure Site	Stage 3 Mine Area
Cycadopsida (cycads)				
Zamiaceae	*Macrozamia communis*	burrawang		x
Zamiaceae	*Macrozamia flexuosa*	a burrawang	x	x
Filicopsida (ferns)				
Adiantaceae	*Adiantum aethiopicum*	common maidenhair	x	x
Adiantaceae	*Cheilanthes distans*	bristly cloak fern	x	x
Adiantaceae	*Cheilanthes sieberi* subsp. *sieberi*	poison rock fern	x	x
Azollaceae	*Azolla pinnata*	ferny azolla		x
Blechnaceae	*Doodia aspera*	prickly rasp fern		x
Blechnaceae	*Doodia linearis*	small rasp fern		x
Dennstaedtiaceae	*Pteridium esculentum*	bracken		x
Marsileaceae	*Marsilea mutica*	nardoo		x
Magnoliopsida (flowering plants) – Liliidae (monocots)				
Anthericaceae	*Laxmannia gracilis*	slender wire lily		x
Asphodelaceae	*Bulbine bulbosa*	bulbine lily		x
Commelinaceae	*Commelina cyanea*	native wandering Jew		x
Commelinaceae	**Tradescantia fluminensis*	wandering Jew		x
Cyperaceae	*Carex appressa*	tall sedge	x	x
Cyperaceae	*Carex inversa*	knob sedge		x
Cyperaceae	*Eleocharis gracilis*			x
Cyperaceae	*Fimbristylis dichotoma*	common fringe-sedge		x
Cyperaceae	*Gahnia aspera*	rough saw-sedge		x
Cyperaceae	*Gahnia melanocarpa*	black-fruit saw-sedge	x	
Cyperaceae	*Lepidosperma laterale*	variable saw-sedge	x	x
Dioscoreaceae	*Dioscorea transversa*	native yam		x
Hydrocharitaceae	*Ottelia ovalifolia*	swamp lily		x
Iridaceae	**Romulea rosea*	onion grass		x
Juncaceae	**Juncus acutus* subsp. *acutus*	sharp rush		x
Juncaceae	*Juncus usitatus*	common rush		x
Juncaginaceae	*Triglochin procerum*	water ribbons		x
Lemnaceae	*Wolffia* sp.			x
Lomandraceae	*Lomandra confertifolia*	mat rush	x	x
Lomandraceae	*Lomandra confertifolia* subsp. *pallida*	mat rush		x
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	wattle mat-rush	x	x
Lomandraceae	*Lomandra glauca*	pale mat-rush	x	
Lomandraceae	*Lomandra longifolia*	spiny-headed mat-rush	x	x
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush	x	x
Lomandraceae	*Lomandra obliqua*	fishbones	x	x
Luzuriagaceae	*Eustrephus latifolius*	wombat berry	x	x
Luzuriagaceae	*Geitonoplesium cymosum*	scrambling lily		x

Family/Sub Family	Scientific Name	Common Name	Surface Infrastructure Site	Stage 3 Mine Area
Orchidaceae	*Acianthus pusillus*	gnat orchid		x
Orchidaceae	*Caladenia carnea*	pink fingers		x
Orchidaceae	*Caladenia catenata*	white caladenia		x
Orchidaceae	*Calochilus paludosus*	red beard orchid		x
Orchidaceae	*Corybas* sp.	a helmet orchid		x
Orchidaceae	*Diuris aurea*	a donkey orchid		x
Orchidaceae	*Diuris dendrobioides*	wedge diuris		x
Orchidaceae	*Glossodia major*	waxlip orchid		x
Orchidaceae	*Glossodia minor*	small waxlip orchid		x
Orchidaceae	*Lyperanthus suaveolens*	brown beaks		x
Orchidaceae	*Pterostylis nutans*	nodding greenhood		x
Phormiaceae	*Dianella caerulea*	blue flax-lily	x	x
Phormiaceae	*Dianella longifolia* var. *longifolia*	blueberry lilly	x	x
Phormiaceae	*Dianella longifolia* var. *stenophylla*	blueberry lilly		x
Phormiaceae	*Dianella* sp.			x
Poaceae	*Aristida* sp.	a speargrass	x	x
Poaceae	*Aristida vagans*	threeawn speargrass		x
Poaceae	*Austrodanthonia caespitosa*	ringed wallaby grass		x
Poaceae	*Austrodanthonia* sp.	a wallaby grass	x	x
Poaceae	*Austrostipa scabra* subsp. *scabra*	speargrass		x
Poaceae	*Austrostipa verticillata*	slender bamboo grass		x
Poaceae	*Bromus* sp.	brome		x
Poaceae	**Chloris gayana*	Rhodes grass		x
Poaceae	*Cymbopogon refractus*	barbed wire grass		x
Poaceae	*Cynodon dactylon*	common couch	x	x
Poaceae	*Dicanthium sericeum* subsp. *sericeum*	Queensland blue grass		x
Poaceae	*Digitaria* sp.			x
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	tufted hedgehog grass	x	x
Poaceae	*Echinopogon ovatus*	forest hedgehog grass		x
Poaceae	**Ehrharta erecta*	panic veldtgrass		x
Poaceae	*Entolasia marginata*	bordered panic		x
Poaceae	*Entolasia stricta*	wiry panic	x	x
Poaceae	*Eragrostis leptostachya*	paddock lovegrass		x
Poaceae	*Eragrostis* sp.	a lovegrass	x	x
Poaceae	*Imperata cylindrica* var. *major*	blady grass	x	x
Poaceae	*Microlaena stipoides* var. *stipoides*	weeping grass		x
	Oplismenus aemulus	basket grass	x	
Poaceae	*Panicum simile*	two-colour panic		x
Poaceae	*Panicum* sp.		x	x

Family/Sub Family	Scientific Name	Common Name	Surface Infrastructure Site	Stage 3 Mine Area
Poaceae	**Pennisetum clandestinum*	kikuyu grass		x
Poaceae	*Setaria* sp.	pigeon grass		x
Poaceae	*Sporobolus creber*	slender rats tail grass		x
Poaceae	**Stenotaphrum secundatum*	buffalo grass		x
Poaceae	*Themeda australis*	kangaroo grass	x	x
Typhaceae	*Typha orientalis*	broad-leaved cumbungi		x
Xanthorrhoeaceae	*Xanthorrhoea* sp.	a grass tree	x	x
Magnoliopsida (flowering plants) – Magnoliidae (dicots)				
Acanthaceae	*Brunoniella australis*	blue trumpet	x	x
Acanthaceae	*Pseuderanthemum variabile*	pastel flower		x
Amaranthaceae	*Alternanthera denticulata*	lesser joyweed		x
Apiaceae	*Centella asiatica*	pennywort		x
Apiaceae	*Platysace ericoides*	heath platysace	x	
Apiaceae	*Trachymene incisa* subsp. *incisa*			x
Apiaceae	*Xanthosia pilosa*	woolly xanthosia		x
Apocynaceae	*Parsonsia straminea*	common silkpod		x
Asclepiadaceae	**Gomphocarpus fruticosus*	narrow-leaved cotton bush		x
Asteraceae	*Ambrosia* sp.	a lacy ragweed		x
Asteraceae	**Bidens pilosa*	cobblers pegs		x
Asteraceae	**Carthamus lanatus*	saffron thistle		x
Asteraceae	*Cassinia* sp.			x
Asteraceae	*Chrysocephalum apiculatum*	common everlasting		x
Asteraceae	**Conyza albida*	tall fleabane		x
Asteraceae	**Conyza* sp.	a fleabane		x
Asteraceae	*Cotula australis*	common cotula		x
Asteraceae	**Facelis retusa*			x
Asteraceae	**Gamochaeta americana*	cudweed		x
Asteraceae	**Gamochaeta pensylvanica*	cudweed		x
Asteraceae	*Helichrysum rutidolepis*	pale everlasting		x
Asteraceae	*Helichrysum scorpioides*	button everlasting		x
Asteraceae	**Hypochoeris radicata*	catsear		x
Asteraceae	*Lagenifera gracilis*	slender lagenophora		x
Asteraceae	*Olearia elliptica*	sticky daisy bush		x
Asteraceae	**Onopordum acanthium* subsp*. acanthium*	Scotch thistle		x
Asteraceae	*Ozothamnus diosmifolius*	white dogwood	x	x
Asteraceae	***Rutidosis heterogama***	**heath wrinklewort**	**x**	**x**
Asteraceae	**Senecio madagascariensis*	fireweed		x
Asteraceae	*Sigesbeckia orientalis* subsp*. orientalis*	Indian weed		x
Asteraceae	**Silybum marianum*	variegated thistle		x
Asteraceae	**Sonchus oleraceus*	common sowthistle		x
Asteraceae	**Taraxacum officinale*	dandelion		x

Family/Sub Family	Scientific Name	Common Name	Surface Infrastructure Site	Stage 3 Mine Area
Asteraceae	*Vernonia cinerea* var. *cinerea*		x	x
Asteraceae	*Vittadinia pterochaeta*	rough fuzzweed	x	
Asteraceae	*Vittadinia* sp.		x	
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	wonga wonga vine	x	x
Brassicaceae	*Lepidium bonariense*	cut-leaf peppercress		x
Cactaceae	*Opuntia stricta* var. stricta	prickly pear		x
Campanulaceae	*Wahlenbergia gracilis*	sprawling or Australian bluebell	x	x
Campanulaceae	*Wahlenbergia littoricola*		x	
Campanulaceae	*Wahlenbergia* sp.			x
Campanulaceae	*Wahlenbergia stricta*	tall bluebell		x
Caryophyllaceae	**Cerastium glomeratum*	mouse-ear chickweed		x
Caryophyllaceae	**Paronychia brasiliana*	Chilean whitlow wort		x
Caryophyllaceae	**Petrorhagia velutina*	pink velvet		x
Caryophyllaceae	**Stellaria media*	common chickweed		x
Caryophyllaceae	*Stellaria pungens*	prickly starwort		x
Casuarinaceae	*Allocasuarina littoralis*	black sheoak		x
Casuarinaceae	*Allocasuarina torulosa*	forest oak	x	x
Casuarinaceae	*Casuarina glauca*	swamp oak		x
Celastraceae	*Maytenus silvestris*	narrow-leaved orangebark	x	x
Ceratophyllaceae	*Ceratophyllum demersum*	hornwort		x
Chenopodiaceae	*Chenopodium album*	fat hen		x
Chenopodiaceae	*Chenopodium pumilio*	small crumbweed		x
Chenopodiaceae	*Einadia hastata*	berry saltbush	x	x
Chenopodiaceae	*Einadia nutans* subsp. *linifolia*	climbing saltbush		x
Chenopodiaceae	*Einadia trigonos* subsp. *trigonos*	fishweed		x
Clusiaceae	*Hypericum gramineum*	small St Johns wort		x
Convolvulaceae	*Dichondra repens*	kidney weed	x	x
Cunoniaceae	*Aphanopetalum resinosum*	gum vine		x
Dilleniaceae	*Hibbertia aspera*	rough Guinea flower	x	x
Dilleniaceae	*Hibbertia linearis*	a Guinea flower	x	
Dilleniaceae	*Hibbertia pedunculata*	a Guinea flower	x	x
Droseraceae	*Drosera peltata*	sundew		x
Elaeocarpaceae	*Elaeocarpus obovatus*	hard quandong		x
Ericaceae (Styphelioideae)	*Acrotriche divaricata*	ground berry	x	x
Ericaceae (Styphelioideae)	*Astroloma humifusum*	native cranberry		x
Ericaceae (Styphelioideae)	*Lissanthe strigosa*	peach heath	x	x
Ericaceae (Styphelioideae)	*Melichrus urceolatus*	urn heath	x	

Family/Sub Family	Scientific Name	Common Name	Surface Infrastructure Site	Stage 3 Mine Area
Ericaceae (Styphelioideae)	*Styphelia triflora*	pink five-corners	x	x
Euphorbiaceae	*Breynia oblongifolia*	coffee bush	x	x
Euphorbiaceae	*Phyllanthus gunnii*	shrubby spurge	x	
Euphorbiaceae	*Phyllanthus hirtellus*	thyme spurge	x	x
Euphorbiaceae	*Poranthera microphylla*	small poranthera		x
Fabaceae (Faboideae)	*Bossiaea obcordata*	spiny bossiaea		x
Fabaceae (Faboideae)	*Bossiaea prostrata*	a bossiaea		x
Fabaceae (Faboideae)	*Bossiaea rhombifolia*		x	
Fabaceae (Faboideae)	*Daviesia genistifolia*	broom bitter pea	x	x
Fabaceae (Faboideae)	*Daviesia ulicifolia* subsp. *ulicifolia*	gorse bitter pea	x	x
Fabaceae (Faboideae)	*Desmodium gunnii*	slender tick-trefoil	x	x
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*	rusty tick-trefoil	x	x
Fabaceae (Faboideae)	*Desmodium varians*	slender tick-trefoil		x
Fabaceae (Faboideae)	*Dillwynia retorta*	eggs and bacon	x	x
Fabaceae (Faboideae)	*Glycine clandestina*	twining glycine	x	x
Fabaceae (Faboideae)	*Glycine latifolia*	a glycine		x
Fabaceae (Faboideae)	*Glycine microphylla*	small-leaf glycine		x
Fabaceae (Faboideae)	*Glycine tabacina*	variable glycine	x	x
Fabaceae (Faboideae)	*Gompholobium minus*	dwarf wedge pea		x
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla	x	x
Fabaceae (Faboideae)	*Hovea linearis*	narrow-leaf hovea		x
Fabaceae (Faboideae)	*Indigofera australis*	Australian indigo	x	x
Fabaceae (Faboideae)	*Jacksonia scoparia*	dogwood	x	x
Fabaceae (Faboideae)	*Kennedia rubicunda*	red Kennedy pea		x
Fabaceae (Faboideae)	*Mirbelia rubiifolia*	heathy mirbelia		x
Fabaceae (Faboideae)	*Oxylobium pulteneae*	wiry shaggy pea		x
Fabaceae (Faboideae)	*Podolobium ilicifolium*	prickly shaggy pea	x	x
Fabaceae (Faboideae)	*Podolobium scandens*	netted shaggy pea		x
Fabaceaw (Faboideae)	*Pultenaea palacea*		x	
Fabaceae (Faboideae)	*Pultenaea villosa*	grey bush-pea	x	x
Fabaceae (Faboideae)	**Trifolium arvense*	haresfoot clover		x
Fabaceae (Faboideae)	**Trifolium repens*	white clover		x
Fabaceae (Mimosoideae)	*Acacia binervata*	two-veined hickory	x	x
Fabaceae (Mimosoideae)	*Acacia deanei* subsp. *deanei*	green wattle, Deanes wattle		x
Fabaceae (Mimosoideae)	*Acacia decurrens*	black wattle, green wattle		x
Fabaceae (Mimosoideae)	*Acacia falcata*	sickle wattle	x	x
Fabaceae (Mimosoideae)	*Acacia floribunda*	white Sally	x	x
Fabaceae (Mimosoideae)	*Acacia implexa*	hickory wattle	x	

Family/Sub Family	Scientific Name	Common Name	Surface Infrastructure Site	Stage 3 Mine Area
Fabaceae (Mimosoideae)	*Acacia leucoclada* subsp. *leucoclada*		x	
Fabaceae (Mimosoideae)	*Acacia linifolia*	white wattle		x
Fabaceae (Mimosoideae)	*Acacia longifolia* var. *longifolia*	Sydney golden wattle		x
Fabaceae (Mimosoideae)	*Acacia longissima*	narrow-leaved wattle	x	x
Fabaceae (Mimosoideae)	*Acacia parvipinnula*	silver-stemmed wattle	x	x
Fabaceae (Mimosoideae)	*Acacia* sp.			x
Fabaceae (Mimosoideae)	*Acacia terminalis* subsp. *longiaxialis*	sunshine wattle		x
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	prickly Moses wattle		x
Fabaceae (Mimosoideae)	*Neptunia gracilis*	native sensitive plant		x
Geraniaceae	*Geranium solanderi* var. *solanderi*	native geranium		x
Geraniaceae	*Geranium* sp.			x
Goodeniaceae	*Goodenia rotundifolia*	a goodenia	x	x
Haloragaceae	*Gonocarpus tetragynus*	a raspwort		x
Lamiaceae	*Plectranthus parviflorus*	native cockspur	x	x
Lauraceae	*Cassytha glabella*	devils twine	x	x
Lauraceae	*Cassytha pubescens*	devils twine	x	x
Lobeliaceae	*Lobelia gibbosa*	tall lobelia	x	
Lobeliaceae	*Pratia purpurascens*	whiteroot	x	x
Loranthaceae	*Amyema gaudichaudii*	paper-bark mistletoe		x
Loranthaceae	*Amyema* sp.	a mistletoe		x
Malvaceae	**Modiola caroliniana*	red-flowered mallow		x
Malvaceae	**Sida rhombifolia*	paddy's lucerne	x	x
Myoporaceae	*Eremophila debilis*	amulla		x
Myrsinaceae	*Myrsine howittiana*	brush muttonwood		x
Myrtaceae	*Angophora bakeri*	narrow-leaved apple		x
Myrtaceae	*Angophora floribunda*	rough-barked apple		x
Myrtaceae	*Backhousia myrtifolia*	grey myrtle		x
Myrtaceae	*Callistemon linearis*	narrow-leaved bottlebrush	x	x
Myrtaceae	*Corymbia eximia*	yellow bloodwood		x
Myrtaceae	*Corymbia maculata*	spotted gum	x	x
Myrtaceae	*Eucalyptus acmenoides*	white mahogany	x	x
Myrtaceae	*Eucalyptus amplifolia* subsp. *amplifolia*	cabbage gum	x	x
Myrtaceae	*Eucalyptus amplifolia* X *tereticornis*		x	x
Myrtaceae	*Eucalyptus canaliculata*	large-fruited grey gum	x	x

Family/Sub Family	Scientific Name	Common Name	Surface Infrastructure Site	Stage 3 Mine Area
Myrtaceae	*Eucalyptus capitellata*	brown stringybark	x	
Myrtaceae	*Eucalyptus crebra*	narrow-leaved ironbark	x	x
Myrtaceae	*Eucalyptus eugenioides*	thin-leaved stringybark	x	x
Myrtaceae	*Eucalyptus fergusonii* subsp. *fergusonii*	an ironbark		x
Myrtaceae	*Eucalyptus fibrosa*	red ironbark	x	x
Myrtaceae	*Eucalyptus globoidea*	white stringybark	x	x
Myrtaceae	*Eucalyptus longifolia*	woollybutt		x
Myrtaceae	*Eucalyptus moluccana*	grey box	x	x
Myrtaceae	*Eucalyptus piperita*	Sydney peppermint		x
Myrtaceae	*Eucalyptus punctata*	grey gum	x	x
Myrtaceae	*Eucalyptus punctata* X *canaliculata*		x	x
Myrtaceae	*Eucalyptus racemosa*	narrow-leaved scribbly gum		x
Myrtaceae	*Eucalyptus resinifera*	red mahogany		x
Myrtaceae	*Eucalyptus siderophloia*	grey ironbark		x
Myrtaceae	*Eucalyptus tereticornis*	forest red gum	x	x
Myrtaceae	*Eucalyptus umbra*	broad-leaved white mahogany		x
Myrtaceae	*Kunzea parviflora*	violet kunzea	x	
Myrtaceae	*Leptospermum parvifolium*	small-leaf tea-tree		x
Myrtaceae	*Leptospermum polygalifolium*	lemon-scented tea tree		x
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*	lemon-scented tea tree		x
Myrtaceae	*Leptospermum trinervium*	paperbark tea tree	x	x
Myrtaceae	*Melaleuca decora*	ball honeymyrtle		x
Myrtaceae	*Melaleuca linariifolia*	snow in summer		x
Myrtaceae	*Melaleuca nodosa*	ball honeymyrtle	x	x
Myrtaceae	*Melaleuca sieberi*	Siebers paperbark		x
Myrtaceae	*Melaleuca styphelioides*	prickly-leaved tea tree	x	x
Myrtaceae	*Melaleuca thymifolia*	thyme honeymyrtle		x
Myrtaceae	*Syncarpia glomulifera* subsp. *glomulifera*	turpentine	x	x
Oleaceae	*Jasminum volubile*	stiff jasmine		x
Oleaceae	*Notelaea longifolia*	large mock-olive		x
Oleaceae	*Notelaea venosa*	veined mock olive	x	x
Oxalidaceae	*Oxalis chnoodes*	a wood sorrel		x
Oxalidaceae	*Oxalis exilis*	a wood sorrel	x	x
Oxalidaceae	*Oxalis perennans*	grassland wood sorrel		x
Phytolaccaceae	**Phytolacca octandra*	inkweed		x
Pittosporaceae	*Billardiera scandens* var. *scandens*	apple berry	x	x
Pittosporaceae	*Bursaria spinosa* var. *spinosa*	blackthorn	x	x
Pittosporaceae	*Pittosporum multiflorum*	orange-thorn	x	
Pittosporaceae	*Pittosporum revolutum*	rough-fruit pittosporum	x	

Family/Sub Family	Scientific Name	Common Name	Surface Infrastructure Site	Stage 3 Mine Area
Plantaginaceae	*Plantago debilis*	common plantain		x
Plantaginaceae	**Plantago lanceolata*	lambs tongues	x	x
Plantaginaceae	**Plantago myosuros* subsp. *myosuros*	a plantain		x
Polygonaceae	*Rumex brownii*	swamp dock		x
Polygonaceae	**Rumex crispus*	curled dock		x
Primulaceae	**Anagallis arvensis*	scarlet/blue pimpernel		x
Proteaceae	*Banksia spinulosa* var. *collina*	hairpin banksia	x	x
Proteaceae	*Grevillea montana*	a grevillea		x
Proteaceae	***Grevillea parviflora* subsp. *parviflora***	**white spider flower**	**x**	**x**
Proteaceae	*Grevillea sericea subsp.* sericea	pink spider flower	x	x
Proteaceae	*Hakea dactyloides*	finger hakea, broad-leaved hakea		x
Proteaceae	*Hakea sericea*	needlebush	x	x
Proteaceae	*Lomatia silaifolia*	crinkle bush	x	
Proteaceae	*Persoonia linearis*	narrow-leaved geebung	x	x
Ranunculaceae	*Clematis glycinoides*	headache vine	x	x
Ranunculaceae	*Ranunculus inundatus*	river buttercup		x
Rosaceae	**Rosa rubiginosa*	sweet briar		x
Rosaceae	**Rubus fruticosus* sp. agg.	blackberry complex		x
Rosaceae	*Rubus parvifolius*	native raspberry	x	x
Rubiaceae	*Asperula conferta*	common woodruff		x
Rubiaceae	*Galium propinquum*	Maori bedstraw	x	
Rubiaceae	*Opercularia aspera*	coarse stinkweed		x
Rubiaceae	*Pomax umbellata*	pomax	x	x
Rubiaceae	**Richardia stellaris*	field madder		x
Rutaceae	*Boronia parviflora*	swamp boronia		x
Rutaceae	*Boronia polygalifolia*	dwarf boronia	x	x
Rutaceae	*Melicope micrococca*	hairy-leaved doughwood		x
Rutaceae	*Phebalium squamulosum* subsp. *squamulosum*	scaly phebalium		x
Santalaceae	*Exocarpos cupressiformis*	native cherry	x	x
Santalaceae	*Exocarpos strictus*	dwarf cherry	x	x
Santalaceae	*Leptomeria acida*	native currant	x	
Sapindaceae	*Dodonaea triquetra*	large-leaf hop-bush	x	x
Sapindaceae	*Dodonaea viscosa* subsp. *spatulata*	sticky hop-bush	x	
Solanaceae	*Solanum brownii*	violet nightshade		x
Solanaceae	*Solanum cinereum*	Narrawa burr		x
Solanaceae	**Solanum mauritianum*	wild tobacco bush		x
Solanaceae	**Solanum nigrum*	black-berry nightshade		x
Solanaceae	*Solanum prinophyllum*	forest nightshade	x	
Solanaceae	*Solanum pungetium*	eastern nightshade		x

Family/Sub Family	Scientific Name	Common Name	Surface Infrastructure Site	Stage 3 Mine Area
Stackhousiaceae	*Stackhousia muricata*	western stackhousia		x
Stackhousiaceae	*Stackhousia viminea*	slender stackhousia		x
Sterculiaceae	*Brachychiton populneus* subsp. *populneus*	kurrajong		x
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	slender rice flower		x
Verbenaceae	*Clerodendrum tomentosum*	hairy clerodendrum,	x	x
Verbenaceae	**Lantana camara*	lantana		x
Verbenaceae	**Verbena bonariensis*	purpletop		x
Violaceae	*Viola hederacea*	ivy-leaved violet		x
Vitaceae	*Cayratia clematidea*	slender grape	x	x
Vitaceae	*Cissus antarctica*	water vine		x

APPENDIX B

Test of Significance (EP&A Act) – Proposed Surface Infrastructure Site

Appendix B – Assessment of Significance under the EP&A Act for the Proposed Surface Infrastructure Development

Threatened species, endangered populations, and endangered ecological communities (EECs) recorded during surveys of the Surface Infrastructure Site are listed in **Tables 1** and **2** below, which also include the results of the searches of the DECC Atlas of NSW Wildlife and DEWHA Protected Matters Database for a 10 kilometre radius of the Study Area.

Tables 1 and **2** contain the relevant ecological details of each listing (including their habitat requirements, known range and reservation within conservation reserves within the region), as well as an assessment as to whether there may be an impact on any recorded or potentially occurring threatened species or EECs as a result of the proposed Surface Infrastructure Development. The specific impacts of the proposed Surface Infrastructure Development are described in **Section 9.1**. For the purposes of these tables, the 'region' is broadly defined as the Lower Hunter Valley, the western limit being Singleton and the eastern limit being approximately West Wallsend. The northern and southern boundaries of the region are approximately 30 kilometres north and south of the Study Area.

A seven part test of significance was prepared in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for each threatened species, population or EEC on which there is the potential for an impact as a result of the proposed development. The seven part tests are provided below **Table 2**. Although seven part tests of significance are not required for developments assessed under Part 3A, seven part tests are nevertheless used as the means of determining the likely level of significance of impacts.

An assessment of significance for species listed under the Commonwealth EPBC Act which have potential to be impacted by the proposed Surface Infrastructure development is provided in **Appendix D**.

Table 1 - Threatened Flora Assessment

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
black-eyed Susan *Tetratheca juncea*	V (TSC) V (EPBC) #	Open forest, woodland, heathland and moist forest, with shrub understorey and grassy groundcover, on low nutrient soils. Generally prefers well drained slopes (often south-facing) and ridges, occasionally occurs in gullies.	Confined to coastal districts from Bulahdelah to Lake Macquarie. Further occurrences are at Buttai, near Mt Sugarloaf. The Study Area is situated to the west of the known distribution of this species.	This species is not known from any conservation reserves in the region.	This species was not recorded in the Surface Infrastructure Site and there is no potential for it to occur. There is no potential for an impact on this species.	No
Bynoes wattle *Acacia bynoeana*	V (EPBC) E (TSC) #	Occurs mainly in heath and dry sclerophyll forest on sandy soils (Kodela and Harden 2002), and appears to prefer open and sometimes slightly disturbed sites such as road edges and recently burnt areas.	Occurs in central eastern NSW from Morisset to the Illawarra region and west to the Blue Mountains. It has also been found in the Parma Creek and Colymea areas west of Nowra) and in the Kurri Kurri and Cessnock areas in the lower Hunter Valley. Also recorded at Bylong, west of the Study Area. The Study Area is within the known distribution of this species.	Lake Macquarie SCA – count 1	There is a low potential for this species to occur within the Spotted Gum – Ironbark Forest of the Surface Infrastructure Site. The proposed Surface Infrastructure Development has potential to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
heath wrinklewort *Rutidosis heterogama*	V (EPBC) V (TSC) *	Occurs mostly in heath, often along disturbed roadsides, primarily in coastal districts, also open forest.	In coastal districts from Maclean to the Hunter Valley and inland to Torrington. It has also been recently recorded at Cooranbong on the Central Coast, and extensively around the Cessnock district. The Study Area is within the known distribution of this species.	Glenrock SCA – count 5 Werakata NP – 9 Werakata SCA – (unknown)	This species was recorded within the Surface Infrastructure Site in the Spotted Gum – Ironbark Forest. The proposed Surface Infrastructure Development has potential to impact on this species.	Yes
Callistemon linearifolius	V (TSC) *	Typically grows in dry sclerophyll forest on the coast and adjacent ranges.	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. The Study Area is within the known distribution of this species.	Munmorah NR – count 1 Werakata NP Yengo NP	This species was not recorded within the Surface Infrastructure Site, however has potential to occur. There is potential for an impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
Parramatta red gum *Eucalyptus parramattensis* subsp. *decadens*	V (EPBC) V (TSC) * #	Typically grows on deep, low-nutrient sands, often subject to periodic inundation. Occurs in dry sclerophyll woodland with a dry heath understorey and also as an emergent in dry or wet heathland.	Occurs in two separate meta-populations, in the Kurri Kurri and Tomago areas. The Study Area is outside the known distribution of this species.	Werakata NP	There is no potential for this species to occur within the Surface Infrastructure Site. There is no potential for an impact on this species.	No
small-flower grevillea *Grevillea parviflora* subsp. *parviflora*	V (EPBC) V (TSC) * #	Occurs in heath and shrubby woodland to open forest, on sandy or light clay soils, usually over thin shales. The species is found over a range of altitudes, and can occur in open and slightly disturbed areas.	The main occurrence of the species is centred around Picton, Appin and Bargo in the Sydney Basin, where it occurs sporadically. Separate populations are known further north from Putty to Wyong, Lake Macquarie, Cessnock and Kurri Kurri. The Study Area is within the known distribution of this species.	Werakata NP	This species was recorded in the Spotted Gum – Ironbark Forest in the Surface Infrastructure Site. The proposed Surface Infrastructure Development has potential to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
leafless tongue orchid *Cryptostylis hunteriana*	V (EPBC) V (TSC) #	Favours moist soils on the flat coastal plains. Occupies swamp heath, but may occupy sclerophyll forest and woodland, often on sandy soils. Typically found in communities containing *Eucalyptus haemastoma, E. capitellata* and *Corymbia gummifera.*	Recorded from Gibraltar Range National Park south into Victoria around the coast as far as Orbost. Known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). Also recorded at Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park, Ben Boyd National Park. The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	This species potentially occurs in the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this potentially occurring species.	Yes
Charmhaven apple *Angophora inopina*	V (EPBC) V (TSC) * #	Typically occurs on the shallow sandy soils of the Narrabeen Group, on exposed ridges and slopes with a westerly or northerly aspect. It has also been recorded on shallow alluvial soils of this geological type, in upper catchments and in embedded clay soil lenses with sandstone.	Distribution confined to the Wyong, Lake Macquarie and Port Stephens Shires of New South Wales. Pure forms of this species have been recorded from the Wallarah catchment in the south and north to the Toronto area. Disjunct populations have been identified at Karuah. The Study Area is outside the known distribution of this species.	Karuah NR – count 5 Lake Macquarie SCA – count 3	There is no potential for this species to occur in the Surface Infrastructure Site. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
slaty red gum *Eucalyptus glaucina*	V (EPBC) V (TSC) #	Typically grows in grassy woodland on deep, moderately fertile and well-watered soil and can be locally frequent but very sporadic.	Occurs near Casino and from Taree to Broke in the North Coast botanical subdivision. The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur in the Surface Infrastructure Site. There is no potential for an impact on this species.	No
North Rothbury persoonia *Persoonia pauciflora*	CE (EPBC) CE (TSC)	Typically occurs in dry open forest or woodland with a moderate to sparse shrub layer and a high percentage of groundcover species, especially grasses.	Very restricted distribution with all known individuals occurring within 2.5 km of the type specimen collected near North Rothbury in the Cessnock LGA. The Study Area is outside the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur in the Surface Infrastructure Site. There is no potential for an impact on this species.	No
Singleton mint bush	V (EPBC) V (TSC)	Grows in open woodlands on exposed sandstone ridges and typically occurs on shallow or skeletal sands (DECC 2008).	Currently known to be restricted to only a few localities near Walcha, Scone and St Albans (DECC 2008). One record near Bellbird, north-west of the Study Area. The Study Area is outside the known distribution of this species.	This species is not known from any conservation reserves within the region.	There is no potential for this species to occur in the Surface Infrastructure Site. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
Groves paperbark *Melaleuca groveana*	V (TSC)	Occurs in heath, shrubland and in dry woodlands, often in exposed sites, at high elevations, on rocky outcrops and cliffs.	Widespread, scattered populations in coastal districts north of Port Stephens to southeast Queensland.	This species is not known from any conservation reserves within the region.	The Surface Infrastructure Site does not support habitats suitable for this species to occur. There is no potential for the proposed development to have a significant impact on this species.	No
River-flat Eucalypt Forest	EEC (TSC) ^	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains (NSW Scientific Committee 2005d).	This EEC was potentially recorded within the Study Area. This EEC occurs in the NSW North Coast, Sydney Basin and South-east corner bioregions. The Study Area is within the known distribution of this species.	This EEC is not known from any conservation reserves in the region.	The River Flat Eucalypt Forest does not occur within the Study Area. There is no potential for an impact on this EEC.	No
Lower Hunter Spotted Gum - Ironbark Forest	EEC (TSC) ^	The *Lower Hunter Spotted gum – Ironbark Forest* EEC occurs in the central to lower Hunter Valley, principally on Permian geology.	This EEC was recorded within the Study Area. The EEC is restricted to a range of approximately 65 kilometres by 35 kilometres centred on the Cessnock – Beresfield area. The Study Area is within this known distribution.	This EEC has been recorded in Werakata NP and Werakata SCA.	This EEC occurs widely within the Study Area, on the drier slopes and ridges. There is potential for the proposed Surface Infrastructure Development to impact on this EEC.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
Swamp Oak Floodplain Forest	EEC (TSC) ^	This EEC is associated with grey-black clay-loams and sandy loams, 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.	This EEC occurs throughout the North Coast, Sydney Basin and South-East Corner bioregions of NSW. The Study Area is situated west of the known distribution of this EEC.	Hexham Swamp NR Pambalong NR Lake Macquarie SCA Kooragang NP	This EEC does not occur within the Surface Infrastructure Site. There is no potential for an impact on this EEC.	No
Quorrobolong Scribbly Gum Woodland	EEC (TSC) ^	This EEC occurs on a residual sand deposit overlying the Permian clay sediments in the Hunter Valley.	This EEC is known from a small area between Quorrobolong and Mulbring in the Cessnock Local Government Area but may occur elsewhere. The Study Area is within the known distribution of this EEC.	This EEC is not known from any conservation reserves in the region.	This EEC is not present within the Surface Infrastructure Site. There is no potential for an impact on this EEC.	No
Swamp Sclerophyll Forest	EEC (TSC) ^	This EEC is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains.	This EEC occurs throughout the North Coast, Sydney Basin and South-East Corner bioregions of NSW. The Study Area is situated west of the known distribution of this EEC.	This EEC is not known from any conservation reserves in the region.	This EEC has no potential to occur within the Surface Infrastructure Site. There is no potential for an impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
Freshwater Wetlands on Coastal Floodplains	EEC (TSC) ^	This EEC is associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains.	This EEC occurs throughout the North Coast, Sydney Basin and South-East Corner bioregions of NSW. The Study Area is within the known distribution of this EEC.	Hexham Swamp NR Pambalong NR	This EEC has no potential to occur within the Surface Infrastructure Site. There is no potential for an impact on this EEC.	No
Hunter Lowland Red Gum Forest	EEC (TSC) ^	Occurs on gentle slopes arising from depressions and drainage flats on permian sediments of the Hunter Valley floor.	Recorded from Maitland, Cessnock and Port Stephens LGAs (in the Sydney Basin Bioregion) and Muswellbrook and Singleton LGAs (in the NSW North Coast Bioregion) but may occur elsewhere in these bioregions. The Study Area is within the known distribution of this EEC.	Werakata NP Werakata SCA	This EEC occurs within the creekline traversing the Surface Infrastructure Site. The proposed Surface Infrastructure Development has potential to impact on this EEC.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
White Box-Yellow Box-Blakelys Red Gum Grassy Woodland and Derived Native Grassland	CEEC (EPBC) #	This ecological community occurs in areas where rainfall is between 400 and 1200 mm per annum, on moderate to highly fertile soils at altitudes of 170 metres to 1200 metres.	This EEC occurs in an arc along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria. It occurs in the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW, North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions. The Study Area is outside the known range of this EEC.	There are no known occurrences of this EEC within the conservation reserves of the region.	This EEC has no potential to occur within the Surface Infrastructure Site. There is no potential for an impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
weeping myall (*Acacia pendula*) in the Hunter Catchment	EP (TSC) ^	Grows on major river floodplains on heavy clay soils, sometimes as the dominant species and forming low open woodlands. Within the Hunter catchment it typically occurs on heavy soils, sometimes at the margins of small floodplains, but also in more undulating locations remote from floodplains, such as at Jerrys Plains.	There are 17 confirmed and four unconfirmed naturally occurring remnants of the *A. pendula* population in the Hunter catchment. These range as far east as Warkworth, and as far west as Kerrabee, west of Sandy Hollow. *Acacia pendula* is not known to occur naturally further north than the Muswellbrook-Wybong area. Eight planted *A. pendula* populations (not naturally occurring) have been recorded in the Hunter, and it is likely that numerous more planted populations occur. The Study Area occurs to the east of the known distribution of the species forming this endangered population.	No known natural remnants/populations of *Acacia pendula* occur on land zoned for conservation and only two stands, both part of the same population (at Jerrys Plains Cemetery), occur on community-owned land that is managed by a Council (Singleton).	No individuals of *Acacia pendula* were recorded within the Surface Infrastructure Site, and there is no potential for this species to occur. There is no potential for an impact on this endangered population.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
tiger orchid (*Cymbidium canaliculatum*) in the Hunter Catchment	EP (TSC) ^	This species occurs within dry sclerophyll forests and woodlands of tablelands and western slopes, growing in hollows of trees. It is usually found occurring singly or as a single clump, typically between two and six metres above the ground.	The population of *Cymbidium canaliculatum* in the Hunter Catchment is at the south-eastern limit of the geographic range for this species. The Study Area is situated to the south-east of the known distribution of the species forming this endangered population.	This species is not known from any conservation reserves within the region.	No individuals of *Cymbidium canaliculatum* were recorded within the Surface Infrastructure Site, and there is no potential for this species to occur. There is no potential for an impact on this endangered population.	No
river red gum (*Eucalyptus camaldulensis*) in the Hunter Catchment	EP (TSC) ^	This endangered population may occur with *Eucalyptus tereticornis*, *Eucalyptus melliodora*, *Casuarina cunninghamiana* subsp. *cunninghamiana* and *Angophora floribunda*.	The Hunter population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River. It has been recorded in the LGAs of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper Hunter. The Study Area occurs within the known distribution of this endangered population.	This species is not known from any conservation reserves in the region.	No individuals of *Eucalyptus camaldulensis* were recorded within the Surface Infrastructure Site and there is no potential for this species to occur. There is no potential for an impact on this endangered population.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required ?
Leionema lamprophyllum subsp. *obovatum* in the Hunter Catchment	EP (TSC) ^	Grows in heath on exposed ridges at higher altitudes. The Hunter population occurs on a rocky cliff line in a dry eucalypt forest.	Mainly occurs south from Tidbinbilla Range in the Canberra area, extending into Victoria. The Hunter Catchment population occurs near Pokolbin, remote from the Study Area.	This endangered population is not known from any conservation reserves within the region.	No individuals of *Leionema lamprophyllum* subsp. *obovatum* were recorded within the Surface Infrastructure Site and there is no potential for this species to occur. There is no potential for an impact on this endangered population.	No

Key:
* Records from DECC Wildlife Atlas Database
# Records from EPBC Protected Matters Search
^ Records added from previous studies or expert knowledge
TSC = *Threatened Species Conservation Act* 1995
EPBC Act = *Environment Protection and Biodiversity Conservation Act* 1999
E = Endangered
V = Vulnerable
CE = Critically endangered species
EP = Endangered population
EEC = Endangered Ecological Community
CEEC = Critically Endangered Ecological Community
EP = Endangered Population
NP = National Park
SCA = State Conservation Area
NR = Nature Reserve

Table 2 - Threatened Fauna Assessment

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
giant burrowing frog *Heleioporus australiacus*	V (TSC) V (EPBC) #	This species prefers woodland and heath in Hawkesbury sandstone ridge-top habitat and broader upland valleys. In particular, it is found in small headwater creek lines and slow flowing or intermittent creek lines (DECC 2008).	Occurs from the central coast of NSW to Victoria (Cogger 2000). The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur due to the absence of suitable sandstone habitats. There is no potential for an impact on this species.	No
stuttering frog *Mixophyes balbus*	E (TSC) V (EPBC) #	This species is found near streams in rainforest and wet, tall open forest in the foothills and escarpments (DECC 2008).	Occurs along the east coast from southern Queensland to north-east Victoria, on the eastern side of the Great Dividing Range (DECC 2008). The Study Area is within the known distribution of this species.	Jilliby SCA – count 7 Watagans NP – count 7	There is no potential for this species to occur due to absence of rainforest or tall open forest habitat. There is no potential for an impact on this species.	No
giant barred frog *Mixophyes iteratus*	E (TSC) E (EPBC) #	This species forages and lives amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 metres (DECC 2008). Breeds in shallow, flowing rocky streams (DECC 2008).	Occurs along the coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW (DECC 2008). The Coffs Harbour-Dorrigo area, is now a stronghold (DECC 2008). The Study Area is within the known distribution of this species.	Jilliby SCA – count 2 Watagans NP – count 15	There is no potential habitat for this species due to absence of suitable rainforest habitats. There is no potential for an impact on this species.	No
green and golden bell frog *Litoria aurea*	E (TSC) V (EPBC) #	Occurs among vegetation in permanent water bodies (Cogger 2000), particularly where bullrush (*Typha* spp.) and spikerush (*Eleocharis* spp.) occur (DECC 2008). Known to occur in degraded water bodies such as brick-pits and industrial sites (DECC 2008).	Occurs in eastern and south-eastern NSW to far eastern Victoria, largely at low altitudes (Cogger 2000). Once widespread, it is now restricted to isolated coastal populations. The Study Area is within the known distribution of this species.	Kooragang NR – count 11 Hexham Swamp NR – count 3	There is no potential for this species to occur in the Surface Infrastructure Site. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
green-thighed frog *Litoria brevipalmata*	V (TSC) *	Occurs in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain (DECC 2008). Breeding occurs around grassy semi-permanent ponds and flood-prone grassy areas (DECC 2008).	Recorded in isolated locations in wet sclerophyll forest along the north coast of NSW and south east Queensland (DECC 2008). The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur within the Surface Infrastructure Site. There is no potential for an impact on this species.	No
Littlejohns tree frog *Litoria littlejohni*	V (TSC) V (EPBC) #	Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops (DECC 2008). Prefers wet forest margins for breeding.	Occurs along the eastern slopes of the Great Dividing Range from the Watagans near Wyong, south to Buchan in north-eastern Victoria. It has not been recorded in coastal habitats (DECC 2008). The Study Area is slightly north of the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur within the Surface Infrastructure Site due to the absence of permanent rocky streams. There is no potential for an impact on this species.	No
broad-headed snake *Hoplocephalus bungaroides*	E (TSC) V (EPBC) #	This species appears to prefer sites where exposed sandstone outcrops and benches occur, particularly in woodland and heath vegetation. It is often found sheltering under rock crevices (winter) and tree hollows (summer) (DECC 2008).	Restricted to a 200 kilometre radius of the Sydney basin (Swan 1990). This range extends from Wollemi National Park to the eastern edge of the Clyde River Catchment, near Bateman's Bay. The Study Area is situated just north of the known distribution of this species.	This species is not known from any conservation reserves in the region.	Due to the absence of sandstone outcrops, there is no potential for this species to occur within the Surface Infrastructure Site. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
black-necked stork (*Ephippiorhynchus asiaticus*)	E (TSC)	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.	This species is widespread across coastal northern and eastern Australia, becoming uncommon further south into NSW, and rarely found south of Sydney. The Study Area occurs within the known distribution of this species.	Limeburners Creek NR - 4 Lake Innes NR - 35 Crowdy Bay NP - 7 Myall Lakes NP - 13 Booti Booti NP - 8	There are no freshwater wetland habitats present within the Surface Infrastructure Site that would provide suitable habitat for this species. There is no potential for an impact on this species.	No
painted snipe *Rostratula benghalensis australis*	E (TSC) V (EPBC) #	Occurs in ephemeral and permanent wetlands where there is a cover of vegetation. Such areas may include shallows and margins of wetlands, dams, sewage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub and open timber (Pizzey & Knight 1997).	Scattered distribution throughout Australia. Nomadic in response to suitable conditions, and may be migratory (DECC 2008). The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur within the Surface Infrastructure Site due to the absence of water bodies such as dam habitats. There is no potential for an impact on this species.	No
freckled duck *Stictonetta naevosa*	V (TSC) *	Generally nomadic between ephemeral inland wetlands. Occurs in large numbers on brackish to hyposaline wetlands that are densely vegetated with Lignum, where they breed (Garnett & Crowley 2000). Other habitat types include large open lakes, creeks, farm dams, sewage ponds and floodwaters (DECC 2008).	Broadly distributed, from eastern and south-western Australia, occurring elsewhere, particularly during years of inland drought (DECC 2008). Has been recorded west of the Study Area at Ellalong Lagoon. The Study Area is within the known distribution of this species.	Kooragang NR – count 4	There is no potential for this species to occur within the Surface Infrastructure Site. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
black-breasted buzzard *Hamirostra melanosternon*	V (TSC) *	Habitat varies, however often includes wooded and open habitats, especially riverine woodlands (Debus 2001). Often recorded in dry open country, arid areas and savannah woodlands (Hollands 2003).	This species is recorded from the majority of the mainland, except for high rainfall areas of the south and south east (Debus 2001). The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur in the Surface Infrastructure Site. There is no potential for an impact on this species.	No
square-tailed kite *Lophoictinia isura*	V (TSC) *	Recorded from a variety of timbered habitats, showing preference for timbered watercourses. Occupies hunting ranges of more than 100km^2. Breeding occurs between July and February and nests are generally near watercourses.	Occurs patchily throughout NSW, usually within 300km of the coast. It is thought to be a regular resident in the north, north-east and the major west-flowing river systems of NSW. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. The Study Area is within this species' known distribution.	This species is not known from any conservation reserves within the region.	The Surface Infrastructure Site supports potential foraging and nesting habitat for this species. The proposed Surface Infrastructure Development has potential to impact on this species.	Yes
comb-crested jacana *Irediparra gallinacea*	V (TSC) *	Requires well vegetated, permanent wetland habitats with floating or emergent vegetation, in particular water-lilies. Feeds primarily on invertebrates and some vegetation. Breeds in spring and summer in NSW, in a nest of wet, floating vegetation.	It occurs in coastal areas and well inland parts of northern and eastern Australia, the most southern limit being the Hunter River. Vagrants may occur further south if unfavourable conditions occur in northern NSW. The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves within the region.	There are no dam habitats suitable for this species within the Surface Infrastructure Site. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
red goshawk *Erythrotriorchis radiatus*	E (TSC) V (EPBC) *	In NSW, preferred habitat is mixed tropical rainforest Melaleuca Swamp Forest and Open Eucalypt forest along coastal rivers, often in rugged terrain (DECC 2008). Prefers mosaic vegetation types; hunts along the ecotones (DECC 2008). Habitats are generally close to permanent bodies of freshwater, nest sites being only up to 1 kilometre away from such water bodies.	Restricted to coastal/subcoastal regions of Australia. Occurs across northern Australia south through eastern Queensland to far north-east NSW (DECC 2008). The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	The Surface Infrastructure Site supports potential habitat for this species. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
glossy black-cockatoo *Calyptorhynchus lathami*	V (TSC) *	Habitat for this species includes forests on low-nutrient soils, specifically those containing key *Allocasuarina* feed species (DECC 2008). Depends on very large tree hollows for nesting.	The glossy black-cockatoo has a sparse distribution along the east coast and adjacent inland areas from western Victoria to Rockhampton in Queensland. In NSW, it has been recorded as far inland as Cobar and Griffith. The Study Area is within the known distribution of this species.	Wallaroo NR – count 1 Karuah NR – count 2 Lake Macquarie SCA – count 1 Jilliby SCA – count 2 Worimi NR – count 1 Watagans NP – count 4	The Surface Infrastructure Site provides potential foraging habitat, however limited nest sites. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
gang-gang cockatoo *Callocephalon fimbriatum*	V (TSC) *	In summer, it occupies tall montane forests and woodlands (DECC 2008), and may also occur in sub-alpine woodland and occasionally in temperate rainforests (DECC 2008). In winter, it occurs at lower altitudes in drier, open eucalypt forests/woodlands, or in dry forest in coastal areas (DECC 2008). May undertake nomadic or seasonal movements.	In NSW, distribution extends from the south-east coast to the Hunter region and inland to the Central Tablelands and south-west slopes. Isolated records are known from as far north as Coffs Harbour and as far west as Mudgee and the Australian Capital Territory (DECC 2008). The Study Area is within the known distribution of this species.	Tomaree NP – count 2 Jilliby SCA – count 2 Watagans NP – count 1	There is potential habitat for this species within the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
swift parrot *Lathamus discolor*	E (TSC) E (EPBC) #	Often visits box-ironbark forests, feeding on nectar and lerp (Garnett & Crowley 2000). In NSW, typical feed species include mugga ironbark, grey box, swamp mahogany, spotted gum, red bloodwood, narrow-leaved red ironbark, forest red gum and yellow box (Swift Parrot Recovery Team 2001).	Breeds in Tasmania, migrating to the mainland in May to August, mainly foraging in Victoria and NSW (Swift Parrot Recovery Team 2001). In NSW, it has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW (Swift Parrot Recovery Team 2001). Has been recorded west of the Study Area near Ellalong. The Study Area is within the known distribution of this species.	Tomaree NP – count 1 Lake Macquarie SCA – count 2	Several winter-flowering species occur in the Surface Infrastructure Site which may provide foraging resources for this species. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
regent honeyeater *Xanthomyza phrygia*	E (TSC) E (EPBC) #	Semi-nomadic, generally occurs in temperate eucalypt woodlands and open forests, commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine *Casuarina* woodlands (DECC 2008).	Patchily distributed across the eastern states of Australia (DECC 2008), from Adelaide, to Dalby, Queensland, and from the coast to the western foothills of the Great Dividing Range (Garnett and Crowley 2000). Has been recorded west of the Study Area near Ellalong. The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	Several winter-flowering species occur in the Surface Infrastructure Site which may provide foraging resources for this species. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
turquoise parrot *Neophema pulchella*	V (TSC) *	The turquoise parrot occupies a variety of habitats, primarily eucalypt woodland and open forest near open water and forested hills. Also found in coastal heath, pasture, roadsides and orchards (Pizzey & Knight 1997).	Occurs from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range (DECC 2008). The Study Area is within the known distribution of this species.	Wallaroo NR – count 1	This species potentially forages within the Surface Infrastructure Site, however is unlikely to be nesting due to the limited availability of hollow trees. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
powerful owl *Ninox strenua*	V (TSC) *	The powerful owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest (Garnett and Crowley 2000). The powerful owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation.	Occurs mostly on the coastal side of the Great Dividing Range, from south western Victoria to Bowen in Queensland (Garnett & Crowley 2000). The Study Area is within the known distribution of this species.	Wallarah NP – count 3 Wallaroo NR – count 2 Karuah NR – count 1 Medowie SCA – count 3 Tomaree NP – count 2 Lake Macquarie SCA – count 1 Kooragang NR – count 1 Moffats Swamp NR – count 1 Munmorah SCA – count 1 Jilliby SCA – count 4	This Surface Infrastructure Site supports suitable foraging habitat, however limited nesting habitat for this species. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
barking owl *Ninox connivens*	V (TSC) *	Habitat for this species includes dry forests and woodlands (Kavanagh 2002), often in association with hydrological features such as rivers and swamps (Taylor et al. 2002). Large hollows are required for breeding.	Distributed sparsely throughout temperate and semi-arid areas of mainland Australia, however is most abundant in the tropical north (Kavanagh 2002). Most records are west of the Great Dividing Range (Kavanagh 2004). There is a record of this species just outside the southern boundary of the Study Area. The Study Area is within the known distribution of this species.	Watagans NP – count 1	This species may forage within the Surface Infrastructure Site, however is not likely to nest due to the limited availability of suitable hollows. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
masked owl *Tyto novaehollandiae*	V (TSC) *	Generally recorded from open forest habitat with sparse mid-storey but patches of dense, low ground cover. It is also recorded from ecotones between wet and dry eucalypt forest, along minor drainage lines and near boundaries between forest and cleared land (Kavanagh 2004).	Occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea (Kavanagh 2002). The Study Area is within the known distribution of this species.	Karuah NR – count 1 Tomaree NP – count 2 Watagans NP – count 1 Medowie SCA – count 2 Jilliby SCA – count 2	This species may forage within the Surface Infrastructure Site, however is not likely to nest due to the limited availability of suitable hollows. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
sooty owl *Tyto tenebricosa*	V (TSC)	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Nests in very large tree hollows.	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. The Study Area is within the known distribution of this species.	Cotton-Bimbang NP - 10 Tapin Tops NP - 5 Kumbatine NP - 5 Werrikimbe NP - 9 Killabakh NR - 1 Talawahl NR - 1 The Glen NR - 2 Myall Lakes NP - 7 Wallingat NP - 3 Ghin-Doo-Ee NP - 3	There is no potential habitat for this species to occur within the Surface Infrastructure Site. There is no potential for the proposed Surface Infrastructure Development to impact on this species.	No
brown treecreeper (eastern subsp.) *Climacteris picumnus victoriae*	V (TSC) *	Typical habitat for this species includes drier forests, woodlands, scrubs, with fallen branches; river red gums on watercourses and around lake-shores; paddocks with standing dead timber; and margins of denser wooded areas (Pizzey & Knight 1997). This species prefers areas without dense understorey (DECC 2008).	This species occurs over central NSW, west of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys (DECC 2008). Has been recorded west of the Study Area near Ellalong. The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	Potential habitat for this species occurs within the Study Area. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
black-chinned honeyeater (eastern subsp.) *Melithreptus gularis gularis*	V (TSC) *	In NSW, it is mainly found in woodlands with annual rainfall of 400-700mm containing box-ironbark associations and river red gum (Garnett & Crowley 2000). It is also known from drier coastal woodlands of the Cumberland Plain, Western Sydney and in the Hunter, Richmond and Clarence valleys (DECC 2008).	Found mainly west of the Great Dividing Range through NSW into southern Queensland, and south into Victoria and South Australia (DECC 2008). The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is potential for this species to occur within the Study Area. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
speckled warbler *Pyrrholaemus saggitata*	V (TSC) *	In NSW, occupies eucalypt and cypress woodlands, generally on the western slopes of the Great Dividing Range. Inhabits woodlands with a grassy understorey, leaf litter and shrub cover, often on ridges or gullies (Garnett & Crowley 2000).	The speckled warbler has a distribution from south-eastern Queensland, through central and eastern NSW to Victoria. The Study Area is within the known distribution of this species.	Belford NP – 1 count (T Peake pers. obs.)	This species has potential to occur within the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
grey-crowned babbler (eastern form) *Pomatostomus temporalis temporalis*	V (TSC) *	Habitat for this species includes open forest and woodland, acacia scrubland and adjoining open areas (Garnett & Crowley 2000).	Occurs on the western slopes and plains of NSW (DECC 2008). Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (DECC 2008). The Study Area is within the known distribution of this species.	Munmorah SCA – count 1 Belford NP – count 1 (T Peake pers. obs.)	This species has potential to occur within the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
diamond firetail *Stagonopleura guttata*	V (TSC) *	Habitat includes a range of eucalypt-dominated communities with a grassy understorey, including woodland, forest and mallee (Garnett & Crowley 2000). Populations appear unable to persist where remnants are less than 200 hectares in area (DECC 2008).	In NSW, it mainly occurs west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain and the Hunter, Clarence, Richmond and Snowy River valleys (DECC 2008). The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There Surface Infrastructure Site supports potential habitat for this species. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
spotted-tailed quoll *Dasyurus maculatus*	V (TSC) E (EPBC) #	Highly varied habitat, ranging from sclerophyll forest, woodlands, coastal heathlands and rainforests. Records exist from open country, grazing lands and rocky outcrops (DECC 2008). Suitable den sites including hollow logs, tree hollows, rocky outcrops or caves are necessary (DECC 2008).	In NSW, the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with highest densities occurring in the north east of the state. It occurs from the coast to the snowline and inland to the Murray River (Edgar & Belcher 2002). The Study Area is within the known distribution of this species.	Wallaroo NR – count 2	The Surface Infrastructure Site provides potential habitat for this species. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
koala *Phascolarctos cinereus*	V (TSC) *	This species inhabits eucalypt forest and woodland. Known to feed on a large number of eucalypt and non-eucalypt species, however tends to specialise on a small number in different areas (DECC 2008).	Fragmented distribution throughout eastern Australia, the majority of records from NSW being on the central and north coasts, and some areas further west (DECC 2008). The Study Area is within the known distribution of this species.	Wallaroo NR – count 5 Karuah NR – count 13 Worimi NR – count 5 Tomaree NP – count 68 Pulbah Island NR – count 3 Medowie SCA – count 11 Moffats Swamp NR – count 3 Lake Macquarie SCA – count 1 Jilliby SCA – count 5 Watagans NP – count 1	Known koala food trees occur within the Surface Infrastructure Site. There is potential for this species to occur. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
yellow-bellied glider *Petaurus australis*	V (TSC) *	Generally found at low population densities in habitat that is patchily distributed (DECC 2008). Prefers tall, mature sclerophyll forests in regions of high rainfall particularly where hollows and year-round food resources are abundant (DECC 2008).	Essentially coastal in NSW and extending inland to adjacent ranges (DECC 2008). The Hunter region may represent a break in the north/south distribution. The Study Area is within the known distribution of this species.	Jilliby SCA – count 13 Watagans NP – count 9	The Surface Infrastructure Site does not support potential habitat for this species. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
squirrel glider *Petaurus norfolcensis*	V (TSC) *	Generally inhabits dry sclerophyll forest and woodland (Suckling 2002). Preferred foraging habitat contains a regenerating understorey of eucalypts, wattles and flowering shrubs. Winter flowering species such as red ironbark, spotted gum and coast banksia are particularly important when other food sources are limited (DECC 2008).	Occupies a range along the east cost and immediate inland districts from western Victoria to north Queensland (DECC 2008). Has been recorded to the west of the Study Area, near Ellalong. The Study Area is within the known distribution of this species.	Wallarah NP – count 1 Karuah NP – count 2 Tomaree NP – count 4 Lake Macquarie SCA – count 3 Medowie SCA – count 4 Munmorah SCA – count 2	The Surface Infrastructure Site provides potential habitat for this species. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
long-nosed potoroo *Potorous tridactylus*	V (TSC) V (EPBC) #	Occupies a variety of habitats from coastal heath to dry or wet sclerophyll forest. Restricted to areas with rainfall greater than 760 mm per year (Strahan 2002) and it prefers habitats with a dense ground cover and light, sandy soils.	Range extends from south-east Queensland to Tasmania. The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	The Surface Infrastructure Site does not support suitable habitat for this species. There is no potential for an impact on this species.	No
brush-tailed rock-wallaby *Petrogale penicillata*	E (TSC) V (EPBC) #	This species occupies rocky escarpments, outcrops and cliffs showing a preference for complex structures with fissures, caves and ledges facing north (DECC 2008). Forage in or adjacent to rocky areas (DECC 2008).	In NSW occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit (DECC 2008). The Study Area is within the known distribution of this species.	Watagans NP – count 4	The Surface Infrastructure Site does not support suitable habitat for this species. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
grey-headed flying-fox *Pteropus poliocephalus*	V (TSC) V (EPBC) # *	This species feeds on a variety of flowering and fruiting plants, including native figs and palms, blossoms from eucalypts, angophoras, tea-trees and banksias (Tidemann 2002). Camps sites are usually formed in gullies, usually in vegetation with a dense canopy and not far from water (Tidemann 2002).	Recorded along the eastern coastal plain from Bundaberg in Queensland, through NSW and south to eastern Victoria. The Study Area is within the known distribution of this species.	Wallaroo NR – count 1 Karuah NR – count 1 Lake Macquarie SCA – count 2 Glenrock SCA – count 1 Munmorah SCA – count 6	The Surface Infrastructure Site provides potential foraging resources for this species, however there are no known roost sites. The Surface Infrastructure Development will potentially impact on this species.	Yes
eastern freetail-bat *Mormopterus norfolkensis*	V (TSC) *	Occurs mostly in dry eucalypt forest and woodland. Also recorded over a rocky river in rainforest and wet sclerophyll forest (Churchill 1998). Generally roosts in tree hollows, but may use man-made structures (Churchill 1998).	Has a distribution along the east coast of NSW from south of Sydney north into south east Queensland, near Brisbane (Churchill 1998). Has been recorded to the west of the Study Area near Ellalong. The Study Area is within the known distribution of this species.	Tomaree NP – count 1	This species was recorded within the Surface Infrastructure Site. The Surface Infrastructure Development will potentially impact on this species.	Yes
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V (TSC) *	Habitat varies widely, from rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998). Requires caves for roosting and maternity sites.	This species has an eastern distribution from Cape York along the coastal side of the Great Dividing Range, and into the southern tip of South Australia (Churchill 1998). There are records of this species north of the Study Area. The Study Area is within the known distribution of this species.	Wallaroo NR – count 2 Kooragang NR – count 1 Lake Macquarie SCA – count 1 Munmorah SCA – count 1	This species was recorded within the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
eastern false pipistrelle *Falsistrellus tasmaniensis*	V (TSC) *	Habitat includes sclerophyll forest from the Great Dividing Range to the coast. It appears to prefer wet habitats, with trees over 20 metres high (Churchill 1998). It generally roosts in tree hollows or trunks, in groups of 6 – 36, but is occasionally recorded from caves or buildings (Churchill 1998).	This species has a range from south eastern Queensland, through NSW and Victoria and into Tasmania (Churchill 1998). The Study Area is within the known distribution of this species.	Werakata NP – count 2	This species has potential to utilise the foraging resources of the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
little bentwing-bat *Miniopterus australis*	V (TSC) *	Habitat includes wet and dry sclerophyll forest, rainforest, dense coastal banksia scrub, and *Melaleuca* swamps. Cave-dwelling, often sharing roosts with the eastern bentwing-bat (*Miniopterus scheribersii oceanensis*). Sometimes roost in tree hollows. Forages for small insects beneath the canopy of densely vegetated habitats. May depend on a large colony for the high temperatures required to rear the young. May hibernate over winter in southern parts of their range.	Occurs in coastal areas from Cape York to northern NSW. The Study Area is within the known distribution of this species.	Werakata NP – count 3	This species was recorded within the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
large-eared pied bat *Chalinolobus dwyeri*	V (TSC) V (EPBC) #	Generally found in a variety of drier habitats, including the dry sclerophyll forests and woodlands, however probably tolerates a wide range of habitats (Hoye & Dwyer 2002). Tends to roost in the twilight zones of mines and caves (Churchill 1998).	Has a distribution from south western Queensland to Bungonia in southern NSW, from the coast to the western slopes of the Great Dividing Range (Churchill 1998, Strahan 2005). The Study Area is within the known distribution of this species.	Watagans NP – count 1	This species has potential to utilise the foraging resources of the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
large-footed myotis *Myotis adversis*	V (TSC)	Occurs in most habitat types providing they are near to water (Richards 2002). Commonly cave-dwelling, however it is also recorded from tree hollows, dense vegetation, bridges, mines and drains (Churchill 1998).	This is a coastal species, ranging from the Kimberley to South Australia (Churchill 1998). The Study Area is within the known distribution of this species. The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	This species was recorded in the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes
greater broad-nosed bat *Scoteanax rueppellii*	V (TSC) *	The greater broad-nosed bat appears to prefer moist environments such as moist gullies in coastal forests, or rainforest. They have also been found in gullies associated with wet and dry sclerophyll forests and open woodland. It roosts in hollows in tree trunks and branches and has also been found to roost in the roofs of old buildings.	The greater broad-nosed bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however it does not occur at altitudes above 500 metres. The Survey Area is within the known distribution of this species.	This species is not known from any conservation reserves within the region.	This species has potential to utilise the foraging resources of the Surface Infrastructure Site. There is potential for the proposed Surface Infrastructure Development to impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact?	7 Part Test Required?
Hastings River mouse *Pseudomys oralis*	E (TSC) E (EPBC) #	This species inhabits a variety of dry open forest types with dense, low ground cover and a diverse mixture of ferns, grass, sedges and herbs (DECC 2008). Access to seepage zones, creeks and gullies is important, as is permanent shelter such as rocky outcrops (DECC 2008).	This species has a patchy distribution along the east side of the Northern Tablelands and great escarpment of north-eastern NSW, usually but not always at elevations between 500 metres and 1100 metres (DECC 2008). The Study Area is slightly south-east of the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential habitat for this species within the Surface Infrastructure Site. There is no potential for an impact on this species.	No

Key: * Records from DECC Wildlife Atlas Database
Records from EPBC Protected Matters Search
^ records added from previous studies or expert knowledge
TSC = *Threatened Species Conservation Act* 1995
EPBC Act = *Environment Protection and Biodiversity Conservation Act* 1999
E = Endangered
V = Vulnerable
NR = Nature Reserve
NP = National Park
SCA = State Conservation Area

From **Tables 1** and **2**, those species or EECs requiring further assessment are listed below. Those species with similar ecology and habitat requirements have been assessed together to avoid unnecessary repetition.

- Hunter Lowland Red Gum Forest EEC
- Lower Hunter Spotted Gum-Ironbark Forest EEC
- heath wrinklewort (*Rutidosis heterogama*)
- small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*)
- *Callistemon linearifolia*
- Bynoes wattle (*Acacia bynoeana*)
- Leafless tongue orchid (*Cryptostylis hunteriana*)

Raptors

- Square-tailed kite (*Lophoictinia isura*)
- Red goshawk (*Erythrotriorchis radiatus*)

Large Parrots

- Glossy black-cockatoo (*Calyptorhynchus lathami*)
- Gang-gang cockatoo (*Calocephalon fimbriatum*)

Migratory Woodland Birds

- Swift parrot (*Lathamus discolor*)
- Regent honeyeater (*Xanthomyza phrygia*)
- Turquoise parrot (*Neophema pulchella*)

Large Forest Owls

- Powerful owl (*Ninox strenua*)
- Barking owl (*Ninox connivens*)
- Masked owl (*Tyto novaehollandiae*)

Woodland Birds

- Brown treecreeper (*Climacteris picumnus victoriae*)
- Black-chinned honeyeater (*Melithreptus gularis gularis*)
- Grey-crowned babbler (*Pomatostomus temporalis temporalis*)

- Diamond firetail (*Stagonopleura guttata*)
- Spotted-tailed quoll (*Dasyurus maculatus*)
- Koala (*Phascolarctos cinereus*)
- Squirrel glider (*Petaurus norfolcensis*)
- Grey-headed flying-fox (*Pteropus poliocephalus*)

Micro-bats

- Eastern bentwing-bat (*Miniopteris schreibersii oceanensis*)
- Little bentwing-bat (*Miniopterus australis*)
- Large-footed myotis (*Myotis adversus*)
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*) and
- Large-eared pied bat (*Chalinolobus dwyeri*)

Below is a seven part test of significance for each of these, which is prepared in accordance with the requirements of the EP&A Act. Although seven part tests of significance are not required for developments assessed under Part 3A, seven part tests are nevertheless used as the means of determining the likely level of significance of impacts.

1.0 Hunter Lowland Red Gum Forest EEC

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

Approximately 0.05 hectares of this EEC will be removed as a result of the proposed development. This is a relatively small area comparative to the likely extent of this EEC within the locality. The conservation of the Hunter Lowland Red Gum Forest EEC within the Biodiversity Offsets Area for the proposed Surface Infrastructure Development contributes to the long-term protection of the EEC within the locality.

Given the above, the proposed Surface Infrastructure Development will not reduce the extent of the Hunter Lowland Red Gum Forest EEC such that its local occurrence is likely to be placed at risk of extinction.

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

The proposed Surface Infrastructure Development will require the removal of approximately 0.05 hectares of the Hunter Lowland Red Gum Forest EEC. To compensate for this, there will be long-term protection of approximately 1-2 hectares of potential Hunter Lowland Red Gum Forest EEC within the proposed Biodiversity Offsets Area which occurs in proximity to the Surface Infrastructure Site.

The proposed Surface Infrastructure Development will not place the local occurrence of the Hunter Lowland Red Gum Forest EEC at risk of extinction.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 0.05 hectares of the Hunter Lowland Red Gum Forest EEC. To compensate for this loss, approximately 1-2 hectares of potential Hunter Lowland Red Gum Forest EEC will be conserved in the proposed Biodiversity Offset Area.

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

The proposed Surface Infrastructure Development will potentially reduce the size of the remnant of the Hunter Lowland Red Gum Forest EEC occurring to the south of the disturbance area of the Surface Infrastructure Site. Given that this remnant is currently small and very narrow, it has comparatively low conservation value relative to other remnants of this EEC within the locality.

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

The Hunter Lowland Red Gum Forest within the Surface Infrastructure Site is small in size and very narrow in width, particularly in the northern portion which is proposed to be disturbed. As such, the removal of 0.05 hectares from this remnant for the proposed Surface Infrastructure development is not regarded to have importance for the long-term conservation of the EEC within the locality. The conservation of 1-2 hectares of potential Hunter Lowland Red Gum Forest EEC within the Biodiversity Offsets Area will contribute to the reduction of the long-term impacts on the EEC.

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

The Surface Infrastructure Site does not support any critical habitat for this EEC or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this EEC or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

2.0 Lower Hunter Spotted Gum – Ironbark Forest EEC

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

Approximately 10 hectares of this EEC will be removed as a result of the proposed development. This is a relatively small area comparative to the extent of this EEC within the locality, which occurs widely throughout Werakata State Conservation Area which adjoins the Surface Infrastructure Site. The conservation of approximately 16 hectares of the Lower Hunter Spotted Gum - Ironbark Forest EEC within the Biodiversity Offsets area for the proposed Surface Infrastructure Development contributes to the long-term protection of the EEC within the locality.

Given the above, the proposed Surface Infrastructure Development will not reduce the extent of the Lower Hunter Spotted Gum – Ironbark Forest EEC such that its local occurrence is likely to be placed at risk of extinction.

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

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of the Lower Hunter Spotted Gum - Ironbark Forest EEC. To compensate for this loss, there will be long-term protection of approximately 16 hectares of the EEC within the proposed Biodiversity Offsets Area which is situated in proximity to the Surface Infrastructure Site.

The proposed Surface Infrastructure Development will not place the local occurrence of the Lower Hunter Spotted Gum - Ironbark Forest EEC at risk of extinction.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of the Lower Hunter Spotted Gum - Ironbark Forest EEC. To compensate for this loss, approximately 16 hectares of EEC will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

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

Due to the widespread extent of the Lower Hunter Spotted Gum – Ironbark Forest EEC within the locality, the removal of approximately 10 hectares for the proposed Surface Infrastructure Development, will result in negligible fragmentation or isolation of known or potential habitat of this EEC.

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

The Lower Hunter Spotted Gum – Ironbark Forest EEC within the Surface Infrastructure Site supports similar characteristics to those areas of this EEC directly adjoining the site and within the large remnant conserved in Werakata State Conservation Area. As such, the removal of 10 hectares from this remnant for the proposed Surface Infrastructure development is not regarded to have importance for the long-term conservation of the EEC within the locality. The conservation of approximately 16 hectares of this EEC within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the EEC.

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

The Surface Infrastructure Site does not support any critical habitat for this EEC or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this EEC or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTP and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

3.0 Heath wrinklewort (*Rutidosis heterogama*)

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

Heath wrinklewort (*Rutidosis heterogama*) was found in abundance throughout the Surface Infrastructure Site. This threatened flora species is also expected to occur widely within the large remnant of the adjoining Werakata State Conservation Area. As shown on **Figure 3.3**, there are numerous records of this species occurring within the locality to the north of the Surface Infrastructure Site.

The proposed Surface Infrastructure Development will require the removal of approximately 100 individuals and 10 hectares of habitat for the heath wrinklewort (*Rutidosis heterogama*). Given the widespread nature of known records and potential habitat for this species within the locality, this loss is not likely to place the local population at risk of extinction. The conservation of approximately 17 hectares of potential habitat for this species in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of the local population of heath wrinklewort (*Rutidosis heterogama*).

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

Not applicable.

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

The proposed Surface Infrastructure Development will lead to the loss of approximately 10 hectares of habitat and 100 known individuals for heath wrinklewort (*Rutidosis heterogama*). To compensate for this loss, approximately 17 hectares of potential habitat for this species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

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

Due to the widespread extent of known records of and potential habitat for heath wrinklewort (*Rutidosis heterogama*) within the locality, the removal of approximately 10 hectares for the proposed Surface Infrastructure Development, will result in negligible fragmentation or isolation of known or potential habitat of this species.

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

Known and potential habitat for heath wrinklewort (*Rutidosis heterogama*) occurs widely within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. As such, the removal of 10 hectares for the proposed Surface Infrastructure development is relatively small, and is not likely to have significant importance for the long-term conservation of the species within the locality. The conservation of 17 hectares of potential habitat for heath wrinklewort (*Rutidosis heterogama*) within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

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

The Surface Infrastructure Site does not support any critical habitat for this species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which

will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

3.0 Small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*)

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

Small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) was found in moderate abundance throughout the Surface Infrastructure Site. This threatened flora species is also expected to occur widely within the large remnant of the adjoining Werakata State Conservation Area. As shown on **Figure 3.3**, there are numerous records of this species occurring within the locality to the north of the Surface Infrastructure Site.

The proposed Surface Infrastructure Development will require the removal of approximately 30 recorded individuals and 10 hectares of potential habitat for the small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). Given the widespread nature of known records and potential habitat for this species within the locality, this loss is not likely to place the local population at risk of extinction. The conservation of approximately 17 hectares of potential habitat for this species in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of the local population of small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*).

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

Not applicable.

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

The proposed Surface Infrastructure Development will lead to the loss of approximately 10 hectares of habitat and approximately 30 known individuals for small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). To compensate for this loss, approximately 17 hectares of potential habitat for this species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

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

Due to the widespread extent of known records of and potential habitat for small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) within the locality, the removal of approximately 10 hectares for the proposed Surface Infrastructure Development, will result in negligible fragmentation or isolation of known or potential habitat of this species.

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

Known and potential habitat for small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) occurs widely within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. As such, the removal of 10 hectares for the proposed Surface Infrastructure development is relatively small, and is not likely to have significant importance for the long-term conservation of this species within the locality. The conservation of 16 hectares of potential habitat for small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

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

The Surface Infrastructure Site does not support any critical habitat for this species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which

will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

4.0 *Callistemon linearifolius*

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

Callistemon linearifolius was not recorded within the Surface Infrastructure Site, however is known to occur within the locality in similar habitats. The Surface Infrastructure Site provides potential habitat for this species, which is also expected to occur in a number of locations in the large remnant of the adjoining Werakata State Conservation Area.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for *Callistemon linearifolius*. Given that there are large areas of potential habitat for this species conserved within the adjacent Werakata State Conservation Area, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for *Callistemon linearifolius* in the proposed Biodiversity Offsets Area, provides potential habitat which may provide further protection for the long-term viability of the local population of this species.

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

Not applicable.

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

The proposed Surface Infrastructure Development will lead to the loss of approximately 10 hectares of potential habitat for *Callistemon linearifolius*, however no known records. To compensate for the loss of potential habitat, approximately 17 hectares of potential habitat for this species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for this species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for this species.

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

Known and potential habitat for *Callistemon linearifolius* is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively small, and is not likely to have significant importance for the long-term conservation of this species within the locality. The conservation of 17 hectares of potential habitat for *Callistemon linearifolius* within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for this species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 17 hectares of potential habitat for this species proposed to be disturbed is not significant to the long-term survival of the species within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for this species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and

- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

5.0 Bynoes wattle (*Acacia bynoeana*)

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

Bynoes wattle (*Acacia bynoeana*) was not recorded within the Surface Infrastructure Site, however has slight potential to occur. There are no known records of this species within reasonable proximity to the Surface Infrastructure Site; the majority of records occur further to the east.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for Bynoes wattle (*Acacia bynoeana*). Given that potential habitat for this species is conserved within the adjacent Werakata State Conservation Area, and there are no known records within proximity, this loss is not likely to place any local population of the species at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for this species in the proposed Biodiversity Offsets Area potentially provides further protection for the long-term viability of the local population of Bynoes wattle (*Acacia bynoeana*).

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for Bynoes wattle (*Acacia bynoeana*). Approximately 17 hectares of habitat which may potentially support this species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for this species in the locality is not likely to be high.

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

Due to the small area of the disturbance and the situation of the Study Area at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for this species.

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

There are no records of this species within reasonable proximity to the Surface Infrastructure Site. Habitats similar to those of the Surface Infrastructure Site (and therefore supporting potential habitat for this species) are conserved within the adjacent Werakata State Conservation Area. The potential for Bynoes wattle (*Acacia bynoeana*) to occur in the habitats of the Surface Infrastructure Site or the State Conservation Area is low.

The removal of 10 hectares for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of this species within the locality.

Taking into consideration the area of habitat potentially supporting this species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 17 hectares of potential habitat for this species proposed to be disturbed is not significant to the long-term survival of the species within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for this species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;

- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and

- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

6.0 Leafless tongue orchid (*Cryptostylis hunteriana*)

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

The leafless tongue orchid (*Cryptostylis hunteriana*) was not recorded within the Surface Infrastructure Site, however has slight potential to occur. There are no known records of this species within reasonable proximity to the Surface Infrastructure Site.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the leafless tongue orchid (*Cryptostylis hunteriana*). Given that areas of similar potential habitat for this species is conserved within the adjacent Werakata State Conservation Area, and there are no known records within proximity, this loss is not likely to place any local population of the species at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for this species in the proposed Biodiversity Offsets Area potentially provides further protection for the long-term viability of any local population of the leafless tongue orchid (*Cryptostylis hunteriana*).

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for the leafless tongue orchid (*Cryptostylis hunteriana*). Approximately 17 hectares of habitat which may potentially support this species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for this species in the locality is not likely to be high.

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

Due to the small area of the disturbance and the situation of the Study Area at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for this species.

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

There are no records of this species within reasonable proximity to the Surface Infrastructure Site. Habitats similar to those of the Surface Infrastructure Site (and therefore supporting potential habitat for this species) are conserved within the adjacent Werakata State Conservation Area. The potential for the leafless tongue orchid (*Cryptostylis hunteriana*) to occur in the habitats of the Surface Infrastructure Site or the State Conservation Area is low.

The removal of 10 hectares for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of this species within the locality.

Taking into consideration the area of habitat potentially supporting this species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 17 hectares of potential habitat for this species proposed to be disturbed is not significant to the long-term survival of the species within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for this species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;

- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and

- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

7.0 Raptors

The following seven part test of significance assesses the impacts of the proposed Surface Infrastructure Development on the two raptor species listed below. These species are assessed under the one test due to the similarities in their ecology and habitat requirements.

- **Square-tailed kite (*Lophoictinia isura*)**
- **Red goshawk (*Erythrotriorchis radiatus*)**

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

Both the square-tailed kite and the red goshawk were not recorded within the Surface Infrastructure Site, however may occur within the locality in similar habitats. The Surface Infrastructure Site provides potential habitat for these species, which are also expected to occur in a number of locations in the large remnant of the adjoining Werakata State Conservation Area. These highly mobile species have potential to forage widely within the locality.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the square-tailed kite and the red goshawk. Given that there are large areas of potential habitat for these species conserved within the adjacent Werakata State Conservation Area, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the red goshawk and the square-tailed kite in the proposed Biodiversity Offsets Area, potentially provides further protection for the long-term viability of any local population of these species.

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for the square-tailed kite and the red goshawk, however no known records. To compensate for the loss of potential habitat, approximately 17 hectares of potential habitat for these species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for these species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the red goshawk or the square-tailed kite.

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

Known and potential habitat for the square-tailed kite and the red goshawk are moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively small, and is not likely to have significant importance for the long-term conservation of these species within the locality. The conservation of 17 hectares of potential habitat for the red goshawk and the square-tailed kite within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for these species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for these species proposed to be disturbed is not significant to their long-term survival within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for these species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to these species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

8.0 Large Parrots

The following seven part test of significance assesses the impacts of the proposed Surface Infrastructure Development on the two large parrot species listed below. These species are assessed under the one test due to the similarities in their ecology and habitat requirements.

- **Glossy black-cockatoo (*Calyptorhynchus lathami*)**

- **Gang-gang cockatoo (*Calocephalon fimbriatum*)**

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

Both the glossy black-cockatoo and the gang-gang cockatoo were not recorded within the Surface Infrastructure Site, however may occur within the locality in similar habitats. The Surface Infrastructure Site provides potential habitat for these species, which are also expected to occur in a number of locations in the large remnant of the adjoining Werakata State Conservation Area. These highly mobile species are likely to forage widely within the locality.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the glossy black-cockatoo and the gang-gang cockatoo. Given that there are large areas of potential habitat for these species conserved within the adjacent Werakata State Conservation Area, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the glossy black-cockatoo and the gang-gang cockatoo in the proposed Biodiversity Offsets Area, potentially provides further protection for the long-term viability of any local population of these species.

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for the glossy black-cockatoo and the gang-gang cockatoo, however no known records. To compensate for the loss of potential habitat, approximately 17 hectares of potential habitat for these species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for these species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the glossy black-cockatoo or the gang-gang cockatoo.

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

Known and potential habitat for the glossy black-cockatoo and the gang-gang cockatoo is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively small, and is not likely to have significant importance for the long-term conservation of these species within the locality. The conservation of 17 hectares of potential habitat for the glossy black-cockatoo and the gang-gang cockatoo within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for these species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for these species proposed to be disturbed is not significant to their long-term survival within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for these species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to these species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

9.0 Migratory Woodland Birds

The following seven part test of significance assesses the impacts of the proposed Surface Infrastructure Development on the three migratory woodland bird species listed below. These species are assessed under the one test due to the similarities in their ecology and habitat requirements.

- **Swift parrot (*Lathamus discolor*)**
- **Regent honeyeater (*Xanthomyza phrygia*)**
- **Turquoise parrot (*Neophema pulchella*)**

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

The occurrence of winter-flowering tree species within the Surface Infrastructure Site provides potential for the three winter migratory bird species listed above to occur. The swift parrot, regent honeyeater and turquoise parrot are also expected to occur in a number of locations in the large remnant of the adjoining Werakata State Conservation Area, which supports similar habitats to those of the Surface Infrastructure Site. These highly mobile species are likely to forage widely within the locality.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the swift parrot, regent honeyeater and the turquoise parrot. Given that there are large areas of potential habitat for these species conserved within the adjacent Werakata State Conservation Area, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the swift parrot, regent honeyeater and turquoise parrot in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of any local population of these species.

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for the swift parrot, regent honeyeater and the turquoise parrot, however no known records. To compensate for the loss of potential habitat, approximately 17 hectares of potential habitat for these species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for these species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the swift parrot, regent honeyeater or turquoise parrot.

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

Known and potential habitat for the swift parrot, regent honeyeater and turquoise parrot is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of these species within the locality. The conservation of 17 hectares of potential habitat for the swift parrot, regent honeyeater and the turquoise parrot within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for these species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for these species proposed to be disturbed is not significant to their long-term survival within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for these species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to these species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

10.0 Large Forest Owls

The following seven part test of significance assesses the impacts of the proposed Surface Infrastructure Development on the three large forest owl species listed below. These species are assessed under the one test due to the similarities in their ecology and habitat requirements.

- **Powerful owl (*Ninox strenua*)**
- **Barking owl (*Ninox connivens*)**
- **Masked owl (*Tyto novaehollandiae*)**

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

The Surface Infrastructure Site provides potential foraging habitat for the three forest owl species listed above, however there are limited large hollows, and therefore limited nesting habitat. The powerful owl, barking owl and the masked owl are also expected to occur in a number of locations in the large remnant of the adjoining Werakata State Conservation Area, which supports similar habitats to those of the Surface Infrastructure Site. These highly mobile species are likely to forage widely within the locality.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the powerful owl, barking owl and the masked owl. Given that there are large areas of potential habitat for these species conserved within the adjacent Werakata State Conservation Area, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the powerful owl, barking owl and the masked owl in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of any local population of these species.

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for the powerful owl, barking owl and the masked owl, however no known records. To compensate for the loss of potential habitat, approximately 17 hectares of potential habitat for these species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site. The proposed Biodiversity Offsets Area supports slightly higher abundance of mature canopy trees, and therefore there are likely to be more nesting opportunities in a shorter period of time than of the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for these species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the powerful owl, masked owl or barking owl.

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

Known and potential habitat for the powerful owl, barking owl and the masked owl is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of these species within the locality. The conservation of 17 hectares of potential habitat for the powerful owl, barking owl and the masked owl within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for these species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for these species proposed to be disturbed is not significant to their long-term survival within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for these species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to these species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

11.0 Woodland Birds

The following seven part test of significance assesses the impacts of the proposed Surface Infrastructure Development on the four woodland bird species listed below. These species are assessed under the one test due to the similarities in their ecology and habitat requirements.

- **Brown treecreeper (*Climacteris picumnus victoriae*)**
- **Black-chinned honeyeater (*Melithreptus gularis gularis*)**
- **Grey-crowned babbler (*Pomatostomus temporalis temporalis*)**
- **Diamond firetail (*Stagonopleura guttata*)**

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

The Surface Infrastructure Site provides potential foraging habitat for the brown treecreeper, black-chinned honeyeater, the grey-crowned babbler and the diamond firetail. These four woodland bird species are also expected to occur in a number of locations in the large remnant of the adjoining Werakata State Conservation Area, which supports similar habitats to those of the Surface Infrastructure Site. These highly mobile species are likely to forage widely within the locality.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the brown treecreeper, black-chinned honeyeater, the grey-crowned babbler and the diamond firetail. Given that there are large areas of potential habitat for these species conserved within the adjacent Werakata State Conservation Area, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the brown treecreeper, black-chinned honeyeater, the grey-crowned babbler and the diamond firetail in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of any local population of these species.

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for the brown treecreeper, black-chinned honeyeater, the grey-crowned babbler and the diamond firetail, however no known records. To compensate for the loss of potential habitat, approximately 17 hectares of potential habitat for these species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for these species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the brown treecreeper, black-chinned honeyeater, the grey-crowned babbler and the diamond firetail.

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

Known and potential habitat for the brown treecreeper, black-chinned honeyeater, the grey-crowned babbler and the diamond firetail is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of these species within the locality. The conservation of 17 hectares of potential habitat for the brown treecreeper, black-chinned honeyeater, the grey-crowned babbler and the diamond firetail within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for these species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for these species proposed to be disturbed is not significant to their long-term survival within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for these species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to these species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

12.0 Spotted-tailed quoll (*Dasyurus maculatus*)

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

The spotted-tailed quoll has potential to forage within the Surface Infrastructure Site as part of a much broader foraging range that may include habitats of the large remnant of the adjoining Werakata State Conservation Area, which supports similar habitats to those of the Surface Infrastructure Site. The Surface Infrastructure Site is unlikely to be frequently utilised by this species. There are limited potential denning sites for this species within the Surface Infrastrucutre Site.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the spotted-tailed quoll. Given that there are large areas of potential habitat for this species conserved within the adjacent Werakata State Conservation Area, and the large home range of this species, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the spotted-tailed quoll in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of any local population of this species.

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

Not applicable.

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

The proposed Surface Infrastructure Development will lead to the loss of approximately 10 hectares of potential habitat for the spotted-tail quoll, however no known records. To

compensate for the loss of potential habitat, approximately 17 hectares of potential habitat for this species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for this species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the spotted-tail quoll.

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

Known and potential habitat for the spotted-tail quoll is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of this species within the locality. The conservation of 17 hectares of potential habitat for the spotted-tail quoll within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for this species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for this species proposed to be disturbed is not significant to the long-term survival of any population within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for this species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;

- invasion of native plant communities by exotic perennial grasses;

- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and

- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

13.0 Koala (*Phascolarctos cinereus*)

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

There are a number of suitable food trees within the Surface Infrastructure Site that may be utilised by the koala. The koala has potential to forage within the Surface Infrastructure Site as part of a much broader foraging range that may include habitats of the large remnant of the adjoining Werakata State Conservation Area, which supports similar habitats to those of the Surface Infrastructure Site. The Surface Infrastructure Site is unlikely to be frequently utilised by this species.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the koala. Given that there are large areas of potential habitat for this species conserved within the adjacent Werakata State Conservation Area, and the large home range of this species, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the koala in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of any local population of this species.

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for the koala, however no known records. To compensate for

the loss of potential habitat, approximately 17 hectares of potential habitat for this species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for this species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the koala.

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

Known and potential habitat for the koala is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of this species within the locality. The conservation of 17 hectares of potential habitat for the koala within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for this species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for this species proposed to be disturbed is not significant to the long-term survival of any population within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for this species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;

- invasion of native plant communities by exotic perennial grasses;

- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and

- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

14.0 Squirrel glider (*Petaurus norfolcensis*)

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

The squirrel glider has potential to forage within the Surface Infrastructure Site, however the lack of tree-hollows limits the potential for this species to be nesting, This species may also forage and nest within the habitats of the large remnant of the adjoining Werakata State Conservation Area, which supports similar habitats to those of the Surface Infrastructure Site.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the squirrel glider. Given that there are large areas of potential habitat for this species conserved within the adjacent Werakata State Conservation Area, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the squirrel glider in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of any local population of this species.

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for the squirrel glider, however no known records. To compensate for the loss of potential habitat, approximately 17 hectares of potential habitat

for this species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for this species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the squirrel glider.

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

Known and potential habitat for the squirrel glider is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of this species within the locality. The conservation of 17 hectares of potential habitat for the squirrel glider within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for this species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for this species proposed to be disturbed is not significant to the long-term survival of any population within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for this species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;

- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and

- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

15.0 Micro-bats

The following seven part test of significance assesses the impacts of the proposed Surface Infrastructure Development on the five micro-bat species listed below. These species are assessed under the one test due to the similarities in their ecology and habitat requirements.

- **Eastern bentwing-bat (*Miniopteris schreibersii oceanensis*)**
- **Little bentwing-bat (*Miniopterus australis*)**
- **Large-footed myotis (*Myotis adversus*)**
- **Eastern false pipistrelle (*Falsistrellus tasmaniensis*)**
- **Large-eared pied bat (*Chalinolobus dwyeri*)**

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

The Surface Infrastructure Site provides potential foraging habitat for the eastern bentwing-bat, little bentwing-bat, large-footed myotis, eastern false pipistrelle and the large-eared pied bat. These four micro-bat species are also expected to occur in a number of locations in the large remnant of the adjoining Werakata State Conservation Area, which supports similar habitats to those of the Surface Infrastructure Site. These highly mobile species are likely to forage widely within the locality.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the eastern bentwing-bat, little bentwing-bat, large-footed myotis, eastern false pipistrelle and the large-eared pied bat. Given that there are large areas of potential habitat for these species conserved within the adjacent Werakata State Conservation Area, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the eastern bentwing-bat, little bentwing-bat, large-footed myotis, eastern false pipistrelle and the large-eared pied bat in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of any local population of these species.

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

Not applicable.

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

The proposed Surface Infrastructure development will lead to the loss of approximately 10 hectares of potential habitat for the eastern bentwing-bat, little bentwing-bat, large-footed myotis, eastern false pipistrelle and the large-eared pied bat, however no known records. To compensate for the loss of potential habitat, approximately 17 hectares of potential habitat for these species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for these species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the eastern bentwing-bat, little bentwing-bat, large-footed myotis, eastern false pipistrelle and the large-eared pied bat.

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

Known and potential habitat for the eastern bentwing-bat, little bentwing-bat, large-footed myotis, eastern false pipistrelle and the large-eared pied bat is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of these species within the locality. The conservation of 17 hectares of potential habitat for the eastern bentwing-bat, little bentwing-bat, large-footed myotis, eastern false pipistrelle and the large-eared pied bat within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for these species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for these species proposed to be disturbed is not significant to their long-term survival within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for these species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to these species or the proposed Surface Infrastructure Development.

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

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

16.0 Grey-headed flying-fox (*Pteropus poliocephalus*)

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

The grey-headed flying-fox has potential to occur in the Surface Infrastructure Site, however there are no known roost sites within the locality. This species may also forage and nest within the habitats of the large remnant of the adjoining Werakata State Conservation Area, which supports similar habitats to those of the Surface Infrastructure Site.

The proposed Surface Infrastructure Development will require the removal of approximately 10 hectares of potential habitat for the grey-headed flying-fox. Given that there are large areas of potential habitat for this species conserved within the adjacent Werakata State Conservation Area, the large home range of this species and its highly mobile nature, this loss will not place any local population at risk of extinction.

The conservation of approximately 17 hectares of potential habitat for the grey-headed flying-fox in the proposed Biodiversity Offsets Area, provides further protection for the long-term viability of any local population of this species.

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

Not applicable.

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

The proposed Surface Infrastructure Development will lead to the loss of approximately 10 hectares of potential habitat for the grey-headed flying-fox, however no known records. To compensate for the loss of potential habitat, approximately 17 hectares of potential

habitat for this species will be conserved within the proposed Biodiversity Offset Area which is situated in proximity to the Surface Infrastructure Site.

Given the large area of potential habitat conserved within the Werakata State Conservation Area, the long-term cumulative impacts on loss of potential habitat for this species in the locality is not likely to be high.

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

Due to the small area of the proposed disturbance and the situation of the Surface Infrastructure Site at the edge of Werakata State Conservation Area, the proposed Surface Infrastructure Development will result in negligible fragmentation or isolation of known or potential habitat for the grey-headed flying-fox.

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

Potential habitat for the grey-headed flying-fox is moderately widespread within the locality, including within Werakata State Conservation Area which adjoins the Surface Infrastructure Site. In comparison, the 10 hectares proposed to be removed for the proposed Surface Infrastructure development is relatively minor, and is not likely to have significant importance for the long-term conservation of this species within the locality. The conservation of 17 hectares of potential habitat for the grey-headed flying-fox within the proposed Biodiversity Offsets Area will further reduce the long-term impacts on the species.

Taking into consideration the area of potential habitat for this species conserved within Werakata State Conservation Area and the proposed Biodiversity Offsets Area, the 10 hectares of potential habitat for this species proposed to be disturbed is not significant to the long-term survival of any population within the locality.

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

The Surface Infrastructure Site does not support any critical habitat for this species or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this species or the proposed Surface Infrastructure Development.

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.

The TSC Act listed key threatening process (KTPs) related to the proposed Surface Infrastructure Development are listed below:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;

- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and

- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

These four KTPs and their implications in relation to the proposed Surface Infrastructure Development are discussed in **Section 7** of this report. Of particular relevance is the clearing of native vegetation. The proposed Surface Infrastructure Development will require the removal of 10 hectares of native vegetation. The impacts of this has been compensated through the reservation of a Biodiversity Offsets Area of approximately 17 hectares, which will ensure the long-term conservation of ecological values similar to those being cleared for the proposed development.

While there is potential risk of affecting some of these KTPs, there are no significant implications for the proposed Surface Infrastructure Development.

Conclusion

The proposed Surface Infrastructure Development will not result in a significant impact on any threatened species, populations or EECs recorded or potentially occurring within the Surface Infrastructure Site. While there will be some impacts on threatened species and EECs, the 17 hectare Biodiversity Offset Area will adequately compensate for these impacts.

APPENDIX C

Test of Significance (EP&A Act) – Proposed Stage 3 Mine Area

Appendix C – Assessment of Significance under the EP&A Act for the Proposed Stage 3 Mine Development

Threatened species, endangered populations, and endangered ecological communities (EECs) recorded during surveys of the Stage 3 Mine Area are listed in **Tables 1** and **2** below, which also includes the results of the searches of the DECC Atlas of NSW Wildlife and DEWHA Protected Matters Database for a 10 kilometre radius of the study area.

Tables 1 and **2** contain the relevant ecological details of each listing (including their habitat requirements, known range and reservation with conservation reserves), as well as an assessment as to whether there may be an impact on any recorded or potentially occurring threatened species or EECs as a result of the proposed Stage 3 Mining development. This assessment for the potential for a threatened species or EEC to be impacted is based on the information contained in **Section 9.2** of this report as well as the specific habitat requirements of each threatened species or EEC. For the purposes of these tables, the 'region' is broadly defined as the Lower Hunter Valley, the western limit being Singleton and the eastern limit being approximately West Wallsend. The northern and southern boundaries of the region are approximately 30 kilometres north and south of the Study Area.

A seven part test of significance was prepared in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for each threatened species, population or EEC on which there is the potential for an impact as a result of the proposed Stage 3 Mining Development. The seven part tests are provided below **Table 2**. Although seven part tests of significance are not required for developments assessed under Part 3A, seven part tests are nevertheless used as the means of determining the likely level of significance of impacts.

An assessment of significance for those species listed under the Commonwealth EPBC Act which have potential to be impacted by the proposed Stage 3 Mining development is provided in **Appendix E**.

Table 1 - Threatened Flora Assessment

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
black-eyed Susan *Tetratheca juncea*	V (TSC) V (EPBC) #	Open forest, woodland, heathland and moist forest, with shrub understorey and grassy groundcover, on low nutrient soils. Generally prefers well-drained slopes (often south-facing) and ridges, occasionally occurs in gullies.	Confined to coastal districts from Bulahdelah to Lake Macquarie. The Study Area is situated to the west of the known distribution of this species.	This species is not known from any conservation reserves in the region.	This species was not recorded in the Stage 3 Mine Area and there is no potential for it to occur. There is no potential for an impact on this species.	No
Bynoes wattle *Acacia bynoeana*	V (EPBC) E (TSC) #	Occurs mainly in heath and dry sclerophyll forest on sandy soils (Kodela and Harden 2002), and appears to prefer open and sometimes slightly disturbed sites such as road edges and recently burnt areas (DECC 2008).	Occurs in central eastern NSW from Morisset to the Illawarra region and west to the Blue Mountains (DECC 2008, Kodela and Harden 2002). It has also been found in the Parma Creek and Colymea areas west of Nowra (DECC 2008) and in the Kurri Kurri and Cessnock areas in the lower Hunter Valley. Also recorded at Ellalong, west of the Study Area. The study area is within the known distribution of this species.	Lake Macquarie SCA – count 1	There is a low potential for this species to occur within the Spotted Gum – Ironbark Forest of the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
heath wrinklewort *Rutidosis heterogama*	V (EPBC) V (TSC) *	Occurs mostly in heath, often along disturbed roadsides, primarily in coastal districts, also open forest.	In coastal districts from Maclean to the Hunter Valley and inland to Torrington (Harden 1992). It has also been recently recorded at Cooranbong on the Central Coast and extensively around the Cessnock district. The study area is within the known distribution of this species.	Glenrock SCA – count 5 Werakata NP - 9 Werakata SCA – (unknown)	This species was recorded within the Stage 3 Mine Area in the Spotted Gum – Ironbark Forest. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No
Callistemon linearifolius	V (TSC) *	Typically grows in dry sclerophyll forest on the coast and adjacent ranges.	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW (DECC 2008). The study area is within the known distribution of this species.	Munmorah NR – count 1 Werakata NP Yengo NP	This species has potential to occur within the Stage 3 Mine Area in a variety of habitats. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
Parramatta red gum *Eucalyptus parramattensis* subsp. *decadens*	V (EPBC) V (TSC) * #	Typically grows on deep, low-nutrient sands, often subject to periodic inundation (DECC 2008). Occurs in dry sclerophyll woodland with a dry heath understorey and also as an emergent in dry or wet heathland (DECC 2008).	Occurs in two separate meta-populations, in the Kurri Kurri and Tomago areas (DECC 2008). The study area is outside the known distribution of this species.	Werakata NP	There is no potential for this species to occur within the Stage 3 Mine Area. There is no potential for an impact on this species.	No
small-flower grevillea *Grevillea parviflora* subsp. *parviflora*	V (EPBC) V (TSC) * #	Occurs in heath and shrubby woodland to open forest (DECC 2008), on sandy or light clay soils, usually over thin shales (Makinson 2002). The species is found over a range of altitudes, and can occur in open and slightly disturbed areas (DECC 2008).	The main occurrence of the species is centred around Picton, Appin and Bargo in the Sydney Basin, where it occurs sporadically (DECC 2008). Separate populations are known further north from Putty to Wyong, Lake Macquarie, Cessnock and Kurri Kurri (DECC 2008). The study area is within the known distribution of this species.	Werakata NP	This species was recorded in the Spotted Gum – Ironbark Forest in the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
leafless tongue orchid *Cryptostylis hunteriana*	V (EPBC) V (TSC) #	Favours moist soils on the flat coastal plains. Occupies swamp heath, but may occupy sclerophyll forest and woodland, often on sandy soils. Typically found in communities containing *Eucalyptus haemastoma, E. capitellata* and *Corymbia gummifera.*	Recorded from Gibraltar Range National Park south into Victoria around the coast as far as Orbost. Known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). Also recorded at Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park, Ben Boyd National Park (DECC 2008). The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	This species potentially occurs in the Stage 3 Mine Area in various habitats. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat of this species.	No
Charmhaven apple *Angophora inopina*	V (EPBC) V (TSC) * #	Typically occurs on the shallow sandy soils of the Narrabeen Group, on exposed ridges and slopes with a westerly or northerly aspect. It has also been recorded on shallow alluvial soils of this geological type, in upper catchments and in embedded clay soil lenses with sandstone.	Distribution confined to the Wyong, Lake Macquarie and Port Stephens Shires of New South Wales (Bell 2001). Pure forms of this species have been recorded from the Wallarah catchment in the south and north to the Toronto area. Disjunct populations have been identified at Karuah (Bell 2001). The study area is outside the known distribution of this species.	Karuah NR – count 5 Lake Macquarie SCA – count 3	There is no potential for this species to occur in the Stage 3 Mine Area. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
slaty red gum *Eucalyptus glaucina*	V (EPBC) V (TSC) #	Typically grows in grassy woodland on deep, moderately fertile and well-watered soil and can be locally frequent but very sporadic.	Occurs near Casino and from Taree to Broke in the North Coast botanical subdivision. The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur in the Stage 3 Mine Area. There is no potential for an impact on this species.	No
North Rothbury persoonia *Persoonia pauciflora*	CE (EPBC) CE (TSC) #	Typically occurs in dry open forest or woodland with a moderate to sparse shrub layer and a high percentage of groundcover species, especially grasses (DECC 2008).	Very restricted distribution with all known individuals occurring within 2.5 km of the type specimen collected near North Rothbury in the Cessnock LGA (DECC 2008). The study area is outside the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur in the Stage 3 Mine Area. There is no potential for an impact on this species.	No
Singleton Mint Bush	V (EPBC) V (TSC)	Grows in open woodlands on exposed sandstone ridges and typically occurs on shallow or skeletal sands (DECC 2008).	Currently known to be restricted to only a few localities near Walcha, Scone and St Albans (DECC 2008). One record near Bellbird, north-west of the Study Area. The study area is outside the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur in the Stage 3 Mine Area. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
Groves paperbark *Melaleuca groveana*	V (TSC)	Occurs in heath, shrubland and in dry woodlands, often in exposed sites, at high elevations, on rocky outcrops and cliffs.	Widespread, scattered populations in coastal districts north of Port Stephens to southeast Queensland. The Study Area occurs to the south of the known distribution for this species.	This species is not known from any conservation reserves within the region.	The Stage 3 Mine Area does not support habitats suitable for this species to occur. There is no potential for the proposed development to have a significant impact on this species.	No
River Flat Eucalypt Forest	EEC (TSC) ^	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains (NSW Scientific Committee 2005d).	This EEC was potentially recorded within the study area. This EEC occurs in the NSW North Coast, Sydney Basin and South-east corner bioregions. The study area is within the known distribution of this species.	This EEC is not known from any conservation reserves in the region.	Approximately 66.7 hectares of River-flat Eucalypt Forest were found to occur within the Stage 3 Mine Area. There is potential for an impact on this EEC.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
Lower Hunter Spotted Gum - Ironbark Forest	EEC (TSC) ^	The *Lower Hunter Spotted gum – Ironbark Forest* EEC occurs in the central to lower Hunter Valley, principally on Permian geology.	This EEC was recorded within the study area. The EEC is restricted to a range of approximately 65 kilometres by 35 kilometres centred on the Cessnock – Beresfield area. The study area is within this known distribution.	Werakata NP Werakata SCA	This EEC occurs widely within the study area, on the drier slopes and ridges. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat of this EEC. As such there is no potential for a significant impact on this EEC.	No
Swamp Oak Floodplain Forest	EEC (TSC) ^	This EEC is associated with grey-black clay-loams and sandy loams, 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.	This EEC occurs throughout the North Coast, Sydney Basin and South-East Corner bioregions of NSW. The study area is situated west of the known distribution of this EEC.	Hexham Swamp NR Pambalong NR Lake Macquarie SCA Kooragang NP	This EEC does not occur within the Stage 3 Mine Area. There is no potential for an impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
Quorrobolong Scribbly Gum Woodland	EEC (TSC) ^	This EEC occurs on a residual sand deposit overlying the Permian clay sediments in the Hunter Valley.	This EEC is known from a small area between Quorrobolong and Mulbring in the Cessnock Local Government Area but may occur elsewhere. The study area is within the known distribution of this EEC.	This EEC is not known from any conservation reserves in the region.	A small remnant of this EEC is present within the Study Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this EEC.	No
Swamp Sclerophyll Forest	EEC (TSC) ^	This EEC is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains.	This EEC occurs throughout the North Coast, Sydney Basin and South-East Corner bioregions of NSW. The study area is situated west of the known distribution of this EEC.	This EEC is not known from any conservation reserves in the region.	This EEC has no potential to occur within the Stage 3 Mine Area. There is no potential for an impact on this EEC.	No
Freshwater Wetlands on Coastal Floodplains	EEC (TSC) ^	This EEC is associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains.	This EEC occurs throughout the North Coast, Sydney Basin and South-East Corner bioregions of NSW. The study area is within the known distribution of this EEC.	Hexham Swamp NR Pambalong NR	This EEC has no potential to occur within the Stage 3 Mine Area. There is no potential for an impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
Hunter Lowland Red Gum Forest	EEC (TSC) ^	Occurs on gentle slopes arising from depressions and drainage flats on permian sediments of the Hunter Valley floor.	Recorded from Maitland, Cessnock and Port Stephens LGAs (in the Sydney Basin Bioregion) and Muswellbrook and Singleton LGAs (in the NSW North Coast Bioregion) but may occur elsewhere in these bioregions. The study area is within the known distribution of this EEC.	Werakata NP Werakata SCA	The Hunter Lowland Red Gum Forest was not recorded within the Stage 3 Mine Area. There is no potential for an impact on this EEC.	No
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CEEC (EPBC) #	This ecological community occurs in areas where rainfall is between 400 and 1200 mm per annum, on moderate to highly fertile soils at altitudes of 170 metres to 1200 metres.	This EEC occurs in an arc along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria. It occurs in the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions. The study area is outside the known range of this EEC.	There are no known occurrences of this EEC within the conservation reserves of the region.	This EEC has no potential to occur within the Stage 3 Mine Area. There is no potential for an impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
weeping myall (*Acacia pendula*) in the Hunter Catchment	EP (TSC) ^	Grows on major river floodplains on heavy clay soils, sometimes as the dominant species and forming low open woodlands. Within the Hunter catchment it typically occurs on heavy soils, sometimes at the margins of small floodplains, but also in more undulating locations remote from floodplains, such as at Jerrys Plains.	There are 17 confirmed and four unconfirmed naturally occurring remnants of the *A. pendula* population in the Hunter catchment. These range as far east as Warkworth, and as far west as Kerrabee, west of Sandy Hollow. *Acacia pendula* is not known to occur naturally further north than the Muswellbrook-Wybong area. Eight planted *A. pendula* populations (not naturally occurring) have been recorded in the Hunter, and it is likely that numerous more planted populations occur. The study area occurs to the east of the known distribution of the species forming this endangered population.	No known natural remnants/populations of *Acacia pendula* occur on land zoned for conservation and only two stands, both part of the same population (at Jerrys Plains Cemetery), occur on community-owned land that is managed by a Council (Singleton).	No individuals of *Acacia pendula* were recorded within the Stage 3 Mine Area, and there is no potential for this species to occur. There is no potential for an impact on this endangered population.	No
tiger orchid (*Cymbidium canaliculatum*) in the Hunter Catchment	EP (TSC) ^	This species occurs within dry sclerophyll forests and woodlands of tablelands and western slopes, growing in hollows of trees. It is usually found occurring singly or as a single clump, typically between two and six metres above the ground.	The population of *Cymbidium canaliculatum* in the Hunter Catchment is at the south-eastern limit of the geographic range for this species. The study area is situated to the south-east of the known distribution of the species forming this endangered population.	This endangered population is not known from any conservation reserves within the region.	No individuals of *Cymbidium canaliculatum* were recorded within the Stage 3 Mine Area, and there is no potential for this species to occur. There is no potential for an impact on this endangered population.	No.

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
river red gum (*Eucalyptus camaldulensis*) in the Hunter Catchment	EP (TSC) ^	This endangered population may occur with *Eucalyptus tereticornis*, *Eucalyptus melliodora*, *Casuarina cunninghamiana* subsp. *cunninghamiana* and *Angophora floribunda*.	The Hunter population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River. It has been recorded in the LGAs of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper Hunter. The study area occurs within the known distribution of this endangered population.	This endangered population is not known from any conservation reserves in the region.	No individuals of *Eucalyptus camaldulensis* were recorded within the Stage 3 Mine Area, and there is no potential for this species to occur. There is no potential for an impact on this endangered population.	No
Leionema lamprophyllum subsp. *obovatum* in the Hunter Catchment	EP (TSC) ^	Grows in heath on exposed ridges at higher altitudes. The Hunter population occurs on a rocky cliff line in a dry eucalypt forest.	Mainly occurs south from Tidbinbilla Range in the Canberra area, extending into Victoria. The Hunter Catchment population occurs near Pokolbin, remote from the Study Area.	This endangered population is not known from any conservation reserves within the region.	No individuals of *Leionema lamprophyllum* subsp. *obovatum* were recorded within the Stage 3 Mine Area, and there is no potential for this species to occur. There is no potential for an impact on this endangered population.	No

Key:
* Records from DECC Wildlife Atlas Database
# Records from EPBC Protected Matters Search
^ Records added from previous studies or expert knowledge
TSC = *Threatened Species Conservation Act* 1995
EPBC Act = *Environment Protection and Biodiversity Conservation Act* 1999
E = Endangered
V = Vulnerable
CE = Critically endangered
EP = Endangered Population
NP = National Park
SCA = State Conservation Area
NR = Nature Reserve
EP = endangered population
EEC = Endangered Ecological Community
CEEC = Critically Endangered Ecological Community

Table 2 - Threatened Fauna Assessment

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
giant burrowing frog *Heleioporus australiacus*	V (TSC) V (EPBC) #	This species prefers woodland and heath in Hawkesbury sandstone ridge-top habitat and broader upland valleys. In particular, it is found in small headwater creek lines and slow flowing or intermittent creek lines (DECC 2008).	Occurs from the central coast of NSW to Victoria (Cogger 2000). The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur due to the absence of suitable sandstone habitats. There is no potential for an impact on this species.	No
stuttering frog *Mixophyes balbus*	E (TSC) V (EPBC) #	This species is found near streams in rainforest and wet, tall open forest in the foothills and escarpments (DECC 2008).	Occurs along the east coast from southern Queensland to north-east Victoria, on the eastern side of the Great Dividing Range (DECC 2008). The study area is within the known distribution of this species.	Jilliby SCA – count 7 Watagans NP – count 7	There is no potential for this species to occur due to absence of rainforest or tall open forest habitat. There is no potential for an impact on this species.	No
giant barred frog *Mixophyes iteratus*	E (TSC) E (EPBC) #	This species forages and lives amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 metres (DECC 2008). Breeds in shallow, flowing rocky streams (DECC 2008).	Occurs along the coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW (DECC 2008). The Coffs Harbour-Dorrigo area, is now a stronghold (DECC 2008). The study area is within the known distribution of this species.	Jilliby SCA – count 2 Watagans NP – count 15	There is no potential habitat for this species due to absence of suitable rainforest habitats. There is no potential for an impact on this species.	No
green and golden bell frog *Litoria aurea*	E (TSC) V (EPBC) #	Occurs among vegetation in permanent water bodies (Cogger 2000), particularly where bullrush (*Typha* spp.) and spikerush (*Eleocharis* spp.) occur (DECC 2008). Known to occur in degraded water bodies such as brick-pits and industrial sites (DECC 2008).	Occurs in eastern and south-eastern NSW to far eastern Victoria, largely at low altitudes (Cogger 2000). Once widespread, it is now restricted to isolated coastal populations. The study area is within the known distribution of this species.	Kooragang NR – count 11 Hexham Swamp NR – count 3	There is no potential for this species to occur in the Stage 3 Mine Area. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
green-thighed frog *Litoria brevipalmata*	V (TSC) *	Occurs in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain (DECC 2008). Breeding occurs around grassy semi-permanent ponds and flood-prone grassy areas (DECC 2008).	Recorded in isolated locations in wet sclerophyll forest along the north coast of NSW and south east Queensland (DECC 2008). The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is a very low potential for this species to occur in the riparian habitats of the Stage 3 Mine Area. There is some potential for an impact on potential habitat for this species as a result of the Stage 3 Mining Development, albeit very low.	Yes
Littlejohn's tree frog *Litoria littlejohni*	V (TSC) V (EPBC) #	Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops (DECC 2008). Prefers wet forest margins for breeding.	Occurs along the eastern slopes of the Great Dividing Range from the Watagans near Wyong, south to Buchan in north-eastern Victoria. It has not been recorded in coastal habitats (DECC 2008). The study area is slightly north of the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur within the Stage 3 Mine Area due to the absence of permanent rocky streams. There is no potential for an impact on this species.	No
broad-headed snake *Hoplocephalus bungaroides*	E (TSC) V (EPBC) #	This species appears to prefer sites where exposed sandstone outcrops and benches occur, particularly in woodland and heath vegetation. It is often found sheltering under rock crevices (winter) and tree hollows (summer) (DECC 2008).	Restricted to a 200 kilometre radius of the Sydney basin (Swan 1990). This range extends from Wollemi National Park to the eastern edge of the Clyde River Catchment, near Batemans Bay. The study area is situated just north of the known distribution of this species.	This species is not known from any conservation reserves in the region.	Due to the absence of sandstone outcrops, there is no potential for this species to occur within the Stage 3 Mine Area. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
black-necked stork *Ephippiorhynchus asiaticus*	E (TSC)	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.	This species is widespread across coastal northern and eastern Australia, becoming uncommon further south into NSW, and rarely found south of Sydney. The Study Area occurs within the known distribution of this species.	Limeburners Creek NR - 4 Lake Innes NR - 35 Crowdy Bay NP - 7 Myall Lakes NP - 13 Booti Booti NP - 8	There are no freshwater wetland habitats present within the Stage 3 Mine Area that would provide suitable habitat for this species. There is no potential for an impact on this species.	No
painted snipe *Rostratula benghalensis australis*	E (TSC) V (EPBC) #	Occurs in ephemeral and permanent wetlands where there is a cover of vegetation. Such areas may include shallows and margins of wetlands, dams, sewage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub and open timber (Pizzey & Knight 1997).	Scattered distribution throughout Australia. Nomadic in response to suitable conditions, and may be migratory (DECC 2008). The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	This species has potential to occur in dam habitats within the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
freckled duck Stictonetta naevosa	V (TSC) *	Generally nomadic between ephemeral inland wetlands. Occurs in large numbers on brackish to hyposaline wetlands that are densely vegetated with Lignum, where they breed (Garnett & Crowley 2000). Other habitat types include large open lakes, creeks, farm dams, sewage ponds and floodwaters (DECC 2008).	Broadly distributed, from eastern and south-western Australia, occurring elsewhere, particularly during years of inland drought (DECC 2008). Has been recorded west of the study area at Ellalong Lagoon. The study area is within the known distribution of this species.	Kooragang NR – count 4	There is a very low potential for this species to occur on farm dams within the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
black-breasted buzzard *Hamirostra melanosternon*	V (TSC) *	Habitat varies, however often includes wooded and open habitats, especially riverine woodlands (Debus 2001). Often recorded in dry open country, arid areas and savannah woodlands (Hollands 2003).	This species is recorded from the majority of the mainland, except for high rainfall areas of the south and south east (Debus 2001). The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential for this species to occur in the Stage 3 Mine Area. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
square-tailed kite *Lophoictinia isura*	V (TSC) *	Recorded from a variety of timbered habitats, showing preference for timbered watercourses. Occupies hunting ranges of more than 100km^2. Breeding occurs between July and February and nests are generally near watercourses.	Occurs patchily throughout NSW, usually within 300km of the coast. It is thought to be a regular resident in the north, north-east and the major west-flowing river systems of NSW. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. The study area is within this species' known distribution.	This species is not known from any conservation reserves within the region.	The Stage 3 Mine Area supports potential foraging and nesting habitat for this species. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
comb-crested jacana *Irediparra gallinacea*	V (TSC) *	Requires well vegetated, permanent wetland habitats with floating or emergent vegetation, in particular water-lilies. Feeds primarily on invertebrates and some vegetation. Breeds in spring and summer in NSW, in a nest of wet, floating vegetation.	It occurs in coastal areas and well inland parts of northern and eastern Australia, the most southern limit being the Hunter River. Vagrants may occur further south if unfavourable conditions occur in northern NSW. The Study Area is within the known distribution of this species.	This species is not known from any conservation reserves within the region.	There are no dam habitats suitable for this species within the Stage 3 Mine Area. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
red goshawk Erythrotriorchis radiatus	E (TSC) V (EPBC) *	In NSW, preferred habitat is mixed tropical rainforest Melaleuca Swamp Forest and Open Eucalypt forest along coastal rivers, often in rugged terrain (DECC 2008). Prefers mosaic vegetation types; hunts along the ecotones (DECC 2008). Habitats are generally close to permanent bodies of freshwater, nest sites being only up to 1 kilometre away from such water bodies.	Restricted to coastal/subcoastal regions of Australia. Occurs across northern Australia south through eastern Queensland to far north-east NSW (DECC 2008). The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	The Stage 3 Mine Area, supports potential habitat for this species. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
glossy black-cockatoo *Calyptorhynchus lathami*	V (TSC) *	Habitat for this species includes forests on low-nutrient soils, specifically those containing key *Allocasuarina* feed species (DECC 2008). Depends on very large tree hollows for nesting.	The glossy black-cockatoo has a sparse distribution along the east coast and adjacent inland areas from western Victoria to Rockhampton in Queensland. In NSW, it has been recorded as far inland as Cobar and Griffith. The study area is within the known distribution of this species.	Wallaroo NR – count 1 Karuah NR – count 2 Lake Macquarie SCA – count 1 Jilliby SCA – count 2 Worimi NR – count 1 Watagans NP – count 4	The Stage 3 Mine Area provides potential foraging habitat, however limited nest sites. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
gang-gang cockatoo *Callocephalon fimbriatum*	V (TSC) *	In summer, it occupies tall montane forests and woodlands (DECC 2008), and may also occur in sub-alpine woodland and occasionally in temperate rainforests (DECC 2008). In winter, it occurs at lower altitudes in drier, open eucalypt forests/woodlands, or in dry forest in coastal areas (DECC 2008). May undertake nomadic or seasonal movements.	In NSW, distribution extends from the south-east coast to the Hunter region and inland to the Central Tablelands and south-west slopes. Isolated records are known from as far north as Coffs Harbour and as far west as Mudgee and the Australian Capital Territory (DECC 2008). The study area is within the known distribution of this species.	Tomaree NP – count 2 Jilliby SCA – count 2 Watagans NP – count 1	This species was recorded within the Study Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No
swift parrot *Lathamus discolor*	E (TSC) E (EPBC) #	Often visits box-ironbark forests, feeding on nectar and lerp (Garnett & Crowley 2000). In NSW, typical feed species include mugga ironbark, grey box, swamp mahogany, spotted gum, red bloodwood, narrow-leaved red ironbark, forest red gum and yellow box (Swift Parrot Recovery Team 2001).	Breeds in Tasmania, migrating to the mainland in May to August, mainly foraging in Victoria and NSW (Swift Parrot Recovery Team 2001). In NSW, it has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW (Swift Parrot Recovery Team 2001). Has been recorded west of the study area near Ellalong. The study area is within the known distribution of this species.	Tomaree NP – count 1 Lake Macquarie SCA – count 2	Several winter-flowering species occur in the Stage 3 Mine Area which may provide foraging resources for this species. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
regent honeyeater Xanthomyza phrygia	E (TSC) E (EPBC) #	Semi-nomadic, generally occurs in temperate eucalypt woodlands and open forests, commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine *Casuarina* woodlands (DECC 2008).	Patchily distributed across the eastern states of Australia (DECC 2008), from Adelaide, to Dalby, Queensland, and from the coast to the western foothills of the Great Dividing Range (Garnett and Crowley 2000). Has been recorded west of the study area near Ellalong. The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	Several winter-flowering species occur in the Stage 3 Mine Area which may provide foraging resources for this species. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
turquoise parrot *Neophema pulchella*	V (TSC) *	The turquoise parrot occupies a variety of habitats, primarily eucalypt woodland and open forest near open water and forested hills. Also found in coastal heath, pasture, roadsides and orchards (Pizzey & Knight 1997).	Occurs from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range (DECC 2008). The study area is within the known distribution of this species.	Wallaroo NR – count 1	This species potentially forages within the Stage 3 Mine Area, however is unlikely to be nesting due to the limited availability of hollow trees. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
powerful owl *Ninox strenua*	V (TSC) *	The powerful owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest (Garnett and Crowley 2000). The powerful owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation.	Occurs mostly on the coastal side of the Great Dividing Range, from south western Victoria to Bowen in Queensland (Garnett & Crowley 2000). The study area is within the known distribution of this species.	Wallarah NP – count 3 Wallaroo NR – count 2 Karuah NR – count 1 Medowie SCA – count 3 Tomaree NP – count 2 Lake Macquarie SCA – count 1 Kooragang NR – count 1 Moffats Swamp NR – count 1 Munmorah SCA – count 1 Jilliby SCA – count 4	This species was recorded in the Stage 3 Mine Area however is not likely to nest due to the limited availability of suitable hollows. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
barking owl Ninox connivens	V (TSC) *	Habitat for this species includes dry forests and woodlands (Kavanagh 2002), often in association with hydrological features such as rivers and swamps (Taylor et al. 2002). Large hollows are required for breeding.	Distributed sparsely throughout temperate and semi-arid areas of mainland Australia, however is most abundant in the tropical north (Kavanagh 2002). Most records are west of the Great Dividing Range (Kavanagh 2004). There is a record of this species just outside the southern boundary of the study area. The study area is within the known distribution of this species.	Watagans NP – count 1	This species may forage within the Stage 3 Mine Area, however is not likely to nest due to the limited availability of suitable hollows. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
masked owl *Tyto novaehollandiae*	V (TSC) *	Generally recorded from open forest habitat with sparse mid-storey but patches of dense, low ground cover. It is also recorded from ecotones between wet and dry eucalypt forest, along minor drainage lines and near boundaries between forest and cleared land (Kavanagh 2004).	Occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea (Kavanagh 2002). The study area is within the known distribution of this species.	Karuah NR – count 1 Tomaree NP – count 2 Watagans NP – count 1 Medowie SCA – count 2 Jilliby SCA – count 2	This species may forage within the Stage 3 Mine Area, however is not likely to nest due to the limited availability of suitable hollows. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
sooty owl *Tyto tenebricosa*	V (TSC)	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Nests in very large tree hollows.	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. The Study Area is within the known distribution of this species.	Cotton-Bimbang NP - 10 Tapin Tops NP - 5 Kumbatine NP - 5 Werrikimbe NP - 9 Killabakh NR - 1 Talawahl NR - 1 The Glen NR - 2 Myall Lakes NP - 7 Wallingat NP - 3 Ghin-Doo-Ee NP - 3	There is no potential habitat for this species to occur within the Stage 3 Mine Area. There is no potential for the proposed Stage 3 Mine Development to impact on this species.	No
brown treecreeper (eastern subsp.) *Climacteris picumnus victoriae*	V (TSC) *	Typical habitat for this species includes drier forests, woodlands, scrubs, with fallen branches; river red gums on watercourses and around lake-shores; paddocks with standing dead timber; and margins of denser wooded areas (Pizzey & Knight 1997). This species prefers areas without dense understorey (DECC 2008).	This species occurs over central NSW, west of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys (DECC 2008). Has been recorded west of the study area near Ellalong. The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	Potential habitat for this species occurs within the study area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
black-chinned honeyeater (eastern subsp.) *Melithreptus gularis gularis*	V (TSC) *	In NSW, it is mainly found in woodlands with annual rainfall of 400-700 mm containing box-ironbark associations and river red gum (Garnett & Crowley 2000). It is also known from drier coastal woodlands of the Cumberland Plain, Western Sydney and in the Hunter, Richmond and Clarence valleys (DECC 2008).	Found mainly west of the Great Dividing Range through NSW into southern Queensland, and south into Victoria and South Australia (DECC 2008). The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is potential for this species to occur within the study area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
speckled warbler *Pyrrholaemus saggitata*	V (TSC) *	In NSW, occupies eucalypt and cypress woodlands, generally on the western slopes of the Great Dividing Range. Inhabits woodlands with a grassy understorey, leaf litter and shrub cover, often on ridges or gullies (Garnett & Crowley 2000).	The speckled warbler has a distribution from south-eastern Queensland, through central and eastern NSW to Victoria. The study area is within the known distribution of this species.	Belford NP – 1 count (T Peake pers. obs.)	This species was recorded during surveys of the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
grey-crowned babbler (eastern form) *Pomatostomus temporalis temporalis*	V (TSC) *	Habitat for this species includes open forest and woodland, acacia scrubland and adjoining open areas (Garnett & Crowley 2000).	Occurs on the western slopes and plains of NSW (DECC 2008). Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (DECC 2008). The study area is within the known distribution of this species.	Munmorah SCA – count 1 Belford NP – count 1 (T Peake pers. obs.)	This species was recorded during surveys of the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No
diamond firetail *Stagonopleura guttata*	V (TSC) *	Habitat includes a range of eucalypt-dominated communities with a grassy understorey, including woodland, forest and mallee (Garnett & Crowley 2000). Populations appear unable to persist where remnants are less than 200 hectares in area (DECC 2008).	In NSW, it mainly occurs west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain and the Hunter, Clarence, Richmond and Snowy River valleys (DECC 2008). The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is potential for this species to occur within the study area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
spotted-tailed quoll *Dasyurus maculatus*	V (TSC) E (EPBC) #	Highly varied habitat, ranging from sclerophyll forest, woodlands, coastal heathlands and rainforests. Records exist from open country, grazing lands and rocky outcrops (DECC 2008). Suitable den sites including hollow logs, tree hollows, rocky outcrops or caves are necessary (DECC 2008).	In NSW, the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with highest densities occurring in the north east of the state. It occurs from the coast to the snowline and inland to the Murray River (Edgar & Belcher 2002). The study area is within the known distribution of this species.	Wallaroo NR – count 2	There is potential for this species to occur in the more densely vegetated habitats in the north of the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
koala *Phascolarctos cinereus*	V (TSC) *	This species inhabits eucalypt forest and woodland. Known to feed on a large number of eucalypt and non-eucalypt species, however tends to specialise on a small number in different areas (DECC 2008).	Fragmented distribution throughout eastern Australia, the majority of records from NSW being on the central and north coasts, and some areas further west (DECC 2008). The study area is within the known distribution of this species.	Wallaroo NR – count 5 Karuah NR – count 13 Worimi NR – count 5 Tomaree NP – count 68 Pulbah Island NR – count 3 Medowie SCA – count 11 Moffats Swamp NR – count 3 Lake Macquarie SCA – count 1 Jilliby SCA – count 5 Watagans NP – count 1	Known koala food trees occur within the Stage 3 Mine Area. There is potential for this species to occur. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
yellow-bellied glider *Petaurus australis*	V (TSC) *	Generally found at low population densities in habitat that is patchily distributed (DECC 2008). Prefers tall, mature sclerophyll forests in regions of high rainfall particularly where hollows and year-round food resources are abundant (DECC 2008).	Essentially coastal in NSW and extending inland to adjacent ranges (DECC 2008). The Hunter region may represent a break in the north/south distribution. The study area is within the known distribution of this species.	Jilliby SCA – count 13 Watagans NP – count 9	There is no potential for this species to occur within the Stage 3 Mine Area. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
squirrel glider *Petaurus norfolcensis*	V (TSC) *	Generally inhabits dry sclerophyll forest and woodland (Suckling 2002). Preferred foraging habitat contains a regenerating understorey of eucalypts, wattles and flowering shrubs. Winter flowering species such as red ironbark, spotted gum and coast banksia are particularly important when other food sources are limited (DECC 2008).	Occupies a range along the east cost and immediate inland districts from western Victoria to north Queensland (DECC 2008). Has been recorded to the west of the study area, near Ellalong. The study area is within the known distribution of this species.	Wallarah NP – count 1 Karuah NP – count 2 Tomaree NP – count 4 Lake Macquarie SCA – count 3 Medowie SCA – count 4 Munmorah SCA – count 2	This species was recorded in the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
long-nosed potoroo *Potorous tridactylus*	V (TSC) V (EPBC) #	Occupies a variety of habitats from coastal heath to dry or wet sclerophyll forest. Restricted to areas with rainfall greater than 760 mm per year (Strahan 2002) and it prefers habitats with a dense ground cover and light, sandy soils.	Range extends from south-east Queensland to Tasmania. The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	The Stage 3 Mine Area does not support suitable habitat for this species. There is no potential for an impact on this species.	No
brush-tailed rock-wallaby *Petrogale penicillata*	E (TSC) V (EPBC) #	This species occupies rocky escarpments, outcrops and cliffs showing a preference for complex structures with fissures, caves and ledges facing north (DECC 2008). Forage in or adjacent to rocky areas (DECC 2008).	In NSW occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit (DECC 2008). The study area is within the known distribution of this species.	Watagans NP – count 4	The Stage 3 Mine Area does not support suitable habitat for this species. There is no potential for an impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
grey-headed flying-fox *Pteropus poliocephalus*	V (TSC) V (EPBC) # *	This species feeds on a variety of flowering and fruiting plants, including native figs and palms, blossoms from eucalypts, angophoras, tea-trees and banksias (Tidemann 2002). Camps sites are usually formed in gullies, usually in vegetation with a dense canopy and not far from water (Tidemann 2002).	Recorded along the eastern coastal plain from Bundaberg in Queensland, through NSW and south to eastern Victoria. The study area is within the known distribution of this species.	Wallaroo NR – count 1 Karuah NR – count 1 Lake Macquarie SCA – count 2 Glenrock SCA – count 1 Munmorah SCA – count 6	The Stage 3 Mine Area supports potential habitat for this species, however, there are no known roost sites. There is potential for an impact on this species.	Yes
eastern freetail-bat *Mormopterus norfolkensis*	V (TSC) *	Occurs mostly in dry eucalypt forest and woodland. Also recorded over a rocky river in rainforest and wet sclerophyll forest (Churchill 1998). Generally roosts in tree hollows, but may use man-made structures (Churchill 1998).	Has a distribution along the east coast of NSW from south of Sydney north into south east Queensland, near Brisbane (Churchill 1998). Has been recorded to the west of the study area near Ellalong. The study area is within the known distribution of this species.	Tomaree NP – count 1	This species was recorded within the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V (TSC) *	Habitat varies widely, from rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998). Requires caves for roosting and maternity sites.	This species has an eastern distribution from Cape York along the coastal side of the Great Dividing Range, and into the southern tip of South Australia (Churchill 1998). There are records of this species north of the study area. The study area is within the known distribution of this species.	Wallaroo NR – count 2 Kooragang NR – count 1 Lake Macquarie SCA – count 1 Munmorah SCA – count 1	This species was recorded within the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
eastern false pipistrelle Falsistrellus tasmaniensis	V (TSC) *	Habitat includes sclerophyll forest from the Great Dividing Range to the coast. It appears to prefer wet habitats, with trees over 20 metres high (Churchill 1998). It generally roosts in tree hollows or trunks, in groups of 6 – 36, but is occasionally recorded from caves or buildings (Churchill 1998).	This species has a range from south eastern Queensland, through NSW and Victoria and into Tasmania (Churchill 1998). The study area is within the known distribution of this species.	Werakata NP – count 2	This species has potential to utilise the foraging resources of the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
little bentwing-bat *Miniopterus australis*	V (TSC) *	Habitat includes wet and dry sclerophyll forest, rainforest, dense coastal banksia scrub, and *Melaleuca* swamps. Cave-dwelling, often sharing roosts with the eastern bentwing-bat (*Miniopterus scheribersii oceanensis*). Sometimes roost in tree hollows. Forages for small insects beneath the canopy of densely vegetated habitats. May depend on a large colony for the high temperatures required to rear the young. May hibernate over winter in southern parts of their range.	Occurs in coastal areas from Cape York to northern NSW. The Study Area is within the known distribution of this species.	Werakata NP – count 3	This species was recorded within the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
large-eared pied bat *Chalinolobus dwyeri*	V (TSC) V (EPBC) #	Generally found in a variety of drier habitats, including the dry sclerophyll forests and woodlands, however probably tolerates a wide range of habitats (Hoye & Dwyer 2002). Tends to roost in the twilight zones of mines and caves (Churchill 1998).	Has a distribution from south western Queensland to Bungonia in southern NSW, from the coast to the western slopes of the Great Dividing Range (Churchill 1998, Strahan 2002). The study area is within the known distribution of this species.	Watagans NP – count 1	This species has potential to utilise the foraging resources of the Stage 3 Mine Area. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
large-footed myotis *Myotis adversis*	V (TSC) ^	Occurs in most habitat types providing they are near to water (Richards 2002). Commonly cave-dwelling, however it is also recorded from tree hollows, dense vegetation, bridges, mines and drains (Churchill 1998).	This is a coastal species, ranging from the Kimberley to South Australia (Churchill 1998). The study area is within the known distribution of this species. The study area is within the known distribution of this species.	This species is not known from any conservation reserves in the region.	This species was recorded in the Stage 3 Mine Area. There is potential for an impact on this species.	Yes

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region	Potential to Occur/Potential for Impact	7 Part Test Required?
greater broad-nosed bat *Scoteanax rueppellii*	V (TSC) *	The greater broad-nosed bat appears to prefer moist environments such as moist gullies in coastal forests, or rainforest. They have also been found in gullies associated with wet and dry sclerophyll forests and open woodland. It roosts in hollows in tree trunks and branches and has also been found to roost in the roofs of old buildings.	The greater broad-nosed bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however it does not occur at altitudes above 500 m. The Survey Area is within the known distribution of this species.	This species is not known from any conservation reserves within the region.	The Stage 3 Mine Area provides potential habitat for this species. The Stage 3 Mine Development will have negligible surface impacts and will not modify any habitat requirements of this species. As such there is no potential for a significant impact on potential habitat for this species.	No
Hastings River mouse *Pseudomys oralis*	E (TSC) E (EPBC) #	This species inhabits a variety of dry open forest types with dense, low ground cover and a diverse mixture of ferns, grass, sedges and herbs (DECC 2008). Access to seepage zones, creeks and gullies is important, as is permanent shelter such as rocky outcrops (DECC 2008).	This species has a patchy distribution along the east side of the Northern Tablelands and great escarpment of north-eastern NSW, usually but not always at elevations between 500 metres and 1100 metres (DECC 2008). The study area is slightly south-east of the known distribution of this species.	This species is not known from any conservation reserves in the region.	There is no potential habitat for this species within the Stage 3 Mine Area. There is no potential for an impact on this species.	No

Key: * Records from DECC Wildlife Atlas Database
Records from EPBC Protected Matters Search
^ records added from previous studies or expert knowledge
TSC = *Threatened Species Conservation Act* 1995
EPBC Act = *Environment Protection and Biodiversity Conservation Act* 1999
E = Endangered
V = Vulnerable
NR = Nature Reserve
NP = National Park
SCA = State Conservation Area

From **Tables 1** and **2**, those listings requiring further assessment are:

- River-flat Eucalypt Forest EEC;
- green-thighed frog (*Litoria brevipalmata*);
- grey-headed flying-fox (*Pteropus poliocephalus*); and
- large-footed myotis (*Myotis adversus*).

Below is a seven part test of significance for each of these, which is prepared in accordance with the requirements of the EP&A Act. Although seven part tests of significance are not required for developments assessed under Part 3A, seven part tests are nevertheless used as the means of determining the likely level of significance of impacts.

1.0 River-flat Eucalypt Forest EEC

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

The Proposed Stage 3 Mining Development is expected to result in minimal subsidence and negligible disturbance of surface and groundwater flow patterns. As such, it is not likely that the proposed Stage 3 Mining Development will result in the loss or modification of any areas of the River-flat Eucalypt Forest EEC and therefore the local occurrence of the community will not be placed at risk of extinction.

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

The proposed Stage 3 Mining Development is predicted to have negligible surface impacts, and negligible changes to the surface and groundwater flows are predicted. As such, it is not likely that the proposed Stage 3 Mining Development will adversely modify the composition of the River-flat Eucalypt Forest EEC such that its local occurrence will be placed at risk of extinction.

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

The proposed Stage 3 Mining Development will not lead to the removal or modification of habitat for the River-flat Eucalypt Forest EEC. It is predicted that the proposed Stage 3 Mining Development will have negligible changes to the habitat characteristics currently present for this EEC.

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

The River-flat Eucalypt Forest EEC continues to occur along Cony Creek, east of the Stage 3 Mine Area boundary. Given that there will be negligible surface impacts, the proposed Stage 3 Mining Development will not cause any habitat of this potential EEC to become fragmented or isolated from other areas in which this community occurs.

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

The Stage 3 Mine Area comprises approximately 66.7 hectares of the River-flat Eucalypt Forest, which also occurs in several other locations within the locality. Bell and Driscoll (2008) identify approximately 1531.31 hectares of this EEC to occur within the Cessnock-Kurri Region. The remnants of River-flat Eucalypt Forest within the Stage 3 Mine Area are in relatively good condition and are regarded to have moderate conservation significance, and therefore provide value for the long-term survival of this EEC within the locality.

Given that the proposed Stage 3 Mining Development will not involve the removal or modification of any areas of this EEC, there will be no impact on the long-term viability of this EEC within the locality.

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

The Stage 3 Mine Area does not support any critical habitat for this EEC or any other threatened species or populations.

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

There is not currently a recovery plan or threat abatement plan which relates to this EEC and the proposed Stage 3 Mining Development.

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.

There are two KTPs relevant to the proposed Stage 3 Mining Development, being 'Alterations due to subsidence associated with longwall mining' and 'Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands'. Several other KTPs were considered for their relevance to the project: these are discussed in **Section 7** of the main

report. Given that the predicted impacts of the proposed Stage 3 Mining Development will be negligible, there are no implications of these KTPs.

2.0 Green-thighed frog (*Litoria brevipalmata*)

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

The Proposed Stage 3 Mining Development is expected to result in minimal subsidence and negligible disturbance of surface and groundwater flow patterns. As such, it is not likely that the proposed Stage 3 Mining Development will result in the loss or modification of any areas of potential habitat for this species. The proposed Stage 3 Mining Development will therefore not affect the lifecyle of the green-thighed frog (*Litoria brevipalmata*) such that a viable local population of the species would 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

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

Not applicable.

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

The proposed Stage 3 Mining Development will not lead to the removal or modification of any areas of potential habitat for the green-thighed frog (*Litoria brevipalmata*). It is expected that the proposed Stage 3 Mining Development will have negligible changes to the characteristics of the habitats currently present.

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

The proposed Stage 3 Mining Development is expected to have negligible surface impacts, and will not result in the disturbance to any characteristics of the potential habitat for the green-thighed frog (*Litoria brevipalmata*). As such, an area of potential habitat for this species will not become fragmented or isolated from other areas of habitat (known or potential) as a result of the proposed Stage 3 Mining Development.

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

The Stage 3 Mine Area comprises approximately 100 hectares of potential habitat for the green-thighed frog (*Litoria brevipalmata*), with most areas of potential habitat being disturbed or modified. The likelihood of this species occurring within these habitats is regarded to be low.

Given that the proposed Stage 3 Mining Development will not involve the removal or modification to any areas of potential habitat for the green-thighed frog (*Litoria brevipalmata*), there will not be an impact on the long-term viability of this species within the locality.

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

The Stage 3 Mine Area does not support any critical habitat for this species or any other threatened species, populations or EECs.

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

There is not currently a recovery plan or threat abatement plan which relates to this species and the proposed Stage 3 Mining Development.

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.

There are two KTPs relevant to the proposed Stage 3 Mining Development, being 'Alterations due to subsidence associated with longwall mining' and 'Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands'. Several other KTPs were considered for their relevance to the project: these are discussed in **Section 7** of the main report. Given that the predicted impacts of the proposed Stage 3 Mining Development will be negligible, there are no implications of these KTPs.

3.0 Grey-headed flying-fox (*Pteropus poliocephalus*)

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

The Stage 3 Mine Area supports potential habitat for the grey-headed flying-fox (*Pteropus poliocephalus*). The Proposed Stage 3 Mining Development is expected to result in minimal subsidence and negligible disturbance of surface and groundwater flow patterns. As such, it is not likely that the proposed Stage 3 Mining Development will result in the loss or

modification of any areas of potential habitat for this species. The proposed Stage 3 Mining Development will therefore not affect the life-cycle of the grey-headed flying-fox (*Pteropus poliocephalus*) such that a viable local population of the species would 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

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

Not applicable.

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

The proposed Stage 3 Mining Development will not lead to the removal or modification of any areas of potential habitat for the grey-headed flying-fox (*Pteropus poliocephalus*). It is expected that the proposed Stage 3 Mining Development will have negligible changes to the characteristics of the habitats currently present.

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

The proposed Stage 3 Mining Development is expected to have negligible surface impacts, and will not result in the disturbance to any characteristics of potential habitat for the grey-headed flying-fox (*Pteropus poliocephalus*). As such, an area of potential habitat for this species will not become fragmented or isolated from other areas of habitat (known or potential) as a result of the proposed Stage 3 Mining Development.

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

The Stage 3 Mine Area comprises potential foraging habitat for the grey-headed flying-fox (*Pteropus poliocephalus*). There are no known roost sites for this species within the Stage 3 Mine Area or the locality.

Given that the proposed Stage 3 Mining Development will not involve the removal or modification to any areas of potential habitat for the grey-headed flying-fox (*Pteropus poliocephalus*), there will not be an impact on the long-term viability of this species within the locality.

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

The Stage 3 Mine Area does not support any critical habitat for this species or any other threatened species, populations or EECs.

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

There is not currently a recovery plan or threat abatement plan which relates to this species and the proposed Stage 3 Mining Development.

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.

There are two KTPs relevant to the proposed Stage 3 Mining Development, being 'Alterations due to subsidence associated with longwall mining' and 'Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands'. Several other KTPs were considered for their relevance to the project: these are discussed in **Section 7** of the main report. Given that the predicted impacts of the proposed Stage 3 Mining Development will be negligible, there are no implications of these KTPs.

4.0 Large-footed myotis (*Myotis adversus*)

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

The Proposed Stage 3 Mining Development is expected to result in minimal subsidence and negligible disturbance of surface and groundwater flow patterns. As such, it is not likely that the proposed Stage 3 Mining Development will result in the loss or modification of any areas of habitat for this species. The proposed Stage 3 Mining Development will therefore not affect the lifecycle of the large-footed myotis (*Myotis adversus*) such that a viable local population of the species would 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

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

Not applicable.

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

The proposed Stage 3 Mining Development will not lead to the removal or modification of any areas of habitat for the large-footed myotis (*Myotis adversus*). It is expected that the proposed Stage 3 Mining Development will have negligible changes to the characteristics of the habitats currently present.

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

The proposed Stage 3 Mining Development is expected to have negligible surface impacts, and will not result in the disturbance to any characteristics of habitat for the large-footed myotis (*Myotis adversus*). As such, an area of habitat for this species will not become fragmented or isolated from other areas of habitat (known or potential) as a result of the proposed Stage 3 Mining Development.

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

The Stage 3 Mine Area comprises known foraging habitat for the large-footed myotis (*Myotis adversus*).

Given that the proposed Stage 3 Mining Development will not involve the removal or modification to any areas of habitat for the large-footed myotis (*Myotis adversus*), there will not be an impact on the long-term viability of this species within the locality.

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

The Stage 3 Mine Area does not support any critical habitat for this species or any other threatened species, populations or EECs.

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

There is not currently a recovery plan or threat abatement plan which relates to this species and the proposed Stage 3 Mining Development.

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.

There are two KTPs relevant to the proposed Stage 3 Mining Development, being 'Alterations due to subsidence associated with longwall mining' and 'Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands'. Several other KTPs were considered for their relevance to the project: these are discussed in **Section 7** of the main report. Given that the predicted impacts of the proposed Stage 3 Mining Development will be negligible, there are no implications of these KTPs.

5.0 Conclusion

The proposed Stage 3 Mine development will not result in a significant impact on any threatened species, populations or EECs recorded or potentially occurring within the Stage 3 Mine Area.

APPENDIX D

Assessment of Significance (EPBC Act) – Surface Infrastructure Site

Appendix D – Assessment of Significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

A search of the Department of Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Database identified threatened and migratory species (EPBC Act listed) known to occur or considered likely to occur, on the basis of habitat modelling, within 10 kilometres of the Study Area. No EPBC Act listed endangered populations or endangered ecological communities (EECs) are known or have potential to occur within the Surface Infrastructure Site.

Of the threatened flora species, two were recorded and two have potential to occur within the Surface Infrastructure Site. Of the threatened fauna species, six were recorded or have potential to occur within the Surface Infrastructure Site.

Of the 13 migratory species identified from the DEWHA database search, 12 species were found to have moderate to high potential to occur within the Study Area.

An assessment of the potential impacts of the proposed development is provided below for each of these threatened and migratory species, based on the impacts of the proposed development as described in **Section 7.1** of this report.

The aim of this assessment is to determine whether the proposed development is likely to have a significant impact on any EPBC Act matters of national environmental significance (MNES). In this instance, MNES with potential to occur within the Study Area include:

- listed threatened species (including endangered and vulnerable species); and
- listed migratory species.

Each category is addressed separately below.

Endangered Species

The following EPBC Act listed vulnerable species are considered in this assessment:

- spotted-tailed quoll (*Dasyurus maculatus*);
- swift parrot (*Lathamus discolor*); and
- regent honeyeater (*Xanthomyza phrygia*).

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

In this case, a *population* means:

- a geographically distinct regional population, or collection of local populations; or
- a regional population, or collection of local populations, that occurs within a particular bioregion.

The three species listed above were not recorded in the Surface Infrastructure Site, however have potential to occur. These species are known to occur in the locality. The Surface Infrastructure Site does not contain a geographically distinct regional population, or collection of local populations for these species, and does not contain a regional population, or collection of local populations of this species that occur within the Sydney Basin bioregion.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a *population*; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*) or spotted-tailed quoll (*Dasyurus maculatus maculatus*) were recorded within the Surface Infrastructure Site. The proposed Surface Infrastructure Development will not lead to a decrease in the size of a *population* (as defined above) of any of these endangered species.

- **reduce the area of occupancy of the species; or**

No populations of swift parrot (*Lathamus discolor*), regent honeyeater (*Xanthomyza phrygia*) or spotted-tailed quoll (*Dasyurus maculatus maculatus*) were recorded within the Surface Infrastructure Site. The proposed Surface Infrastructure Development will reduce the area of potential habitat for these endangered species, however this is not a significant reduction. Substantial areas of similar potential habitats for these species are protected within the adjacent Werakata State Conservation Area.

- **fragment an existing *population* into two or more populations; or**

No populations of swift parrot (*Lathamus discolor*), regent honeyeater (*Xanthomyza phrygia*) or spotted-tailed quoll (*Dasyurus maculatus maculatus*) were recorded within the Surface Infrastructure Site. The proposed Surface Infrastructure Site will not fragment an existing population of any endangered species into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

No populations of swift parrot (*Lathamus discolor*), regent honeyeater (*Xanthomyza phrygia*) or spotted-tailed quoll (*Dasyurus maculatus maculatus*) were recorded within Surface Infrastructure Site. The proposed Surface Infrastructure Development will not adversely affect habitat critical to the survival of these endangered species.

- **disrupt the breeding cycle of a population; or**

No populations of swift parrot (*Lathamus discolor*), regent honeyeater (*Xanthomyza phrygia*) or spotted-tailed quoll (*Dasyurus maculatus maculatus*) were recorded within the Surface Infrastructure Site. The proposed Surface Infrastructure Development will not disrupt the breeding cycle of any population of any endangered species.

- **modify, destroy, remove isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

No populations of swift parrot (*Lathamus discolor*), regent honeyeater (*Xanthomyza phrygia*) or spotted-tailed quoll (*Dasyurus maculatus maculatus*) were recorded within the Surface Infrastructure Site. The proposed Surface Infrastructure Development will not modify,

destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that these endangered species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat; or**

No populations of swift parrot (*Lathamus discolor*), regent honeyeater (*Xanthomyza phrygia*) or spotted-tailed quoll (*Dasyurus maculatus maculatus*) were recorded within the Surface Infrastructure Site. The proposed Surface Infrastructure Development will not result in invasive species that are harmful to these endangered species becoming established in their habitat.

- **interfere with the recovery of the species.**

No populations of swift parrot (*Lathamus discolor*), regent honeyeater (*Xanthomyza phrygia*) or spotted-tailed quoll (*Dasyurus maculatus maculatus*) were recorded within the Surface Infrastructure Site. The proposed Surface Infrastructure Development will not interfere with the recovery of these species.

Vulnerable Species

The following EPBC Act listed vulnerable species are considered in this assessment:

- leafless tongue orchid (*Cryptostylis hunteriana*);
- Bynoes wattle (*Acacia bynoeana*);
- heath wrinklewort (*Rutidosis heterogama*);
- small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*);
- koala (*Phascolarctos cinereus*);
- grey-headed flying-fox (*Pteropus poliocephalus*); and
- large-eared pied bat (*Chalinolobus dwyeri*).

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

In this case, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

Of the above-listed vulnerable species, the heath wrinklewort and small-flower grevillea were recorded, while all other species were found to have potential to occur within the Surface

Infrastructure Site. There are no species for which the Study Area supports an important population based on the definition described above.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of an *important population* of a species; or**

The proposed Surface Infrastructure Development will require the removal of 10 hectares of potential habitat (known habitat in the case of heath wrinklewort and small-flower grevillea) for each of the vulnerable species listed above. A significant area of known and potential habitat for these species is protected within the adjacent Werakata State Conservation Area and the nearby Werakata National Park. Given the small area of the disturbance, and the substantial area of similar habitat conserved within the locality, the proposed Surface Infrastructure Development will not lead to a long-term decrease in the population of any of the above-listed species.

- **reduce the area of occupancy of an *important population*; or**

The proposed development will result in the removal of approximately 10 hectares of potential or known habitat for the above-listed species. The Surface Infrastructure Site does not comprise an important population for any of these species. In order to provide compensation for the removal of habitat, an area of similar size to that being disturbed is proposed to be conserved within the Werakata State Conservation Area as a biodiversity offset. Given the relatively small area of the disturbance, the compensation through biodiversity offsets, and the large areas of similar habitats protected within the adjacent Werakata State Conservation Area, the proposed Surface Infrastructure Development will not substantially reduce the area of occupancy of an important population.

- **fragment an existing important population into two or more populations; or**

Due to the small size of the proposed disturbance, and the substantial size of the adjacent remnant comprising Werakata State Conservation Area, there will not be any fragmentation of existing populations.

- **adversely affect habitat critical to the survival of a species; or**

The Surface Infrastructure Site does not contain any habitats that are critical to the survival of any of the above listed vulnerable species. The adjacent Werakata State Conservation Area protects a very large area of similar habitats to those present within the Surface Infrastructure Site.

- **disrupt the breeding cycle of an important population; or**

The proposed development does not comprise any actions that would disrupt the breeding cycle of any of the above listed vulnerable species. The Surface Infrastructure Site does not support any important population for any of these species.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

Given the small area of the proposed disturbance, and the large area of similar habitats protected within the adjacent Werakata State Conservation Area, the proposed Surface

Infrastructure Development will not cause any of the above listed vulnerable species to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or**

There are very low numbers of invasive species within the Surface Infrastrucutre Site and surrounding Werakata State Conservation Area. The species of most potential to become invasive is lantana (*Lantana camara*). The proposed Surface Infrastructure Development is not likely to result in significant increase in the extent this species. Recommendations have been made to undertake weed monitoring as part of the project (refer to **Section 9.1** of this report) to ensure that no invasive species become established to the detriment of vulnerable species.

- **interfere substantially with the recovery of the species.**

The potential habitats for the above-listed vulnerable species protected within Werakata State Conservation Area are regarded to be of significant importance for the conservation of the species within the locality. The removal of a relatively small area of habitat for the proposed Surface Infrastructure Development will not interfere substantially with the recovery of any of these vulnerable species.

Migratory Species

The following EPBC Act listed migratory species are considered in this assessment:

- white-bellied sea-eagle (*Haliaeetus leucogaster*);
- white-throated needletail (*Hirundapus caudacutus*);
- rainbow bee-eater (*Merops ornatus*);
- black-faced monarch (*Monarcha melanopsis*);
- satin flycatcher (*Myiagra cyanoleuca*);
- rufous fantail (*Rhipidura ruffifrons*);
- regent honeyeater (*Xanthomyza phrygia*);
- fork-tailed swift (*Apus pacificus*); and
- swift parrot (*Lathamus discolor*).

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

An area of *important habitat* is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; or

- habitat utilised by a migratory species which is at the limit of the species range; or

- habitat within an area where the species is declining.

None of the above-listed migratory species were recorded in the Surface Infrastructure Site, however there is potential habitat for these species to occur. The Surface Infrastructure Site is not regarded to comprise important habitat for any of the listed migratory species.

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- **substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;**

The proposed Surface Infrastructure Development will require removal of a small area of potential habitat for migratory species. A substantial expanse of similar habitats are protected within the adjoining Werakata State Conservation Area.

Given the small area of potential habitat to be removed, the highly mobile nature of these species, and the significant area of habitat conserved within the locality, the Surface Infrastructure Development would not substantially modify, destroy or isolate an area of important habitat for a migratory species.

- **result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or**

There are very low numbers of invasive species within the Surface Infrastructure Site and surrounding Werakata State Conservation Area. The species of most potential to become invasive is lantana (*Lantana camara*). The proposed Surface Infrastructure Development is not likely to result in significant increase in the extent this species. Recommendations have been made to undertake weed monitoring as part of the project (refer to **Section 9.1** of this report) to ensure that no invasive species become established.

- **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species**

The potential habitats for the above-listed migratory species protected within Werakata State Conservation Area are regarded to be of significant importance for the conservation of the species within the locality. The removal of a relatively small area of habitat for the proposed Surface Infrastructure Development will not interfere substantially with the lifecycle of an ecologically significant proportion of the population of any of these migratory species.

Conclusion

The proposed Surface Infrastructure Development will not result in a significant impact on any EPBC Act listed threatened species or migratory species.

APPENDIX E

Assessment of Significance (EPBC Act) – Stage 3 Mine Area

Appendix E – Assessment of Significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

A search of the Department of the Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Database identified threatened and migratory species (EPBC Act listed) known to occur or considered likely to occur, on the basis of habitat modelling, within a 10 kilometre radius of the Study Area. No EPBC Act listed endangered populations or endangered ecological communities (EECs) are known or have potential to occur within the Stage 3 Mine Area.

Of the threatened flora species identified from the DEWHA database search, two were recorded within the Stage 3 Mine Area. Of the threatened fauna species, six were recorded or have potential to occur within the Surface Infrastructure Site. Of the 13 migratory species identified from the DEWHA database search, 12 species were found to have moderate to high potential to occur within the Study Area. Given that the proposed Stage 3 Mine development comprises underground mining which is predicted to have negligible impacts on surface habitats, an assessment has only been undertaken for those species with potential to be impacted by the proposed development. Consequently, three species require assessment, the listed endangered and migratory swift parrot (*Lathamus discolor*) and regent honeyeater (*Xanthomyza phrygia*) and the vulnerable listed grey-headed flying-fox (*Pteropus poliocephalus*). These three species forage on blossom resources within riparian habitats, and therefore have potential to be impacted if there is any change in riparian vegetation. An assessment of the potential impacts of the proposed development on this species is provided below.

Endangered

The following EPBC Act listed vulnerable species are considered in this assessment:

- swift parrot (*Lathamus discolor*); and
- regent honeyeater (*Xanthomyza phrygia*).

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

In this case, a *population* means:

- a geographically distinct regional population, or collection of local populations; or
- a regional population, or collection of local populations, that occurs within a particular bioregion.

The two species listed above were not recorded in the Surface Infrastructure Site, however have potential to occur. These species are known to occur in the locality. The Surface Infrastructure Site does not contain a geographically distinct regional population, or collection of local populations for these species, and does not contain a regional population, or collection of local populations of this species that occur within the Sydney Basin bioregion.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a *population*; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*) were recorded within the Stage 3 Mine Area. The proposed Stage 3 Mine Development will not lead to a decrease in the size of a *population* (as defined above) of either of these endangered species.

- **reduce the area of occupancy of the species; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*) were recorded within the Stage 3 Mine Area. The proposed Stage 3 Mine Development has potential to modify the area of potential habitat for these endangered species, however will not lead to a significant reduction. Substantial areas of similar potential habitats for these species are protected within the adjacent Werakata State Conservation Area and Werakata NP.

- **fragment an existing *population* into two or more populations; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*) were recorded within the Stage 3 Mine Area. The proposed State 3 Mine Development will not fragment an existing population of any endangered species into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*) were recorded within Stage 3 Mine Area. The proposed Stage 3 Mine Development will not adversely affect habitat critical to the survival of these endangered species.

- **disrupt the breeding cycle of a population; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*) were recorded within the Stage 3 Mine Area. The proposed Stage 3 Mine Development will not disrupt the breeding cycle of any population of any endangered species.

- **modify, destroy, remove isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*) were recorded within the Stage 3 Mine Area. The proposed Stage 3 Mine Development will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that these endangered species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*) were recorded within the Stage 3 Mine Area. The proposed Stage 3 Mine

Development will not result in invasive species that are harmful to these endangered species becoming established in their habitat.

- **interfere with the recovery of the species.**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*) were recorded within the Stage 3 Mine Area. The proposed Stage 3 Mine Development will not interfere with the recovery of these species.

Vulnerable Species

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for the grey-headed flying-fox (*Pteropus poliocephalus*).

In this case, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

The grey-headed flying-fox (*Pteropus poliocephalus*) was not recorded within the Stage 3 Mine Area; however the area supports potential foraging resources for this species. Based on the definition described above, the Study Area does not support an important population of this species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of an *important population* of a species; or**

The proposed Stage 3 Mine development will not disturb any areas of potential habitat for the grey-headed flying-fox. Significant areas of potential habitat for this species are protected within the adjacent Werakata State Conservation Area and the nearby Werakata National Park. Given the small area of the disturbance, and the substantial area of similar habitat conserved within the locality, the proposed Stage 3 Mine Development will not lead to a long-term decrease in the population of the grey-headed flying-fox (*Pteropus poliocephalus*).

- **reduce the area of occupancy of an *important population*; or**

The proposed Stage 3 Mine development will not disturb any areas of potential habitat for the grey-headed flying fox. The Stage 3 Mine Area does not comprise an important population for this species. Given the relatively small area of the disturbance and the large areas of similar habitats protected within the adjacent Werakata State Conservation Area, the proposed Stage 3 Mine Development will not substantially reduce the area of occupancy of an important population of this species.

- **fragment an existing important population into two or more populations; or**

Given that there will be negligible surface impacts as a result of the Stage 3 Mine development, and the substantial size of the adjacent remnant comprising Werakata State

Conservation Area, there will not be any fragmentation of potential habitat for the grey-headed flying-fox (*Pteropus poliocephalus*).

- **adversely affect habitat critical to the survival of a species; or**

The Stage 3 Mine Area does not contain any habitats that are critical to the survival of the grey-headed flying-fox (*Pteropus poliocephalus*). The adjacent Werakata State Conservation Area protects a very large area of similar habitats to those present within the Stage 3 Mine Area.

- **disrupt the breeding cycle of an important population; or**

The proposed development does not comprise any actions that would disrupt the breeding cycle of the grey-headed flying-fox (*Pteropus poliocephalus*). The Stage 3 Mine Area does not support any important population for the grey-headed flying-fox (*Pteropus poliocephalus*).

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

Given the negligible surface impacts associated with the proposed development and the large area of similar habitats protected within the adjacent Werakata State Conservation Area, the proposed Stage 3 Mine development will not cause the grey-headed flying-fox (*Pteropus poliocephalus*) to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or**

There are very low numbers of invasive species within the Stage 3 Mine Area and surrounding Werakata State Conservation Area. The species of most potential to become invasive is lantana (*Lantana camara*). The proposed Stage 3 Mine development is not likely to result in a significant increase in the extent of this weed species.

- **interfere substantially with the recovery of the species.**

The potential habitats for the grey-headed flying-fox (*Pteropus poliocephalus*) protected within Werakata State Conservation Area are regarded to be of significant importance for the conservation of the species within the locality. Due to the negligible surface impacts predicted, the proposed Stage 3 Mine Development will not interfere substantially with the recovery of the grey-headed flying-fox (*Pteropus poliocephalus*).

Migratory Species

The following EPBC Act listed migratory species are considered in this assessment:

- regent honeyeater (*Xanthomyza phrygia*); and

- swift parrot (*Lathamus discolor*).

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

An area of *important habitat* is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; or

- habitat utilised by a migratory species which is at the limit of the species range; or

- habitat within an area where the species is declining.

None of the above-listed migratory species were recorded in the Stage 3 Mine Area, however there is potential habitat for these species to occur. The Stage 3 Mine Development is not regarded to comprise important habitat for any of the listed migratory species.

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- **substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;**

The proposed Stage 3 Mine Development will not require the removal of any known or potential habitat for the swift parrot (*Lathamus discolor*) or regent honeyeater (*Xanthomyza phrygia*). There may be minor impacts on foraging resources for this species in riparian areas due to hydrology changes as a result of subsidence. These impacts are not predicted to be significant. A substantial expanse of similar habitats is protected within the adjoining Werakata State Conservation Area and nearby Werakata National Park.

The Stage 3 Mining Development would not substantially modify, destroy or isolate an area of important habitat for any migratory species.

- **result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or**

There are very low numbers of invasive species within the Stage 3 Mine Area and surrounding Werakata State Conservation Area. The species of most potential to become invasive is lantana (*Lantana camara*). The proposed Stage 3 Mining Development is not likely to result in significant increase in the extent this species.

- **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species**

The potential habitats for the swift parrot (*Lathamus discolor*) and the regent honeyeater (*Xanthomyza phrygia*) protected within Werakata State Conservation Area are regarded to be of significant importance for the conservation of the species within the locality. The potential impact to a relatively small area of foraging resources as a result of the proposed Stage 3 Mine Development will not interfere substantially with the lifecycle of an ecologically significant proportion of the population of any of the swift parrot (*Lathamus discolor*) or the regent honeyeater (*Xanthomyza phrygia*).

Conclusion

The proposed Stage 3 Mine development will not result in a significant impact on any EPBC Act listed threatened species or migratory species.

APPENDIX F

Fauna Species List

Appendix F – Fauna Species List

Table 1 lists all species recorded within the study area during field surveys undertaken by Umwelt during 2007. Details of the surveys undertaken are provided in **Section 2.3** of the main report.

The following abbreviations or symbols are used to identify the method of detection in the appendix table:

X	Recorded sighting or audio identification of the species' call during the Umwelt surveys;
S	Identified from scat sample(s) in field;
T	Identified from tracks and/or traces such as burrows, nests or feathers;
C	"Confident" identification by Ecotone Ecological Consultants Pty Ltd;
Prob.	"Probable" identification by Ecotone Ecological Consultants Pty Ltd; and
Poss.	"Possible" identification by Ecotone Ecological Consultants Pty Ltd.

All threatened species are indicated in **bold** type.

Any species that could not be identified to the species taxonomic level are denoted in the following manner:

?	specimens for which identification was uncertain.

The following abbreviations or symbols are used in the list:

asterisk (*) denotes species not indigenous to the study area;

MAR	Listed marine species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
MIG	Listed migratory species under the EPBC Act;
V	Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act); and
E	Endangered under Schedule 2 of the TSC Act.

Birds recorded were identified using descriptions in Slater et al. (2003) and the scientific and common name nomenclature of Birds Australia. Reptiles recorded were identified using keys and descriptions in Cogger (2000), Swan et al. (2004), Weigel (1990) and Wilson & Swan (2003) and the scientific and common name nomenclature of Cogger (2000).

Amphibians recorded were identified using keys and descriptions in Cogger (2000), Robinson (1998), Anstis (2002) and Barker et al. (1995) and the scientific and common name nomenclature of Cogger (2000). Mammals recorded were identified using keys and descriptions in Strahan (1995), Churchill (1998) and Menkhorst & Knight (2004) and the scientific and common name nomenclature of Strahan (2002) for non-bat species and Churchill (1998) for bats.

Table 1 - Fauna Species Recorded within the Proposed Stage 3 Mining Area and Surface Infrastructure Areas, 2007

Scientific Name	Common Name	Conservation Status		SITE	
		TSC Act	EPBC Act	Surface Infrastructure Site	Stage 3 Mining Area
Birds					
Anatidae					
Chenonetta jubata	Australian wood duck		MIG		X
Anas superciliosa	Pacific black duck		MIG		X
Anas gracilis	grey teal				X
Podicipedidae					
Tachybaptus novaehollandiae	Australasian grebe				X
Phalacrocoracidae					
Phalacrocorax sulcirostris	little black cormorant				X
Pelecanidae					
Pelecanus conspicillatus	Australian pelican		MAR		X
Ardeidae					
Egretta novaehollandiae	white-faced heron			X	X
Threskiornithidae					
Platelea flavipes	yellow-billed spoonbill				X
Threskiornis molucca	Australian white ibis				X
Threskiornis spinicollis	straw-necked Ibis				X
Accipitridae					
Haliaeetus leucogaster	white-bellied sea-eagle		MIG/MAR		X
Aquila audax	wedge-tailed eagle		MIG		T
Rallidae					
Porphyrio porphyrio	purple swamphen			X	X
Gallinula tenebrosa	dusky moorhen				X
Fulica atra	Eurasian coot				X
Charadriidae					
Vanellus miles	masked lapwing		MIG		X
Columbidae					
Ocyphaps lophotes	crested pigeon			X	X
Leucosarcia melanoleuca	wonga pigeon				X
Phaps chalcoptera	common bronzewing				X
Cacatuidae					
Cacatua roseicapilla	galah				X

Scientific Name	Common Name	Conservation Status		SITE	
		TSC Act	EPBC Act	Surface Infrastructure Site	Stage 3 Mining Area
Calyptorhynchus funereus	yellow-tailed black-cockatoo			X	
Callocephalon fimbriatum	gang-gang cockatoo				X
Psittacidae					
Glossopsitta concinna	musk lorikeet				X
Glossopsitta pusilla	little lorikeet			X	X
Platycercus eximius	eastern rosella				X
Trichoglossus haematodus	rainbow lorikeet				X
Trichoglossus chlorolepidotus	scaly-breasted lorikeet				X
Psephotus haematonotus	red-rumped parrot			X	X
Strigidae					
Ninox strenua	**powerful owl**	**V**			X
Ninox noveseelandiae	southern boobook				X
Podargidae					
Podargus strigoides	tawny frogmouth				X
Halcyonidae					
Dacelo novaeguineae	laughing kookaburra			X	X
Halcyon macleayii	forest kingfisher				X
Maluridae					
Malurus cyaneus	superb fairy-wren			X	X
Pardalotidae					
Pardalotus punctatus	spotted pardalote			X	X
Sericornis frontalis	white-browed scrubwren				X
Pyrrholaemus sagittatus	**speckled warbler**	**V**			X
Acanthiza chrysorrhoa	yellow-rumped thornbill			X	X
Acanthiza lineata	striated thornbill				X
Acanthiza nana	yellow thornbill			X	
Meliphagidae					
Anthochaera carunculata	red wattlebird			X	X
Entomyzon cyanotis	blue-faced honeyeater			X	
Manorina melanocephala	noisy miner			X	X
Lichenostomus ornatus	yellow-plumed honeyeater				X
Lichenostomus penicillatus	white-plumed honeyeater			X	
Lichenostomus chrysops	yellow-faced honeyeater			X	X

Scientific Name	Common Name	Conservation Status		SITE	
		TSC Act	EPBC Act	Surface Infrastructure Site	Stage 3 Mining Area
Lichenostomus melanops	yellow-tufted honeyeater			X	X
Lichenostomus fuscus	fuscous honeyeater				X
Philemon corniculatus	noisy friarbird			X	X
Meropidae					
Merops ornatus	rainbow bee-eater				X
Climacteridae					
Climacteris leucophaea	white-throated treecreeper			X	X
Pachycephalidae					
Colluricincla harmonica	grey shrike-thrush			X	
Petroicidae					
Microeca leucophaea	Jacky winter			X	
Petroica goodenovii	red-capped robin			X	
Petroica multicolor	scarlet robin				X
Pomatostomidae					
Pomatostomus temporalis temporalis	**grey-crowned babbler (eastern subspecies)**	**V**		X	X
Neosittidae					
Pachycephala pectoralis	golden whistler			X	
Pachycephala rufiventris	rufous whistler			X	X
Dicruridae					
Myiagra cyanoleuca	satin flycatcher				X
Grallina cyanoleuca	magpie-lark		MAR	X	X
Rhipidura leucophrys	willie wagtail			X	
Rhipidura fuliginosa	grey fantail			X	X
Campephagidae					
Coracina novaehollandiae	black-faced cuckoo-shrike		MAR	X	X
Oriolidae					
Oriolus sagittatus	olive-backed oriole			X	
Cuculidae					
Scythrops novaehollandiae	channel-billed cuckoo				X
Artamidae					
Cracticus torquatus	grey butcherbird			X	
Cracticus nigrogularis	pied butcherbird			X	X
Gymnorhina tibicen	Australian magpie			X	X
Strepera graculina	pied currawong			X	X
Corvidae					
Corvus coronoides	Australian raven			X	X

Scientific Name	Common Name	Conservation Status		SITE	
		TSC Act	EPBC Act	Surface Infrastructure Site	Stage 3 Mining Area
Corcoracidae					
Corcorax melanorhamphos	white-winged chough				X
Motacillidae					
Anthus novaeseelandiae	Richards pipit		MAR	X	
Passeridae					
Taeniopygia bichenovii	double-barred finch				X
Hirundinidae					
Hirundo neoxena	welcome swallow		MAR		X
Reptiles					
Agamidae					
Amphibolurus muricatus	Jacky lizard			X	
Physignathus lesueurii	eastern water dragon				X
Pogona barbata	bearded dragon			X	
Cheloniidae					
Emydura macquarii	Macquarie turtle				X
Scincidae					
Eulamprus quoyii	eastern water skink				X
Carlia tetradactyla	southern rainbow skink				X
Amphibians					
Myobatrachidae					
Crinia signifera	brown froglet			X	X
Limnodynastes tasmaniensis	spotted marsh frog				X
Limnodynastes peronii	striped marsh frog				X
Uperoleia laevigata	smooth toadlet				X
Hylidae					
Litoria fallax	dwarf tree frog				X
Litoria latopalmata	broad-palmed frog				X
Litoria peronii	Perons tree frog				X
Litoria tyleri	Tylers tree frog				X
Litoria verreauxii	Verreauxs tree frog			X	X
Mammals					
Phalangeridae					
Trichosurus vulpecula	common brushtail possum			X	X
Macropodidae					
Macropus giganteus	eastern grey kangaroo			X	X

Scientific Name	Common Name	Conservation Status		SITE	
		TSC Act	EPBC Act	Surface Infrastructure Site	Stage 3 Mining Area
Molossidae					
Nyctinomus australis	white-striped freetail-bat			X	X
Nyctinomus australis	white-striped mastiff-bat			X	
Momopterus norfolkensis	**eastern freetail-bat**	**V**			X
Vespertilionidae					
Miniopterus australis	**little bentwing-bat**	**V**		X	X
Miniopterus schreibersii oceanensis	**eastern bentwing-bat**	**V**		X	X
Nyctophilus sp.	-			X	X
Chalinolobus gouldii	Goulds wattled bat			X	X
Chalinolobus morio	chocolate wattled bat			X	X
Myotis adversus	**large-footed myotis**	**V**		X	X
Falsistrellus tasmaniensis	**eastern false-pipistrelle**	**V**			X
Scotorepens balstoni	inland broad-nosed bat				poss.
Scotorepens orion	eastern broad-nosed bat			prob.	
Vespadeus pumilus	eastern forest bat			X	X
Vespadeuls vulternus	little forest bat			X	X
Petauridae					
Petaurus breviceps	sugar glider			X	X
Petaurus norfolcensis	**squirrel glider**	**V**			X
Dasyuridae					
Antechinus stuartii	brown antechinus			X	X
Antechinus flavipes	yellow-footed antechinus			X	X
Acrobatidae					
Acrobates pygmaeus	feathertail glider				X
Vespertilionidae					
Nyctophilus gouldi	Goulds long-eared bat				X
Canidae					
**Vulpes vulpes*	fox				X
Leporidae					
**Oryctolagus cuniculus*	rabbit				X